THE SAMUEL ROBERTS
NOBLE
FOUNDATION

ANNUAL REPORT

TWO THOUSAND ELEVEN
THE SAMUEL ROBERTS NOBLE FOUNDATION

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Use of fertilizers and irrigation changed farming methodology and dramatically increased crop productivity during the 20th century.

AN AGRICULTURAL REVOLUTION

No era in the history of agriculture experienced more revolution in farming practices than the last 100 years. At the dawn of the 20th century, farmers and ranchers produced food and fiber in the same manner they had for centuries. Man broke ground and sowed fields by hand – a system that required almost 40 percent of the United States' workforce just to feed its citizens.

Beyond the manually intensive requirements of farming, agricultural production often fell prey to man's lack of fundamental knowledge. Improper land usage drained fields of their nutrients. Droughts amplified negative impacts, and soils eroded. In Oklahoma, Lloyd Noble became one of the pioneers of land stewardship, protecting the state's most fundamental resource – the soil. He helped infuse technology and scientific research into traditional practices, and the land once again became productive.

By the end of the 20th century, farmers and ranchers produced previously unimaginable yields through use of technological and scientific advancements advocated by visionaries like Noble. When India stood on the brink of widespread starvation, geneticists and plant breeders developed new crop varieties and applied modern agricultural practices, including heavy use of fertilizers and irrigation. History now credits their efforts with saving a billion lives. In the cosmic blink of an eye, agriculture had reinvented itself. As a result, fewer people were needed in the fields, cities grew and the population was freed to pursue other industry. Society was forever changed.

The 2011 drought across Oklahoma and Texas illuminated the precarious nature of fresh water supplies available for agricultural use.

TODAY'S FOOD PRODUCTION CHALLENGES

Change from an agrarian to an industrial society resulted in prosperity. This growth, in turn, continues to create new and significant challenges for agriculture. In October 2011, the world's population crested 7 billion. Estimates push that number past 9.5 billion by 2050, an exponential leap considering humanity just surpassed 1 billion in the early 19th century.

To meet the requirements of the escalating population, the United Nation's Food and Agriculture Organization forecasts food production will need to increase 70 percent. Agricultural producers spent 10,000 years attaining the current production of roughly 6 billion gross tons of food per year. Now, they must almost double that production in the next four decades. Compounding the effects of population growth are a myriad of secondary issues with equally daunting implications.

Urban centers will continue to swell, reducing the amount of land available for crops and livestock. At the same time, arable soil is rapidly eroding. The United States is losing soil 10 times faster than the natural replenishment rate, while China and India's soils are eroding three to four times faster than the U.S. Add to the equation diminishing fresh water supplies and concerns regarding rates of fertilizer and pesticide use. The result is a global agricultural community charged with producing more, using fewer traditional inputs. However, with challenge comes innovation. New agricultural leaders will arise to inspire the changes that will continue to feed a growing world.

The Noble Foundation uses both traditional and modern plant breeding methods to move laboratory discoveries into agriculturally beneficial crops.

THE NOBLE FOUNDATION'S ROLE IN AGRICULTURE

Agricultural producers will meet the many challenges of the coming generation by combining the experience of the past with the technology of tomorrow. Agricultural research then becomes the linchpin of the creation of innovative solutions for heartier and more productive crops. Scientists continue to employ traditional breeding techniques, while incorporating modern tools like genomics and biotechnology, to overcome environmental limitations such as drought and disease. These new technologies will combine with improved agricultural practices to increase production while consuming fewer resources.

The initiative to generate positive change will come from the individuals and institutions, such as the Noble Foundation, dedicated to advancing agriculture. Established to foster land stewardship, the Noble Foundation is uniquely positioned to impact global agriculture.

For more than 65 years, the Noble Foundation has developed an institutional research program that extends from the laboratory to the field. This research-to-ranch approach coordinates every step from laboratory science and advanced plant breeding to direct consultation with farmers and ranchers. The Noble Foundation's efforts will contribute to a wider pursuit of agricultural improvement that will once again change the world.

LLOYD NOBLE SERVED AS A CATALYST FOR CHANGE

WHETHER IN ENERGY PRODUCTION OR AGRICULTURAL PRACTICES, THE OILMAN AND PHILANTHROPIST ADVOCATED CREATIVE THINKING AND THE USE OF TECHNOLOGY TO SUCCESSFULLY FACE CHALLENGES.

Lloyd Noble viewed change with neither fear nor contempt. Change, he believed, afforded new opportunities. It served as an undercurrent to innovation and propelled society to achieve more than it previously imagined.

Noble knew that change was invaluable, and he was often its catalyst. His ability to see beyond immediate realities and embrace innovation ultimately redefined two industries and forever transformed society's perceptions about the importance of conserving natural resources.

As a young adult, Noble studied law at the University of Oklahoma, but his passion and instinct drove him out of the classroom and into the oilfields of the 1920s. The 24-year-old entrepreneur purchased his first drilling rig in 1921 and throughout the next two decades revolutionized the oil and gas drilling industry, becoming a leader in the adoption of technology.

Oklahoma Business Monthly published an article in July 2000 recounting Noble's ongoing pursuit of new ideas and the latest machinery. "Noble Drilling would have a long history of innovations …, a direct result of Lloyd Noble constantly continuing to educate himself, intent on learning all there was to be known about the oilfield."

While Noble found continued success in energy production, he began to recognize that poor agricultural practices had taken a toll on his home state. Failure to return nutrients to the soil resulted in unproductive land that was susceptible to erosion. A decades-long drought compounded the problem.

Winds that swept through the Great Plains in the 1930s carried off precious topsoil – literally blowing away Oklahoma's economic lifeblood. Agriculture and other industries were stifled, and those whose livelihood depended on the land fled for financial sanctuary to the American West. A great change was needed, and Noble once again led the way.

He refocused his energy and resources on promoting land management and soil conservation. In May 1943, Noble addressed these issues when he contributed a column to the 50th anniversary edition of his hometown newspaper, the Daily Ardmoreite. He wrote: "Are we going to encourage the terracing, conservation and upbuilding of our soil so it will support a growing, healthy and prosperous livestock and agrarian industry, or are we going to allow our soils to be depleted and our population shifted to other areas as we read about it in the newspapers?" Two years later, Noble established a permanent resource for the agricultural community and helped spark a land renewal renaissance when he established The Samuel Roberts Noble Foundation in October 1945. He named the organization after his father, citing him as the most charitable man he had ever met.

The Noble Foundation's early efforts focused on educating and encouraging area farmers and ranchers to practice land stewardship and resource conservation. Noble knew that proper soil management would help prevent another Dust Bowl and ultimately secure the land for future generations.

Lloyd Noble, 53, suffered a fatal heart attack on Feb. 14, 1950. Noble passed away less than five years into the Noble Foundation's existence, but his vision had been cemented. Throughout the ensuing six decades, the stewards of the Noble Foundation – largely comprised of his descendants – have stayed true to Noble's original directive to bring positive change to agriculture.

In the late 1980s, the Board of Trustees seized an opportunity to complement the organization's agricultural programs by branching into fundamental plant science research. The Noble Foundation launched its Plant Biology Division to study the basic genetic and molecular workings of plants with the goal of increasing plant productivity and hardiness.

Less than a decade later, the Noble Foundation expanded again by establishing the Forage Improvement Division, which advances the organization's plant breeding and crop management research of forages – grasses and legumes consumed by livestock. This group is a link between the fundamental plant science of the Plant Biology Division and the Agricultural Division's direct consultation with farmers and ranchers.

Today, the three operating divisions collaborate to enhance agriculture and land stewardship throughout the Southern Great Plains and around the world. While Lloyd Noble could have never foreseen the global impact of his organization, his convictions concerning land stewardship still ring true today.

CHANGE HAS COME, BUT LLOYD NOBLE'S VISION REMAINS

NEW NOBLE FOUNDATION PRESIDENT BILL BUCKNER FINDS A PERFECT FIT BETWEEN HIS LIFE'S CALLING AND LLOYD NOBLE'S VISION.

I met Lloyd Noble on a Wednesday afternoon.

Three days into my tenure as president of the Noble Foundation, I discovered Noble's charge to the original trustees, a document he penned in 1945 when he established this organization.

For months, I had been researching Noble, reading biographies, editorials and speeches. Each new document provided more insight into the man and his desire to endow an organization to support agriculture. However, seeing Noble's charge to the original trustees served as a crystallizing moment for me and his vision became tangible.

Noble wrote: "The degree to which any organization succeeds does not depend upon capital assets, but rather the honesty, energy and wisdom of its management, and the loyal and intelligent support of their fellow workers."

It was clear: Noble's focus was people, helping and supporting people. And he knew that only inspired, dedicated individuals focused on a defined goal could truly fulfill his vision.

His words spoke to me as the new president, but they also offer a simple reminder to an organization experiencing change – continued success depends on a unified belief in a common cause.

If we remain righteous in our endeavors, passionate about our cause and have the foresight to see around the next bend in the road, then we will fulfill our mission and positively impact the countless lives of those who depend on agriculture. Noble's principles and vision continue to guide our path. It is also what drew me to the Noble Foundation.

I was raised on a farm near Mexico, Mo., and the lessons I learned there have shaped my life and career. I've dedicated three decades to advancing agriculture. The last 18 years have been with Bayer CropScience, where I was involved in both their animal health and crop protection business groups.

When I retired, I looked for an opportunity where I could have a meaningful, substantive impact on agriculture. I soon learned about Lloyd Noble and became passionate about the mission he gave to the Noble Foundation.

Noble's purpose for developing a charitable institution was to provide sustainable solutions for a region recovering from the Dust Bowl. Today, his vision remains applicable to a world trying to provide more food, feed and fiber for a burgeoning population while making wiser use of resources. I can think of no better mission than promoting the success of farmers and ranchers as they strive to feed a hungry world.

Because of the passion and energy I've seen at the Noble Foundation, I am confident this organization will play a key role in providing solutions through both practical agricultural techniques and revolutionary scientific discoveries.

