

Legacy

Fall 2011

Looking Back, Moving Forward

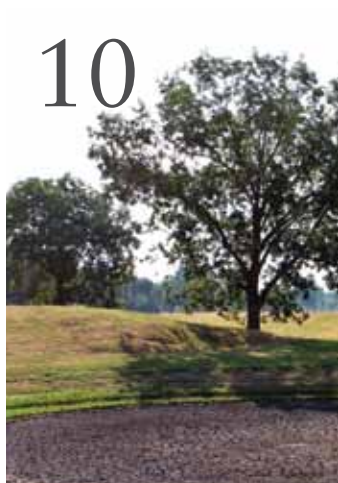
*Mike Cawley reflects on two decades
as president of the Noble Foundation*





(on the cover) After 20 years as president and chief executive officer of the Noble Foundation, Mike Cawley announces his retirement, beginning the final chapter of a storied career that has reshaped an organization.

(above) More than 2.6 million head of cattle live within a 100-mile radius of the Noble Foundation's Ardmore, Okla., campus, making cow-calf and stocker operations the region's primary agricultural endeavor. The Noble Foundation is dedicated to helping all farmers and ranchers through direct consultation, research and plant science.



Cover Story

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In a personal Q&A, Mike Cawley discusses his life and career as president and chief executive officer of the Noble Foundation.

Michael A. Cawley, President/CEO
J. Adam Calaway, Editor/Writer
Scott McNeill, Art Director
Broderick Stearns, Photographer
Katie Brown, Graphic Designer
Jackie Kelley, Copy Editor
Laura Beil, Writer
Arthur Dixon, Writer

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Reprints

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The Samuel Roberts Noble Foundation
2510 Sam Noble Parkway
Ardmore, Okla. 73401
580.223.5810 (general information)
580.224.6209 (media)

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Redefining success

Retirement has always been a distant end point on the horizon of my career – something to be planned for at the organizational level – but never a personal goal.

I subscribe to the Ralph Waldo Emerson belief that “life’s a journey, not a destination.” So as I approach retirement, I see and feel the change – change for me, my family and the Noble Foundation – but I hold no illusions that I’m achieving anything. This is more of a mile marker than a finish line.

Still, the twists and turns in life’s road often bring pause, and I find myself reflecting on the lessons I’ve learned from my journey thus far. The lesson that stands out the most, the one that rings the truest, is the lifelong transformation of my definition of “success.”

To be “a success” was the driving force for much of my early life. As a young man driving a tractor and digging ditches in the Oklahoma Panhandle, I correlated success with tangible objects – money and possessions. As a young lawyer, success was measured in wins and losses, and the subsequent respect. A lifetime later, I have discovered real success.

Success is seeing my children grow into quality people and great parents. Success is watching grandchildren take first steps. Success is being able to give, whether it is time, energy or resources, to those around me. Today I truly understand what Winston Churchill meant when he said, “We make a living by what we get, but we make a life by what we give.”

I’ve spent 35 years working for the Noble Foundation in some capacity. My time here has reshaped me both personally and professionally because this organization’s entire purpose is giving. I am blessed to have had this association.

Our founder, Lloyd Noble, was a man of tremendous wealth. He could have hoarded, recklessly spent or used his resources for personal advancement. Money can open doors to powerful opportunities, but Noble was indifferent to that journey. Instead he reached out to the people who were the core of Oklahoma’s past and future – agricultural producers.

He established The Samuel Roberts Noble Foundation, naming this institution after his father, who he said was the most charitable man he had ever met. And he gave us a simple, but profound, mission – benefit mankind.

Mr. Noble was a giver in every sense of the word, not just



with his financial resources, but with his time and deeds. He centered his life on giving to people. They were his top priority. They were his ultimate success. The past 66 years have seen the Noble Foundation change the lives of thousands around the world through our agricultural consultation program, research and generosity. I never met Lloyd Noble, but I have long admired him for his decisions.

So when people ask me, “What are you going to do when you retire?” I have an immediate answer. I’m going to give back.

I’m going to give to my family by going from president to grandpa. I’m going to wrestle with my grandchildren, feed them chicken nuggets and help gently guide them through this life.

I’m going to give to my wife, Betty Jane, who has stood by me for more than 40 years. She’s the love of my life, my rock and my best friend. Her wisdom, compassion and generosity have often served as a model for me, and I look forward to continuing our great journey together. And I’m going to give back to my community and my state.

When I look down the road, I see no specific destinations, just new opportunities with my family, church, community and numerous causes near and dear to my heart.

Because when my journey ends, I do not want to be remembered as a president or a lawyer, I want to be remembered as a father, friend and colleague. Then I’ll know I have succeeded.

Sincerely,

A handwritten signature in dark ink, reading "Michael A. Cawley". The signature is fluid and cursive, with a large, stylized 'M' and 'C'.

Michael A. Cawley
President and Chief Executive Officer

Notables

Noble Foundation earns top 10 ranking in national survey

For the fourth consecutive year, The Samuel Roberts Noble Foundation has ranked as one of the top 10 scientific institutions for academic faculty in the United States.

