CELEBRATING

70 *years*

ESTABLISHED 1945

THE SAMUEL ROBERTS NOBLE FOUNDATION
2015 ANNUAL REPORT

“The obligation that rests squarely on the shoulders of each generation is not what they inherit, what they have handed to them or what they acquire from the standpoint of wealth or position, but what they do with the wealth or power that they have in their hands.”

– LLOYD NOBLE, 1943

A bust of Lloyd Noble by artist Paul Moore

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Lloyd Noble as a young man

ESTABLISHED 1945

be BOLD

Beginnings belong to the bold.

Those who see a challenge and dare to act. Those who take the first step when others cannot. Those who see a path forward where none exists.

Lloyd Noble envisioned a novel solution to an unthinkable problem and, despite having no guarantees, walked into the unknown and changed history.

Noble established The Samuel Roberts Noble Foundation in 1945 and endowed it with a mission to rebuild agriculture in the Southern Great Plains following the Dust Bowl.

This oilman's vision has now endured for 70 years, passed from one generation to the next, carried on by the men and women of the Noble Foundation.

While each era brings a unique set of challenges and equally novel solutions, the purpose remains steadfast – safeguard the soil and help agricultural producers advance land stewardship practices.

This annual report highlights seven decades of achievement; success that is best realized in the golden wheat fields of an Oklahoma farmer, in a student who suddenly discovers a lifelong pursuit in agriculture, in a researcher who unlocks a critical discovery, and in the consumer who receives the fruits of these labors.

And, to think, all of these lives were changed because of one bold man.

This is his story. This is our story. This is your story.

Charlie Sykora demonstrates the difference between his treated and untreated garden plots as part of the Noble Foundation's soil and garden contest on July 7, 1949, on his farm 6 miles north of Marietta, Oklahoma.

1940s *and* 1950s

The dust clouds on the Southern Great Plains had nearly settled by the dawn of 1940. But Lloyd Noble could not erase from his mind the devastating results to the land and those who depended on it. Just days after the formal end of World War II, Lloyd Noble established The Samuel Roberts Noble Foundation on Sept. 19, 1945. Its purpose was to safeguard the soil by supporting and encouraging farmers to adopt soil-conserving practices that would prevent the land from lying vulnerable to extreme drought as it had during the Dust Bowl. The Noble Foundation began testing soil and making fertilization recommendations to farmers. Soon, the young organization launched small-scale agricultural research projects, seeking a connection between soil fertility and the nutrition of plants, animals and humans. This research eventually led to an expansion into human health and disease.

Larkin Martin, an Alabama farmer, serves the Soil Health Institute as a board member.

SOIL HEALTH

the GREAT DREAM

The twin-engine Lockheed 10 slipped through the cloudless sky and began its steady descent toward a small landing strip near Springer, Oklahoma.

As the details of the prairie floor rose into focus, the plane's lone passenger surveyed the landscape below as he had so many times before.

Lloyd Noble once again witnessed from his lofty perch idle fields stripped of topsoil. His eyes traced the jagged edges of deep ravines cut by storms of dirt. These were the physical scars of the Dust Bowl, permanently etched into the countryside and into the minds of a generation.

Noble had survived and even managed to thrive during the natural disaster that dominated much of the Southern Great Plains during the 1930s. He rode the black crude wave of the oil boom to become one of the energy sector's most respected drillers.

Many of his fellow Oklahomans, however, experienced the despair that resulted from the inability of the state's agricultural producers to grow food or earn a livelihood from the ruined topsoil. The loss of the state's agricultural foundation stalled the economic engine, disrupted the social order and threatened the long-term viability of the region.

As the 1940s dawned, Lloyd Noble's business endeavors took him across the country and back home to southern Oklahoma frequently enough to warrant a private aircraft. From his bird's-eye view, Noble saw what few of his generation ever would – the magnitude of devastation. He decided to take action. He began writing and speaking a commanding mantra: "No civilization has outlived the usefulness of its soils. When the soil is destroyed, the nation is gone."

Within a few years, Noble offered his permanent solution – the Noble Foundation – an organization dedicated to conserving the soil and fostering land stewardship practices. "Being naturally interested in the soil," he said, "(this) is where we will start."

The young organization worked to provide counsel to area farmers and ranchers about soil management and offered testing services. As knowledge and technical abilities advanced, so did the Noble Foundation's offerings. Research and plant breeding led to better crops, and the mission spread to the surrounding region.

More than 70 years have passed since the Dust Bowl, and the fight to advance the cause of soil health remains as critical as it did during Noble's generation.

In addition to the Noble Foundation, three national organizations were born during the Dust Bowl era to support soil health and land stewardship:

Jason Weller, chief of Natural Resources Conservation Services, plays an important role in supporting increased public-private partnerships, such as through the Soil Health Institute, to advance soil health.

the Farm Foundation, the National Association of Conservation Districts (NACD) and the Natural Resources Conservation Service (NRCS). While these organizations focused on soil advancements, public and private research in soil health slowed for several decades as scientists' focus shifted more toward the inner workings of crop plants.

In recent decades the focus on soil health has been rejuvenated. For the Noble Foundation, the legacy of regional soil health has now advanced to the national stage in the form of two key efforts. These movements are designed to provide an entire country the same urgent perspective on soil that Noble gained during his post-Dust Bowl flights so many generations ago.

There is just one key difference today: time is no longer an ally.

A RENAISSANCE IN THE MAKING

Most stories about soil include the inevitable lengthy interview with a farmer standing in a field. Larkin Martin would love to spend more time on her family farm nestled in the Tennessee Valley near Courtland, Alabama, but Martin is the modern farmer, and the modern farmer has to be on the move. The seventh generation farmer understands the critical nature of keeping agriculture relevant to the consuming public. As such, she's entrenched in agricultural education, helping to foster the next generation of farmers.

On this particular morning, she wheels down I-55 from Memphis to New Orleans, jumping from the Cotton Board meeting to the 2016 Commodity Classic, while handling an interview request via phone (a hands-free device, of course).

Martin was part of the Farm Foundation Round Table in 2013 that assembled governmental agencies, academicians and producers

from every part of the spectrum – organic to conventional production – to discuss the challenges facing the sector as a whole.

While the conversations yielded interesting dialogue, there was little agreement on any subject of significance until the topic of soil emerged. "All of a sudden, everyone was in agreement that one of the most important aspects of any farming operation was soil health," Martin said. "We needed to understand it better and have more research. This was the opportunity that brought everyone together."

The Round Table ended but the discussions continued. Soon, a group reassembled and a name emerged – the Soil Renaissance.

Within months, the Soil Renaissance meetings were bringing together farmers, ranchers, soil scientists, economists, environmental interests, agribusinesses, nongovernmental organizations and governmental agencies to examine the state of soil health. The goal was simple: advance soil health and make it the cornerstone of land use management decisions. In other words, this soil movement stayed focused on the farmers, ranchers and land managers.

For two years, the group held round table discussions. They discussed the critical need for a standardized measurement system that focuses more on the biology of the soil than just the chemical and physical attributes. They debated the economics of soil health in an agricultural system: (How can farmers benefit from investing in soil? Will appraisers recognize land with healthy soil as more valuable?).

The group dissected current soil research and uncovered a vast network of disconnected scientists and a bevy of unexplored areas.

Underscoring it all was the need for more education and communication. The roots of the farmer-faced soil movement grew deeper and deeper until sprouting an idea: there was a need for a broadly funded national organization to serve as a hub for measurement standards, economic data and coordinated research. And with that, the Soil Health Institute was born.

PARTNERING FOR GREATER GOOD

In recognition of World Soil Day, Dec. 3, 2015, the Noble Foundation and the Farm Foundation, NFP, officially announced the launch of the Soil Health Institute from the Washington Press Club in Washington, D.C.

From the podium, Bill Buckner, president and chief executive officer of the Noble Foundation, said: "Leonardo da Vinci once mused 'We know more about the movement of celestial bodies than about the soil underfoot.' Hundreds of years later, that sentiment is just as accurate. The Soil Health Institute will provide much needed research funding so we can better understand our soil. We will make that research publicly available so we can work together to provide solutions for improving our soil and protecting it for our children and grandchildren."

The Soil Health Institute's mission is simple: safeguard and enhance the vitality and productivity of the soil. The organization will work to set soil health standards and measurement, build knowledge about the economics of soil health, offer educational programs, and coordinate research in soil health, running the gamut from basic to applied.

This research includes understanding the soil-root interface. "While plant scientists know how plants respond in general to soil, they do not understand the relationship of the microbiomes in soil and how they interact with plants through the roots," Buckner said. "This research space is largely unexplored."

On the morning of the Soil Health Institute launch, Jason Weller was preparing for his own soil-related event just a few blocks away. Weller serves as chief of the NRCS in the United States Department of Agriculture, which – on that day – was marking the International Year of Soils (as designated by the 68th United Nations General Assembly) with a special reception and guest speakers.

Weller, as well as other members of the NRCS, played pivotal roles in the Soil Renaissance, and their support for the Soil Health Institute helped unify efforts in the soil sector.

The NRCS has played a critical role in natural resource management within the United States. In 2012, the agency launched the "Unlock the Secrets of the Soil" campaign that provided educational resources to farmers and students. The campaign helped lay the foundation for the creation of the NRCS's soil health division. (It was also led by Wayne Honeycutt, Ph.D., deputy chief for Science and Technology, and future Soil Health Institute president and chief executive officer.)

On that December morning, as the Soil Health Institute came into existence, Weller couldn't help but think the NRCS had just gained a tag-team partner in the match of the century. "One organization cannot take on this challenge alone," Weller said. "We need as many organizations as possible to contribute. The Soil Health Institute offers a huge opportunity to have public-private partnerships come together to advance a specific problem. These collaborations amplify our country's strength in soil research and will expand the knowledge base to find solutions."

Shortly after its founding, the Soil Health Institute named 13 people to its board of directors, including four full-time farmers, one of whom was Martin. "We're starting from scratch in so many ways, but we have brought together individuals who believe in taking care of our soil," Martin said. "The Soil Health Institute will be the catalyst for fact-based, science-based, directed research. The great dream is to build an organization that does for soil what NASA did for space."

Q&A

Ann Noble Brown

The youngest child of founder Lloyd Noble, Ann Noble Brown reflects on her father's life and legacy. While others called Mr. Noble a leader, philanthropist or visionary, Ann simply knew him as "Daddy."

HOW DID YOUR FATHER MEET YOUR MOTHER?

Mother was in Alpha Chi Omega, a sorority, and so was Daddy's sister Mary. So one time when he was visiting Aunt Mary, he met Mother. He thought she was pretty, and he liked her.

WHAT ATTRIBUTE CAUGHT YOUR MOTHER'S ATTENTION?

His persistence. Her family lived in this little town near Holdenville, Oklahoma, that had a train station. One day, Daddy called Mother. Her family did have a telephone. I think it was one of those that you cranked. He said he wanted to come see her. She said, "I think that would be nice, but you should come another time." There had been a rainstorm, so she explained that roads were not usable and the train was not available. He said, "Oh, I can get there." He was persistent, and she said, "OK."

WHAT HAPPENED WHEN YOUR FATHER WENT TO SEE HER?

As the story goes, he drove his car as far as he could go, then walked 9 miles down the tracks. Daddy said: "It was the funniest thing. I met this old boy coming down the tracks the opposite way." Apparently it was another boy who had called on Mom, but she had sent him on his way. (Laughter) So that's how they got together. I guess she decided that if he was willing to walk that far, he was worth a second look. They married in 1924.

WHAT'S YOUR EARLIEST MEMORY OF YOUR FATHER?

I have many memories of Daddy. One is of him coming home from work and playing with us kids. Daddy would get down on the floor and my brother Eddie would ride on his back like a horse. Eddie wouldn't fall off. He would stay right with him. Daddy would call him "horse fly" because he couldn't get rid of him.

HOW DID HE COME TO SERVE THE UNIVERSITY AS A REGENT?

He attended the University of Oklahoma a few times as a young man to study law but never graduated. He loved education. After Daddy had become a successful businessman, Gov. William "Alfalfa Bill" Murray asked him to serve on the Board of Regents in 1934. They had never met, and Daddy was of the opposing political party. Daddy eventually served two, seven-year terms.

WHAT CHANGES DID HE HELP MAKE AT THE UNIVERSITY?

Daddy thought the professors weren't paid enough, so he helped get pay raises for promotions and a retirement plan. He helped create the faculty senate and the University College, a two-year program for all freshman and sophomores who would study liberal arts before selecting a major. Daddy remembered his own difficulties in selecting a major when he was a student. He also played a role in promoting athletics at the university. He believed a good football team would build school pride. Boy, was he right.

HOW DID YOUR FATHER GET INTO THE OIL BUSINESS?

My grandmother, his mother Hattie, cosigned a $15,000 loan for him to purchase his first drilling rig with his partner Art Olsen. After just a few years, Daddy went out on his own, forming his first drilling business. Shortly after, he formed an oil production company.

WHAT WAS THE NAME OF THE PRODUCTION COMPANY?

It was called Samedan. The name came from combining the names of us kids – Sam, Ed and Ann. The funny thing is his first secretary, Myrtle Moore, was the one who came up with the name. Today, it is called Noble Energy.

WHAT DID PEOPLE SAY ABOUT HIM AS AN OILMAN?

He was one of the best drillers of his day. He brought new technologies into the business. He was able to drill places where others had failed. He earned a reputation as an honest and smart businessman. His handshake was gold.

DID PEOPLE ENJOYING WORKING FOR YOUR FATHER?

People loved working for Daddy. He gave them a good wage and expected an honest day's work

in return. There are stories of his workers who would hit a rough spot, they got sick or needed something, and suddenly the problem would be taken care of. He never told anybody, not even us, but we knew it was him.

WHY WAS HE BIG ON LUNCH MEETINGS?

He liked to bring people home for lunch because that way, he said, "They have to go back to the office, and I have to go back to the office." So no one lingered too long. Daddy would bring home anybody for lunch. It could be the roughnecks or the janitor. Anybody he wanted to learn from.

WAS YOUR FATHER OUTGOING OR FOND OF SOLITUDE?

I think he could be either way. He loved people. He had a very diverse group of friends. Some of them were characters. He liked interesting people. But he also built a cabin out on some land north of town (Ardmore, Oklahoma). It had one bedroom and a nice porch. But the one thing he refused to have out there was a telephone.

WHEN HE RETURNED FROM TRAVELING, HOW DID HE LET YOU KNOW HE WAS HOME?

Daddy had his own plane, and his pilots were characters, to say the least. When they'd fly back into town, he'd have the pilot buzz the house so we'd know to come pick him up at the airstrip.

WHAT ROLE DID YOUR FATHER PLAY IN WORLD WAR II?

Along with a partner, he provided the manpower and equipment for a secret mission to drill oil in Sherwood Forest. Before the U.S. got into the war, England was running out of oil to fuel their planes and ships. They couldn't drill the way we could, so Daddy sent people over there and got the oil they needed to keep them in the war. Without it, the English might have surrendered. He never took a penny for anything he did. He said it was his contribution to the war effort.

HOW DID YOUR FATHER BECOME SO INVESTED IN THE LAND?

As a young man, Daddy saw the result of planting too much cotton and not taking care of the soil. At that time, farmers just didn't have the education we have today. Then he spent a year living on a farm by himself. He loved the land, and he respected the people who worked it. He saw farmers and ranchers as some of the best people. As a grown man, he lived through the Dust Bowl. He knew that we had to take care of the land. He saw how without good soil and good land, Oklahoma suffered.

WHY DID HE START THE NOBLE FOUNDATION?

He wanted to create a place where farmers and ranchers could go to get answers and help, a place where they could help solve the problems facing agriculture.

WHY WAS THE FOUNDATION NAMED FOR YOUR GRANDFATHER?

Daddy wasn't about personal recognition. Instead, he took the opportunity to recognize his father, the most charitible individual he said he had ever known.

WHAT WAS HIS HOPE FOR THE NOBLE FOUNDATION?

He wanted the organization to help farmers and ranchers and improve the soil, but he gave the leaders the room to decide how they would do that. He knew each generation would need to explore and make that mission their own so they could solve the particular problems their generation was facing.

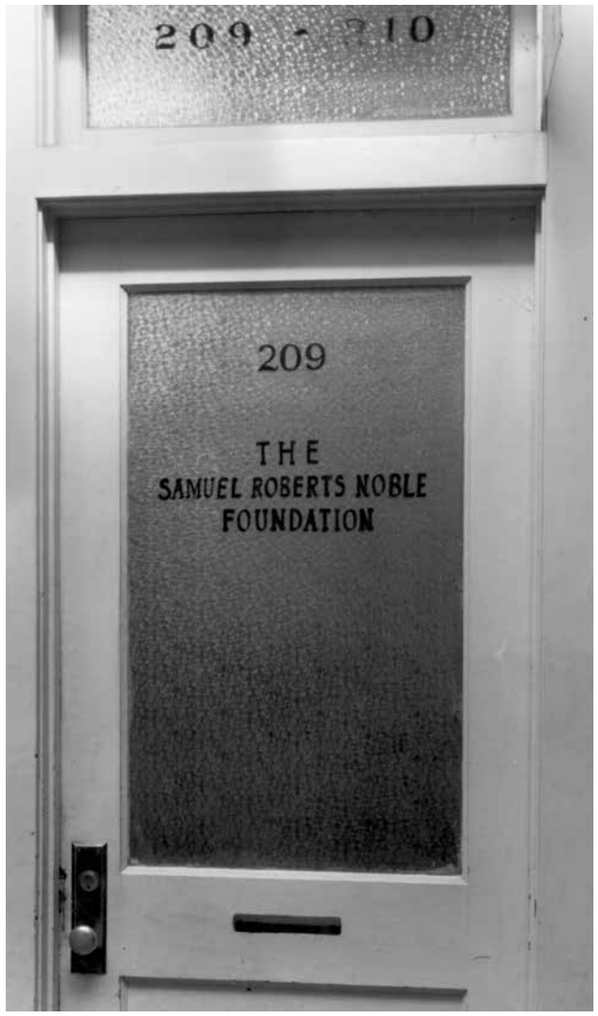
WHAT WOULD HE SAY ABOUT TODAY'S NOBLE FOUNDATION?