This enthusiasm is a tradition inherited from the men and women who previously dedicated their careers to the Noble Foundation – people such as my predecessor, Mike Cawley. A man of towering faith, Cawley served the Noble Foundation for more than 20 years, laying the groundwork for much of what we will accomplish in our future. He is a testament to Noble's desire to support a greater cause, to positively impact mankind.

Yes, the employees past and present carry the lifeblood of our mission. As Noble said, "My hope is that when into other hands are placed the responsibility for the management of our mutually built enterprise, those in command will not lose sight of the fact that no individual builds anything worthwhile by his effort alone."

I will not. As president, I pledge to devote myself to fulfilling Noble's vision and advance agriculture in the process. As an organization, I promise that we will provide solutions to some of agriculture's most pressing needs. We will serve as Lloyd Noble's living legacy.

Just as in Noble's day, significant challenges lay ahead, but the dedication, imagination and abilities of the Noble Foundation and the agricultural community as a whole will overcome them.

So as I look towards tomorrow, I again turn to our founder and his words give me encouragement: "The only degree to which we have reached the end of the road of opportunity is the degree to which we have exhausted the imaginative capacity of the human mind."

Sincerely,

BILL BUCKNER
President and Chief Executive Officer

MIKE CAWLEY SAYS GOODBYE AFTER TWO DECADES

THE LONGEST SERVING PRESIDENT IN NOBLE FOUNDATION HISTORY GUIDED THE ORGANIZATION THROUGH CHANGES IN PROGRAMS AND A PERIOD OF UNPRECEDENTED GROWTH.

Careers end the same way they begin – with cardboard boxes.

As the 2011 holiday season faded into the new year, Mike Cawley entered his office on a quiet Thursday afternoon to perform one of his last acts as president and chief executive officer of the Noble Foundation. All the retirement receptions, emotional speeches, handshakes and hugs had given way to the simple task of packing up his office. Cawley slipped off his blue pinstriped jacket, rolled up the sleeves on his pressed white shirt and began sorting through the memories on his shelves. "I'm not really that sad," Cawley said, flashing a smile. "I've already been through all that. This is the right time for me and the institution."

Cawley set to work on the bookshelves, pulling down hefty tomes. He glanced at each one, even opened a few to read a line or two before sorting into an appropriate box. "I may actually get to read some of these now," he said.

Each object elicited another memory. An old scorecard made him recall one of his best rounds of golf. A book chronicling the University of Oklahoma's football conquests caused him to reminisce about his alma mater. A Ronald Reagan biography plunged him into a discussion of leadership.

Cawley chatted and packed box after box. Each time one filled, his assistant of 30 years, Liz Aldridge, instinctively appeared with an empty one, but she never lingered long. "I know this has to happen, but that doesn't make it any easier," she said.

When Cawley reached the shelf with the photos of his six grandchildren, he paused and studied each image. "Grandparents play such an important part in the lives of their grandchildren. I want to be there for them," he said, looking at the round, fresh faces in the black and silver frames. "They're the reason I'm going."

In less than an hour, the longest tenured president in the Noble Foundation's 66-year history had checked the last item off his to-do list. Twenty years as president ended with empty shelves and boxes full of memories.

A NOBLE JOURNEY

Cawley had been the incoming president once. But his first day was not filled with unfamiliarity. He already had been a part of the Noble Foundation for 15 years when he unpacked his cardboard boxes.

Cawley came to Ardmore with his young wife, Betty Jane, in the early 1970s just months after graduating from OU's College of Law and completing an assignment with the U.S. Army. His first law office sat one floor below that of Jim Thompson, a seasoned attorney with an excellent legal library he was willing to share. The two became friends and eventually shared office space.

Thompson, who had served as Noble Foundation president from 1953 to 1966, conducted legal work for the foundation and Noble Affiliates, Inc. (the predecessor to Noble Energy, Inc.). By 1977, Thompson was ready to transition out of his legal responsibilities so he introduced Cawley to Sam Noble (founder Lloyd Noble's eldest son), chairman of the board of Noble Affiliates, and to Roy Butler, CEO of Noble Affiliates. Cawley performed legal work for both organizations for the next decade before Noble asked him to join the Noble Foundation Board of Trustees. Four years later, Noble asked him to succeed John Snodgrass and become the organization's seventh president. "I was stunned and flattered beyond words," Cawley said.

Under Cawley's guidance, the Noble Foundation experienced an unparalleled era of growth: net assets increased more than 500 percent; the Board of Trustees invested more than $100 million to expand the campus; research programs grew exponentially; and the employee base doubled from 200 employees to more than 400 from 25 countries.

"It was during Cawley's tenure that we saw this shift from a family foundation focused on southern Oklahoma to an organization with international reach," said Rusty Noble, a member of the Board of Trustees Executive Committee and Lloyd Noble's grandson. "Cawley's thoughtful, devoted stewardship was critical to that growth."

GROWING PAINS

On Cawley's first day, the Noble Foundation was in the midst of fundamental change. The organization consisted of three divisions: the original Agricultural Division, the Biomedical Division, which had been founded shortly after Lloyd Noble's death in 1950, and the Plant Biology Division, which had been added just three years prior.

Just as Cawley became president, Biomedical Division Director Bud Patterson was preparing to retire. Recruitment of a successor was difficult because Ardmore did not offer a university-style teaching hospital – a necessity for human health

research. Cawley and the Board of Trustees decided to move the division to the Oklahoma Medical Research Foundation. "It was a difficult decision, but the right one," Cawley said. "We knew it would ultimately better serve the global biomedical effort and allow us to refine our agricultural focus."

With just two divisions – one performing fundamental research on plants and the other in applied agricultural programs – Cawley quickly recognized a new challenge. "I remember walking into our cafeteria during that time. You had the agricultural consultants on one side and this young group of international plant scientists on the other side," he said. "They were not interacting at all."

Cawley sat down with the Agricultural Division staff and posed a question to them: How can science help agricultural producers? "I really thought the agricultural consultants would take some time to answer the question, but hands shot up around the room," Cawley said. "The answer was unanimous: they needed a cool-season perennial forage."

Livestock is the primary agricultural enterprise in the Southern Great Plains, and the ranchers needed a cool-season perennial forage so they could avoid replanting ryegrass or wheat each winter. The project took shape quickly and soon a forage development group was formed. This group became integral to the organization's agriculture enhancement mission. By 1997, the staff and programs transitioned into the Forage Improvement Division with the purpose of developing and enhancing forages. The division ultimately linked the fundamental and applied research of the other two divisions. "The three divisions can now work in concert, moving plant science and agricultural research from the laboratory to the field," Cawley said. "That ability is unique to this organization."

This refined and integrated focus opened up limitless opportunities for the Noble Foundation to impact agriculture by adding more core programs. There was just one problem – there was no space. The Board of Trustees again responded to a Cawley-led proposal and approved a $100 million campus expansion. The next decade saw the Noble Foundation double its infrastructure footprint to 500,000 square feet of research and administration space, including one of the largest and most technologically advanced research greenhouses in North America.

"Everyone shared the same vision of having a real impact on agriculture," Cawley said. "Our facilities are now recognized as among the best anywhere and they help us recruit some of the best people in the world."

The expansion had the desired effect. Not only did the institution add physical space, but it developed additional plant science and agricultural research programs.

The massive construction project began to wind down in 2009, leaving Cawley and the Board of Trustees with another major issue – succession planning. Together, the group set a goal of 2012 for leadership transition. "There was some symmetry to the date," Cawley said. "I would turn 65 and be celebrating 20 years as president. We all just knew it was the right timetable."

THE GREAT CHANGE

The Board of Trustees hired an executive search firm in April 2011 to identify Cawley's successor. Seven months later, recently retired Bayer CropScience President Bill Buckner was selected to become the organization's eighth president.

That November, Buckner visited the organization he'd soon lead and attended the year's final all-employee meeting with Cawley; one president introducing himself, one saying goodbye. "I have thousands of good memories and they are all of you," said Cawley to the employees. "I loved working with you. I loved what we accomplished and appreciate your dedication and hard work. I cannot wait to see what is next. You all are going to do great things."

Cawley then called Buckner to the front and passed a symbolic gift – a runner's baton – inscribed with the words of Lloyd Noble: "The degree to which any organization succeeds does not depend upon capital assets, but rather the honesty, energy and wisdom of its management, and the loyal and intelligent support of their fellow workers."

A few months later in mid-January, Buckner slipped into his new office on a quiet Sunday afternoon and began his presidency at the Noble Foundation with a simple task – unpacking cardboard boxes. The first item he placed on a shelf was the baton from his friend Mike Cawley.

DIVISION OVERVIEWS AND RESEARCH REPORTS

NOBLE FOUNDATION RESEARCH EMBRACES TECHNOLOGICAL INNOVATION AND PROVIDES NEW GENOMIC RESOURCES FOR THE SCIENTIFIC COMMUNITY.

AGRICULTURAL DIVISION

THROUGH CONSULTATION, EDUCATION AND RESEARCH, THE AGRICULTURAL DIVISION ASSISTS AGRICULTURAL PRODUCERS AND LAND MANAGERS IN ATTAINING THEIR GOALS.

When Lloyd Noble established The Samuel Roberts Noble Foundation in 1945, the new organization's first employees provided soil testing for southern Oklahoma farmers and ranchers. The Soils Branch, as the group was called, soon evolved into the Agricultural Division. More than six decades later, the division remains central to the Noble Foundation's mission to advance agriculture and conserve the soil. The division fulfills this charge through education and consultation programs for agricultural producers and by conducting applied research.

The Agricultural Division's consultation service, established in 1958, provides individually tailored recommendations to land managers with property in any of the 47 Oklahoma and Texas counties included in the program. In 2011, the program served more than 1,400 clients. Consultation is provided at no cost to participants.

The beef cattle industry remains the dominant agricultural enterprise in the Southern Great Plains. As a result, much of the Agricultural Division's work is geared toward addressing the needs and concerns of regional ranchers of all sizes and levels of experience. Through its education and research programs, the division encourages comprehensive management of cattle to promote animal health, as well as efficient and cost-effective stewardship of forage, land and water resources.

The Agricultural Research Team complements and advances the consultation program by conducting a multidisciplinary, systems-based approach to applied research. The division's research programs focus on answering real-world questions posed by regional agricultural producers, with outcomes applicable to both regional and global producers.