The Scientist magazine recently announced the results of its annual “Best Places to Work in Academia” survey, and the Noble Foundation ranked No. 7 out of more than 80 research institutions nationwide. The Noble Foundation, which employs more than 110 Ph.D.s from 29 different countries, received top scores for research and resources, as well as management and policies.

The organization ranked as the highest agricultural and plant science research institute, and was also the highest ranked Oklahoma institution (Oklahoma Medical Research Foundation ranked No. 10 and the University of Oklahoma Health Science Center ranked No. 14), leading the way for Oklahoma to be the only state with three institutions in the top 15.

The Noble Foundation topped such recognized research organizations as the National Cancer Institute and Mount Sinai School of Medicine, as well as two dozen research universities such as Princeton and Johns Hopkins.



Plant image galleries available online

Having problems identifying a specific grass, forb, shrub or tree? Visit Noble's online Plant Image Gallery at www.noble.org/WebApps/PlantImageGallery. The gallery assists botanists, ecologists, natural resource managers, educators and hobbyists with the identification of plants commonly found in the Southern Great Plains.

Oklahoma Pecan Growers' Association honors Noble with Grove of the Year

The Noble Foundation received the inaugural Pecan Grove of the Year award from the Oklahoma Pecan Growers' Association during the organization's annual meeting this summer. The award is presented to the grower who uses quality production practices and has the overall best grove in the state. Assistant Professor Charles Rohla, Ph.D., horticulturist, oversees the Noble pecan groves and accepted the award on behalf of the organization.





Pete and Rose Hammert display the 2011 Leonard Wyatt Memorial Outstanding Cooperator Award.

Hammert family receives Leonard Wyatt Memorial Outstanding Cooperator Award

This summer, Pete and Rose Hammert were selected as the winners of the Noble Foundation's 2011 Leonard Wyatt Memorial Outstanding Cooperator Award.

The Leonard Wyatt award is given annually to one of the 1,300 farmers and ranchers who work with the Noble Foundation's Agricultural Division.

As part of its mission, the organization provides farmers, ranchers and other land managers – called cooperators – with no-cost consultation services and educational programs in an effort to help them achieve their financial, production, stewardship and quality-of-life goals.

The Hammerts were selected based on their accomplishments within operation, community service and willingness to assist other farmers and ranchers.

"The advice of the Noble Foundation is simple and fundamental," Hammert said. "They have experts in many different fields of agriculture who can devise a step-by-step plan to help farmers and ranchers advance their pastures and cattle."

Four Noble researchers earn state grants

Four Noble Foundation researchers have earned funding from the Oklahoma Center for the Advancement of Science and Technology (OCAST). Richard Dixon, D.Phil., D.Sc., was awarded \$200,000 to continue his research in lignin to improve digestibility of forage crops used for grazing animals. Mingyi Wang, Ph.D., was awarded \$82,500 to develop computational methods for understanding how groups of genes are regulated in the model plant *Medicago truncatula*. Xiaoqiang Wang, Ph.D., was awarded \$100,000 for examining the structures of enzymes that make cell wall elements. Patrick Zhao, Ph.D., was awarded \$100,000 to use advanced computer technology to uncover which plant genes are being regulated by specific species of RNA.



A pair of Noble Summer Research Scholars examine forages as part of a field trial.

Summer internships offer students research opportunities in science, agriculture

Each summer the Noble Foundation offers a series of research internships in a broad range of scientific (Noble Summer Research Scholars) and agricultural (Lloyd Noble Scholars in Agriculture) fields. These internships provide students the opportunity to conduct actual research in a real-world setting.

Interns work alongside mentors in their chosen field at one of the nation's foremost agricultural consultation and research organizations. For more information on the Noble Summer Research Scholars and the Lloyd Noble Scholars in Agriculture internships, visit www.noble.org/SummerScholar or www.noble.org/LloydNobleScholar.



A Legacy Extended

Agricultural consultants join special mission
to educate farmers in war-torn Iraq

by J. Adam Calaway

Jim Johnson and Chan Glidewell stepped off the airplane after a 17-hour flight and found themselves in what looked like western Oklahoma. “Northern Iraq is not at all what I envisioned,” said Johnson, a soils and crops consultant for the Noble Foundation. “I expected sand dunes, no water and no vegetation. To me, it looked sort of like home.” ▶

In July, Johnson and Glidewell, a pasture and range consultant, flew to northern Iraq to teach agriculture to a farming industry whose practices currently mirror those of pre-Dust Bowl Oklahoma. “It was like stepping back in time,” Glidewell said. “You can see the path they are on. It is like the one we took when we settled the Great Plains more than a century ago. You want them to learn from our mistakes.”

Seven months before landing in northern Iraq – a region dominated by the autonomous Kurdistan Regional Government (KRG) – Johnson and Glidewell received emails from Patrick Broyles requesting assistance as part of an educational mission sponsored by the United States Department of State and implemented by the United States Department of Agriculture (USDA).