He'd be proud. We're all proud of it. It has helped so many people, and that's what he wanted it to do.

Ann Noble Brown and her husband, David Brown, M.D.

MILESTONES

1940s



1946

The Noble Foundation awarded its first grant – $14,000 for an electron microscope – to the University of Oklahoma.

1945

Lloyd Noble established The Samuel Roberts Noble Foundation on Sept. 19 as a resource to encourage farmers and ranchers to adopt practices that would benefit the land, increase agricultural productivity and improve quality of life. He named it in honor of his father, who he described as the most charitable man he ever knew.

1946

A three-year soil and garden contest featuring cash prizes was established to create widespread interest in the Noble Foundation's work. In addition to providing fertilization recommendations, Noble Foundation field agriculturalists advised participants on how to plant and conserve the soil.

1946

Operations relocated from the Samedan (Lloyd Noble's oil company) office building to the second floor of the Von Weise office building at the southeast corner of the intersection of C Street and Main Street in downtown Ardmore, Oklahoma, and a soil testing laboratory was established. Local farmers brought soil samples to be analyzed for fertilization recommendations.

Q&A

M.K. "Bud" Patterson, Ph.D.

In the 1950s, Bud Patterson saw agricultural research progress into cancer research at the Noble Foundation. He retired as the Biomedical Division director in 1993, after 42 years of service to the organization.

WHEN DID YOU JOIN THE NOBLE FOUNDATION?

I was the first summer intern in the Soils Laboratory. I spent the summers of 1948, 1949 and 1950 working in the lab on C Street in downtown Ardmore. I was hired on full time in 1951. I was assigned to a broom closet to grind soil samples on my first day of work, and I will never forget: I wore a white shirt. I never did get those stains out.

WHAT WAS THE FOCUS OF YOUR WORK?

Our focus was soil. Mr. (Lloyd) Noble was concerned about the nutrition of the plant life. I recall him visiting the lab during the summers of 1948 and 1949. He was very inquisitive and thorough. He wasn't just a founder; he had a vision and was interested in what was going on.

HOW DID BIOMEDICAL RESEARCH BEGIN AT NOBLE?

Our biomedical research stemmed from our work in agriculture. In 1948, a greenhouse had been built on the SEA Ranch north of town and hydroponics studies were conducted. We used sterile sand to grow plants, like oats, to measure the effect of specific elements on growth and nutritional content. We soon found out the added nutrients had a limited effect on the nutrition plants could provide to livestock or humans. In 1952, Thomas McCoy, Ph.D., proposed that the laboratory's emphasis be directed toward understanding how cells grow. This is when the Laboratory Section became separate from the Agricultural Division, although we continued to test soil for farmers.

WHAT RESEARCH WAS HAPPENING IN THE 1950s?

We were still publishing some significant agricultural research, but the emphasis on cellular metabolism continued. We started growing cells, first from chick embryos, then from cancerous tissues obtained from the local hospital. In 1954, Donald Kizer, Ph.D., joined us and started studying carcinogenesis and how normal cells turn into cancerous cells. Ralph Kampschmidt, Ph.D., joined the next year. He was interested in the systemic results of tumors on the body. Many of the studies initiated in the 1950s came to fruition in the 1960s and later years. Out of Kampschmidt's studies came the discovery of interleukin-1 (a naturally occurring protein that enhances the body's defense mechanisms when the body is under stress) in the 1970s. Interleukin-1 led to the development of interleukin-2, which continues to be used as a treatment for certain cancers.

HOW WAS THE BIOMEDICAL DIVISION UNIQUE?

We were an interesting phenomenon: a medical research group not connected to a hospital, university or governmental funding. Many spent their entire careers here, which is unusual in research. Six technicians – Elizabeth Anderson, Gene Conway, Boyd Howell, Merle Maxwell, Herb Upchurch and Wilbur Whittle – served a combined 208 years by the time the division transferred to the Oklahoma Medical Research Foundation in 1993.

DO YOU HAVE A FAVORITE MEMORY FROM YOUR CAREER?

In 1956, McCoy and Robert Neuman, Ph.D., were the first to report that the amino acid asparagine is required by some tumors. A large part of my work built on this finding, and through the 1960s we developed research that became the basis of the drug L-asparaginase, which is still a viable treatment for childhood leukemia. Merle Maxwell was one of the technicians involved with this work. One day, he brought a young fellow up to me and said, "He is what we are all about." The fellow had been diagnosed with acute lymphocytic leukemia and was treated with L-asparaginase. This young man actually thanked me. It felt good to see our work help people.

1950s

1950

Headquarters Farm was purchased and established as the main campus. The downtown offices and laboratory relocated to the new campus 2 miles east of Ardmore in 1951.

1951

A plant breeding program was launched to develop new small grains varieties, including oat, rye, wheat and triticale, better suited for grazing cattle on the Southern Great Plains.

1951

Oklahoma A&M University (now Oklahoma State University) partnered with the Noble Foundation to extend agricultural research operations beyond soil conservation to include beef and cattle production, field and horticulture crops, cropping systems, irrigation, and marketing. The partnership continued until March 1958 when the Noble Foundation's focus shifted to consultation in addition to research.

1956

Elbon winter rye was publicly released.

1952

The Laboratory Section was formed to study the possible relationships between soil fertility and the nutrition of plants, animals and humans. In 1958, this work evolved into the Biomedical Division to study how cells grow and, ultimately, into significant cancer, nutrition, tissue culture and aging research.

1958

The Agricultural Division consultation program was formed to assist local farmers and ranchers in applying research-based information to their operations. Consultation began with three farms in Carter County, Oklahoma, and seven surrounding counties.

Henry Carter works in a Biomedical Division laboratory in the 1960s.

1960s *and* 1970s

As man walked on the moon for the first time and new technologies like television became an everyday part of life, agriculture also saw a rapidly increasing amount of innovation. During this era, the Agricultural Division's consultation program grew in popularity as it provided research-based information to farmers and ranchers in the region and helped them adopt new tools and practices to improve productivity. By 1979, consultants regularly provided technical assistance to 354 cooperators while maintaining a growing waiting list of those seeking expertise. The Biomedical Division laboratories were also abuzz with exciting findings that led to the development of cancer treatments still viable decades later.

Bill Chapman and his son Ian Chapman stand in a pasture of winter wheat grazed by their cattle.

A RANCHING LEGACY

CHANGING *and* THRIVING

A black cowboy hat shades Ian Chapman's eyes as he watches the cattle in action before him. Hide and hooves dart from a working pen into pasture, a fluid stream of movement. Guided by three cowboys, the stocker steers circle back into a large, green wheat pasture where they slow, disperse and start munching.

It's a typical day at Chapman Farms, though "typical" is a word used loosely. Ian's father, Bill Chapman, sits in a white pickup truck nearby. Bill admires the way his son manages the operation he built up from his own father's years of farming, and he comments on the slow but steady changes that have occurred here.

This land, along the Washita River in southern Oklahoma, was once covered in peanuts and other crops, like corn and cotton. Now, it's cattle country.

Bill has seen technological advancements and urban sprawl, policy changes and market shifts. With change as a constant, agility is an attitude the Chapmans have adopted. And so is a willingness to listen to advice. For the past 48 years, Noble Foundation consultants have come alongside the family with the latest information to help them adjust and thrive, assisting them as they seek to improve and prepare for the change ahead.

PERFECT TIMING

Steam rises from Bill Chapman's University of Oklahoma coffee mug as he settles in at the head of a long wooden table in his downtown Ardmore office. Though retired, Bill can be found in the office most afternoons. The space speaks of years gone by. A farm sign honoring Bill's father, Fred Chapman, hangs from a wood-paneled wall; a fading black-and-white photograph of Fred during the Great Depression days rests on a cabinet.

Bill returned home to help manage the family farm in the 1960s, with a law degree. Fred had also graduated from law school but succumbed to the call of the land early on, nearly 100 years ago. Fred used to boast about the land along the Washita River and bought pieces of it when he could.

Though Bill and his older brother, Fred Chapman Jr., whose family also continues to build on the elder Chapman's legacy, spent their childhood summers living and working alongside their father's farmhands, Bill is quick to say he came to farming with no formal agriculture background. He started helping with the peanut, corn and cotton operations, doing everything as his father had always done.

As a native of Ardmore, Bill knew about the Noble

Foundation. His family attended the same church as the Nobles, and he knew Lloyd Noble's children from school. In 1958, the Noble Foundation's Agricultural Division initiated its consultation program (now called producer relations) to help farmers implement modern practices that would improve their land and livelihood. In 1966, the 12-person division had already had 1,766 personal interactions with farmers in the area. When Bill heard of these services in 1967, he signed up.

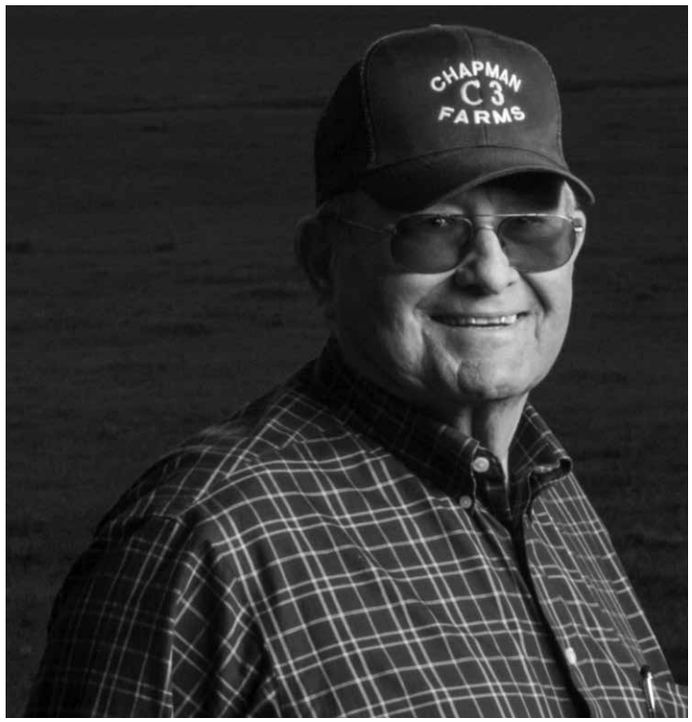
"It was perfect timing for me," Bill said. "The consultation services were getting going about the time I needed them, and I've always been so appreciative that they were there to help guide me."

When Bill first came home to farm, his father grew corn for silage to feed his cattle and oats for horses. Any wheat was grown for grain, and cotton and peanuts were major crops. But humidity scourged the fields of peanuts along the river. Fungal diseases crippled the crop, and changes to governmental agriculture programs through the 1970s and 1980s compounded the struggle.

As peanuts declined, wheat gained popularity with the formation of feedlots in the drier climates of western Oklahoma. One of the first practices the Noble Foundation consultants helped Bill adopt was transitioning peanut fields to wheat fields. Where any wheat grown by Bill's father would have been sold as grain, the Noble Foundation taught Bill to raise the wheat to be grazed by cattle.

In the areas Bill could not farm because of slope or soil quality, the Noble Foundation consultants showed him how to increase productivity by adjusting the size and breed of cattle. They helped him improve the soil by incorporating clover into wheat pasture as a cover crop. They tested soil, forage and hay samples, and they showed him how to keep records.

"They gave us the technology and advice we'd never had before," Bill said. "With their


CHAPMAN
C3
FARMS

help, we saw what we were producing and where we needed to improve."

EXPECTING CHANGE

Ian Chapman, one of Bill's four children, returned to help manage the family operation in the 1990s, after earning his degree in agriculture from Oklahoma State University. Out in the field, he and Bill stand on winter wheat pasture that was once covered in peanuts.

During the 1990s, the Chapmans completely transitioned away from the peanut business and focused on cattle.

In Ian's time on the ranch, he has seen change, too. Every day is different, and that's part of why he enjoys it. "It's a challenge," he said. "Things are always changing, so you've got to be looking at how you are doing it."

Increased regulation, from water use to antibiotics, means Ian is conscious of the need to decrease expenses. In the 1990s, the Noble Foundation helped the Chapmans transition to no-tilling their wheat fields, which provides benefits to their soil and saves time and money.

New technologies that provide data specific to individual cattle interest Ian as a way to further drill down the details of the operation and gain information to support his decision making.

This technology, and many others, is a focus of the Agricultural Division's Center for Advanced Agricultural Systems and Technology (CAAST), one of four research centers developed to meet the needs of agriculture's next generation.

"There is a lot of technology coming on the scene in agriculture," said Evan Whitley, Ph.D., CAAST manager. "We see our role as vetting these new technologies so that producers don't have to use their resources to do so. We want

Ian Chapman (in plaid front, right) oversees his employees preparing to move sorted cattle from working pens to grazing pasture.

to provide them with the data, the science, that will help them continue to improve upon the forage-based beef systems in the Southern Great Plains."

As part of CAAST, the Noble Foundation research farms, which are managed using proven practices comparable to other farms in the region, adopt cutting-edge tools like electronic identification (EID) technology to see how they could benefit real-world producers. The purpose is twofold. First, data collected renders knowledge related to animal health and performance, which can immediately be passed along to producers. And beneficial technologies can be moved along in the commercialization process so that they become tangible tools in the hands of producers.

The other three centers focus on pecan and specialty agriculture, economics, and land stewardship.

"That's one of the Noble Foundation's strengths," Bill said. "We can actually visit them and see what they are doing on their research farms, and they visit us in our environment. They also see change coming long before we do and give us real valuable advice through it."

As the sun sets on the day's work, Ian says he hopes to be able to pass the farm down to the next generation of Chapmans like it was passed to him. In order to do that, he fully expects change.

"We have to be flexible enough to change with the change so that we can do it again next year," he said. "The Noble Foundation has helped us manage in the past. They'll be there when we need to make decisions in the future."

Q&A

Gary Simmons

Gary Simmons served as a soils scientist and specialist in the Agricultural Division's fledgling consultation program. In 1965, he became the division's director, a role in which he served until retiring in 1988 with 31 years of service.

WHEN DID YOU JOIN THE NOBLE FOUNDATION?

Boyd Howell and I grew up together and served at Fort Hood, Texas, during the Korean War. He resumed his employment with the Noble Foundation when we returned home in 1955 and informed me of an opening in the Agricultural Division. Lyle Thompson, a research agronomist, interviewed me. Eight days after discharge from the U.S. Army, I started work.

WHAT WAS YOUR FIRST ROLE AT THE NOBLE FOUNDATION?

I did whatever needed done. I started out working in the laboratory, preparing soil and plant samples, and assisting with outside projects. The Agricultural Division was in full agricultural research in the 1950s. We hosted field days where farmers would come out and see what we were finding in our projects and how it could apply to their farms.

DID YOU RETURN TO YOUR STUDIES?

Boyd and I signed up for night classes at Murray State College. After a year or so, I decided to resign and go full time at Murray, then attend Oklahoma State University (OSU).

HOW DID YOU END UP BACK AT THE NOBLE FOUNDATION?

By 1958, Ray Dyer had become the Agricultural Division director, and the program emphasis changed to include team consultation along with research. In 1959, he visited OSU and asked if I would like to come back as a soils and fertility specialist.

WHAT WERE THE DIVISION'S PRIMARY ACTIVITIES?

The 1960s were years of change. We were putting new programs together, adding demonstration farms, a bull performance test, turf plots, stocker calf grazing studies, limited grazing studies, small grains research plots, catfish farming, grape production, intensified cattle operations, and major symposiums. We also released Bonel rye. We did all we could to serve the farmers and ranchers in our 100-mile service area. We had formed two consultation teams to help farmers implement practices to improve their operations.

SO THE CONSULTATION PROGRAM BEGAN TO GROW?