The Agricultural Division is led by Senior Vice President and Division Director Billy Cook, Ph.D.

Facing page: Wildlife Consultant Steven Smith (left) and Agricultural Economist Jeri Donnell (right) review land use plans with Chris Cowlbeck, a Noble Foundation consultation client, at his recreational cabin near Ardmore, Okla.

DURING THE PAST YEAR, THE AGRICULTURAL DIVISION:

- Added 134 new consultation clients for a total of 1,420.
- Gave research reports at 44 state, national and international scientific meetings, and made 166 scientific presentations to university and agricultural groups.
- Published 48 abstracts, four annual field trial variety reports and 21 peer-reviewed journal articles.
- Managed 46 research projects, eight demonstration and variety trial projects, and initiated two new research projects.
- Hosted 90 educational events that reached 2,994 adults and 952 youth.
- Hosted 13 youth events, including the Junior Beef Excellence Program, which recognizes the carcass merit of steers exhibited at junior livestock shows by 4-H and FFA members in eight southern Oklahoma counties; a tour by 123 Nebraska FFA members; Progressive Ag Safety Day; and a Science in Ag Day for southern Oklahoma students.
- Hosted 24 teachers for the Oklahoma Agriculture in the Classroom program, which is designed to spread knowledge about the state's food and fiber industries.

FORAGE IMPROVEMENT DIVISION

THE FORAGE IMPROVEMENT DIVISION TRANSLATES SCIENTIFIC DISCOVERIES INTO TANGIBLE PLANT VARIETIES USING BOTH TRADITIONAL AND MODERN PLANT BREEDING TECHNOLOGIES.

The Forage Improvement Division, established in 1997, serves as the translational research group for the Noble Foundation. Through both traditional plant breeding techniques and the application of emerging biotechnologies, the group develops new cultivated varieties of grasses and legumes for use as livestock forages. These activities constitute a bridge between laboratory discoveries from the Plant Biology Division and other prominent research institutions around the world and in-field application by the Agricultural Division.

This division focuses on development of improved plant performance in cool-season grasses and forage legumes. As one example, cattle producers in the Southern Great Plains have long sought cool-season forage alternatives that can fill the gaps between growing seasons of traditional warm-season grasses. The use of cool-season perennial forages benefits both domestic livestock production and consumers, as grazing becomes more efficient and costs are better managed.

In 2011, the Forage Improvement Division released and commercialized its first improved cool-season tall fescue, Texoma MaxQ II®, in concert with Grasslands Innovation Limited (New Zealand) and Pennington Seed, Inc.

Other work within the division explores crop sustainability issues, including agronomy and crop management programs. Individual laboratories use and develop techniques to improve plant performance during drought, adapt plants to tolerate adverse soil conditions and increase plant yield using fewer fertilizer and pesticide inputs. Forage Improvement researchers also contribute to the wider scientific community through the development and public release of genomic resources and genetic tools to assist in cultivar improvement.

The Forage Improvement Division is led by Senior Vice President and Division Director E. Charles Brummer, Ph.D.

Facing page: Associate Professor Malay Saha, Ph.D., examines tall fescue grass after recording a plant's infrared signature. The test plot is inside the Noble Foundation's "rainout" facility, a movable structure that simulates the dry conditions plants experience during drought.

DURING THE PAST YEAR, THE FORAGE IMPROVEMENT DIVISION FACULTY:

- Maintained seven primary Noble Foundation laboratories.
- Identified millions of DNA sequence variants among cultivated alfalfa germplasm that will be used to identify genes for important traits.
- Created systems for using annual legumes versus nitrogen fertilizer to maximize productivity and profitability of bermudagrass, tall fescue and rye/ryegrass pastures.
- Developed a high throughput genetic transformation system for switchgrass with an efficiency greater than 90 percent.
- Produced transgenic alfalfa plants overexpressing phytase and acid phosphatase genes that improve phosphate uptake in regular and phosphate-challenged soils.
- Identified molecular markers associated with stem rust resistance in tall fescue and used them to identify tolerant genotypes from breeding populations.
- Identified genetic markers associated with aluminum tolerance in alfalfa and initiated marker-assisted breeding programs.
- Successfully commercialized Texoma MaxQ II® tall fescue in collaboration with outside partners.
- Published 75 papers in international, peer-reviewed journals and books, and received 29 invitations to speak at national and international conferences.

PLANT BIOLOGY DIVISION

THE PLANT BIOLOGY DIVISION CONDUCTS WORLD-CLASS RESEARCH INTO THE BIOCHEMISTRY, GENETICS AND GENOMICS OF PLANTS.

By the late 1980s, agricultural technology continued to advance to the point that field-based studies alone were no longer adequate. The era's laboratory research played an increasingly vital role in agricultural advancements and new food production developments. In this environment, the Noble Foundation Board of Trustees approved the establishment of the Plant Biology Division. The new group was challenged to discover the inner workings of plants at the most fundamental genetic, biochemical and cellular levels.

The division has quickly matured into an internationally renowned research group, published widely in leading scientific journals. Through the division's programs, the Noble Foundation is recognized as a leader in several plant research fields that address plant quality and sustainability, including legume genomics; cell wall engineering; plant natural products; and plant developmental and stress biology.

Eleven laboratories, each focused on a core research mission, study a wide variety of plant processes. The integrated structure of the Noble Foundation allows laboratory discoveries in the Plant Biology Division to be passed along to the plant breeders within the Forage Improvement Division and eventually to field application by the Agricultural Division.

Since its inception in 1988, the division has been led by Senior Vice President and Division Director Richard A. Dixon, D.Phil., D.Sc. Dixon was elected to the National Academy of Sciences in 2007, becoming the first Noble Foundation researcher to attain the honor and only the second active academy member in Oklahoma.

Facing page: Professor Rick Nelson, Ph.D., (left) and Postdoctoral Fellow Chengke Liu, Ph.D., assess plant growth inside a controlled environment chamber. The growth chamber allows regulation of light, temperature and humidity for exact replication of experiments.

DURING THE PAST YEAR, PLANT BIOLOGY DIVISION FACULTY:

- Maintained 11 primary Noble Foundation laboratories.
- Received extramural support from the National Science Foundation; Oklahoma Center for the Advancement of Science and Technology; U.S. Department of Energy; National Center for Complementary and Alternative Medicine (National Institutes of Health); the National Aeronautics and Space Administration; and EPSCoR Research Experience for Undergraduates.
- Held 12 adjunct faculty positions at seven institutions of higher education, including Oklahoma State University, Rice University, Texas A&M University, University of Oklahoma, University of North Texas and University of Texas Southwestern Medical Center at Dallas.
- Served on 17 international editorial boards.
- Discovered a gene for manipulating plant leaf shape and agronomic properties.
- Discovered a novel lignin molecule with potential for carbon fiber manufacture.
- Discovered a new gene for engineering tannin production in alfalfa for bloat production.
- Published 85 peer-reviewed papers in international journals including *Annual Review of Phytopathology*, *Nature*, *Plant Cell*, *Plant Journal*, *Plant Physiology*, *Proceedings of the National Academy of Sciences* and *Trends in Plant Science*.
- Received $3.7 million in new extramural funding from both public and private sources.

TECHNOLOGY REVOLUTIONIZES AGRICULTURAL RESEARCH

NOBLE FOUNDATION ADOPTION OF TECHNOLOGY, SUCH AS THE GROWSAFE BEEF® SYSTEM, IS REVOLUTIONIZING AGRICULTURAL RESEARCH.

For generations, the goal of agricultural producers has been to produce more: more bushels of grain, more beef per acre, more food for a ballooning global population. Today, the goal remains the same, but with one additional stipulation: farmers and ranchers need to produce more grain and beef, but need to do so while using less – less water, less land, less fertilizer and less pesticide.

Technology becomes the linchpin to increasing agricultural efficiency with fewer inputs. This includes not only more sophisticated machinery to reduce labor, but advanced electronics that are reshaping how agricultural research is conducted.

"You cannot manage what you cannot measure," said Billy Cook, Ph.D., director of the Noble Foundation's Agricultural Division. "Technology is revolutionizing how we conduct agricultural research, allowing us to answer questions that producers have asked for decades; questions that will ultimately lead to better information and a more efficient industry."

BETTER BEEF

Chief among these regional agricultural questions is how to improve efficiencies in cattle production. The demand for protein-rich beef continues to increase as the world's population soars.

"Efficient livestock production optimizes natural resources, supports the producer's bottom line and keeps food costs manageable for the consumer," Cook explained.

To this end, the Noble Foundation and GrowSafe Systems Ltd. formed a collaboration in 2011 to test and leverage GrowSafe's latest technology. The two organizations hope to better understand feed efficiency in pasture-based beef cattle (i.e., which animal inherently turns feed into more weight). Feed efficiency has largely gone unstudied because of the difficulty and expense of calculating feed intake and weight gain. Measuring cattle weight required producers or researchers to round up and run an animal through a chute to collect one data point. Calculating intake was even more cumbersome as cattle were separated and fed by hand two or three times a day.

Through the last decade, GrowSafe has pioneered the development of new technology-based feed systems with sensors that continually monitor how much each animal eats in a production environment. Called the GrowSafe Feed Intake System, feed "bunks" recognize individual animals through an electronic RFID ear tag, then track the amount of food consumed and relay volumes of data back to a central computer.

A second GrowSafe system, GrowSafe Beef®, records the animal's water intake and weight. As each animal approaches the water trough, it steps on a scale that captures weight information. These two systems allow researchers to collect exponentially more data than before. "Think of the data as a picture," Cook said. "Traditional feed efficiency research would be like looking at a View-Master, where you clicked from one single grainy photo to the next. Feed efficiency research with GrowSafe is like watching high definition television."

The data allows researchers to pinpoint animals that are naturally feed efficient, then breed for this heritable trait. Initial studies have shown that after just two generations of selecting for this trait, steers and heifers consumed 11 percent less feed, but had similar weight and performance to randomly mated groups.