Broyles, the USDA Soil and Water Ministry advisor in Baghdad, graduated from Oklahoma State University and has interacted with the Noble Foundation since the early 1970s. “I have always been impressed with their knowledge and approach towards working with people in agriculture,” he said.

Most individuals would balk at the idea of spending 10 days in a war-torn nation. Since the Noble Foundation consultants have been training Army National Guardsmen for similar agricultural operations in Afghanistan, a willingness to contribute directly had been sparked.

“I’ve always said if I had a chance to go overseas and teach, I would go,” said Johnson, who mentioned that at no time during the trip did he feel concerned about his safety.

For the Noble Foundation, dispatching two consultants on a 7,000-mile journey was viewed as an extension of the organizational mission set forth by founder Lloyd Noble. “What began as a small regional effort is now going around the world,” said Billy Cook, Ph.D., director of the Agricultural Division. “This shows that one man can impact the world.”

After pre-trip vaccinations and wrangling short-term visas, Johnson and Glidewell arrived in Erbil – one of

the oldest cities in the world (founded in 6000 BC) and one of the largest in Iraq with more than 1.2 million inhabitants.

The Noble consultants spent the first two days learning about the region’s agricultural status, visiting research stations supported by Al Sala Din University, the region’s major agricultural college.

Since the fall of Saddam Hussein, who systematically destroyed 4,500 villages in the KRG region, the Kurdish people have been rebuilding their land and culture.

Decades of war have destroyed more than physical buildings. The country has no agricultural records, meaning Kurdish producers are screening hundreds of lines of wheat and dozens of fruit trees just to find which varieties are most adapted to the region.

Beyond the lack of modern equipment, the Kurds’ farming methods remain dated at best. “I often say that when Alexander the Great conquered Mesopotamia and left, he told the farmers not to do anything different and they haven’t,” Broyles said. “The educational courses we’re providing serve as a good foundation for their agricultural programs.”

The Noble consultants spent a week teaching 15 students each – Johnson on crop residue and water management, and Glidewell on rangeland management.

Much like the early farmers in the Southern Great Plains, the Kurdish producers overuse the land, removing most of the organic matter from the soil and leaving it vulnerable to erosion. Johnson worked with his students on alternative planting methods like no-till, while also discussing options for livestock feed so farmers could leave wheat residue in place – a key for soil stability.

“I felt like I had answers for them, but that we may not have been asking the right questions,” Johnson said. “I answered the farming questions of how to grow better crops. The more appropriate question may have been: Should they grow forages for livestock instead of growing crops? Every time you answer a question, three more pop up.”

Glidewell’s topics were equally as

challenging since rangeland conditions are so poor.

“Iraq has been overgrazed for 5,000 years and it shows,” Broyles said. “Lack of good management practices means that the livestock suffer from diseases, poor nutrition and horrible breeding practices.”

Glidewell focused on calculating stocking rates, specifically for sheep, the region’s primary livestock. “They wanted a silver bullet to fix all the problems just like we did 100 years ago,” Glidewell said. “But you can’t just keep doing what you’re doing and expect different results. There has to be change, and many of their progressive farmers want it.”

But no problem in Iraq is easily solved. Some progressive farmers may be willing to alter practices, but societal norms are still dominant. “All the land is public so there is little control,” Johnson said. “In the case of wheat residue, I learned that if they do the right thing and leave the straw, someone else will come in and take it. So why leave it?”

“And if you decided to run the correct stocking rate, that doesn’t mean all the people who use the land will go along with your plan,” Glidewell added. “We were able to provide them principles to work from. Hopefully, it will spark a change and that will spread to other producers.”

Though communicating through a translator, Johnson and Glidewell connected with their students. Johnson was even given a Kurdish name – Azad, meaning “freedom” – in appreciation for his lessons. Their bond has continued as they are now communicating via Facebook, and this spring five students from each of their classes will visit the United States with a possible stop at the Noble Foundation.

“The best thing America has done throughout the world is freely spread our knowledge of agriculture,” Broyles said. “These educational interactions influence Iraqis who are entombed in poor management and failing agricultural techniques. This will ultimately lead to better agricultural production, a higher standard of living and better conservation of resources.” ■



photos by Chan Glidewell

(top left) A Kurdish farmer tends to a test plot of fruit trees. Generations of war have left the agricultural producers without basic knowledge of what crops are best adapted to the region. The fruit trees being tested include varieties from California.

(top right) A Kurdish shepherd milks a sheep. Noble Foundation agricultural consultants traveled to Iraq to educate the region's producers on topics ranging from crop residue and water management to best practices for livestock, such as sheep, and rangeland management.

(below) Flocks of sheep and goats roam the foothills surrounding Erbil, Iraq. Agricultural producers in the region have difficulty effectively managing rangeland because all the available land is public and typically overgrazed.

David McSweeney

Like so many of the grasses and legumes in the Noble Foundation greenhouse, David McSweeney flourishes where he's planted. With deep roots in his native New Zealand, the 45-year-old McSweeney was transplanted to the United States, following the blossoming career of his wife, Carolyn Young, Ph.D., who leads one of Noble's mycology labs.