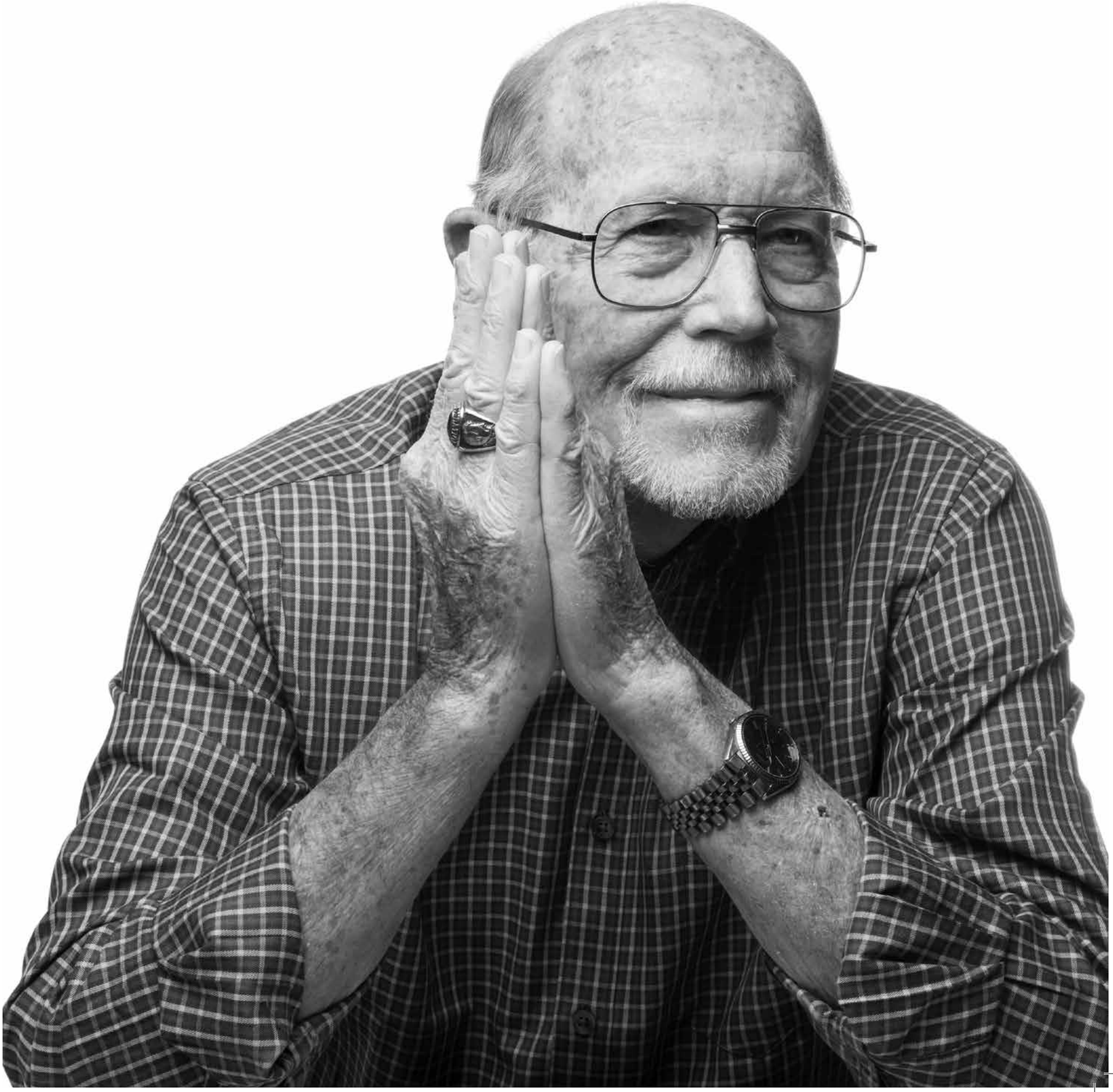
Yes, three farm families were selected in Carter County and each of the seven surrounding counties. They were officially recognized in their communities as "Noble Foundation cooperators." These families were the original participants in the newly organized specialized team approach program. A detailed plan based on their goals was bound between red covers and presented as a guide to improve production and income. Field days were sometimes held on their units to help pass information to others of their community.

IN WHAT AREAS DID FARMERS NEED CONSULTATION?

Very few farmers were using fertilizers in the beginning. Our soil testing laboratory and fertilizer demonstration plots helped show the need. Recordkeeping was often lacking, and we tried to help. In most instances, we weren't advising people to do anything we hadn't done. We could relate to them because we were involved in the work ourselves on the research farms.

HOW DID YOU BECOME THE DIVISION DIRECTOR IN 1965?

Ray Dyer was a humble person and met people well. These attributes qualified him to become the public relations representative for the Noble Foundation. Following a short period without a director, the trustees met and John March, president at the time, came down the hallway to my office, paused at the doorway and said, "Gary, you've been appointed as the new director." That was a shock to me. I was 32. Looking back, that's pretty young, but it lasted 23 years with the effort of a dedicated staff concerned for others.



1960s

1965

The Biomedical Division initiated research on what would become the L-asparaginase treatment for acute lymphocytic leukemia.

1966

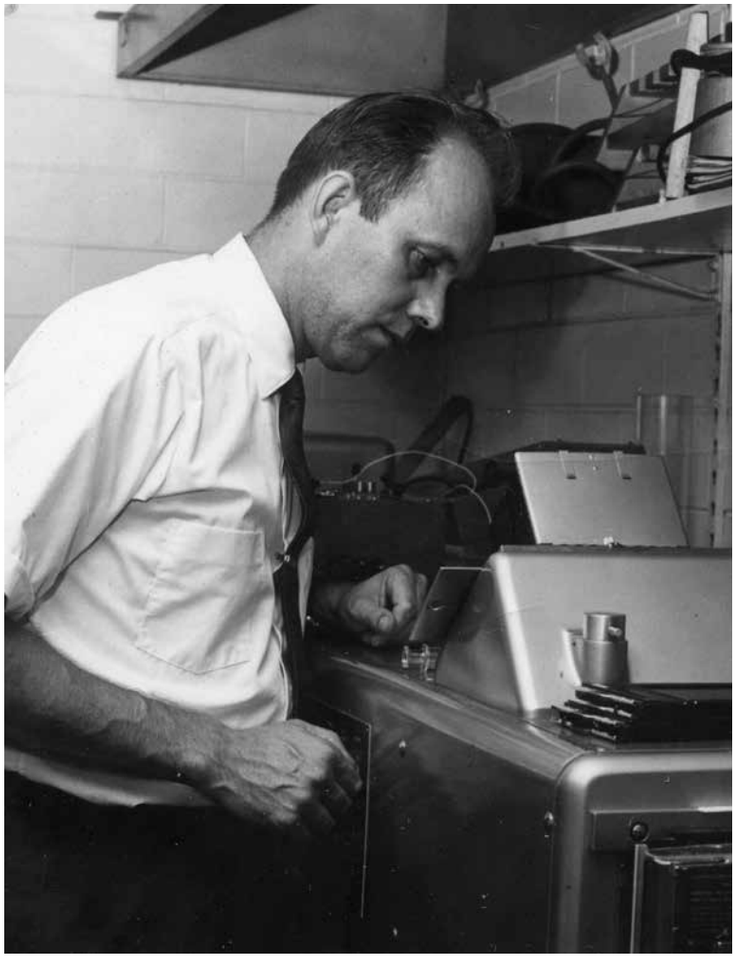
A small grains variety trial program was created to provide area producers with information about new varieties.

1966

Bonel winter rye was publicly released.

1966

The Agricultural Division's consultation program continued to grow and expand its service to area farmers and ranchers. Team specialists wrote 64 farm plans, and they received 254 long distance telephone calls, had 390 office visitors, wrote 845 letters relating to farm planning, and made 277 "follow-up" farm visits.



1969

Time magazine listed the L-asparaginase treatment for leukemia as one of the top 10 medical stories of the decade in its Dec. 26 issue.

Q&A

Boyd Howell

During the 1970s, Boyd Howell was part of the Noble Foundation's work in advancing cancer research. He contributed 42 years of service by the time he retired in 1993.

WHEN DID YOU JOIN THE NOBLE FOUNDATION?

In 1951, I interviewed with Col. Francis Wilson, the second president of the Noble Foundation. He called Thomas McCoy, Ph.D., and said, "I've got a man here you might be interested in." They hired me, and I started to test soils in the soils laboratory.

HOW DID YOU JOIN THE BIOMEDICAL DIVISION?

I was drafted into the U.S. Army in 1953. I was told that I would have a job when I got back, which I did. I came home in 1955 and went right back to work. They had started the Biomedical Division by that time. McCoy gave me the option to continue soil testing or to go into the newly formed Biomedical Division. I chose to go into the Biomed Division because I was interested in helping the overall cancer problem. I started as a lab technician and made my way up to senior technical associate.

HOW DID YOU ADVANCE IN YOUR CAREER?

I was fortunate to have the GI Bill and be able to go to school at night. After seven years of night classes, there were certain classes I needed to finish my degree that I could only get during the day. I talked with my supervisor, and he allowed me to work half-time and go to school the other half for my last year of school. The Noble Foundation has always supported their people as they pursued additional education, and they were willing to help make the schedule work. As a result, I earned my degree in business with minors in biology and chemistry.

WHAT WAS YOUR ROLE IN THE BIOMEDICAL DIVISION?

I worked in the laboratory preparing experiments and collecting and analyzing data. Because of my degree, I was able to become a lab manager. I ordered all of the supplies we needed to conduct our research. I was also in charge of the animal facility. We had maybe 1,000 rats at a time. I oversaw the people who tended to the animals' daily care.

WHAT WAS THE BIOMEDICAL DIVISION STUDYING?

By 1975, there were five research sections in the Biomedical Division: Cell Biology, Nutrition, Biochemical Pharmacology, Tumor-Host and Immunology. I carried out research in the Biochemical Pharmacology Section led by Donald Kizer, Ph.D., through the 1970s. Much of our research related to liver cancer. Beginning in the 1950s, we studied the development of cancer in rats to understand when the change occurred from normal cells to cancerous cells. We also worked on heart cells and lymph node cells.

WHY WAS THIS IMPORTANT?

If you could understand why cells change, you could potentially find ways to prevent or reduce cancer. Everyone across the country was looking for a cure. We weren't necessarily looking for a cure; we were looking for a cause. Finding the cause could lead to treatments that would lead to a cure.

HOW DID YOUR WORK FURTHER CANCER RESEARCH?

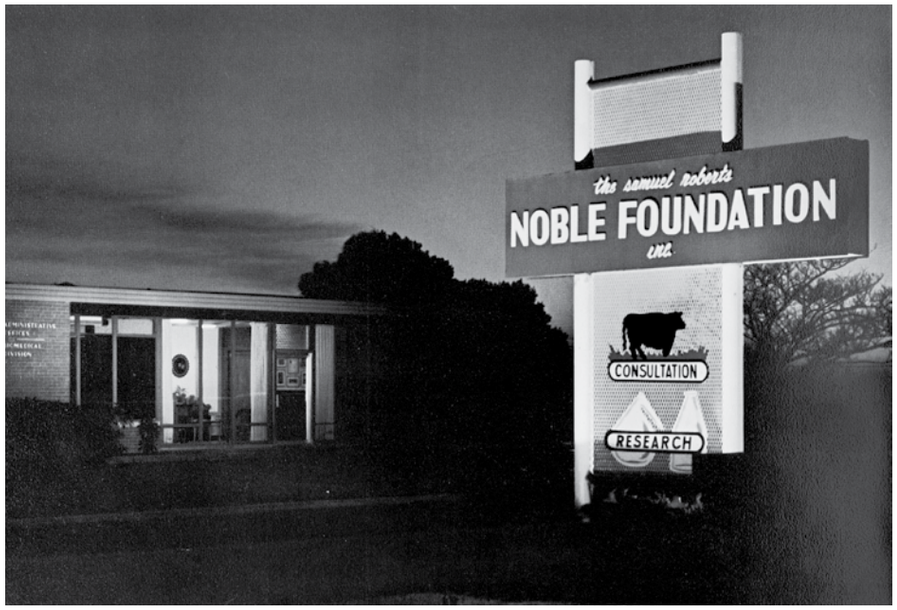
We added knowledge to the field of carcinogenesis – the beginning of cancer formation. Everything we did involved new findings that could help other researchers seeking answers about cancer. We'd find ourselves in places no one else had ever been; we walked on ground that had never been treaded.

HOW DID THAT FEEL?

It gave you the feeling that you were doing something important for mankind. What if what we were doing, what we were discovering, just happened to be the key to helping cure cancer? That was exciting. I am proud of the work we did.

MILESTONES

1970s



1973

The Red River Demonstration and Research Farm was purchased to demonstrate proper management and farming techniques for crops, livestock, pecans, irrigation and wildlife.

1974

The Biomedical Division was ranked 55th out of 527 institutions worldwide in the number of papers published in five leading cancer journals from 1966 to 1971. The ranking was published in a paper in the *International Journal of Cancer Research* authored by a staff member of the National Cancer Center Library in Tokyo, Japan.

1975

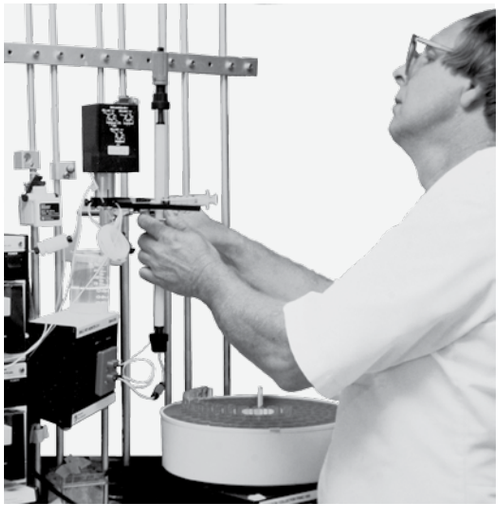
Maton rye was publicly released.

1976

The Pasture Demonstration Farm was purchased to demonstrate a model cow-calf and stocker grazing ranch.

1976

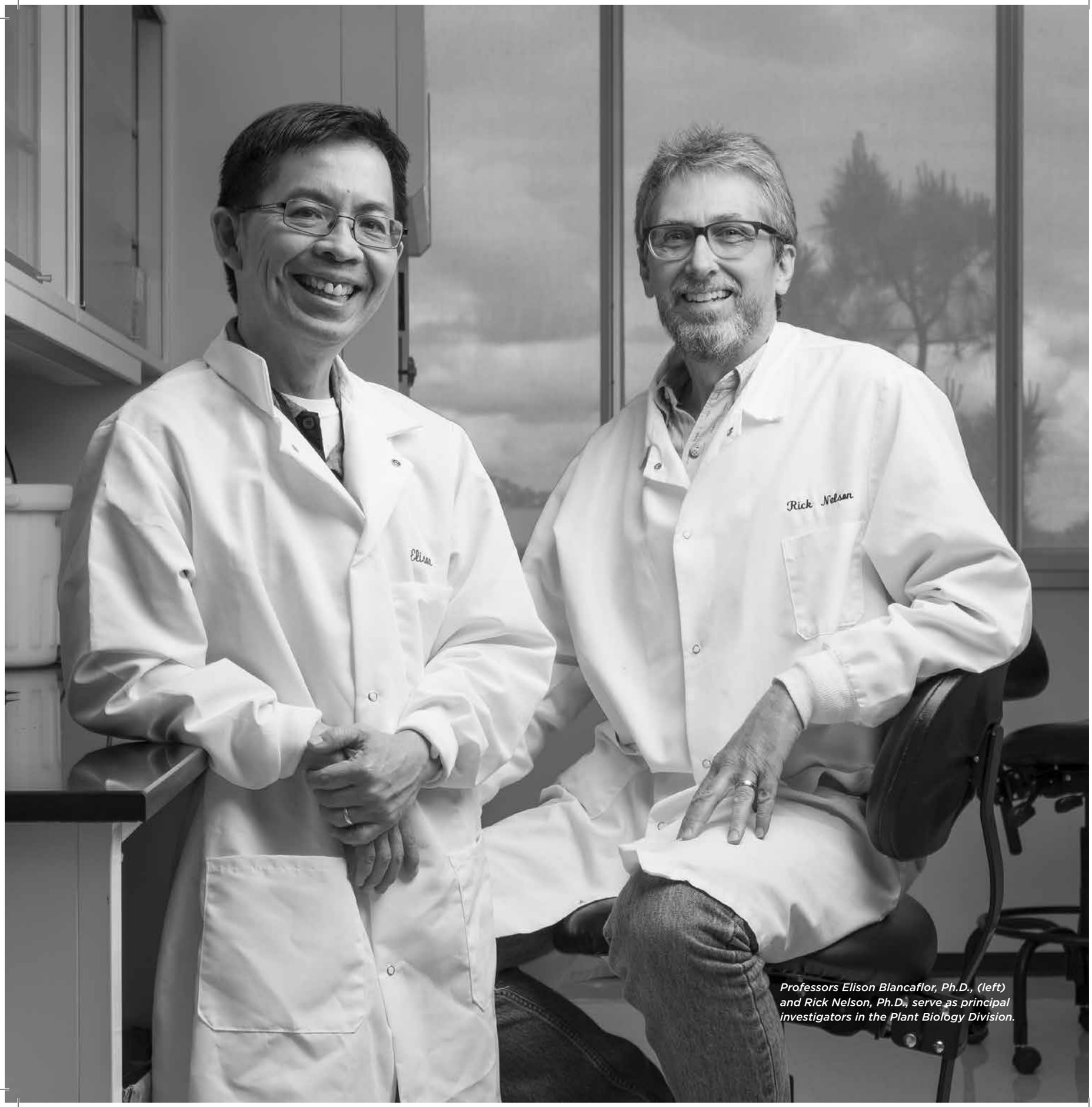
Biomedical Division researchers discovered that interleukin-1, a naturally occurring protein, enhances the body's defense mechanisms when the body is put under stress. This finding led to the scientific community's development of interleukin-2, a treatment for certain cancers.