GrowSafe also allows researchers to examine animal behavior. Cattle exhibit disinterest in feeding or drinking during illness. The system monitors which animals' intakes have slowed and then alerts producers. "Behavior is a great indicator. Cattle start acting differently before you can see that anything is wrong," said Ryan Reuter, Ph.D., assistant professor. "We're now able to manage individual cattle, whereas in the past we could only manage herds."

EARLY OUTCOMES

Using GrowSafe, Noble Foundation agricultural researchers are seeking answers to questions that come directly from ranchers. One such project centers on understanding the effect of transportation stress on weaned calves. Noble researchers collaborated with Drs. Ron Randle and Tom Welch, as well as Andrea Lloyd (former Noble intern, 2005) from Texas A&M AgriLife Research and Extension Center at Overton on the project.

A set of calves was divided into two groups, shipping one directly from Overton to the Noble Foundation, while the other group experienced a longer trip that included unloading and loading. After the trip, researchers monitored the calves' feed and water intake for 28 days using GrowSafe. They discovered that the second group did experience some initial weight loss from longer travel, but there was no difference in performance, health or well-being of the calves after the monthlong trial. "This means a producer can ship cattle a little farther to get a better market price without any long-term impact on the calf," Reuter said.

Facing page: GrowSafe Beef® units allow the Agricultural Research Team to electronically gather cattle weight and water intake data.

GrowSafe Beef® technology is yielding new insight into animal behavior and cattle growth performance on pasture.

Assistant Professor Ryan Reuter, Ph.D., attaches a GPS collar to a steer to monitor the animal's movement in a real-world production environment. Such studies will give insight into cattle grazing patterns for better management practices.

In an application unique to the Noble Foundation, GrowSafe Beef systems were installed on small grains pasture where weight gain from grass is measured. This is the first time the technology has been taken out of the feeding pen and used in the pasture.

Researchers will now be able to take multiple readings on cattle weight gain during grazing, as well as monitor behavior through water intake. "We're going to have a better idea of what is happening in our grazing systems than ever before," Reuter said. "Beyond the contribution this makes to the research community, this makes the technology tangible for the producer."

BY LAND AND BY AIR

Noble Foundation agricultural researchers are also infusing technology into other projects designed to better understand forages consumed by livestock and wildlife. Farmers and ranchers have needed a large-scale method for analyzing the plant composition within their pastures. Producers cannot accurately assess the effects of grazing livestock if they do not know what plant species – as well as bare ground and natural formations – exist on their land.

Previously, producers or researchers could spend days or weeks tromping through pastures, measuring the composition of plant species. The labor-intensive process only sampled a small area, leaving the producer to make assumptions about the remaining land. The solution was putting one man in a small plane equipped with the right technology.

Noble Foundation researchers expanded on technology first developed by Terry Booth, Ph.D., who recently retired from the USDA Agricultural Research Service in Cheyenne, Wyo. Booth created specially equipped sport utility planes (slightly larger than ultralight planes) to provide "very large-scale aerial" (VLSA) vegetation surveys in a pasture.

Using planes carrying two or three cameras, researchers snap photos of the ground every 100 meters. The images are so clear that researchers can "zoom into specific areas so closely we can read the label of a soda can," said Corey Moffet, Ph.D., Noble Foundation assistant professor.

VLSA surveys produce more information than ever before. "If you spent 1,000 man-hours sampling vegetation, you would not have collected as much information as one person can collect in a plane with VLSA equipment in just a few hours," Moffet said. "We can now determine the plant species composition across an entire property."

Noble Foundation researchers have successfully used VLSA technology to show the change in vegetation after prescribed burns. "It was clear that we were able to reduce woody cover like the eastern red cedar in the areas that were burned compared to those that were not," Moffet said. "VLSA will someday allow producers to realize the impact treatments like burning are having on their individual operations."

Prescribed burning also played a role in another technology-based project, this one centered on the use of habitat by livestock and deer. Simple behavioral questions have been largely unanswerable: How are livestock and deer using the pasture? How do they interact? Does prescribed burning change foraging behavior?

To find answers, Moffet and Ken Gee, senior wildlife researcher, use GPS collars on both deer and cattle to track and compare individual animal movement on burned and unburned pastures. While GPS is not a new technology, using it to answer specific questions is unique.

GPS collars allow researchers to obtain multiple readings each hour. Previous technology only provided a few of these readings a day and required manual triangulation, which was less accurate. "We used to go out and look at where the cattle were, but there was no way to accurately know where they had been or where they were going," Gee said. "Now we're able to track them 24 hours a day and know which resources they're using. This information will be invaluable to producers."

Together, this array of technologies is advancing the way that Noble Foundation researchers ask and answer questions, which translates into more useful information for the agricultural producer and ultimately more efficient production.

"You begin to combine all of these technologies and you can see how the industry is preparing to undergo radical changes," Cook said. "Our adoption of GrowSafe, VLSA and animal tracking truly distinguishes the Noble Foundation as an agent of change in advanced agricultural research."

ALFALFA GENOME EXPLORATION ROOTED IN NOBLE LEGACY

THE NOBLE FOUNDATION IS LEVERAGING ITS LEGUME GENOMICS EXPERTISE TO UNDERSTAND AN ECONOMICALLY IMPORTANT PLANT.

Humans have long tinkered with plant genetics. For centuries, plant breeders improved the offerings of nature by choosing plants with the best features, growing them and then selecting the best of the offspring to breed the next time around. This approach has been highly effective: it has brought mankind ears of corn that dwarf the maize of ancient Mexico and strawberries that are spectacularly red and sometimes the size of apricots. But improving plants through trial and error is sometimes an inexact process. It's a bit like baking without a recipe. Cooks have to rely on what they can see and smell, which doesn't necessarily cover everything that goes into the cake.

While plant breeding remains central to plant improvement, scientists are developing new tools to better understand the "ingredients" of a plant. Understanding the underlying genetics of the plant allows plant breeders to more easily and quickly improve plants, making them better able to tolerate drought, resist disease or be more nutritious.

Finding a plant's most basic composition is the goal of researchers in the era of molecular genetics. Each plant contains a set of instructions, called a genome, for producing every molecule it needs to make. The genome is the blueprint that makes each plant what it is. The recipe has always been there, but researchers are finally able to understand it through genetic advancements.

DECODING ALFALFA'S GENES

The individual components of a genome are genes, which contain the instructions for every protein (the chemical catalysts, as well as many of the structural building blocks) made by a plant cell. The code itself – a gene's "sequence" – is determined by the order of basic building blocks, or "base pairs," along the gene.

A generation ago, obtaining a catalog of a plant's genome would have been too arduous and too expensive to attempt because sequencing even a handful of genes took years. But technological innovation has come along that can sequence multiple genes at once and offer signposts about their location along the genome.

Just as technology has transformed cell phones into miniature computers and flattened televisions to the thinness of plywood, so has it revolutionized the ability to sequence a gene. So much so that scientists at The Samuel Roberts Noble Foundation have launched an effort to sequence all the genes present in alfalfa.

Alfalfa will not be the first plant to have its genome revealed, but it will be among the most significant. It produces seeds in pods like all legumes and represents the fourth most important U.S. crop economically. Alfalfa is one of the most valued forms of hay and is one of the foundations of the nation's dairy industry.

"Alfalfa has always been center stage for legumes from the Noble Foundation's perspective," said Michael Udvardi, a professor in the Noble Foundation's Plant Biology Division. Grown since the beginning of recorded human history, alfalfa is commonly referred to as the "Queen of Forages" for its reputation of being able to tolerate harsh conditions and still yield biomass that is nutritiously rich. But until recently, alfalfa was considered so genetically complex that an effort to sequence its genome would have been considered too ambitious to even put on the table. "The project was always possible, but it would have taken more money than we could have put into it," Udvardi said.

In the past five years, biological researchers have watched in awe as gene sequencing has become so quick and affordable that even dog owners can send off a drool sample and obtain a genetic snapshot of their pets. "The advancement in gene sequencing technology has surprised everyone," Udvardi said. "Every year, the technology has improved almost 10-fold. It's even outpacing what's happened to computers."

Which is why, in 2011, the Noble Foundation, in collaboration with other groups, launched an effort to determine the sequence of the alfalfa genome. Once completed, it will be one of the most complex genomes ever unveiled. Scientists have already obtained the genomes for many other significant plant species – including corn, rice, soybean and tomatoes – but the genome composition of alfalfa remains unknown.

MEDICAGO TRUNCATULA – ALFALFA'S RELATIVE

Noble has led an important genome quest before. In the 2000s, it began an effort to sequence the genes of *Medicago truncatula* (barrel medic), a small legume native to the Mediterranean. *Medicago truncatula* is not an economically important plant in the United States, but it contains nuggets of gold in scientific hands. It has one advantage over its close relative alfalfa (*Medicago sativa*); *Medicago truncatula* has a relatively simple genetic architecture, making it an easier plant to use for research. It is made up of about 40,000 genes and contains two copies of each one of its eight chromosomes. (If the idea of

Facing page: Professor Michael Udvardi, Ph.D., examines alfalfa, a legume, in the Noble Foundation greenhouse. Udvardi's laboratory has performed extensive analysis of legume genomes.

An alfalfa sample is snipped for analysis in a laboratory. Alfalfa is a close relative of Medicago truncatula, *which has long been used as a model plant in global legume studies.*

Assistant Professor Maria Monteros, Ph.D., and Postdoctoral Fellow Dong-Man Khu, Ph.D., prepare alfalfa samples for genetic analysis. Monteros' laboratory specializes in legume research.

two copies sounds familiar, it is because humans also contain two copies of each gene bundled within 23 pairs of chromosomes).

Medicago truncatula is a vital research tool because it is easy to grow and reproduce, its genes are easy to handle, and it has a convenient pedigree. Many of the genes in alfalfa – and other legumes such as soybeans and peas – are shared by *Medicago truncatula*. This kind of genetic double duty is not unique to the plant world. Humans and chimpanzees are about 98 percent genetically similar, and about 85 percent of our genes are also found in mice.

The project to sequence the genome of *Medicago truncatula* began with an initial investment of $5 million from the Noble Foundation, followed by additional funding from the National Science Foundation and institutions in Europe. This was not a small undertaking; 124 scientists from eight countries ultimately were involved in the project.