He has tended to lambs and children, with equal parts humor and skill, while pursuing his own endeavors – first as a researcher, then as a greenhouse manager. At the Noble Foundation, he oversees one of the largest and most technologically advanced research greenhouses in the world, blending his background in genetics and practical experience with a dry wit and true grit.

McSweeney and his team mow an acre of grass and legumes with scissors twice a week, keep water, air and mechanics moving, and wage an ongoing battle with the region's hordes of insects. That's not to mention the thousands of people – from CEOs to students – who tour the facility annually, each educated and entertained by McSweeney's razzle-dazzle showmanship and splash of personal style (just look for his pointy boots). Below, McSweeney discusses bugs, blisters and some bad advice.

What is a Kiwi?

People in the United States think it is a fruit and it is, but it is actually a small, flightless bird from New Zealand. They are rugged, absurd little buggers that shouldn't survive, but they do. New Zealanders are called Kiwis, which may not be seen as a compliment by outsiders, but to us it's a badge of honor.

If you had to describe your work to a stranger on the street, what would you say?

I try to provide leadership and an enjoyable workplace for a group of dedicated, clever people so that they can maintain a facility for a larger group of creative, innovative people who do amazing research.

What is your favorite part about your job? Hardest?

I love seeing the clever ways people go about finding answers to tricky research questions. The hardest part is dealing with the Oklahoma insects. Between the thrips, the aphids, the crickets and the cockroaches, it is like a Biblical plague.

What major events impacted your life, work?

When Carolyn earned her doctoral degree, we had to leave New Zealand for her to get postdoctoral experience. We traveled to the U.S., and I went from being breadwinner to bread maker. I loved being a stay-at-home dad. Getting to spend all of your time with your kids is an experience that most fathers miss out on. That being said, after a few years, I wasn't crushed when I got a work permit.

If you weren't a greenhouse manager, what would your profession be?

I would probably be a teacher of some sort. I love to talk, and I love a captive audience.

What is your favorite childhood memory?

My favorite memory is lying in bed at my boyhood home in Akaroa late on Christmas Eve, listening to the cricket match from Australia fading in and out on the radio, and waiting up for my brothers and sister to arrive home from school for the holiday break.

What is something people would be surprised to know about you?

I am a failed elf. I was rejected in a casting call for "The Lord of the Rings." Despite extensive use of computer graphics, they still couldn't make me march in time. I was also New Zealand University's public speaking champion, and I have a brown belt in karate.

What was your worst job?

As a student, I would work summers taking care of a flock of research goats, trimming their hooves for foot rot. If you are going to spend all day in the sun bent over, make sure that your shirt is tucked in and your shorts are pulled up. I got burn blisters where they were never intended to be.

What inspires you?

People who are passionate and principled in what they do are a great inspiration. Conversely, apathy and hypocrisy turn me off.

What is your favorite hobby/pastime?

I am a bit of a fan of home brewing beer.

What's your favorite food?

Coming from New Zealand, it has to be lamb. We have 4 million people and 40 million sheep so it is kind of inevitable.

What's the last thing you purchased?

I recently bought an evaporative air cooler for the patio. I have finally conceded that I am not man enough for Oklahoma summers.

So what's up with the pointy boots?

There are many reasons. They pay homage to the Rolling Stones of the mid 1960s. They are great bug killers – most useful in southern Oklahoma. And since I'm living in the land of the Old West, these are cowboy chic. ■

by J. Adam Calaway



BORN HERE.



No Rain on the Plains

Noble Foundation offers assistance, continues research for drought-stricken Southern Great Plains

by J. Adam Calaway

Every step Creede Speake takes through the sun-scorched wheat stubble produces a rhythmic crunch followed by the cascading rat-tat-tat of fleeing grasshoppers raining back to Earth.

Step. Crunch. Rat-tat-tat. Step. Crunch. Rat-tat-tat. This is the soundtrack of drought.

On a midafternoon in early August, Speake left behind his air-conditioned bungalow to examine the drought ravaged pastures that make up his 6,800-acre ranch near Milo, Okla.

With the truck's electronic gauges registering the outside temperature at 112 degrees, all Speake could think about was his land. "She doesn't have on her Sunday best, that's for sure," said Speake, surveying the fields he's ranched since 1946. "I've got nothing but dry, nasty looking ground."

Speake stopped to check a

cluster of cattle bunched under a thick grove of shade trees and then spotted a lone oak covered in grasshoppers. "Grasshoppers hate oak trees," he said. "They must be getting desperate, too."

Driving deeper into Speake's property, the former World War II fighter pilot pointed to each pond, some with small pools of water surrounded by cracked earth, some completely dry. "If anybody ever told me we'd run out of water on this place, I would have laughed at them," Speake said. "We have three spring-fed creeks, and we built our ponds right. This just isn't a good year for us, for anybody."