Richard Bates, Ph.D., small grains breeder, works in the greenhouse in 1981.

1980s *and* 1990s

Troubling economic times fell on the nation in the 1980s, particularly in the Southwest where the energy and agriculture sectors were hit hard. The agricultural consultants continued to help farmers and ranchers in the area improve their land and increase efficiency. Public funds for research dropped, but the Noble Foundation continued to expand. The Plant Biology Division, created in 1988, and the Forage Improvement Division, established in 1997 as the Forage Biotechnology Group, emerged from an interest in exploring the inner workings of plants and using the latest technologies to produce new crop varieties that would ultimately help farmers as well as consumers. Together with the Agricultural Division, the Noble Foundation now possessed the ability to move research and discovery from the laboratory to the field.



Professors Elison Blancaflor, Ph.D., (left) and Rick Nelson, Ph.D., serve as principal investigators in the Plant Biology Division.

FUNDAMENTAL RESEARCH

from LAB *to* FIELD

Scientist Ana Paez-Garcia crouches in a wheat field bundling the young, green plants that James Rogers, Ph.D., a forage systems researcher, has dug from the ground. In the greenhouse, she washes dirt away from each plant to reveal an intricate network of roots. She counts each one and readies them to be photographed and analyzed in the microscopy laboratory.

Down a long corridor in an office nearby, root cells glow green on Principal Investigator Elison Blancaflor's computer screen. Bright fluorescence marks the location of the cytoskeleton, the "highways" where materials used to build and shape the root cell are transported. With the latest in microscopy technology, he sees the inner workings of roots.

Together, researchers in all three of the Noble Foundation's divisions – Agricultural, Forage Improvement and Plant Biology – move discoveries from the laboratory to the greenhouse to the field and back again. Each step builds upon the last, capturing new information about roots, how they acquire their complex architecture and how that knowledge could be applied to breeding improved plant varieties.

This single project – one of nine in the larger Forage365 initiative, which seeks to extend the grazing season and enable livestock producers to reduce hay consumption – illustrates how a united research effort can provide tangible outcomes for agriculture and consumers.

BUILDING THE LAB

Twenty-eight years ago, a section of the building in which Elison Blancaflor, Ph.D., and Ana Paez-Garcia, Ph.D., make their offices was just a hole in the ground.

Rick Nelson, Ph.D., remembers standing in the original building overlooking the construction site in 1988, the year he joined the newly formed Plant Biology Division. Richard Dixon, Ph.D., the division's founding director, stood next to him. An open door gave them the perfect view into the man-made crater from which the new division building would be built.

"I remember Rick Dixon wondering if the building would be big enough for everything planned," Nelson said. "We knew exciting times were ahead."

Three years prior, in 1985, the Plant Biology Division was a mere thought. The Board of Trustees began exploring the possibility that year by visiting the Salk Institute's plant biology program in California. A relationship had formed between the two organizations in the 1970s, first out of a mutual interest in biomedical research, then toward increasing

Construction on the Plant Biology Division building began in 1988.

agricultural productivity.

By October 1987, the decision to create a Plant Biology Division at the Noble Foundation was official. Research staff and postdoctoral fellows began to arrive on campus the following February, and they set up laboratory space from scratch in what was then the Biomedical Division until their new building was completed in the summer of 1989.

Within the year, 23 staff members began conducting studies in the laboratory to complement the Agricultural Division's work serving farmers and ranchers. They studied plants important to agriculture at the cellular and molecular levels, learning how viruses, fungi and environmental stresses affected plant performance. They were especially interested in genetically improving plants consumed by livestock. With the help of the Agricultural Division, in 1993 the division became the first group in Oklahoma to field-test genetically engineered plants – a line of alfalfa that carried a potential oral vaccine against cholera.

In 1998, the Plant Biology Division decided to promote the use of *Medicago truncatula* as a model legume because it is a close relative of alfalfa, a major forage crop. Through the next three years, the Noble Foundation led the advancement of *M. truncatula* as the choice model for legume studies around the world by unravelling its genetic code.

This work gained the division international attention, and in 2001 the Noble Foundation collaborated with the University of Oklahoma to initiate the genome sequencing project of *M. truncatula*. "Scientists worldwide have used this sequence for basic and applied research," Nelson said. "There is no question that the Noble Foundation is understood to be the originator of that work."

Within 10 years of the division's creation, the staff more than tripled to 75. The next step for the Noble Foundation was to bring in a team that could take the Plant Biology Division's findings to the field to be produced and tested in conditions comparable to those in which real-world agricultural producers operate.

In 1997, the Forage Biotechnology Group, now known as the Forage Improvement Division, was formed to develop cool-season forage varieties better suited for farmers and ranchers

Ana Paez-Garcia, Ph.D., studies root architecture through the Forage365 initiative as a postdoctoral fellow in the laboratory of Elison Blancaflor, Ph.D.

Associate Professor Carolyn Young, Ph.D., serves as a principal investigator in the Forage Improvement Division.

The Plant Biology Division employed 14 staff members and hosted nine postdoctoral fellows and visiting scientists by December 1988.

in Oklahoma, a task that bridged the gap between Plant Biology's fundamental work and the Agricultural Division's applied work.

TO THE FIELD

Carolyn Young was a Ph.D. student in New Zealand when she first heard about the Noble Foundation during a presentation by scientist Maria Harrison, Ph.D., in the early 2000s. "I was sitting there in amazement at this private institution," Young said. "I didn't know where Ardmore, Oklahoma, was, but I was captivated by all the great research they were doing."

She told her husband, David McSweeney, who now serves as the Noble Foundation biosafety and greenhouse research manager, that he needed to sit in on Harrison's next seminar because this was where she wanted to work.

Young joined the Forage Improvement Division in 2006 and started a laboratory to study how a fungus, called a fungal endophyte, living within cool-season grasses like tall fescue provides its host protection against dry climates.

This characteristic is important to those who grow tall fescue in the Southern Great Plains, but the endophyte also produces compounds toxic to cattle that eat it. Young's research takes her both to the lab and the field as she works with grass breeders to produce tall fescue with an endophyte that carries the beneficial characteristics minus the toxicity.

In 2011, a collaboration between the Forage Improvement Division and Grasslands Innovation Limited in New Zealand led to the commercialization of a new tall fescue variety, Texoma MaxQ II, which provides those characteristics to beef producers in the Southern Great Plains.

"From that initial meeting with Maria, I could see how the pieces fit together," Young said. "I enjoy lab work, but I am also interested in seeing how basic science turns into applied science and ultimately helps farmers and ranchers."

Today those pieces have culminated in research clusters that harness the expertise of Noble Foundation researchers from all three divisions. They come together, discuss problems facing agriculture and work together to solve the most pressing ones. The clusters focus on understanding how plants grow and develop, interact with microbes and animals, and grow productively with fewer inputs, as well as gather the information plant breeders need to develop improved varieties.

"It makes sense," Blancaflor said. "You can't tackle complex problems on your own. You need a multidisciplinary approach – basic science, translational science, getting the information and technology to farmers and ranchers. We already had the pipeline. By forming the clusters, we were able to strengthen working relationships among the operating divisions, as well as advance our research with our outside collaborators."

More recently, Young's focus has expanded to include a soil-borne fungus that infects crops like alfalfa and pecan trees, resulting in a deadly and economically devastating cotton root rot disease. She works directly with James Rogers, Ph.D., a scientist in the Agricultural Division, and Kiran Mysore, Ph.D., a scientist in the Plant Biology Division, to study the progression of cotton root rot and ways to overcome it as part of Forage365 and the plant-microbe cluster.

For the future, Noble Foundation researchers hope these clusters will help them develop new plant varieties and management practices that reduce farmers' and ranchers' need for costly inputs, and enable them to continue producing food and caring for the land in the face of dwindling resources and climatic challenges such as drought.

"The research clusters enable us to see and discuss what other researchers are doing so that we can identify new ways of interacting on projects like Forage365," Nelson said. "To keep those special outcomes coming, we have to understand what's going on in the field at the basic level. And findings in the laboratory have to be tested in real-world situations. There is no doubt that Forage365 is an effort to get work done that has practical application by spanning the spectrum of research from laboratory to field."

Q&A

Maria Harrison, Ph.D.

In February 1988, Maria Harrison became the first postdoctoral fellow to arrive at the new Plant Biology Division. She ultimately led her own laboratory at the Noble Foundation before taking a position at the Boyce Thompson Institute in 2003.

WHAT DREW YOU TO THE NOBLE FOUNDATION?

I was interested in the research being carried out by Richard Dixon, Ph.D., who was the founding director of the Plant Biology Division. In particular, I was interested in the question of how plant defense genes were rapidly induced on perception of signal molecules from fungal pathogens. He offered me a position and a project that aligned well with my interests. Additionally, the opportunity to participate in the development of the new research division, from the ground up, was very exciting.

HOW WOULD YOU DESCRIBE THE ATMOSPHERE THEN?

There was an atmosphere of excitement and opportunity. Obviously, it is challenging to start from scratch, really from scratch, including unpacking the first lab equipment, which I did on one of my first days. But as additional members arrived and Rick's vision for the Plant Biology Division became apparent to us, there was an increasing sense of the huge potential to build something significant and make a real impact, advancing plant science and ultimately agriculture.

WHAT WAS YOUR MOST VALUABLE POSTDOC EXPERIENCE?

It is difficult to say because your time as a postdoc is filled with new experiences that shape your future. For me, one of the most valuable experiences was the many opportunities to present talks at lab meetings, to visitors or at conferences. As a new postdoc, the mere thought of standing up to present a talk to an audience petrified me. My first presentation outside of the Noble Foundation was at a meeting of a section of the Oklahoma Academy of Sciences. I survived.

WHAT IS THE MOST VALUABLE LESSON YOU LEARNED HERE?

Fifteen years is a long time, and there were many valuable experiences, lessons and advice from Rick Dixon, my many colleagues and the nonresident fellows. One that has stayed with me was a question that nonresident fellow Professor Sharon Long from Stanford University asked me during an annual research presentation: "Is the question big enough?" She was asking whether the proposed research addressed a really significant question in my research field. It was an excellent question for a young group leader to consider and one that I have continued to ask myself whenever I plan new research.

HOW DID THIS IMPACT YOUR CURRENT POST AT BTI?

At BTI, I lead a research group in studying an interaction between plant roots and beneficial fungi that helps plants capture phosphate and nitrogen from the soil. I started this research at the Noble Foundation, so much of our research today builds on the initial discoveries my group and I made during my days at the Noble Foundation.

WHAT CURRENT RESEARCH ARE YOU MOST PROUD OF?

The identification of a phosphate transporter protein that the plant uses to capture phosphate that the fungus delivers to the root, and the finding that this protein is essential both for phosphate delivery and for the continuation of symbiosis. Also, the discovery of how the plant cell puts the phosphate transporter in the correct location in the cell. These discoveries provided important insights into how symbiosis works.

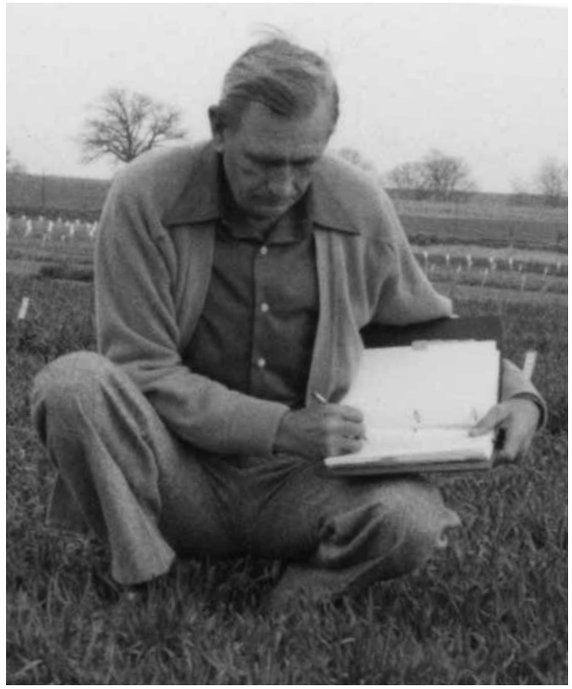
WHAT ADVICE DO YOU HAVE FOR POSTDOCS CONSIDERING WORKING AT THE NOBLE FOUNDATION?

The Noble Foundation is an exceptional organization. The research support and facilities are unparalleled among plant biology research institutes, and this provides possibilities for high risk, high reward research programs. I greatly enjoyed working there and am thankful for the many opportunities it afforded me as I launched my career.

1980s

1982

The Salk Institute requested the Noble Foundation's financial support of its biomedical research, first provided in 1977, be redirected to its new plant biology research program. This partnership eventually resulted in the Noble Foundation forming its own Plant Biology Division.

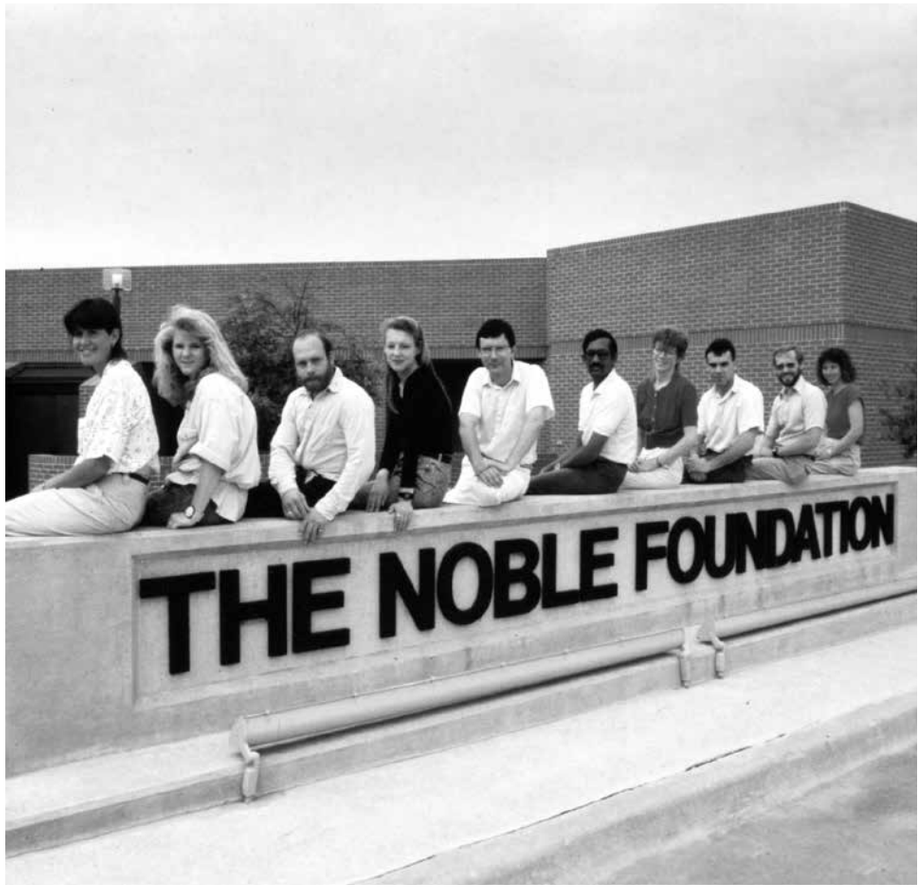


1986

The Noble Foundation acquired by lease the Coffey Ranch, which was used to research and demonstrate low-budget controlled grazing on native pastures.

1988

Red River crabgrass, the market's first forage-quality crabgrass variety, was publicly released.



1988

The Plant Biology Division was established to complement the Agricultural Division's service to farmers and ranchers by advancing research in plant genetics and crop improvement.

Q&A

Jerry Baker, Ph.D.

Jerry Baker joined the Noble Foundation in the 1990s and soon inherited the longstanding small grains breeding program. After 14 years of full-time service and another 10 as a consultant, Baker fully retired in 2014.

WHEN DID YOU JOIN THE NOBLE FOUNDATION?

In February 1990, I was hired to direct and organize the research activities of the Agricultural Division as well as the Plant Biology Division's field testing of transgenic plant products.

WHO LAUNCHED THE SMALL GRAINS BREEDING PROGRAM?

Roy Chessmore, Ph.D., started the program in the 1950s and released Elbon rye, the first forage rye variety in the U.S, in 1956. Elbon rye was widely adopted. The name "Elbon" became used as a term for any improved rye, similar to Coke and soda pop, and the variety remains popular today. Chessmore left in 1965, and in 1966 his Bonel rye cultivar was released.

WHERE DO THE NEW VARIETY NAMES COME FROM?

Both names – "Elbon" and "Bonel" – are made up of the same letters as "Noble."

WHEN DID YOU HEAD UP THE SMALL GRAINS BREEDING?