After a decade of work and a price tag that approached $20 million, an international scientific team described the *Medicago truncatula* genome in December 2011 in the scientific journal *Nature*. Because it serves as a model for other legumes, the *Medicago truncatula* genome stands to contribute a wealth of information to plant biology, but the genes of keen interest to many researchers are those that drive a process called nitrogen fixation. Legumes have the unique ability to capture nitrogen from the air, snap a few atoms of hydrogen onto the nitrogen and create ammonia, which they then use as a self-made fertilizer. Other crops typically rely on artificial sources of nitrogen fertilizer, which can lead to

environmental problems. Among the concerns: algal blooms in creeks and rivers, and dead zones around coastal waters, all of which arise from unnatural levels of run-off nitrogen fueling the growth of algae.

Being able to identify the genes Medicago uses for nitrogen fixation might enable researchers to one day transfer that ability to other types of plants. If a nitrogen-hungry plant like corn, for example, could avail itself of nitrogen from the atmosphere, farmers would not need to apply so much chemical fertilizer – an attractive prospect both economically and environmentally.

COMPLEX GENOME MEETS TECHNOLOGY ADVANCEMENT

Importantly for the alfalfa genome, something happened between the launch of the *Medicago truncatula* project and its completion – sequencing technology kept getting better and cheaper.

Technology had finally reached the point where genes could be sequenced fast enough and cheap enough to be used for a plant like alfalfa, which just a few years earlier would have been a daunting task.

Unlike *Medicago truncatula*, which has two copies of each chromosome, alfalfa contains four non-identical copies of each chromosome for a total of 32 chromosomes. These quadruplicates complicate the effort to assemble the genes in the correct order. The way Noble researcher Maria Monteros, Ph.D., assistant professor, explained it, assembling a genome with four slightly varying versions of each gene is similar to trying to put together one puzzle from four almost alike sets of pieces. "You know that piece is part of the genome, but it's harder to tell exactly where it goes," she said.

Alfalfa's quadruple set of genes always made genetic investigation and genome sequencing challenging. But following the revolution in DNA sequencing technology – which continues even now – genomes that would normally take years of exhaustive research to sequence can now be completed in a matter of months.

In 2008, during a meeting of the North American Alfalfa Improvement Conference, researchers began tossing around the idea of sequencing alfalfa in addition to *Medicago truncatula*. "We said, 'Having a model genome is great, but why don't we look at sequencing the actual crop?'" Monteros recalled. For all its usefulness, *Medicago truncatula* still lacks some important genes that alfalfa depends on, such as those that drive its ability to persist over years and provide high yields. A task that once seemed impossible and too expensive had become feasible. And all for a bargain, as genomes go. Whereas the *Medicago truncatula* genome took 10 years and close to $20 million, Udvardi estimates that alfalfa may cost less than $1 million, and a rough draft might be available as early as next year.

OUTSIDE COLLABORATIONS

The actual sequencing is taking place outside Ardmore, Okla. Given the speed of technological advancement and the capital cost of new equipment, Noble Foundation scientists have contracted much of the sequencing to institutions that specialize in that field. The collaborators are the National Center for Genome Resources, which was also involved in the sequencing of *Medicago truncatula*, and the molecular breeding company KeyGene for additional sequencing and assembly of the alfalfa genome.

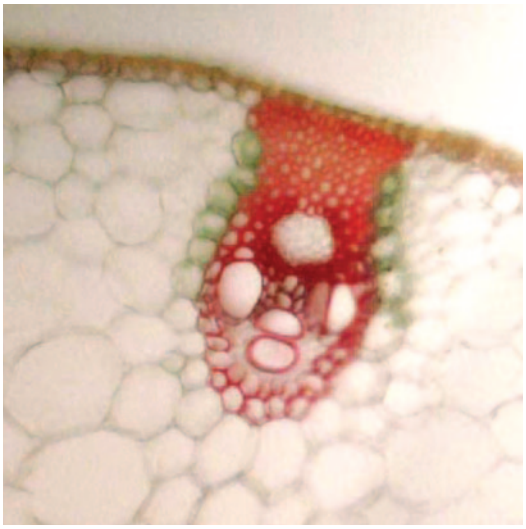
"This is a great example of Noble taking leadership in this area," said Greg May, Ph.D., a former Noble scientist who served as president of the National Center for Genome Resources until fall 2011. Once the genome for the Queen of Forages is in hand, researchers can start to uncover her secrets. For example, researchers could identify the genes that are involved in disease resistance and select those plants for breeding – without having to wait for the plants to grow in the field and either wait for a natural infestation of the disease or perhaps inoculate, to visually identify the resistant plants.

"Let's say you're trying to develop an alfalfa with better drought resistance," said Mark McCaslin, Ph.D., the president of Forage Genetics International, an alfalfa improvement company that is also a partner in the project. "The way it has traditionally worked, you would take plants into the field and hope you have drought conditions sufficient to evaluate the plants for drought tolerance. You would then select those plants that performed best under limited moisture. But if you have molecular markers associated with genes that confer drought tolerance," he said, "You could take a leaf sample from a seedling in the greenhouse and say, 'Does it have those genetic markers? If so, I'll use it in my drought breeding program.'"

With a recipe in hand, scientists could start to cook up a kind of alfalfa that farmers will find truly delectable. ■

DISCOVERIES

THE FOLLOWING PAGES PRESENT A SAMPLING OF SIGNIFICANT NOBLE FOUNDATION RESEARCH FINDINGS AND EDUCATIONAL ACTIVITIES DURING 2011.



NOBLE RESEARCHERS IMPROVE PLANT DIGESTIBILITY

For more than two decades, Plant Biology Division Director Richard Dixon, D.Phil., D.Sci., has been researching improving plant digestibility by reducing lignin, a compound that serves as a structural component in plants. Lignin is difficult for ruminant animals to digest and also hinders access to plant sugars that must be unlocked for biofuel fermentation. When lignin is reduced too much, the plant's biomass is, in some cases, strongly decreased. Therefore, scientists sought the key to decreasing lignin while maintaining normal biomass.

Dixon, along with Noble researchers Lina Gallego-Giraldo, Ph.D., Luis Escamilla-Trevino, Ph.D., and Lisa A. Jackson, observed that plants with low lignin possessed high levels of salicylic acid. The more they decreased lignin, the more the salicylic acid increased, so they concluded that salicylic acid may be involved in a signaling process linking cell wall structure to growth of the plant. The group took low-lignin plants and crossed them with plants that were unable to produce salicylic acid. The offspring possessed low lignin, but no salicylic acid, and grew normally while maintaining enhanced digestibility.

Salicylic acid plays an important role in disease resistance, so the new plants have lowered resistance to pathogens. Still, the breakthrough is another step towards production of low lignin plants that maintain normal growth. This research, which was funded by the Oklahoma Bioenergy Center and the Department of Energy's Bioenergy Sciences Center (BESC), was published in the *Proceedings of the National Academy of Sciences*.

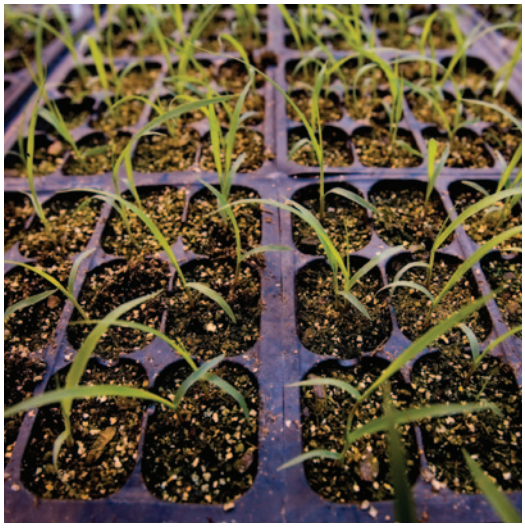
NEW DISCOVERY COULD PRODUCE CARBON FIBER

Collaborators at the Noble Foundation, Rutgers University and the University of Wisconsin have discovered a new type of lignin, a compound that serves as a structural component and circulatory system in plants. Lignin can theoretically be made from five components (so-called monolignols, represented by the letters H, C, G, 5-OH-G and S). Of these, C-lignin is essentially unreported.

While analyzing the lignin of vanilla beans for Daphna Havkin-Frenkel, Ph.D., Rutgers University, Noble research scientist Fang Chen, Ph.D., spotted a low level of the C component and found the seeds of vanilla contained all C units.

John Ralph, Ph.D., professor of biochemistry at the University of Wisconsin, and his postdoctoral fellow, Yuki Tobimatsu, Ph.D., confirmed the findings. Chen then found C-lignin in the seeds of Melocactus and several other cactus species. Ralph's team determined the linear nature of the C-lignin chemical polymer, and now Oak Ridge National Laboratory is evaluating its role in the potential manufacture of useful consumer products, like carbon fibers or plastics.

This discovery was selected as the cover story for the *Proceedings of the National Academy of Sciences* and an "editor's choice" story in *Science* magazine.



LIGNIN-LITE SWITCHGRASS BOOSTS BIOFUEL POTENTIAL

Plant engineering by the Noble Foundation and fermentation research by Oak Ridge National Laboratory (ORNL) has produced a new lignin-lite version of switchgrass, a native prairie grass being studied as a potential biofuel source.

Noble Foundation Professor ZengYu Wang, Ph.D., and his team "downregulated" the plant's primary structural component, lignin, by about one-eighth, then passed the materials to Jonathan Mielenz at the Department of Energy's BioEnergy Science Center at ORNL. Mielenz's research team followed up with fermentation research that revealed the new transgenic version of switchgrass produces about one-third more ethanol than conventional switchgrass.

Additionally, the "lite" switchgrass is more easily converted to biofuel with fewer costly inputs required during fermentation. This improved plant feedstock will generate more fuel per acre, benefiting not only the transportation sector, but also the growers.

This research was published in the *Proceedings of the National Academy of Sciences* and included authors from the Noble Foundation, ORNL and Georgia Institute of Technology.