In fact, this has not been a normal year, an average year or even a bad year when it comes to precipitation or heat. No, 2011 will be remembered as one of the greatest droughts ever recorded in the Southern Great Plains. "It is absolutely the worst I've ever seen," Speake said.

He should know. At 87 years old, he has endured some of history's severest regional droughts. As a boy, he lived through the Dust Bowl. A few years after he began ranching, he survived the blistering heat of 1956 – the standard-bearer for 20th century droughts. And in 1980, he outlasted his third, once-in-a-lifetime drought. "None of those years – absolutely none – compare to this year," he said. "And I don't see it getting better anytime soon."

The La Niña Effect

The 2011 drought actually began in fall 2010 with the arrival of a La Niña weather pattern, an abnormal cooling of the Pacific Ocean that prevents moisture from reaching the southern portion of the United States. "We've experienced similar weather patterns in the past," said Billy Cook, Ph.D., senior vice president and director of the Agricultural Division. "However, ►



the intensity and duration of this one is much more severe. We came out of winter with very low soil moisture levels and pond levels. That set the stage for the extreme situation we are experiencing now.”

The drought now encompasses 14 states from Florida to Arizona with Oklahoma, Texas and Louisiana experiencing the most extreme conditions. By the end of July, the United States Department of Agriculture (USDA) declared 74 of Oklahoma’s 77 counties natural disaster areas. The USDA had already proclaimed all 254 counties in Texas natural disaster areas the month before.

According to the United States Drought Monitor, the entire state of Oklahoma is experiencing a severe drought, and more than 88 percent is in extreme or exceptional drought, the highest level possible. (Exceptional drought is defined as widespread crop/pasture loss and shortages of water, creating emergencies.) Comparatively, only about 5 percent of Oklahoma faced anything more than moderate drought conditions at this same time last year.

South of the Red River, more than 91 percent of Texas is in extreme or exceptional drought. Texas climatologist John Nielsen-Gammon said that if the drought continues through the fall, it will be the worst one in state history since recordkeeping began in 1895.

As a result of the prolonged drought, agricultural producers have experienced dramatic yield reductions. Hugh Aljoe, pasture and range consultant with the Noble Foundation, estimated most crops have produced only about 25 percent of last year’s totals, with some producers experiencing almost complete crop losses as in the case of wheat farmers.

For livestock producers, the drought has been particularly distressing. Conditions have reduced or eliminated vital water resources and destroyed

forages integral for grazing. Texas and Oklahoma combine to produce more than 20 percent of the beef cattle in the United States. However, without forages for grazing or a supply of hay for this winter, many are forced to destock.

“Usually producers feed beef cattle with hay for about 80 to 90 days during the winter months,” Aljoe said. “Because pastureland is now virtually unusable, they will end up feeding more than 200 days on hay this fall and winter. However, hay is scarce and expensive so many producers are selling their cattle early. With more and more destocking in the region, the market will flood and prices will drop.”

Beginning in July 2011, the Noble Foundation’s agricultural consultants were inundated with hundreds of calls, each asking a version of the same question: How am I going to survive this? The Noble Foundation consultants and researchers were ready with answers.

Lloyd Noble’s Legacy

The Noble Foundation’s origins are linked to one of the most infamous droughts – the Dust Bowl of the 1930s. Philanthropist Lloyd Noble established the organization in 1945 after witnessing the devastation on the Great Plains. Throughout the decades, Noble’s agricultural consultants have assisted thousands of producers through every imaginable natural and economic disaster. “We are uniquely equipped with the expertise and experience to help farmers and ranchers survive and recover from these extreme situations,” Cook said. “We provide educated counsel and bring much needed perspective, and do it all without charging a penny. We’re Lloyd Noble’s legacy.”

Noble’s agricultural consultants approach each drought-related phone call or farm visit like triage physicians, assessing the specific problems,

then mapping out financially feasible solutions. Each operation is unique, but the advice remains consistent.

“The industry is in a different market situation today than it has been in past droughts,” Cook said. “Producers must develop a well thought out plan with multiple contingencies, while focusing on long-term objectives.”

Technology has aided the Noble Foundation’s quest to quickly aid producers across the drought-stricken Great Plains. With a growing need to supply immediate, comprehensive advice to thousands of farmers and ranchers, the Noble Foundation launched a new online resource – www.noble.org/drought – to serve as a central repository for drought management information. Content for the site was developed by the Noble Foundation’s agricultural consultants, as well as accumulated from university researchers and agricultural experts from around the country.

The online resource discusses almost every aspect of drought management, from safeguarding pastures and destocking to tax implications and wildlife concerns. “This is a comprehensive resource that should answer many of the questions that come with working through this situation,” Aljoe said. “This is sound information that will help farmers and ranchers meet their specific challenges.”

Additionally, Noble’s agricultural consultants developed a special double issue of *Ag News and Views* (available by calling 580.224.6411) and a series of webinars – www.noble.org/drought/webinars – that discuss the most pressing drought issues.