When I interviewed, Richard Bates, Ph.D., who had led the program since 1965, had already reached retirement age. George Hedger, Agricultural Division director at the time, told me that since I had plant breeding experience they may need me to take over the program when Bates retired. Three years after I started, Bates passed away. I took over the program, as well as the forage variety testing.

WHAT WAS BATES' LEGACY?

Through the rest of the 1960s until his death in 1993, Bates continued to develop better, higher yielding forage varieties for farmers. At the time of his death, he had only released Maton in 1975, but he had several in the pipeline. Breeding plants takes years of selecting, screening and testing before a new variety is released.

HOW DID THE PROGRAM GROW DURING THE 1990s?

The program was already well established and well known by the 1990s. I had the opportunity to continue Bates' work. I was able to complete the release of Oklon rye in cooperation with Oklahoma State University in 1993 and Bates rye with Texas A&M – his alma mater – in 1995.

HOW DO THE NEW FORAGE VARIETIES HELP PRODUCERS?

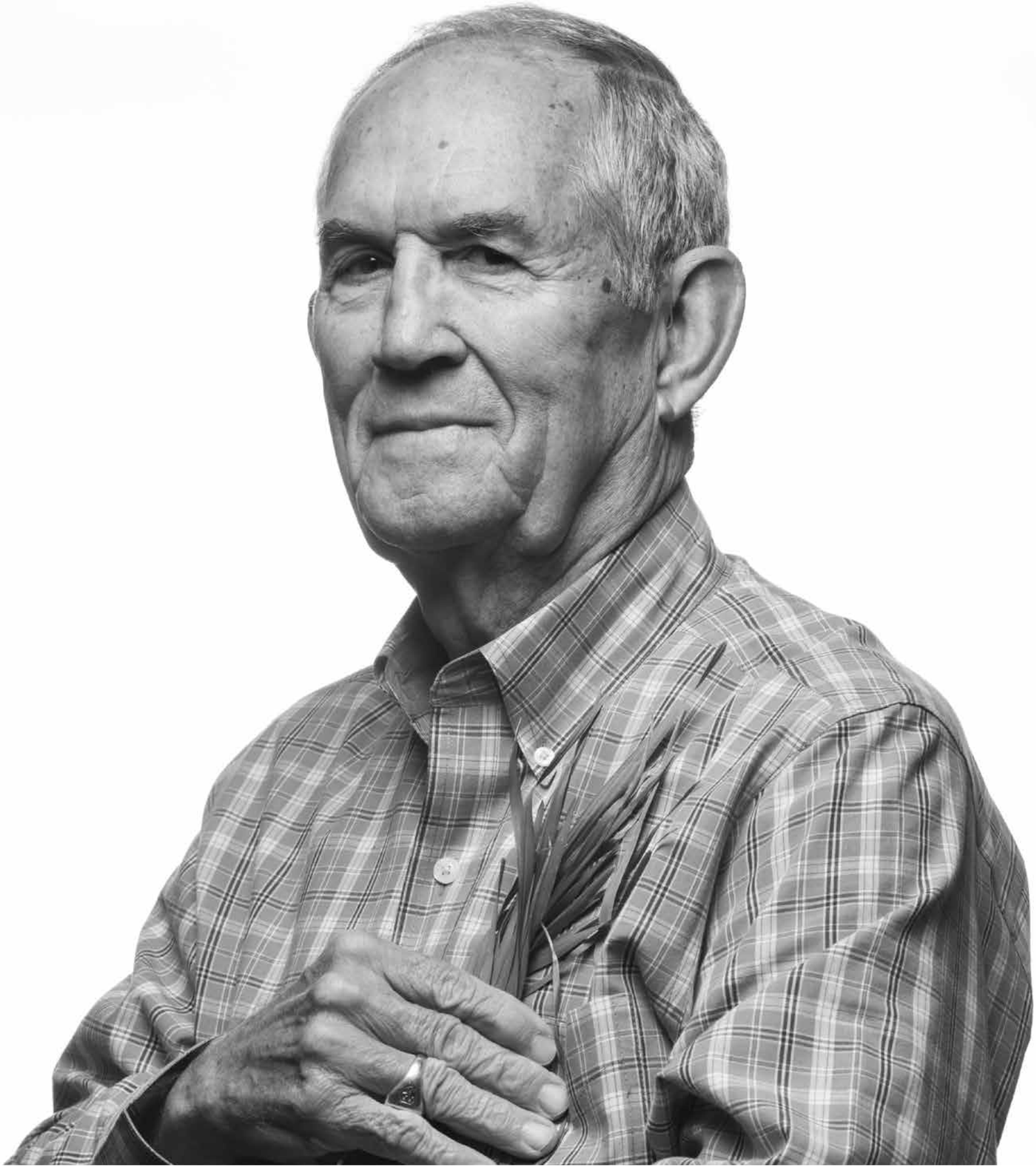
Every variety has its unique characteristics, and breeding new varieties is done to produce certain characteristics to meet the needs of farmers and ranchers. Since we work with mainly livestock producers, our focus was and continues to be breeding small grains for improved forage quality rather than grain quality. Developing a rye best suited for forage rather than grain made a big impact with producers in this part of the world and beyond, in part because rye produces faster fall and winter forage compared to other small grains.

WHAT INFORMATION DO VARIETY TESTS PROVIDE?

The variety tests are a way to show farmers how different varieties perform in the field. We also provided information to the consultants who in turn could help advise the farmers on what varieties to plant to get the best results.

WHAT DID YOUR WORK MEAN TO YOU?

It made you feel good to know you were a part of it. I did my best to work hard and continue to make progress in the program. By the time I retired from working full time in 2004 (I continued as a consultant until 2014), we had various good small grains forages in our program – varieties of rye, winter wheat, oat and triticale. Those are then handed to the next breeder, who continues the legacy of this work. You don't own this program; you only steward it for a time. I am appreciative that the Noble Foundation gave me the opportunity to be part of it for 24 years.



1990s

1993

The Plant Biology Division's initial vision of genetically engineering and field-testing crop plants with built-in disease resistance and other improved traits became reality in March, with the assistance of the Agricultural Division. The Noble Foundation became the first to field-test genetically engineered crops in Oklahoma.

1993

Oklon rye was publicly released.

1995

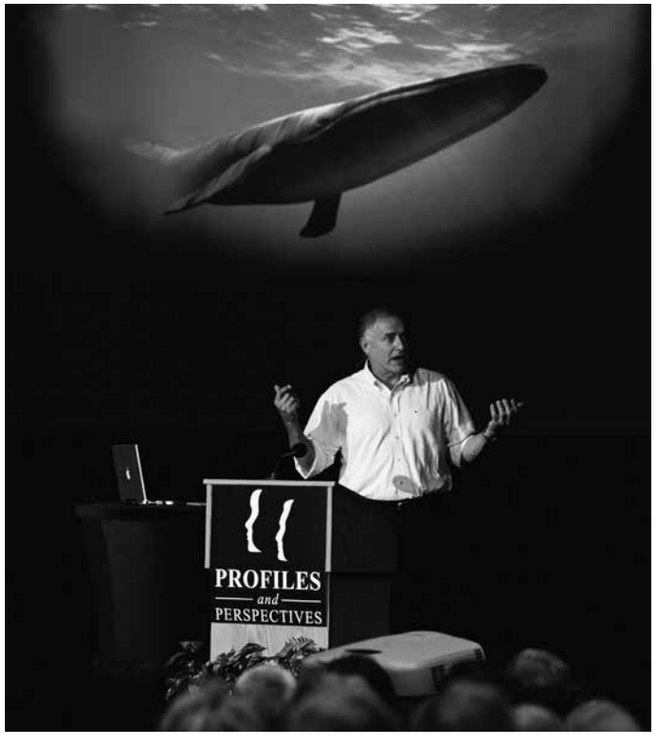
Bates rye was publicly released.

1997

The Forage Biotechnology Group was created to develop cool-season forages better suited for farmers and ranchers in Oklahoma and to serve as a link between the Plant Biology and Agricultural divisions.

1999

The first Sam Noble Scholarships in Agriculture and Technology were awarded to students in southern Oklahoma.



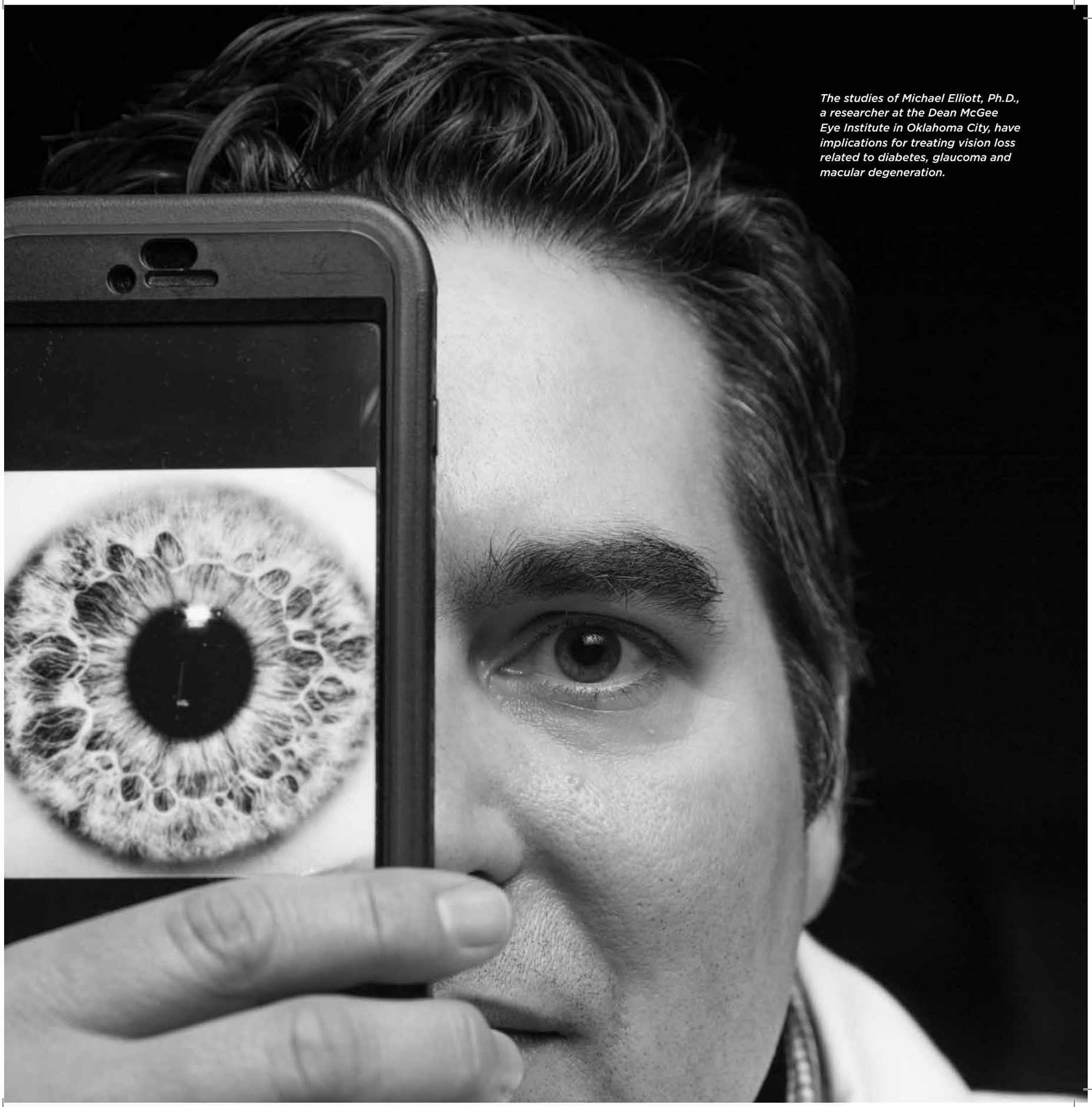
1998

The *Profiles and Perspectives* Community Enrichment Series launched to bring nationally recognized speakers, from astronauts to zoologists, to southern Oklahoma.


Medicago truncatula

2000s *and* 2010s

As the new millennium unfolds, the Noble Foundation's research accelerates in all phases - basic, translational and applied. Centered on gaining information about plants and animals essential to the Southern Great Plains, the work both adds to the international science community's knowledge and continues to develop into applications for farmers and ranchers. During this era, the Noble Foundation surpassed $1 billion in philanthropic giving to nonprofits and expanded its youth educational outreach through scholarships, internships (the Noble Summer Research Scholars in Plant Science and Lloyd Noble Scholars in Agriculture programs), and Noble Academy.



The studies of Michael Elliott, Ph.D., a researcher at the Dean McGee Eye Institute in Oklahoma City, have implications for treating vision loss related to diabetes, glaucoma and macular degeneration.

as FAR *as the* EYE CAN SEE

Soft sunlight shines through the glass walls of the Dean McGee Eye Institute (DMEI) in Oklahoma City. As the eye captures light and works with the brain to produce images of the surrounding world, so, in a way, does the Institute.

At DMEI, knowledge is generated through research and clinical trials much like the eye captures light. Instead of producing images, the research brings clarity to methods of preventing and treating eye disease. Just like the eye works with the brain, the Institute people – researchers, clinicians and surgeons – collaborate to help others continue to see the world around them.

In the early 2000s, research at the Dean McGee Eye Institute boomed. More space became a necessity, and a capital campaign was launched. In 2004, the Noble Foundation joined other donors to the campaign with a $1 million gift to help expand the facilities.

The result: these glass walls and the space to accommodate a vibrant world-class vision research program.

AT THE TOP OF THE LIST

It didn't take long for Michael Elliott to realize he needed to be in a laboratory with other vision science researchers.

Elliott stumbled upon eye research as a Ph.D. student at the University of Kansas in the 1990s. The laboratory in which he worked studied damage caused by oxidation in parts of the brain. A colleague at the time, who previously worked at the National Eye Institute, told him some of their research could be applied to the retina, the back-inside coating of the eye. Why not take a look, Elliott thought?

The more Elliott studied the eye, the more interested he became in the system and how the eye and brain partner to produce images. The lone eye researcher in the laboratory, Elliott buried himself in papers to learn more. He picked up on researchers' names through these papers, then met the name bearers at national meetings of the Association for Research in Vision and Ophthalmology.

"It became quite clear to me that if I wanted to stay in this field, I needed to be part of a lab that specifically studies the eye," Elliott said.

When the time came to apply for postdoctoral fellowships, the Dean McGee Eye Institute was at the top of his list because of a name that kept reappearing in the papers he had studied: Anderson, as in Robert E. "Gene" Anderson, M.D., Ph.D.

PRESTIGIOUS HONOR

Research at the Dean McGee Eye Institute was gain-

ing momentum in the early 2000s, thanks to several significant milestones still in play today, said Anderson, DMEI research director and Elliott's mentor.

First was a grant from the National Eye Institute that enabled DMEI to provide core research facilities to its research staff.

Then, in 2002, the Institute received the prestigious NIH Centers of Biomedical Research Excellence (CoBRE) grant, which provided$1.5 million per year for 10 years to identify and mentor young researchers in vision science.

Elliott was selected for the program in 2007.

"The program was phenomenally successful," Anderson said. "It launched the careers of seven young investigators." All seven are now tenured or on tenure track and have won their own R01 funding, the gold standard in grants from NIH.

There was only one problem: space.

"As we became more successful, we were bursting at the seams," Anderson said. "We were packed in 'cheek by jowl'."

Everyone, from junior to senior level, was sharing laboratory and office space. They were outsourcing clinical activity, which meant the researchers and clinicians couldn't have a close relationship to connect molecular knowledge with real-world situations.

Though they had the funds and desires to expand research projects and add researchers, they didn't have the room to accommodate anyone new.

Michael Elliott, Ph.D., studies retinal cells in laboratory space at the Dean McGee Eye Institute that was made possible through a gift from the Noble Foundation.

EXPANSION FOR THE FUTURE

About a hundred miles south, the Noble Foundation had a long history of supporting DMEI. Since 1974, the Noble Foundation has awarded DMEI nearly $3 million in support for research, construction and renovations.