WORKSHOP OFFERS FERAL HOG CONTROL ADVICE

The Noble Foundation, Oklahoma Cooperative Extension Service and Mississippi State University Extension Service hosted a wild hog management workshop in the spring of 2011 that drew more than 500 agricultural producers.

The workshop explored methods to control damage due to wild hogs (also known as “feral hogs”). Feral hogs are an invasive species that has spread across the South and the Southern Great Plains. They compete with native wildlife, damage pastures and crops, and can spread disease, creating a need for effective control. The USDA estimates that wild hog numbers nationally may exceed 5 million and that the species may cost the economy more than $1 billion each year in property damage and control costs.

Seminar attendees received information on wild hog history, biology (including diseases and parasites), and trapping techniques and designs. There was also a discussion on wildlife services available in Oklahoma and laws governing removal of animals.

NOBLE FOUNDATION PROVIDES DROUGHT EDUCATION

The 2010-2011 drought was one of the most severe one-year periods for heat and lack of precipitation in the Southern Great Plains since the Dust Bowl.

Farmers and ranchers experienced dramatic yield reductions (up to 75 percent less than the previous year) or complete crop losses. Drought conditions reduced or eliminated vital water resources and destroyed forages, causing most Oklahoma and Texas livestock producers to dramatically destock.

In response to the dire situation, the Noble Foundation launched a new online resource – www.noble.org/drought – that served as a central repository for information on managing resources during drought, including safeguarding pastures, destocking, tax implications and wildlife concerns.

Information was developed by Noble's agricultural consultants as well as university researchers and agricultural experts from around the country. The Web page remains active to provide drought recovery advice to producers.

NEW TALL FESCUE VARIETY OFFERS GRAZING ALTERNATIVE

For decades, farmers and ranchers in the Southern Great Plains have had two choices for feeding livestock during the fall and early spring – purchase hay or plant a winter annual, for example, ryegrass, for forage production. Perennial options have been unavailable because they can rarely survive the region's blazing summer heat.

Certain varieties of tall fescue held the potential to last through the summer months and return each year, but they often carried the risk of fescue toxicosis, an illness due to a small fungus that forms symbiotic relationships within the plant.

Noble Foundation plant breeders and researchers, along with collaborator Grasslands Innovation Limited of New Zealand, spent more than a decade developing a new variety of tall fescue that combines the advantages of a perennial – reduced time and expense of replanting annual crops – while removing the risk of toxicity.

Called Texoma MaxQ II®, the new tall fescue variety is the first commercial forage designed specifically as a cool-season perennial grass for the Southern Great Plains. Texoma MaxQ II® is licensed to Pennington Seed Co. and will be commercially available this year.

GENOME REVEALS ORIGINS OF INVALUABLE LEGUME TRAITS

In 2001, the Noble Foundation kicked off an international research project to sequence the genome of the legume *Medicago truncatula* and use Medicago as a model plant for studying other agriculturally significant legumes like alfalfa.

The Medicago genome project yielded significant data about legume gene structure and function, including how legumes evolved symbiotic nitrogen fixation, a process by which legumes convert atmospheric nitrogen to ammonia for plant growth.

Legumes form a symbiotic relationship with bacteria called rhizobia that form in root nodules. Through nitrogen fixation, legumes improve the soil for other crops and reduce the need for nitrogen fertilizer. Researchers will use this knowledge to enhance nitrogen fixation in other legumes and perhaps develop the trait in crops like corn, which do not have this ability.

The Medicago genome sequence and insight into the evolution of symbiotic nitrogen fixation was published in the Dec. 22 edition of *Nature*. The paper had 124 co-authors at 31 institutions in eight countries.

NOBLE FOUNDATION CHAMPIONS NEW MEDICAL RESEARCH TOWER

THE OKLAHOMA MEDICAL RESEARCH FOUNDATION'S NEW RESEARCH TOWER STANDS PROMINENTLY IN THE HEART OF OKLAHOMA CITY'S BIOMEDICAL COMMUNITY.

"If you could dream the ideal research facility, you could not dream it better."

Such is the conclusion of Gabriel Pardo, M.D., about the new Oklahoma Medical Research Foundation (OMRF) research tower, which stands in the heart of Oklahoma City's biomedical community.

As director of OMRF's new Multiple Sclerosis Center of Excellence, which is located in the tower, Pardo takes into account all the impressive architectural and aesthetic aspects of the facility. Expanses of windows allow natural daylight in and reduce the need for artificial lighting. Construction included extensive use of both recycled and regionally sourced materials. Helix-shaped wind turbines, a landscaped roof, a rain garden and water-efficient landscaping are just a few of the tower's features that led to a LEED (Leadership in Energy and Environmental Design) gold certification and recognition as a finalist for the 2010 Renewable Energy World North America Award.

But what Pardo really marvels about is inside the tower. In addition to the MS center, the facility houses The Samuel Roberts Noble Cardiovascular Institute, named in recognition of the Noble Foundation's $6 million gift for its construction. The institute houses the Cardiovascular Biology Research Program, which is headed by Rodger McEver, M.D., a leading researcher in the fields of inflammation and blood clotting, processes that contribute to conditions such as heart attacks, strokes and sickle cell anemia.

DESIGNED FOR INTERACTION

The center features dozens of world-class research laboratories, which enable OMRF's scientists to advance medical discovery within spaces specially designed to encourage serendipitous interactions among researchers.

A great deal of thought went into the design of the facility, explained OMRF President Stephen Prescott, M.D.

"The extraordinary space in the tower sets a new standard," said Prescott, under whose leadership this expansion, the largest in OMRF history, was conceived and implemented. "It's also a sociology experiment. There are four laboratory pods on each floor that are shared by two scientists who are members of the same department, but work in different areas. We intentionally mix people up, not so much to specifically collaborate, but to get them to interact more. The hope is that chance interactions will lead to more and better science."

Since OMRF's founding in 1946, its contributions to modern science and medicine include three FDA-approved drugs, more than 600 domestic and international patents, and a dozen biotechnology spin-off companies. "The new facility will increase these activities, fueling additional private-sector growth in Oklahoma's biotechnology industry," Prescott said.

Key to that growth is an emphasis on translational research, moving laboratory theory into clinical application. "Historically, we have been primarily laboratory-based with some clinical research," Prescott said. "That ratio will change. Both will grow, but clinical research will grow more. That is our focus moving forward."

RESEARCHING A NEUROLOGICAL DISORDER

Nowhere is that more evident than in the Multiple Sclerosis Center of Excellence. "The only way to tackle a disease as complex as MS is to attack it from multiple points of view," explained Pardo, an internationally renowned neurologist and neuro-ophthalmologist who joined OMRF in 2011. "Our first priority is to provide excellent clinical care to our patients. That care implies a multidisciplinary team approach. Because MS is a neurological disease, a neurologist leads the team. But we also have physician's assistants, who extend our ability to meet patients' needs in a timely fashion; we have nurses to administer medications; we have a physical therapist who specializes in the deficits suffered by MS patients; and we have a counselor and social worker to help patients work through the emotional and even financial components of having this chronic illness."

This comprehensive approach also includes clinical research. "We want to find better answers for why MS occurs and how it can be treated or even prevented," Pardo said. "Some of our patients try new medications that are in Phase II and Phase III clinical trials. We are working to better understand balance and gait abnormalities so we can improve our patients' quality of life." Pardo and his colleagues also take advantage of OMRF's phenomenal basic research resources. "Nowhere else in the country is translational research facilitated as much as it is here," he said. "Integrating basic and clinical research is how we will be able to provide answers to our many questions about MS and other diseases."

UNDERSTANDING CARDIOVASCULAR MECHANISMS

The same is true in The Samuel Roberts Noble Cardiovascular Institute, where researchers like Courtney Griffin, Ph.D., investigate fundamental

Facing page: The Oklahoma Medical Research Foundation's new research tower houses world-class laboratories and clinics. A $6 million grant from the Noble Foundation assisted with the facility's construction.


OMRF

Gabriel Pardo, M.D., (right) reviews patient records with Physician's Assistant David Dube in OMRF's new Multiple Sclerosis Center of Excellence.

Courtney Griffin, Ph.D., (left) discusses cardiovascular research results with Associate Research Scientist Mandi Wiley, Ph.D.

mechanisms involved in blood coagulation, inflammation and arterial plaque formation. Griffin, who joined OMRF in 2008, heads a laboratory team of six, where she studies blood vessel development. "Certain diseases require blood vessel development for their progression. Tumors, for example, thrive on blood flow. We want to know how to stop vessel growth to stop disease progression," she explained. "But vessel growth also can be necessary and positive, as in the case of healing wounds. So we also want to learn how to build new vessels."

Since moving into her tower laboratory in spring 2011, Griffin already has experienced the type of interaction the building design was intended to spark. One of the scientists with whom she shares laboratory space is a renowned microscopist who helped one of her students understand a blood vessel disorder through high magnification imagery. "That has been a wonderful collaboration," she said. "The luxury of having colleagues nearby has pushed my research forward faster than if I had gone to an institution where I was the only blood vessel researcher. We help each other do the best science we can."