Noble’s agricultural consultants will continue to support struggling producers throughout the duration of the drought and beyond, while the organization’s plant scientists and breeders are researching solutions to the next drought. ►

Creede Speake stands in the shade of a grasshopper-infested oak tree on his ranch. Like many producers in the Southern Great Plains, Speake is suffering through one of the worst droughts in recorded history.

“Every time (agriculture faces a challenge),
our farmers and ranchers fight back
through their determination and ingenuity,
and the Noble Foundation has been
right there fighting beside them.”

Billy Cook

Unlocking drought tolerance

If humans and livestock are going to successfully navigate future droughts, they will need plants adapted to the harsher environment. Noble scientists have spent more than a decade developing new methods for identifying and breeding these drought-tolerant plants.

The complexity of the process is undeniable; plants do not respond to drought with a single mechanism like an on-off switch. Instead, they mitigate drought by employing multiple strategies like a pianist pressing various keys at different times to generate music.

Noble Foundation researchers begin their search for these invaluable drought survival mechanisms by first examining plants that exhibit natural drought tolerance in the field or greenhouse. By looking at the physiological, biochemical and molecular traits of drought-tolerant plants, the researchers can begin to trace back to the genes that control these processes.

Noble Foundation Professor Michael Udvardi, Ph.D., has discovered many of these telltale traits in alfalfa. Udvardi, along with Postdoctoral Fellow Yun Kang, Ph.D., believes stomata, which are pores within the leaves, play a role in drought tolerance. Stomata allow gasses – primarily carbon dioxide – to enter the plant, but they are also the main site of water loss. Udvardi and Kang’s research indicates that drought-tolerant plants have a lower density of stomata than drought-sensitive plants, helping to retain water. Udvardi has also taken drought research to the biochemical level, measuring plant metabolism. Plants with better drought endurance produce more beneficial chemical compounds such as antioxidants and osmolytes, the latter of which help retain water in the cells.

“Plants cope with drought in many ways,” Udvardi said. “The more of these mechanisms we can identify and understand, the better our ability to enhance

drought tolerance in plants.”

Using the physical attributes of a plant as the launching pad, Noble Foundation researchers then search a plant’s genes, attempting to link them to specific drought survival traits.

Assistant Professor Maria Monteros, Ph.D., uses molecular markers, which are like genetic mile markers on the chromosomal highway, to identify particular regions of a genome. If specific markers are consistently found in drought-tolerant plants, Monteros can be confident that genes conferring tolerance are nearby.

Recently, Monteros found a specific type of marker (single nucleotide polymorphism or SNP) that clearly highlighted a series of genes involved in drought tolerance. To confirm her findings, she subjected plants containing these genes to a series of progressive drought trials. During these experiments, the genes in question increased their activity, thus indicating their role



in response to drought. “We can use this knowledge in our breeding program to quickly and efficiently identify plants with drought tolerance, increasing the efficiency of the breeding process,” Monteros said. “We can also work to integrate these genes into plants that don’t have them through molecular breeding approaches or genetic transformation.”

Professor Zeng-Yu Wang, Ph.D., is renowned for his expertise in genetic transformation, wherein a specific gene is moved directly from one species into another. In the area of drought tolerance, Wang tested a series of genes that had been identified as key contributors to a plant’s production of a protective waxy layer on its leaves.

Functionally similar to Udvardi’s stomatal density discovery, this wax moderates evaporation to allow plants to preserve water and imparts greater drought tolerance during dry conditions.

Wang inserted one of the genes into alfalfa. The resulting transgenic plant’s

ability to endure drought was significant. When wild-type plants and transgenic plants grew under normal conditions, there was almost no difference. When water was removed, however, the transgenic plants far outlasted the normal plants and recovered better when re-watered. The transgenic plants have now been crossed into special lines of alfalfa used for agriculture, and field tests will begin this fall. “The goal is to produce plants with more consistent performance despite climate conditions,” Wang said. “The potential impact is far reaching.”

Fighting Back

While Noble Foundation plant scientists continue to strive for new, hardier plants and agricultural consultants support producers in need, the only action that remains is to wait for the drought to break. The fall forecast, however, looks bleak – above average temperatures and dry. The financial forecast is equally unsettling. A recent New York Times

article estimated that damages from the drought have already reached into the billions of dollars (more than \$3 billion in Texas alone), while the full impact of crop and livestock losses to the agricultural industry will not be fully realized for many years to come.

“Agricultural producers face tremendous challenges every year, whether it’s drought, pests, diseases or bad markets,” Cook said. “Every time, our farmers and ranchers fight back through their determination and ingenuity, and the Noble Foundation has been right there fighting beside them.”

Fighting back sounds good to Creede Speake. He’s been doing it longer than most. At the end of his ranch tour, the 87-year-old rancher crouched down and clutched a handful of dried dirt from a pond bottom, a patch of ground that had been 12 feet underwater less than a year ago.

“How do you survive drought?” he asked. “Be tough and outlast it. That’s what we’ve always done.” ■



Looking Back, Moving Forward

With his retirement date set, President Mike Cawley discusses the people and events that shaped his life

by J. Adam Calaway

The president's luncheon is one of Mike Cawley's favorite events of the year, and 2011 was no exception.