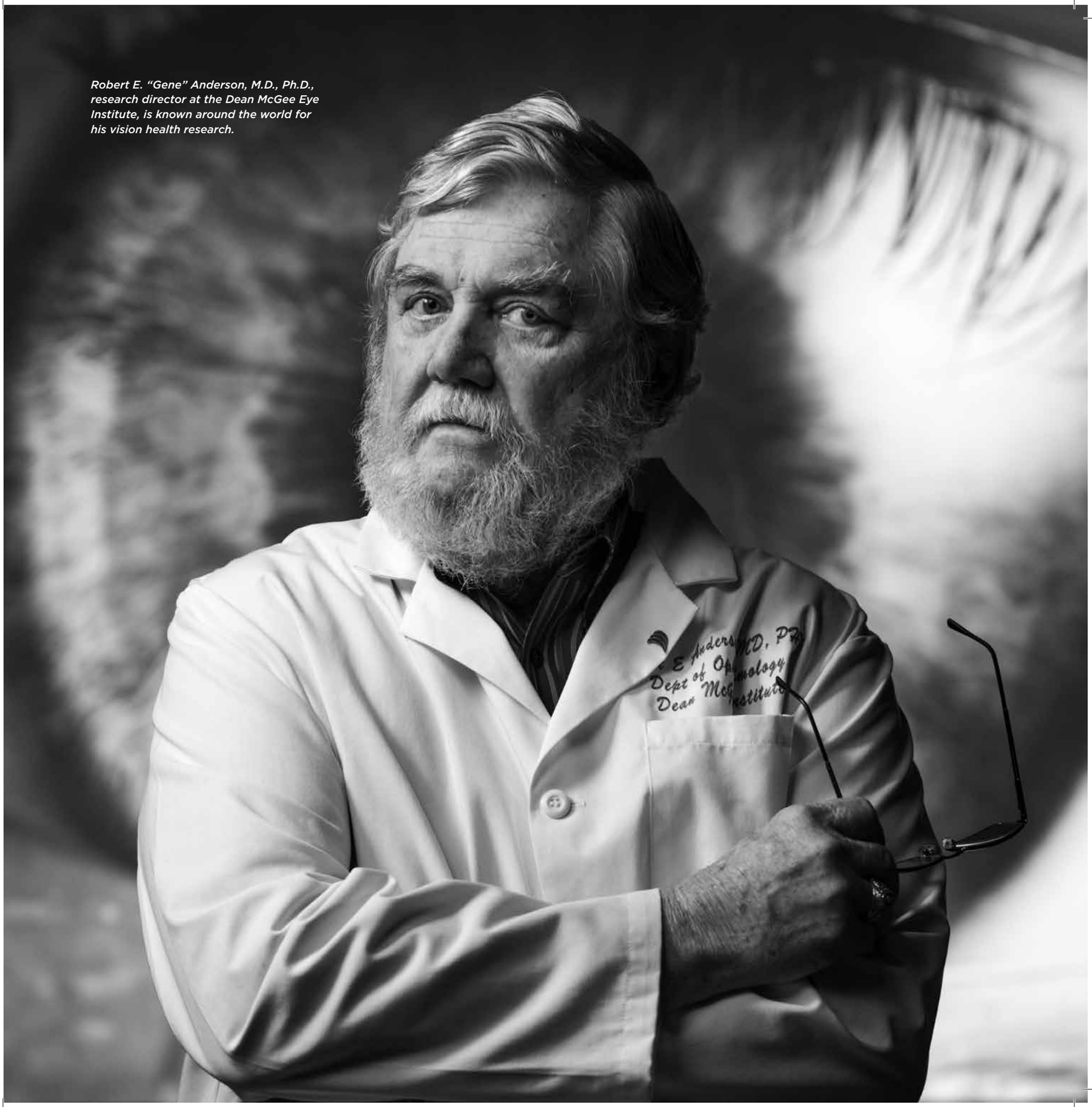
During this new era of growth and need in the 2000s, the Noble Foundation again stepped forward to help, providing its largest gift to date to DMEI: a $1 million contribution toward a facility expansion that doubled research space and expanded clinical programs by 40 percent.

"The Noble Foundation trustees value the Dean McGee Eye Institute's vital contributions to science and quality of life for those struggling with eye problems," said Mary Kate Wilson, Noble Foundation director of philanthropy, project management and engagement. "As stewards of a research institution themselves, they understand the importance of quality working facilities and were pleased to support this important project."

Construction was completed in 2011, and the effect was immediately felt by the researchers. "It was tangibly huge," Elliott said. "We went from everyone stumbling over each other to having enough space to bring in more people."

Elliott's lab space quadrupled, and for the first time he moved into his own office. The CoBRE-funded mentorship program provided him the funds and support he needed to kick-start his retina research, which has implications for understanding the mechanisms behind and treating vision loss from diabetes, glaucoma and macular degeneration. The building expansion provided the space he and the rest of DMEI needed to continue growing into the exciting research possibilities of the future.

"We are deeply grateful to the Noble Foundation," said Gregory Skuta, M.D., president of the Dean McGee Eye Institute. "Their meaningful and consistent support over the past four decades has allowed us to deliver a profound, lasting impact on vision health."



Robert E. "Gene" Anderson, M.D., Ph.D., research director at the Dean McGee Eye Institute, is known around the world for his vision health research.

Q&A

Lynn Riley

Lynn Riley became the director of CASA of Southern Oklahoma in 2004. For more than a decade, she and the Noble Foundation have enjoyed a relationship that strives to ensure the children in the court system have a strong and compassionate voice.

WHAT IS CASA?

CASA stands for "court appointed special advocates." A judge appoints a CASA volunteer to a child or sibling group when there is a problem at home requiring them to go through the justice system. The volunteer becomes the judge's extra set of eyes and ears; they become a voice for the child in order to find a permanent home for the child sooner rather than later. We are regular people who have only one concern: to investigate and research what is in the child's best interest.

HOW DO YOU HELP THE CHILDREN?

CASA volunteers are there through the entire legal process. In addition, we do everything we can to encourage and help get the child on track for success. We might buy glasses for the child, a musical instrument so he or she can participate in band, or clothing. It's not necessarily the big things that put a smile on kids' faces; it's being there to support them however we can. We do anything we can to encourage the children, to help build their self esteem and make them feel like they belong.

WHAT IS YOUR GOAL?

We want all children to be able to go back home, but sometimes that is not the case. Finding a safe, loving, permanent home for a child is one of the most vital things we can do. That's the ultimate goal. Sometimes, unfortunately, a child will stay in the justice system until they are 18. Our goal is to ensure their CASA is with them through the whole process to provide some stability, to make sure they know they are important and loved.

HOW DO YOU DEFINE SUCCESS?

There are big successes and little successes. Big successes are helping a child through a difficult family situation. Then there are the daily successes. I had a CASA volunteer come in the other day. She is working with a child who has struggled in classes and in different homes, and the child got student of the week at school. To us, that child getting student of the week is success for us and for them.

HOW MANY CHILDREN HAS CASA HELPED IN 2015?

In 2015, CASA of Southern Oklahoma served 216 children in Carter County and four surrounding counties.

WHAT IS THE CONNECTION BETWEEN CASA AND NOBLE?

The Noble Foundation has been the backbone of CASA of Southern Oklahoma since its early years of operation. They contributed significantly through the 1990s and early 2000s, and continue to this day. As years have gone on, we have been able to grow and extend our funding base, but I credit the Noble Foundation with helping us get established and helping us succeed. The Noble Foundation helps us feel solid.

WHAT DOES THE SUPPORT MEAN TO THE CHILDREN?

There are so many stories, so many things we are able to do for these kids because of the Noble Foundation. We become the call-home person for the children, and the Noble Foundation's support enables us to be there when the phone rings. I had one child who would call me just to see if I still loved her and if I missed her. Is that not what we do with our parents? Just as a CASA volunteer becomes a piece of the kids' lives, the Noble Foundation is a piece of us, a vital piece.

2000s

2001

The Board of Trustees approved a $100 million expansion that, within a decade, would broaden campus to more than 500,000 square feet of research and administrative space, and include the largest private, single-unit research greenhouse in the United States.

2004

The Noble Summer Research Scholars in Plant Science program was launched to offer undergraduate students the opportunity to conduct plant science in a real-world laboratory setting.

2001

The Board of Trustees committed $5 million toward the DNA sequencing of the legume *Medicago truncatula*. The genome of this model legume commonly used in research related to alfalfa, an important forage crop, was described by an international team of scientists in the scientific journal *Nature* in 2011.

2008

The Noble Foundation earned top 10 rankings as one of the "Best Places to Work in Academia" for scientific faculty and the "Best Place to Work for Postdocs."

2009

The Noble Foundation surpassed $1 billion in total charitable expenditures.

2009

The Lloyd Noble Scholars in Agriculture program was launched to offer undergraduate students the opportunity to work alongside agricultural consultants and researchers in a real-world, working environment.

Q&A

Fiona McAlister, Ph.D.

Fiona McAlister is the founding teacher of the Southern Oklahoma Technology Center Biotechnology Academy. Noble Academy partnered with McAlister and co-teacher Janie Herriott when developing the Noble Foundation's educational outreach program.

WHAT IS THE SOTC BIOTECHNOLOGY ACADEMY?

The Biotech Academy is a program for high school juniors and seniors. About 60 students come to us from 13 area high schools. They get real-world, hands-on experience in biotechnology concepts with applications in agriculture, environment, medicine, forensics and industry. The program started in 2006 and is now the model program for other biotechnology programs at technology centers throughout Oklahoma.

HOW DID YOU HEAR ABOUT NOBLE ACADEMY?

In 2013, Frank Hardin, Ph.D., called Janie Herriott and me with the news that the Noble Foundation was starting Noble Academy as a youth outreach program. The three of us met after classes one day, and we shared our ideas about how to light the fires of excitement for science and agriculture in the younger students. We were excited about this program. Both Janie and I were scientists at the Noble Foundation before becoming teachers. We thought Noble Academy would be a great avenue for the Noble Foundation to engage the community and students.

WHY IS IT IMPORTANT TO ENGAGE STUDENTS IN SCIENCE?

Science is interwoven into daily life. There are science issues all around us, and it's important for consumers to be informed about science so they can make educated decisions. Science also teaches students how to ask questions, to explore and to be creative. Part of what you also learn from science is how to move forward from failures. It's about knowledge, and knowledge, as we know, is powerful.

WHAT IS YOUR INVOLVEMENT WITH NOBLE ACADEMY?

Janie and I are on the Noble Academy curriculum writing team. Between us, we've taught both middle school and high school science, so we understand the limitations teachers face. Last year, we wrote 10 lessons designed for teachers as a low-cost but super effective hands-on way to bring science to life in the classroom.

HOW DOES NOBLE ACADEMY HELP YOUR PROGRAM?

There are so many ways. Noble Academy is the coordinator that enables us to expose our students to the real-life science going on at the Noble Foundation. Our students visit the campus and individual laboratories for tours and workshops. Postdoctoral fellows come to our classes and give guest lectures. There is a unique spirit of openness and flexibility here. We've received endless support from Noble Academy and the principal investigators. Right now, I have nine second-year students who are interning in laboratories three days a week.

WHAT ARE THEY DOING THROUGH THE INTERNSHIPS?

In some of the laboratories, students have their own projects. In others, they work alongside a postdoctoral fellow who becomes their mentor. The laboratory takes the student in for up to 10 weeks and shows them what working in plant science is really like.

ARE THESE EXPERIENCES HELPFUL?

The internships are a huge benefit. Almost every student has that light bulb moment when they more fully grasp a concept or better understand the possibilities for a career in science.

WHAT DOES NOBLE ACADEMY MEAN TO YOU?

Beyond exposing my students to real-world science, Noble Academy is helping create a pipeline for future scientists by engaging kids in science and inspiring teachers. I have juniors in my biotech program who remember doing the strawberry DNA laboratory through Noble Academy when they were eighth and ninth graders at their schools. They remember because it was hands-on and fun, and they are now willing to step out and explore science more. It's been a really good partnership. The Noble Foundation's perspective on science education is unique, and we're lucky to have them.

2010s

2010

Scientists earned the first of two NASA grants to send plants into space on the space shuttle Discovery to study the impact of gravity on cell development and root growth. This research aims to discover genes that control vital plant functions, which is intended to impact Earth-based as well as future space-based crop production. The second grant, in 2012, enabled plant seedlings to be placed on the International Space Station.

2011

Texoma MaxQ II was commercially introduced in collaboration with Grasslands Innovation Limited as a tall fescue with a novel endophyte that protects the plant from disease and insects, and enables better drought tolerance without toxicity to grazing animals.

2012

Noble Academy was created to centralize the Noble Foundation's educational and outreach activities. Noble Academy's goals are to increase student knowledge of agriculture and its importance to society; create greater appreciation for agriculture and science; and increase the number of students pursuing agriculture or careers in the STEM (science, technology, engineering and math) fields.

2014

Four new small grains varieties were commercially released in collaboration with Oklahoma Genetics Inc.: NF101 wheat, Maton II rye, NF402 oat and NF201 triticale.

2014

The Forage365 initiative was created to provide ranchers with a sustainable year-round grazing system.

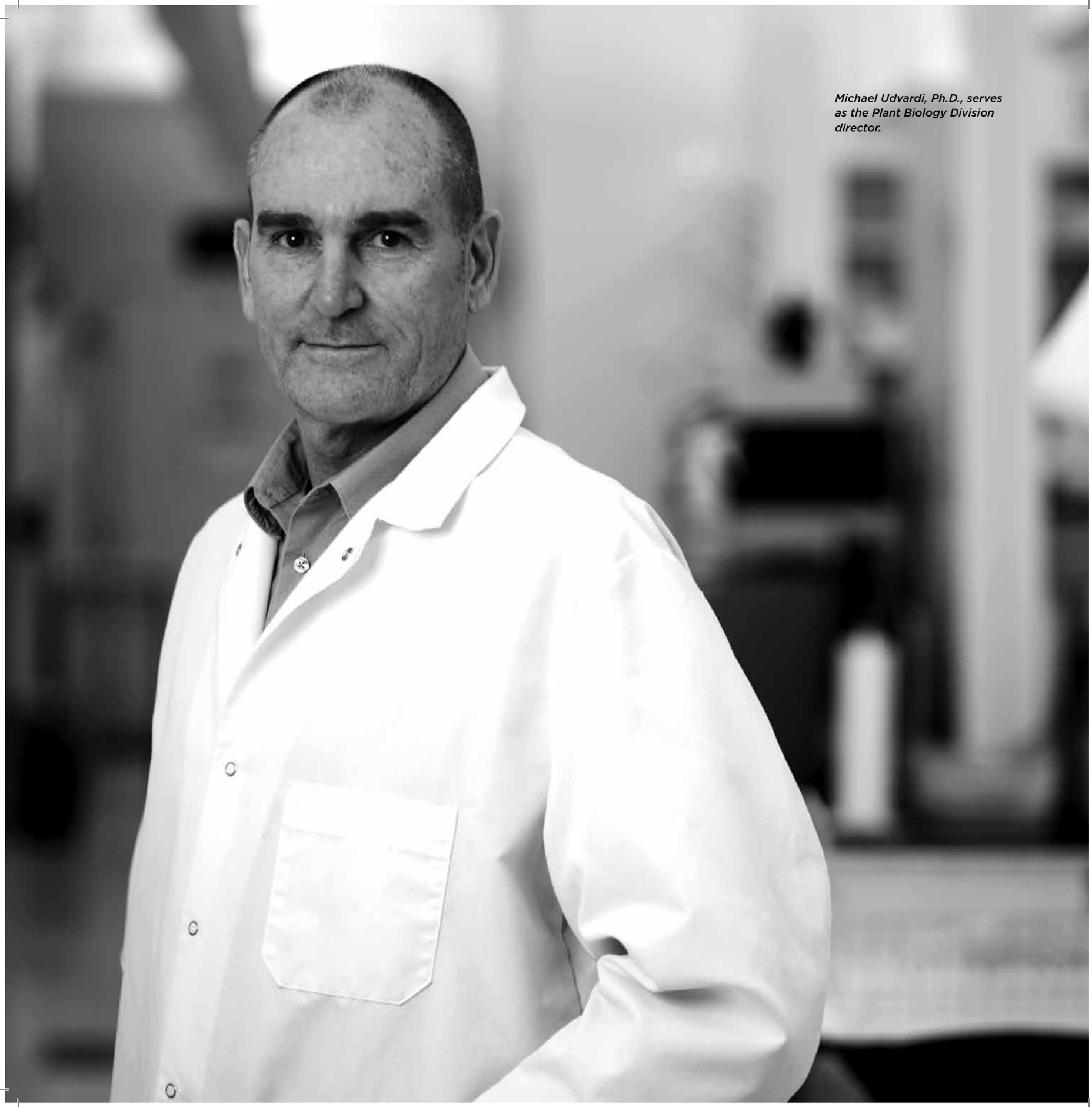
2015

The *BoarBuster®* trap system was commercially introduced in collaboration with W-W Manufacturing Co., Inc. to help reduce the rapidly expanding, nonnative, feral hog population.

Chance Johnson, 13, son of soils and crops consultant Jim Johnson, bottle feeds an orphaned calf he calls "Toughy."

next ERA

Historians make observations about the past. Commentators analyze current events. Visionaries look into the future, seeing the possibilities of tomorrow, then charting a bold path to success. Lloyd Noble saw beyond the dire situations of his Dust Bowl era and served as a catalyst for change within agriculture and beyond. Today, his living legacy – the men and women of the Noble Foundation – address the ever-mounting challenges facing agriculture in this generation. Like their founder, they do not approach these trials with despair but envision opportunities and strive to unlock the potential of discovery. They seek to shape tomorrow and do so for the benefit of all mankind.



Michael Udvardi, Ph.D., serves as the Plant Biology Division director.

TOMORROW

CHARTING *the* COURSE AHEAD

On a bright morning in early spring, three men enter a boardroom on the second floor of the Noble Foundation's administration building. Handshakes and chitchat give way to locating suitable spots at the highly polished table that usually hosts a leadership team of more than a dozen.

In the quiet spaciousness of this room, adorned only with the portrait of founder Lloyd Noble, Drs. Billy Cook, Michael Udvardi and Zengyu Wang revisit an all too familiar subject – the future.

This trio plays a fundamental role in aligning the Noble Foundation's activities with an institutional mission to advance agriculture, while always keeping a watchful eye on the horizon for opportunities and challenges.