Endorsements like those of Griffin and Pardo are clear signals that OMRF scientists have embraced the translational research initiative. "We already have seen great progress in reaching that goal," Prescott said. "But our aspirations are even greater than what we have accomplished so far." ■

GRANTING REPORT

THE SAMUEL ROBERTS NOBLE FOUNDATION

ORGANIZATION	GRANT AMOUNT	YEAR APPROVED	PAID IN 2011
ARBUCKLE LIFE SOLUTIONS, INC. *Ardmore, Okla.* Renewed operating support	$30,000	2011	$30,000
ASSOCIATION OF PROFESSIONAL OKLAHOMA EDUCATORS FOUNDATION *Norman, Okla.* Renewed operating support	20,000	2011	20,000
ATLANTA HISTORICAL SOCIETY, INC. *Atlanta, Ga.* Capital campaign	20,000	2011	20,000
ATLANTA UNION MISSION CORPORATION *Atlanta, Ga.* Support of the men's program Support of the women's program	10,000 10,000	2011 2011	10,000 10,000
BOY SCOUTS OF AMERICA, ARBUCKLE AREA COUNCIL *Ardmore, Okla.* Facility improvements at Camp Simpson	100,000	2011	100,000
CAPITAL RESEARCH CENTER *Washington, D.C.* Operating support	25,000	2011	25,000
CARTER COUNTY CASA, INC. *Ardmore, Okla.* Renewed operating support	10,000	2011	10,000
CENTER OF FAMILY LOVE *Okarche, Okla.* Support to renovate intermediate care facilities	100,000	2011	100,000
CHARLES B. GODDARD CENTER FOR VISUAL AND PERFORMING ARTS, INC. *Ardmore, Okla.* Renewed operating support	25,000	2011	25,000
CHISHOLM TRAIL HERITAGE CENTER ASSOCIATION *Duncan, Okla.* Educational program support and capital improvements	25,000	2011	25,000
COLONIAL WILLIAMSBURG FOUNDATION *Williamsburg, Va.* 2011 Oklahoma Teachers Institute	10,000	2011	10,000
COMMUNITIES IN SCHOOLS ARDMORE OKLAHOMA, INC. *Ardmore, Okla.* 2012 Summer of Service program and operating support	47,600	2011	47,600
COURTNEY COMMUNITY FIRE DEPARTMENT *Ringling, Okla.* Operating support	500	2011	500
CRINER HILLS FIRE DEPARTMENT *Overbrook, Okla.* Operating support	500	2011	500

ORGANIZATION	GRANT AMOUNT	YEAR APPROVED	PAID IN 2011
DEAN A. MCGEE EYE INSTITUTE			
Oklahoma City, Okla.			
Capital campaign	250,000	2011	250,000
DIABETES SOLUTIONS - OK, INC.			
Oklahoma City, Okla.			
Support for Camp Endres	7,500	2011	7,500
EASTMAN COMMUNITY VOLUNTEER FIRE DEPARTMENT			
Marietta, Okla.			
Operating support	500	2011	500
EASTSIDE LAKE MURRAY VOLUNTEER FIRE DEPARTMENT			
Marietta, Okla.			
Operating support	500	2011	500
EDUCATION AND EMPLOYMENT MINISTRY, INC.			
Oklahoma City, Okla.			
Renewed operating support	10,000	2011	10,000
ENVILLE VOLUNTEER FIRE DEPARTMENT			
Marietta, Okla.			
Operating support	500	2011	500
FALCONHEAD FIRE DEPARTMENT			
Burneyville, Okla.			
Operating support	500	2011	500
FAMILY SHELTER OF SOUTHERN OKLAHOMA			
Ardmore, Okla.			
Support for three full-time advocates	50,000	2011	50,000
GLORIA AINSWORTH CHILD CARE & LEARNING CENTER, INC.			
Ardmore, Okla.			
Renewed operating support	10,000	2011	10,000
GOOD SHEPHERD MEDICAL AND DENTAL CLINIC FOUNDATION			
Ardmore, Okla.			
Renewed operating support	30,000	2011	30,000
Operating support	365,676	2011	365,676
GREAT EXPECTATIONS FOUNDATION			
Tahlequah, Okla.			
Renewed operating support	15,000	2011	15,000
GREATER ARDMORE SCHOLARSHIP FOUNDATION, INC.			
Ardmore, Okla.			
Distribution from the Pettitt Educational Fund	59,508	2011	59,508
GREENVILLE-OVERBROOK VOLUNTEER FIRE DEPARTMENT			
Marietta, Okla.			
Operating support	500	2011	500
HARDY MURPHY COLISEUM AUTHORITY			
Ardmore, Okla.			
Capital improvements	280,000	2011	280,000

ORGANIZATION	GRANT AMOUNT	YEAR APPROVED	PAID IN 2011
INTEGRIS BAPTIST MEDICAL CENTER FOUNDATION *Oklahoma City, Okla.* Research and development of miniature blood pumps	150,000	2011	150,000
INTERCOLLEGIATE STUDIES INSTITUTE, INC. *Wilmington, Del.* Leadership for America's Future campaign	25,000	2011	25,000
JIMTOWN VOLUNTEER FIRE DEPARTMENT *Burneyville, Okla.* Operating support	500	2011	500
LAKE MURRAY VILLAGE FIRE DEPARTMENT *Ardmore, Okla.* Operating support	500	2011	500
LAKE THUNDERBIRD EDUCATIONAL FOUNDATION *Norman, Okla.* BoatHouse maintenance	5,000	2011	5,000
LEADERSHIP INSTITUTE *Arlington, Va.* Renewed operating support	5,000	2011	5,000
LEADERSHIP OKLAHOMA, INC. *Oklahoma City, Okla.* Support for the adult leadership program	10,000	2011	10,000
LEADING THE WAY WITH DR. MICHAEL YOUSSEF, INC. *Atlanta, Ga.* Support for KINGDOM SAT broadcasting	150,000	2011	150,000
LEON FIRE DEPARTMENT *Leon, Okla.* Operating support	500	2011	500
LONE GROVE VOLUNTEER FIRE DEPARTMENT *Lone Grove, Okla.* Operating support	500	2011	500
MARIETTA VOLUNTEER FIRE DEPARTMENT *Marietta, Okla.* Operating support	500	2011	500
MURRAY STATE COLLEGE FOUNDATION, INC. *Tishomingo, Okla.* Agriculture scholarships	5,000	2011	5,000
NATIONAL CENTER FOR POLICY ANALYSIS *Dallas, Texas* Four Star Debate	10,000	2011	10,000
OKLAHOMA ARTS INSTITUTE *Oklahoma City, Okla.* Renewed support for the Summer Arts Institute	7,500	2011	7,500

ORGANIZATION	GRANT AMOUNT	YEAR APPROVED	PAID IN 2011
OKLAHOMA COUNCIL OF PUBLIC AFFAIRS, INC.			
Oklahoma City, Okla.			
Operating support	400,000	2008	100,000
OKLAHOMA MEDICAL RESEARCH FOUNDATION			
Oklahoma City, Okla.			
Research tower construction	6,000,000	2008	2,000,000
OKLAHOMA SCHOOL OF SCIENCE AND MATHEMATICS FOUNDATION			
Oklahoma City, Okla.			
2012 faculty awards	35,000	2011	35,000
OKLAHOMA STATE UNIVERSITY FOUNDATION			
Stillwater, Okla.			
Renewed support for the Oklahoma Agriculture Leadership Program	20,000	2010	20,000
Agriculture scholarships	10,000	2011	10,000
ORR FIRE DEPARTMENT			
Ringling, Okla.			
Operating support	500	2011	500
PANHANDLE STATE FOUNDATION			
Goodwell, Okla.			
Agriculture scholarships	8,000	2011	8,000
PHILANTHROPY ROUNDTABLE			
Washington, D.C.			
Renewed operating support	10,000	2011	10,000
READING ROOM, INC.			
Ardmore, Okla.			
Reading therapists' salaries	50,000	2011	50,000
REGIONAL FOOD BANK OF OKLAHOMA, INC.			
Oklahoma City, Okla.			
Operating support	50,000	2011	50,000
REINHARDT UNIVERSITY			
Waleska, Ga.			
Restoration of historic structures	20,000	2011	20,000
SALVATION ARMY			
Ardmore, Okla.			
Employee contribution match for Japanese tsunami relief	2,815	2011	2,815
Women's shelter furnishings and equipment	50,000	2011	50,000
SHADY DALE VOLUNTEER FIRE DEPARTMENT			
Marietta, Okla.			
Operating support	500	2011	500
SOUTHEASTERN LEGAL FOUNDATION, INC.			
Marietta, Ga.			
Operating support	40,000	2011	40,000
SOUTHERN OKLAHOMA TECHNOLOGY CENTER			
Ardmore, Okla.			
Scholarships	4,100	2011	4,100

ORGANIZATION	GRANT AMOUNT	YEAR APPROVED	PAID IN 2011
SOUTHWESTERN DIABETIC FOUNDATION, INC. *Gainesville, Texas* Air conditioner for Camp Sweeney cafeteria	10,000	2011	10,000
SPECIAL OLYMPICS OKLAHOMA, INC. *Tulsa, Okla.* Operating support	5,000	2011	5,000
U.S. FOUNDATION FOR INSPIRATION AND RECOGNITION OF SCIENCE AND TECHNOLOGY *Manchester, N.H.* Support for 2012 Oklahoma FIRST Robotics Competition	25,000	2011	25,000
UNITED WAY OF SOUTH CENTRAL OKLAHOMA, INC. Ardmore, Okla. Employee contribution match 2012	35,464	2011	35,464
WASHINGTON LEGAL FOUNDATION *Washington, D.C.* Renewed operating support	5,000	2011	5,000
WILSON VOLUNTEER FIRE DEPARTMENT *Wilson, Okla.* Operating support	500	2011	500
YMCA OF ARDMORE *Ardmore, Okla.* Renewed operating support	40,000	2011	40,000

EMPLOYEE MATCHING GRANTS AND SCHOLARSHIPS	
EMPLOYEE MATCHING GRANTS To match 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	$282,247
NOBLE EDUCATIONAL FUND To provide a maximum of ten $20,000 four-year awards to children of employees of Noble companies	200,000
SAM NOBLE SCHOLARSHIPS To provide scholarships in the fields of agriculture and technology to southern Oklahoma students	130,625
TOTAL GRANT PAYMENTS DURING 2011	**$5,018,535**