The annual meal allows Cawley, president and chief executive officer of the Noble Foundation, to loosen his tie and break bread with the 60-plus interns, research scholars and summer employees who journey to Ardmore each summer to learn and work.

This year, the students stuffed themselves with Tex-Mex and shared some of their summer highlights while Cawley listened from a corner table.

As he has done every year for two decades, Cawley closed the lunch with a few unscripted words. In his rich baritone, he discussed the importance of agriculture to society, the vital nature of charity and the students' future role in both. His young audience sat captivated. Then, with a smile, he offered his thanks for their hard work and dismissed them

for the annual group photograph.

As the last students piled out of the door, Cawley looked up at a few staff members and said, "I guess this is the last of these I will do." Then he paused as though his own words had just registered. In April, Cawley announced he would retire the following spring (sooner if a successor is found before then). Since then, each month has brought surprising moments of reflection when the reality and enormity of the impending change sneaks up and grabs him.

Cawley has served the Noble Foundation in some capacity for almost 35 years; first as outside counsel (1977), later as a board of trustees member (1987) and then as president (1992). He is the longest tenured president in the Noble Foundation's 66-year history with two decades of helming the institution. Under his guidance, the Noble Foundation has experienced its largest growth in programs and infrastructure, branching out from

a regional organization to an international one.

But the boy from Hooker, Okla., knows the timing is right to make his exit. He maintains a rigorous schedule and a business-as-usual attitude, but quietly he's learning to let go.

In the following interview, Cawley chronicles the organization that shaped his past, the people who continue to fill his life and the grandchildren who are defining his future.

Tell me about your parents.

My father, F.P. Cawley, was a medical doctor - the only doctor in Hooker for many years. My father and mother, Jean, met at the University of Oklahoma Health Sciences Center when my dad was in medical school and my mother was studying dietetics. During World War II, he was an Army medical officer stationed on a ship in the Atlantic Ocean. I'm not sure when he came back from the war, but I know he was overseas when I was born (in 1947). ►

Mike Cawley stands on a balcony overlooking the Noble Foundation's campus. Cawley announced his retirement date of April 2012 after 20 years as president and chief executive officer.

What's your nickname?

My nickname is "Doc." Because my father was the town doctor, it started off as "Little Doc." Then it turned into just Doc. It follows me to this day.

What memories do you have of growing up in Hooker, Okla.?

I have nothing but fond memories of growing up in Hooker. But the weather could be challenging at times. We were in the high plains and the Dust Bowl was still ongoing. These clouds of dust would form that looked like huge thunderheads and would just start boiling. It became dark as midnight.

We lived in a small house, and I had four siblings, three brothers and a sister. My mother would holler out at the kids, "Okay, it's time to get your stuff wet." We would pull out all of the drawers and get our towels, sheets, whatever we had and start stuffing it under the doors and window facings to try and keep the dust out. I'm sure it kept some out, but we'd spend the next week cleaning house.

When did you first become involved in agriculture?

I grew up around agriculture, but I started to appreciate it after the seventh grade because I started working for a farmer. I drove a tractor, cut wheat, built fence and stacked hay. I did this every summer through my completion of high school. I truly appreciate how hard farmers work.

Did you always want to be a lawyer?

No, I assumed I would become a doctor. My dad had a habit of polishing his shoes at the breakfast table on

Saturday afternoons. I would often sit down with him and talk. I remember I was a junior in high school, and I was starting to think about college. I said to him, "I assume you want me to be a doctor." He said, "I want you to do what you want to do. That's most important." I went to college and started out in pre-med. I don't know why. I had no interest in becoming a doctor. It took me until my junior year to finally change my major.

What was college like for you?

I attended the University of Oklahoma. It was wonderful. I practiced my social skills (he laughs). I made a lot of lifelong friends, and I met Betty Jane (Cawley's wife).

Do you remember your first date?

Our first date was to a nightclub called the Sundowner. It was full of college kids, and they had phenomenal bands. Betty Jane and I danced to Ronny Hawkins and the Hawks. What I remember the most, however, was that a cocktail waitress dropped a tray of drinks on me. I was in a khaki suit. I looked like a guy who had been flung into a swimming pool.

When did you know you were going to marry her?

It didn't take me too long to figure it out. I was quicker to the idea than she was. We were pinned, that was the fraternity thing to do, during our junior year. We were married in March 1969.

What led you to law school?

I didn't know what I wanted to do professionally. A number of my friends

were going, and I thought I needed a graduate degree. Fortunately, I liked law school and truly enjoyed practicing law.

What brought you from Norman to Ardmore?

I graduated from law school in 1972. A friend's father-in-law had a law firm in Ardmore, and they needed another lawyer. The town met Betty Jane's and my requirements of being smaller than Oklahoma City, but bigger than Hooker. Ardmore was also close to Duncan where Betty Jane's folks lived.

What role did Jim Thompson play in your life and career?