Each man serves as a senior vice president and division director for one of the Noble Foundation's three operating divisions – Agricultural (Cook), Plant Biology (Udvardi) and Forage Improvement (Wang). And each man brings a unique perspective shaped by his country of origin (United States, Australia and China) and area of expertise (animal sciences, plant molecular biology and plant biotechnology).

But they are drawn together by the shared vision of Lloyd Noble and a desire to contribute to a great legacy of gaining knowledge and improving agriculture for ranchers, the scientific community and consumers. While 70 years of organizational success is laudable, these three men – and the people within their respective divisions – are charting a course for the next generation.

OLD PROBLEMS, NEW SOLUTIONS

Any conversation about the future of agriculture includes two truths: 1) there are many challenges ahead and 2) few of them have simple solutions.

Some of the challenges date back to Lloyd Noble's era (i.e., how to effectively use inputs and produce more food from finite land resources), while newer challenges include fluctuating weather patterns and seasonal shifts. These factors, along with many others, are part of an equation that can best be summarized as more people equals the need for more food, but more food must be produced in a sustainable manner.

"The sheer volume of production that will be expected from the agricultural sector is remarkable," Cook explained. "Less than 2 percent of the United States population is in production agriculture, and our numbers are shrinking. Mix in environmental,

policy and economic challenges, and societal demands of land managers, and you have hurdles at a scale that we've never experienced before."

In the past when agricultural researchers faced production challenges, they simply honed in on the specific item (e.g., cows or plants), then increased productivity by increasing inputs (e.g., feed or fertilizers). But today's researchers understand that gains must be earned in a manner that reinvests in the land. Critical to this piece is understanding more than just the individual plant or animal but also the interconnected web of biological processes underpinning the entire ecosystem.

"The natural environment is complex and ever changing." Udvardi said. "It's a living, dynamic system, and it requires that you manage multiple components together. We need multifaceted solutions. We have to have a partnership with soil to avoid depleting it. Ideally, we will improve the land by finding natural ways of fixing nitrogen from the atmosphere and sequestering greater amounts of carbon in our soil."

To answer questions that cross over multiple disciplines, the Noble Foundation decided to undertake a practical approach to its research infrastructure. Instead of scientists working solely in their respective areas of expertise, the organization formed multidisciplinary research clusters.

The concept is simple: identify a problem facing agriculture in the Southern Great Plains (e.g., the need for year-round grazing); assemble a team of applied, translational and basic researchers from across disciplines; and proceed as a team looking at the whole spectrum of solutions.

The research clusters have more firmly aligned the Noble Foundation's research with regional challenges. Clusters have shown applied researchers the power of molecular biology to address practical challenges, and they have provided fundamental researchers the opportunity to see how their work impacts real-world agriculture.

"Teamwork is our word of the future," Wang

Billy Cook, Ph.D., serves as the Agricultural Division director.

Zengyu Wang, Ph.D., serves as the Forage Improvement Division director.

said. "No individual or single division or even one institution can solve these problems alone. We must continue to look at the broader issues and how we can create solutions together."

Cook added to Wang's thought, "From the big picture perspective, this organization is well positioned to undertake a systematic approach of transferring knowledge from the Noble Foundation to the producer who ultimately delivers affordable, safe and nutritious food to consumers."

TOMORROW'S TECH TODAY

Technology will play an essential, enabling role in unraveling near and distant challenges. Advanced plant breeding techniques, genomics, sensors, new genome-editing technologies, and modeling will all be critical to accelerating the activities and outcomes of research.

Through the course of the hour-long discussion, the three division directors outlined current technologies as well as those cresting the horizon that hold the greatest potential to impact agriculture.

These technologies include everything from in-pasture sensors capable of measuring animal weight and performance in real time to unmanned aerial vehicles (UAVs) and sensors that detect and measure encroachment of crop diseases and pests. The technology also extends to laboratory-based genome editing tools that can help produce plants with desired characteristics without the traditional genetic engineering techniques and controversies related to genetically modified organisms (GMOs).

The technological advancements are allowing researchers to address questions that were unimaginable earlier. As one example, the division directors used the mainstay of agriculture in the Southern Great Plains – the cow – to illustrate their point. "Many go with the assumption that a cow is a cow is a cow," Cook explained. "But because of the higher resolution data, we can see how that animal integrates with the forages it eats and potentially identify those animals that are more efficient in converting forage to beef."

Udvardi takes the conversational baton, "In fact, the cow could be considered an instrument to measure the quality of the forage it eats, either through weight gain or even the amount of nitrogen it returns to the soil in urine."

Wang draws the conclusion for the trio, "We are looking at how the soil impacts the plant and how the plant impacts the cow, and then how the cow impacts the soil."

However, more technology results in more data. "You're creating mountains of data that will tell a compelling story and provide answers," Cook said. "But the challenge will be processing, analyzing and interpreting all that data to capture the opportunities within."

Despite the potential offered by various technologies, the future of agriculture hinges on a fundamental challenge that served as the genesis for the Noble Foundation – renewing the soil.

"Soil is the life support system for all forages and animals. It is the foundation of agriculture," Wang said. "The health of soil determines plant productivity. Maintaining plant performance under limited soil conditions is one of the greatest issues facing us and the next generation."

THE NEXT FRONTIER: SOIL

Historically, management practices have taken advantage of what the soil has offered at the cost of the soil. Scientists have long focused on the chemical and physical qualities of soil but not the biology. But both soil managers and researchers are changing their approach to the complex world under their feet.

"Soil scientists admit that the microbiology of soil is the final frontier of soil science," Udvardi explained. "There are many new ways to explore soil biology and lots of opportunity to establish sustainable practices."

"This represents an important shift. We can develop management practices that can benefit production as well as benefit the soil," said Cook, picking up the sustainability theme. "You have to look at how the systems evolved with grazing and fire. Mother Nature has provided us with a model. We have to build management practices that incorporate these natural elements so we can positively contribute to the carbon balance and, in the future, create management systems that are truly sustainable."

Plants, particularly perennials, are the primary source of fixed carbon and nitrogen for soils, be it grass species with deep root systems; the shedding of aboveground plant material; or legumes, such as alfalfa, clover and peanuts, which turn atmospheric nitrogen into their own type of fertilizer through a naturally occurring symbiotic relationship with a bacteria in the soil.

Soon the trio began discussing the virtues of cover crops and how they protect the soil from erosion while enhancing microbe diversity. Udvardi talked about adding more species of legumes into the cover crop cocktail. Cook saw the need for grazing studies to test new cover cropping systems while Wang delved into exploring ways to minimize nitrogen loss by blocking nitrification, a process in soil that causes the conversion of fertilizer nitrogen into a greenhouse gas.

As their conversation progressed, it was clear the interview had transitioned into actual engagement. They were brainstorming together, enjoying the camaraderie and creative energy. They were problem solving, bringing their unique backgrounds and perspectives together just like their respective teams.

They were planning and preparing for a future that is right around the corner.

Q&A

Bill Buckner

Having spent more than 30 years in the agriculture sector, President and CEO Bill Buckner peers into the future to discuss the challenges and changes, the opportunities and aspirations that lie ahead of the Noble Foundation.

WHAT ARE THE CHALLENGES FACING AG IN THE FUTURE?

The list of challenges is extensive and well known: a rapidly growing global population, the need to grow more food with less resources, urban sprawl consuming land resources, poor air quality, issues with clean and accessible water, development and integration of cost-effective technology, and positive engagement of consumers.

WHICH CHALLENGE IS THE MOST PRESSING?

Hands down, it's the health of our soils.

WHY SOIL?

Over the past 150 years, we've lost half of the Earth's topsoil due to wind and water erosion. If left to nature, it will take hundreds of years to replenish just a quarter of an inch of soil. Ironically, healthy soil plays a significant role in most of the challenges we've discussed. It helps grow more food with fewer inputs, contributes to cleaner air and water, stores water, and serves as the foundation for a productive ecosystem. So, why soil? Because, along with water, it is our most valuable natural resource. It is fundamental to life. Without it we do not survive.

WHAT ROLE HAS NOBLE PLAYED IN ADVANCING SOIL?

Soil has been a part of our organizational DNA since our inception. Mr. (Lloyd) Noble founded the Noble Foundation with the express direction to safeguard the soil. He lived through the Dust Bowl. He knew soil was the foundation of life. For decades, our organization has helped producers properly measure and manage the physical and chemical aspects of their soil. Now we are striving to unlock proper management of the soil biology, which has been overlooked for decades. Currently, we do not have a standard method for measuring the health of soil biology. It's a vital piece.

HOW ELSE HAS NOBLE ADVANCED SOIL HEALTH?

More recently, we worked with the Farm Foundation to form the Soil Renaissance, which brought together individuals from government, universities, industry and the nonprofit sector to identify the barriers and solutions for soil, soil measurement and soil research. The Soil Renaissance evolved into the creation of a new, nonprofit institution, the Soil Health Institute. The Noble Foundation took a leadership role in establishing, launching and providing initial funding for operations of the Soil Health Institute.

WHAT CURRENT PROJECTS HOLD THE MOST POTENTIAL?

There are too many to choose just one. Our work in gene editing is transformational. It is an exciting new area of science that holds great potential. The Noble Learning Center is a new endeavor that focuses on specialty agriculture. It will give people a chance to get up close and experience food production in their own backyards. One of the most exciting Noble projects is Forage365, which draws together all of our researchers plus outside collaborators to develop a year-round grazing system for the Southern Great Plains. This is not just a Foundation-wide effort. It is an industry-wide effort to bring new traits to the market in a focused way.

WHY IS A YEAR-ROUND GRAZING SYSTEM IMPORTANT?

A year-round grazing system, which includes native and introduced forages, small grains, and cover crops, could decrease the need for farmers and ranchers to purchase costly hay during the months that there is no forage production for livestock. The project also illustrates the Noble Foundation's promise to improve agricultural practices and how this ultimately has a positive impact on farmers, ranchers and consumers.

WHAT IS CARA?

The Charitable Agricultural Research Act, or CARA, was federal, tax-related legislation that was a very small part of the 2015 end-of-year combined tax and budget bill passed by Congress and signed into law by the president.

In essence, CARA created a new type of 501(c)(3) public charity called agricultural research organizations (AROs) that are committed to performing agricultural research. The Noble Foundation led a coalition of more than 65 associations, nonprofit organizations and universities that supported the passage of CARA and the creation of AROs. CARA represents yet another example of Noble Foundation efforts to innovate and benefit agriculture.

WHY CREATE AROs?

AROs can reach a new type of donor that commonly does not contribute to nonprofit agricultural research. AROs were patterned after a successful nonprofit model, medical research organizations (MROs), created in the Internal Revenue Code in the mid-1950s. MROs have contributed greatly to human medical research and have been founded by notable individuals and families such as Howard Hughes, James E. Stowers, Paul G. Allen and the Van Andel family, as just a small number of examples. We believe that AROs can have a similar impact on agricultural research. Our founder, Lloyd Noble, serves as a great example of how one man, and now three generations of his family, can use private wealth to drive agricultural innovation and change for public good. AROs can more readily enable others to do the same.

WHAT NEW PROJECT EXCITES YOU THE MOST?

The incorporation of new technologies – in the form of sensors, interactive equipment and software – in a pasture or ranch environment to provide U.S. livestock producers with new decision-making tools that will give them the information they need to increase production efficiencies, improve animal health, reduce inputs and increase soil health.

WHAT ROLE WILL THE NOBLE FOUNDATION PLAY?

Precision agriculture technologies play a large role in modern agriculture. However, incorporating these technologies can be challenging, whether it is because of cost or the need for education. We seek to help producers gain efficiencies by making better informed decisions through data. We want to help them understand the new technologies and how they fit into their operations. We want them to better understand how all the pieces of their operations interact and impact each other, from the weather to soil health. Additionally, as the science advances faster than the regulatory environment, education will be required to create a predictable and understandable regulatory system.

WHERE DOES NOBLE FIT INTO THE AGRICULTURE SPECTRUM?

The Noble Foundation plays many key roles. We perform research, deliver new plant varieties and traits to the marketplace, create publicly accessible research tools and resources, train postdoctoral scientists, and conduct adult and youth education programs. Additionally, we serve as a facilitator, bringing together groups that might never interact if not introduced. We connect individuals, nonprofits, governmental agencies and private industry to help bring resources and solutions to agriculture. The bottom line is this: we are problem solvers focused on identifying problems, finding the right people to bring to the table, and charting a clear course that delivers beneficial outcomes for agriculture and the consumer.

WHAT WORD BEST DESCRIBES THE FUTURE OF AGRICULTURE?

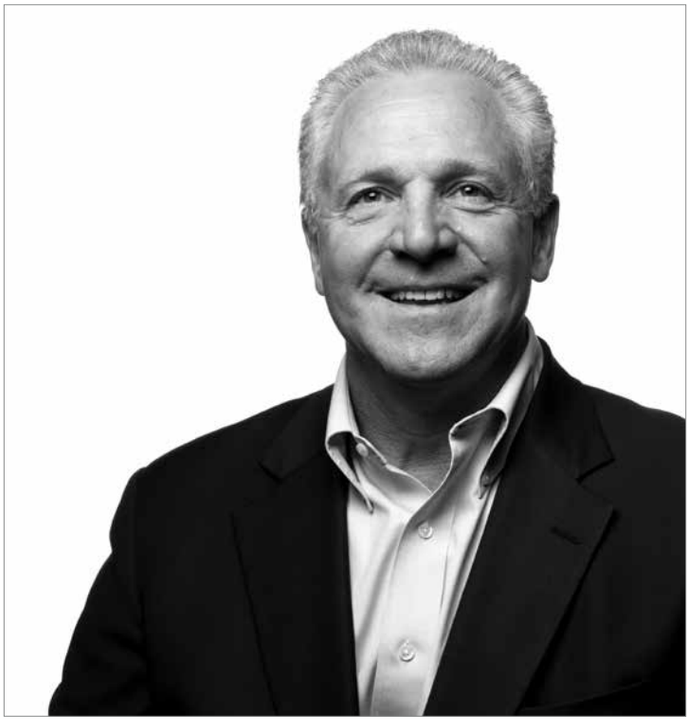
Innovation. We are facing significant challenges, but agriculture has been overcoming challenges since man planted the first seed. We will find the solutions we need. I hear the words of Mr. Noble, our founder, "The only degree to which we have reached the end of the road of opportunity is the degree to which we've exhausted the imaginative capacity of the human mind." He believed that no matter the challenge, we as a society could pull together, imagine a possibility and then create it. He believed there was always an answer, and so do I.

WHAT WOULD MR. NOBLE SAY ABOUT TODAY'S FOUNDATION?

When I first came to the Noble Foundation four years ago, I studied many of Mr. Noble's writings as well as articles written about him. He had a great vision. I believe he'd be pleased with our progress and not a bit surprised. While he may have never imagined the specifics, I'm confident he knew we'd achieve great things.

WHAT'S NEXT FOR THE NOBLE FOUNDATION?

We will do what we've done for 70 years: support farmers, ranchers and landowners; innovate through research; safeguard the soil; advance the knowledge of students, scientists and producers; create stronger advocates for agriculture; and give grants to worthy nonprofits. How we do that will continue to morph and change with each generation, but our focus remains the same – to benefit mankind.

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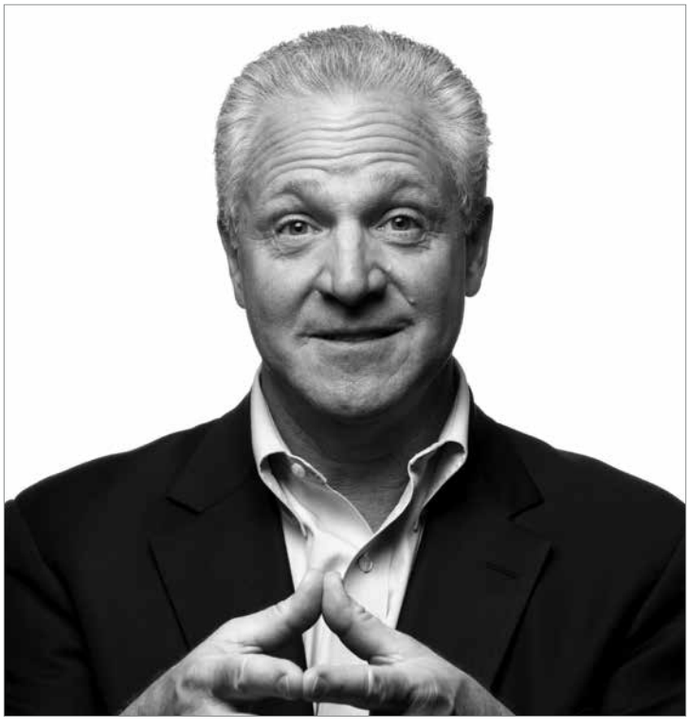
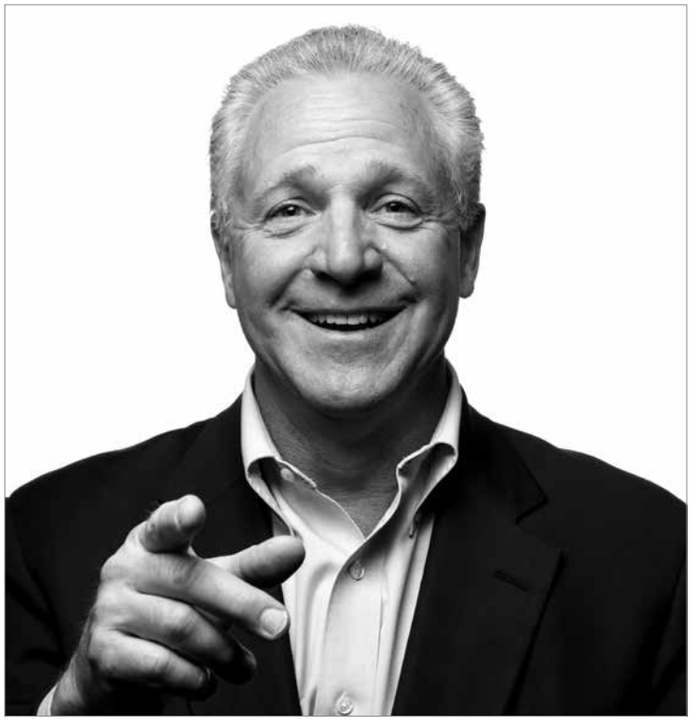




The Noble Foundation's philanthropic function provides grants to health, educational and charitable nonprofit organizations, including youth art programs at the Goddard Center in Ardmore, Oklahoma.