FINANCIAL REPORT

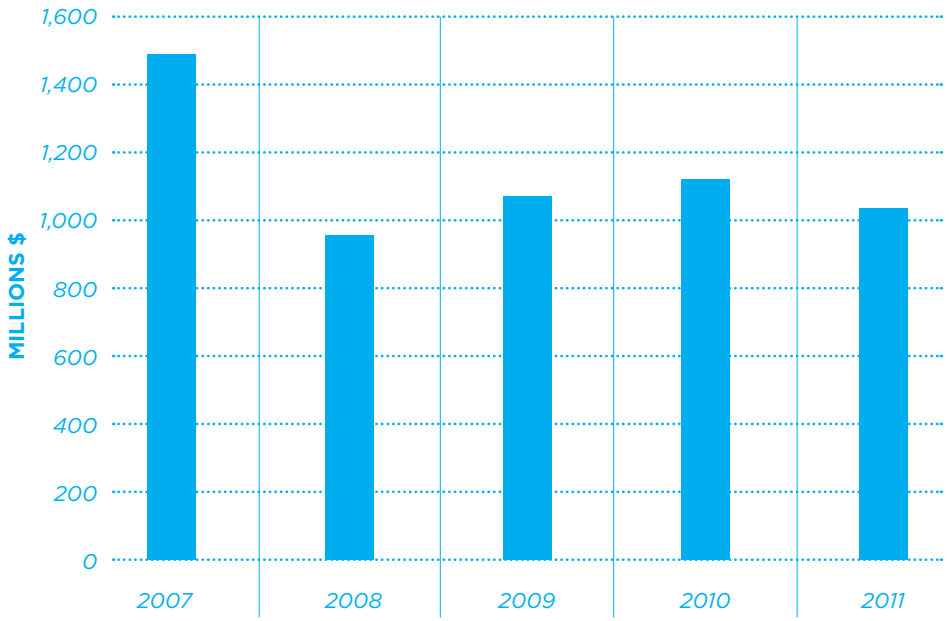
THE SAMUEL ROBERTS NOBLE FOUNDATION

THE SAMUEL ROBERTS NOBLE FOUNDATION
STATEMENTS OF FINANCIAL POSITION
DECEMBER 31

ASSETS

	2011	2010
CURRENT ASSETS		
Cash	$1,200	$510,236
Short-term investments	12,912,335	10,000,292
Accrued interest and dividends receivable	1,454,628	1,303,387
Due from brokers for securities sold	572,776	254,087
Accounts receivable and other assets	1,641,364	2,501,151
Prepaid expenses	259,420	347,180
Limited partnerships	131,631,444	109,980,252
MARKETABLE SECURITIES, AT FAIR VALUE		
U.S. government securities	16,277,120	24,414,042
Corporate securities	75,948,559	88,508,599
Corporate stock	377,080,373	440,944,132
Derivatives	123,750	34,065
Mutual and commingled funds	276,578,984	299,433,856
Total marketable securities	**746,008,786**	**853,334,694**
Total current assets	**894,481,953**	**978,231,279**
Other investments	388,557	388,557
Deferred financing costs, net of accumulated amortization	-	17,908
Property and equipment	200,423,983	196,519,460
Accumulated depreciation	(65,748,258)	(58,217,596)
Net property and equipment	134,675,725	138,301,864
TOTAL ASSETS	**$1,029,546,235**	**$1,116,939,608**

GROWTH IN TOTAL ASSETS



THE SAMUEL ROBERTS NOBLE FOUNDATION
STATEMENTS OF FINANCIAL POSITION
DECEMBER 31

LIABILITIES AND NET ASSETS

	2011	2010
CURRENT LIABILITIES		
Accounts payable and accrued expenses	$6,140,324	$6,243,732
Interest payable	-	130,917
Due to brokers for securities purchased	571,141	80,120
Grants payable, current	287,500	2,385,000
Bonds payable, current	-	20,375,628
Total current liabilities	**6,998,965**	**29,215,397**
Grants payable, net of current portion	313,750	345,625
Liability for pension and post-retirement medical benefits	46,230,746	18,482,290
Total liabilities	**53,543,461**	**48,043,312**
NET ASSETS		
Unrestricted	974,079,171	1,067,035,290
Permanently restricted	1,923,603	1,861,006
Total Net Assets	**976,002,774**	**1,068,896,296**
TOTAL LIABILITIES AND NET ASSETS	**$1,029,546,235**	**$1,116,939,608**

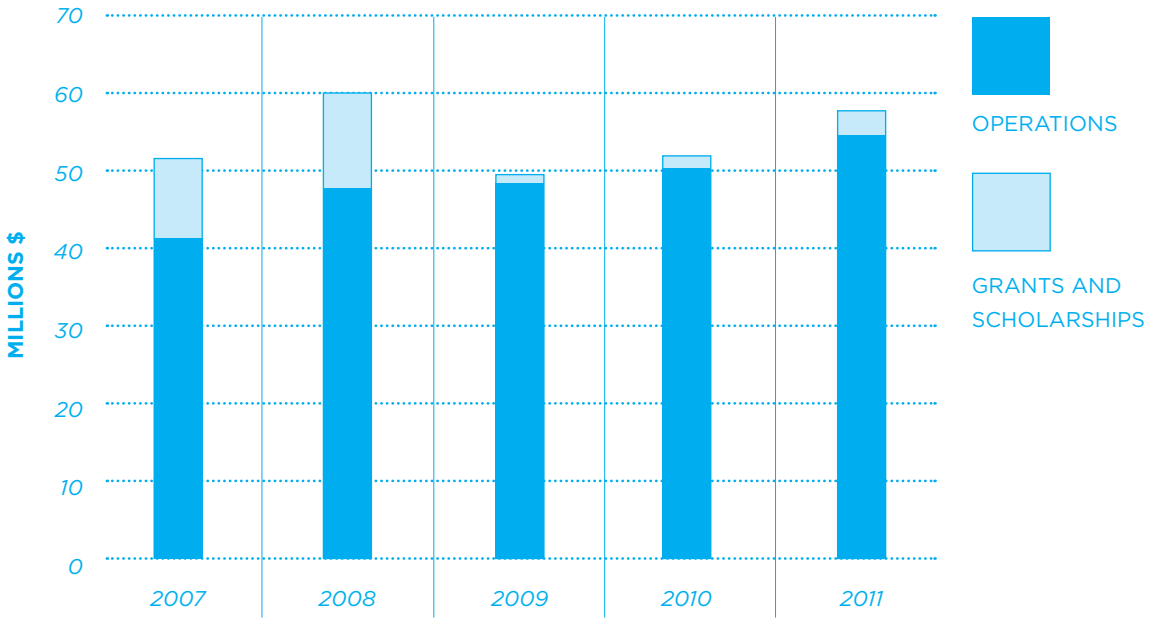
THE SAMUEL ROBERTS NOBLE FOUNDATION

DECEMBER 31

STATEMENTS OF ACTIVITIES

	2011	2010
REVENUES, GAINS AND LOSSES		
Interest	$5,001,002	$5,181,346
Dividends	13,888,654	11,254,693
Net realized and unrealized (losses) gains on investments	(27,956,730)	96,539,805
Other miscellaneous program and royalty income	8,854,560	8,581,352
Total revenues, gains and losses	**(212,514)**	**121,557,196**
EXPENSES		
Research (Agricultural, Plant Biology and Forage Improvement)	54,641,755	50,269,203
Grants	2,889,160	1,428,301
Management and administrative	7,793,093	7,092,019
Provision for federal excise taxes	1,339,867	1,340,770
Total expenses	**66,663,875**	**60,130,293**
Revenues, gains and losses (less than) in excess of expenses	**(66,876,389)**	**61,426,903**
Pension and post-retirement medical related changes other than net periodic costs	(26,079,730)	1,622,981
Change in unrestricted net assets	(92,956,119)	63,049,884
Change in permanently restricted net assets	62,597	1,169,953
Change in net assets	**(92,893,522)**	**64,219,837**
NET ASSETS, BEGINNING OF YEAR	**1,068,896,296**	**1,004,676,459**
NET ASSETS, END OF YEAR	**$976,002,774**	**$1,068,896,296**

OPERATING EXPENDITURES AND GRANTING



NOBLE FOUNDATION 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 four permanent committees: Executive, Audit, Compensation and Investment.

INDEPENDENT PROFESSIONAL ADVICE

The Board, each Board committee and each trustee have 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. Historical returns for the Noble Foundation are available at www.guidestar.org.

BOARD OF TRUSTEES

D. Randolph Brown, Jr., M.D.	Oklahoma City, Okla.
Susan Brown	Dallas, Texas
Michael A. Cawley	Ardmore, Okla.
James C. Day	Sugar Land, Texas
*Ginger DuBose**	Atlanta, Ga.
Sam DuBose	Atlanta, Ga.
Vivian Noble DuBose	Atlanta, Ga.
Bill Goddard	Ardmore, Okla.
Shelley Dru Mullins	Vancouver, British Columbia, Canada
*Jessie Nance**	Ardmore, Okla.
Cody Noble	Ardmore, Okla.
Russell Noble	Ardmore, Okla.
Marianne Rooney	Oklahoma City, Okla.
*William Thurman, M.D.**	Coupeville, Wash.
Stephen F. Young	Oklahoma City, Okla.

** Advisory Trustee*

MANAGEMENT

Bill Buckner	President and Chief Executive Officer (beginning January 2012)
Michael A. Cawley	President and Chief Executive Officer (until January 2012)
E. Charles Brummer, Ph.D.	Senior Vice President and Director, Forage Improvement Division
Billy Cook, Ph.D.	Senior Vice President and Director, Agricultural Division
Richard Dixon, D.Phil., D.Sc.	Senior Vice President and Director, Plant Biology Division
Steven Rhines	Vice President, General Counsel and Director of Public Affairs
Jill Wallace	Vice President, Chief Financial Officer, Assistant Secretary/Treasurer
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Pat Weaver-Meyers, Ph.D.	Director of Library Services
Robert Williams	Safety Manager
Mary Kate Wilson	Director of Granting

NONRESIDENT FELLOWS

The Nonresident Fellows program brings together a distinguished panel of scientists, researchers and industry leaders to strengthen the Noble Foundation through objective evaluation of its programs. These outside reviewers perform candid examinations, offer advice and guidance, and provide fresh perspectives to the organization.

AGRICULTURAL DIVISION

Mary Sue Butler Clyne ..... Accel Consulting Solutions
Floyd P. Horn, Ph.D. ..... USDA-Agricultural Research Service (retired)
James William (Bill) Turner, Ph.D. ..... Texas A&M University (retired)
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Barbara Valent, Ph.D. ..... Kansas State University
Carroll P. Vance, Ph.D. ..... U.S. Department of Agriculture

SCIENTIFIC COMPUTING

Henry Neeman, Ph.D. ..... University of Oklahoma

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Robbie Brooks, Controller, Financial Report
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Russell Stevens, Wildlife Consultant, Feral Hog Photo
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