2015

Granting List

ORGANIZATION	GRANT AMOUNT
A CHANCE TO CHANGE FOUNDATION Oklahoma City, Oklahoma. *Support for the Chance to Succeed program*	**$20,000**
ARBUCKLE LIFE SOLUTIONS INC. Ardmore, Oklahoma. *Renewed operating support*	**$30,000**
ASSOCIATION OF PROFESSIONAL OKLAHOMA EDUCATORS FOUNDATION Norman, Oklahoma. *Renewed operating support*	**$20,000**
ATLANTA UNION MISSION CORPORATION Atlanta, Georgia. *Support for the men's and women's programs*	**$20,000**
CARTER COUNTY CASA INC. Ardmore, Oklahoma. *Renewed operating support*	**$10,000**
CHARLES B. GODDARD CENTER FOR VISUAL AND PERFORMING ARTS INC. Ardmore, Oklahoma. *Renewed operating support, art education outreach program and art studio scholarships*	**$35,000**
CITIES IN SCHOOLS INC. Ardmore, Oklahoma. *2015 Summer Day Camp*	**$35,000**
COLONIAL WILLIAMSBURG FOUNDATION Williamsburg, Virginia. *2015 Oklahoma Teachers Institute*	**$12,000**
DEAN MCGEE EYE INSTITUTE Oklahoma City, Oklahoma. *Scientific recruitment fund*	**$75,000**
DIABETES SOLUTIONS OF OKLAHOMA INC. Oklahoma City, Oklahoma. *Support for Camp Endres*	**$7,500**
THE EDUCATION AND EMPLOYMENT MINISTRY INC. Oklahoma City, Oklahoma. *Renewed operating support*	**$15,000**
EPISCOPAL DIOCESE OF OKLAHOMA Oklahoma City, Oklahoma. *Capital campaign for St. Crispin's Phase II*	**$50,000**

2015 Granting List

ORGANIZATION	GRANT AMOUNT
FAMILY SHELTER OF SOUTHERN OKLAHOMA FOR VICTIMS OF DOMESTIC VIOLENCE Ardmore, Oklahoma. *Shelter program and shelter advocate*	**$35,000**
GLORIA AINSWORTH CHILD CARE AND LEARNING CENTER INC. Ardmore, Oklahoma. *Renewed operating support*	**$40,000**
GOOD SHEPHERD COMMUNITY CLINIC INC. Ardmore, Oklahoma. *Renewed operating support*	**$50,000**
GREAT EXPECTATIONS FOUNDATION Tahlequah, Oklahoma. *Renewed operating support*	**$15,000**
HEARTS FOR HEARING Oklahoma City, Oklahoma. *Capital campaign*	**$25,000**
INTEGRIS BAPTIST MEDICAL CENTER FOUNDATION Oklahoma City, Oklahoma. *Capital campaign for Arcadia Trails*	**$100,000**
INTERCOLLEGIATE STUDIES INSTITUTE INC. Wilmington, Delaware. *ISI Society Initiative at the University of Oklahoma*	**$25,000**
THE MORE FOUNDATION Ardmore, Oklahoma. *Distribution from the Pettitt Educational Fund*	**$64,675**
MURRAY STATE COLLEGE FOUNDATION INC. Tishomingo, Oklahoma. *Agriculture scholarships*	**$5,000**
MYRIAD GARDENS FOUNDATION Oklahoma City, Oklahoma. *Capital campaign for the tropical conservatory*	**$50,000**
OKLAHOMA ARTS INSTITUTE Oklahoma City, Oklahoma. *Support for Summer Arts Institute*	**$10,000**
OKLAHOMA CITY MUSEUM OF ART Oklahoma City, Oklahoma. *Digital projector/screen for educational art studio*	**$6,000**
OKLAHOMA MEDICAL RESEARCH FOUNDATION Oklahoma City, Oklahoma. *Cardiovascular researcher recruitment*	**$50,000**
OKLAHOMA SCHOOL OF SCIENCE AND MATHEMATICS FOUNDATION Oklahoma City, Oklahoma. *Faculty retention bridge stipend program*	**$15,000**

2015 Granting List

ORGANIZATION	GRANT AMOUNT
OKLAHOMA STATE UNIVERSITY FOUNDATION Stillwater, Oklahoma. *Agriculture scholarships*	**$10,000**
PANHANDLE STATE FOUNDATION Goodwell, Oklahoma. *Agriculture scholarships*	**$8,000**
PHILANTHROPY ROUNDTABLE Washington, D.C. *Renewed operating support*	**$10,000**
SHILOH SUMMER CAMP INC. Oklahoma City, Oklahoma. *Operating support*	**$10,000**
SOUTHEASTERN LEGAL FOUNDATION INC. Marietta, Georgia. *Operating support*	**$25,000**
SOUTHERN OKLAHOMA AMBULANCE SERVICE INC. Ardmore, Oklahoma. *Capital campaign for Healdton ambulance substation*	**$70,000**
SOUTHERN OKLAHOMA TECHNOLOGY CENTER Ardmore, Oklahoma. *Scholarships*	**$4,600**
SOUTHWESTERN DIABETIC FOUNDATION INC. Gainesville, Texas. *Diabetic camp waterfront equipment*	**$6,000**
UNITED WAY OF SOUTH CENTRAL OKLAHOMA INC. Ardmore, Oklahoma. *Match employee contributions*	**$28,037**
EMPLOYEE MATCHING GRANTS AND SCHOLARSHIPS	
EMPLOYEE MATCHING GRANTS Matches, dollar for dollar, contributions made by employees and trustees of the Noble Foundation and employees of Noble Energy Inc. and Noble Corporation to qualifying educational institutions.	**$271,606**
NOBLE EDUCATIONAL FUND SCHOLARSHIPS Provides a maximum of 10 $20,000 four-year awards to children of employees of Noble companies.	**$185,000**
SAM NOBLE SCHOLARSHIPS Provides scholarships in the fields of agriculture and technology to southern Oklahoma students.	**$115,625**
TOTAL GRANTS AWARDED AND PAID IN 2015	**$1,564,043**

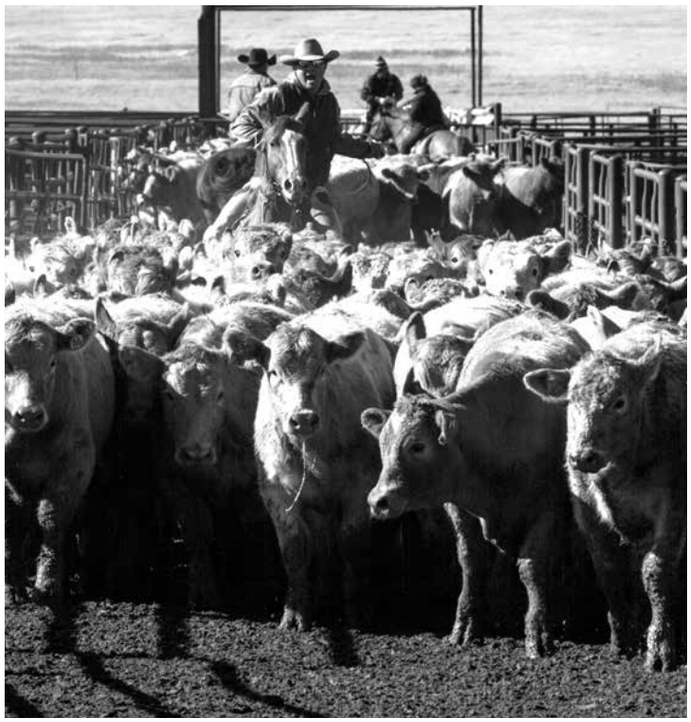
Statements *of* Financial Position

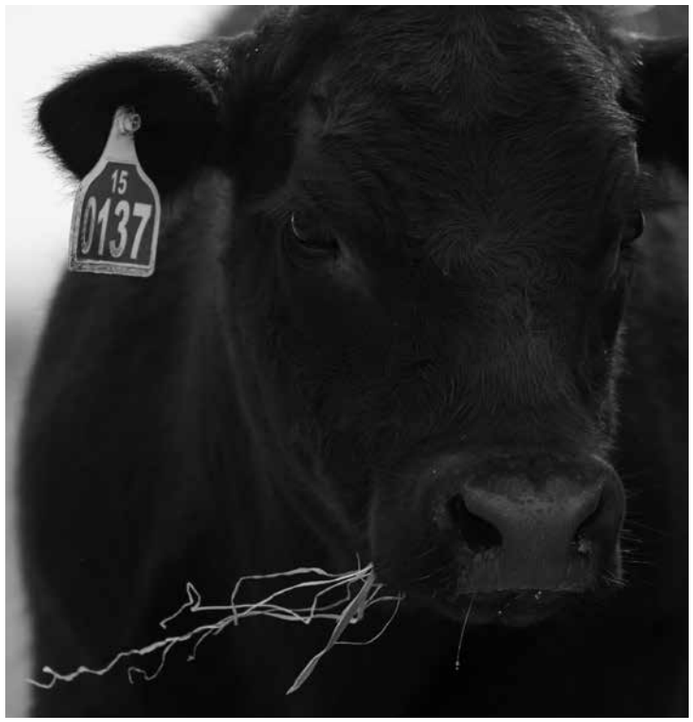
Unaudited	Dec. 31, 2015	Dec. 31, 2014
ASSETS		
Cash	$94,729	$185,440
Short-term investments	21,665,978	9,699,394
Accrued interest and dividends receivable	1,008,219	1,021,371
Due from brokers for securities sold	1,898,911	43,370
Accounts receivable and other assets	1,555,465	1,686,072
Prepaid expenses	700,172	704,321
Limited partnerships	236,226,004	237,829,961
U.S. government securities	17,883,994	18,621,016
Corporate securities	69,625,302	77,168,526
Corporate stock	399,445,082	457,293,755
Mutual and commingled funds	181,674,203	229,426,222
Total marketable securities, at fair value	**668,628,581**	**782,509,519**
Other investments	388,557	388,557
Property and equipment	203,306,813	209,413,238
Accumulated depreciation	(81,877,945)	(88,088,080)
Net property and equipment	**121,428,868**	**121,325,158**
TOTAL ASSETS	**$1,053,595,484**	**$1,155,393,163**

Unaudited	Dec. 31, 2015	Dec. 31, 2014
LIABILITIES		
Accounts payable and accrued expenses	$5,698,355	$4,823,327
Due to brokers for securities purchased	1,115,418	383,344
Grants payable	580,625	576,875
Liability for deferred taxes	3,250,000	5,100,000
Liability for pension and postretirement medical benefits	23,421,332	31,373,453
TOTAL LIABILITIES	**$34,065,730**	**$42,256,999**
NET ASSETS		
Unrestricted	$1,017,170,704	$1,110,666,047
Permanently restricted	2,359,050	2,470,117
TOTAL NET ASSETS	**$1,019,529,754**	**$1,113,136,164**
TOTAL LIABILITIES AND NET ASSETS	**$1,053,595,484**	**$1,155,393,163**

Statements *of* Activities

Unaudited	Year ended 2015	Year ended 2014
ACTIVITIES		
Interest	$3,329,224	$2,955,734
Dividends	10,605,825	12,977,636
Net realized and unrealized losses on investments	(66,360,043)	(45,880,928)
Other miscellaneous program and royalty income	10,186,640	6,179,078
TOTAL REVENUES, GAINS AND LOSSES	**(42,238,354)**	**(23,768,480)**
Operations (Agricultural, Plant Biology and Forage Improvement)	47,191,583	45,606,907
Grants	1,567,793	2,368,616
Management and administrative	11,654,249	7,144,423
Provision for federal excise taxes	(777,036)	(463,918)
TOTAL EXPENSES	**59,636,589**	**54,656,028**
REVENUES, GAINS AND LOSSES LESS THAN EXPENSES	**(101,874,943)**	**(78,424,508)**
Pension and postretirement medical related changes other than net periodic costs	8,379,601	(20,345,501)
Change in unrestricted net assets	**(93,495,342)**	**(98,770,009)**
Change in permanently restricted net assets	**(111,068)**	**145,835**
Change in net assets	**(93,606,410)**	**(98,624,174)**
NET ASSETS, BEGINNING OF YEAR	**$1,113,136,164**	**$1,211,760,338**
NET ASSETS, END OF YEAR	**$1,019,529,754**	**$1,113,136,164**

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Clouds billow over the Noble Foundation administration building in Ardmore, Oklahoma.

2015

Institutional Governance

The Noble Foundation Board of Trustees endeavors to have the highest standards of corporate governance practice and ethical conduct by all trustees and employees. Consistent with these intentions, the Board adopted the following Statement of Principles:

We, the Board of Trustees and the employees of The Samuel Roberts Noble Foundation, acknowledge and agree that the following principles apply to our association with the Noble Foundation and the activities we conduct on behalf of the Noble Foundation:

1. The Noble Foundation exists because of the vision and generosity of our founder, Lloyd Noble.
2. We are stewards of the resources and the vision of Lloyd Noble.
3. Our conduct will be fair and honest, and our activities will adhere to the purposes for which the Noble Foundation was established.

ROLE OF THE BOARD OF TRUSTEES

The Board charts the strategic direction of the institution, focuses the organization to carry out its charitable purposes, serves as stewards of the Noble Foundation's resources, and conducts and supports activities in accordance with the vision of Lloyd Noble.

The Board is responsible for the appointment and evaluation of the president and chief executive officer. The president and chief executive officer is responsible for the conduct of the day-to-day affairs of the organization. Moreover, this position is charged with implementing and executing operations to support the Board's strategy.

BOARD COMMITTEES

The Board includes five committees: executive, audit, compensation, investment and strategic planning.

INDEPENDENT PROFESSIONAL ADVICE

The Board, each Board committee and each trustee has the right to seek independent legal counsel and other professional advice at the Noble Foundation's expense, concerning any aspect of the organization's operations or undertakings.

BOARD EDUCATION

The Board encourages each trustee to continue his or her education. The Noble Foundation hosts seminars, programs and other events to assist in continuing trustee education. Each trustee also is encouraged to attend external educational programs that concern exempt organizations, corporate governance, grantmaking and administration, as well as other programs relevant to the Noble Foundation's operations and research objectives.

CONFLICT OF INTEREST

The Board's conflict of interest policy outlines a procedure to disclose, identify and address the potential intersection between external interests and the interests of the institution. The Board, in adopting such policy, acknowledges and agrees that each trustee must at all times act with transparency and in the best interest of the Noble Foundation.

BOARD EVALUATION

Each year, the Board completes a Board evaluation, and each Board committee completes a committee evaluation. The results of all evaluations are compiled and presented to the full Board for review and discussion.

"WHISTLEBLOWER" POLICY

The Board established a system for the confidential, anonymous submission of employee reports concerning any known or suspected violation of statutory, regulatory or internal requirements as well as questions or concerns regarding Foundation accounting, internal accounting controls or audit matters. This system further includes processes for the receipt, treatment and reporting (to the Board) of any such reports.

990-PF INFORMATIONAL RETURN

The Noble Foundation annually files a 990-PF informational return with the Internal Revenue Service. The Noble Foundation's current 990-PF may be downloaded at www.noble.org/about/governance. Historical returns for the Noble Foundation are available at www.guidestar.org.

ADDITIONAL GOVERNANCE INFORMATION

Noble Foundation governance information, including policies and procedures, may be found at www.noble.org/about/governance.

2015

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Nonresident Fellows

The Nonresident Fellows program brings together a distinguished panel of scientists, researchers and industry leaders to assist the Noble Foundation's three operating divisions – Agricultural, Forage Improvement and Plant Biology – and the Department of Computing Services. These outside reviewers perform candid examinations of their division's programs, offer objective advice and guidance, and provide fresh perspectives.

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70TH ANNIVERSARY
EST. 1945
THE SAMUEL ROBERTS NOBLE FOUNDATION