My first law office was in a building in downtown Ardmore. I'd heard that there was a lawyer upstairs with an excellent law library, so I went upstairs and introduced myself to Jim Thompson, who had been a Noble Foundation president (from 1953 to 1966), unbeknownst to me. I inquired if I could use his law library. He was gracious and allowed me access.

When were your kids born?

Kristen was born in December 1973, and Kevin was born in August 1977. Betty Jane was pregnant with Kevin when I told her I was going to leave the law firm after five years and start my own practice.

But you had a client who would help you make the transition?

One day I was in Jim's law library, and his secretary asked if I would have any interest in doing work for Noble Affiliates (now Noble Energy). You could imagine the response of a young lawyer



“I am most proud that we are doing what Lloyd Noble wanted done. We are staying true to his mission and adding to his legacy.”

Mike Cawley

looking for work. I visited with Jim, who was doing general counsel work for them. He wanted to step down so he introduced me to Sam Noble (Lloyd Noble's son), who was chairman of the board for Noble Affiliates. I happened to be at the right place at the right time. Jim and I became good friends. We shared office space until I went to the Foundation in 1991. I came to know Sam Noble and started doing legal work for the Noble Foundation. In 1987, he asked me to join the board of trustees.

Right before you joined the board of trustees, they decided to add a fundamental plant science research group. What did you think about the decision?

I really take my hat off to the board for their courage then and now. At the time, we were funding plant science research at the Salk Institute. It would have been easy to continue that. The board appreciated agriculture and understood the importance of agriculture to Oklahoma and the world. They made a long-term commitment, and you can see the success of that decision now.

Within four years, Sam asked you to be president. What was that conversation like?

I had an interesting call from Sam one day. He said, “Mike, do you have a few minutes? I'd like to come visit with you.” That was strange, because normally when I got a call from Sam, he'd say, “Cawley? Sam. Get over here.” So he came in and we kicked the rocks for a few minutes, then he said, “I want you to come be president of the Noble Foundation and take over for John (Snodgrass) when he retires.” I was taken aback and honored beyond belief, but I said, “Sam why would I want to do that? I enjoy my law practice, I” About this time, Sam started getting red, then he pounds on the desk and he said, “Because I asked you to.” We agreed that we'd try it for a year, and if either party didn't like it, then we could walk away without any hard feelings. Then we shook on it.

When you officially became president in February 1992, what challenges did you face?

Keeping the focus of the Noble

Foundation moving forward. We had the Agricultural Division, a Plant Biology Division and a Biomedical Division. The Biomedical Division's director, Bud Patterson, was preparing to retire. Recruitment of a successor was difficult because of our location in Ardmore. We concluded that moving the Biomedical Division to the Oklahoma Medical Research Foundation (on the Health Sciences Center campus in Oklahoma City) would better serve the biomedical effort and help us focus on our agricultural efforts.

Any memorable stories from that first year?

John Snodgrass said if I needed fuel to just go down to this little green barn on the south part of campus and see a guy named Dan Jones who ran the garage. One day, I drove up, introduced myself, “Mr. Jones, Mike Cawley. Please fill it up.” He looked at me and said, “Who are you?” He had to call to find out who I was. I thought that was pretty funny.

What is your management style?

I try to identify good people, give them



parameters and let them work. What I was interested in doing was seeing that this overall agricultural mission that the Foundation was pursuing was carried out with excellence. I wanted all of us to be able to stand up and say with pride that we are part of the Noble Foundation and know that the work done here set the standard.

What spurred the development of the Forage Improvement Division?

Gap building. If you walked into our cafeteria in the early 1990s, you had the agricultural consultants on one side and this young group of international plant scientists on the other side. They were not interacting. We needed to develop some interaction between these two groups. So I posed a question to the agricultural guys: What can science do for you? Instead of them forming a committee or writing a white paper, hands went up around the room. The answer was unanimous: they needed a cool-season perennial forage. Livestock is the primary agricultural enterprise in the region, and the ranchers needed a cool-season perennial forage so they

could avoid planting ryegrass or wheat in the winter. As a result of the project, the Forage Improvement Division was born. In many respects, the Forage Improvement Division is the glue that binds the Agricultural and Plant Biology divisions together.

How is the interaction among the Noble Foundation's research groups unique?

In the last 15 years, we've formed a research pipeline, which coordinates efforts among the divisions. It allows us to move plant science and agricultural research from the laboratory to the field. If you were to try this at a major university, it would be an issue to coordinate the different colleges or departments. Here, one of our folks just makes a phone call.

How did the campus expansion come about?

In the late 1990s, we had three growing divisions and no space. There was a lot of opportunity, but we couldn't bring in additional people or core programs because we had no room. So we put

together a plan and went to the board. They stepped up again. Everyone shared the same vision of having a real impact on people and agriculture. The board approved a \$100 million campus expansion. We have had 10 years of construction, which has made a huge difference in the organization. Our facilities are recognized as some of the best in the world. They allow us to recruit some of the best people in the world.

Any funny memories you can share?

I hadn't been here very long when a gentleman came in to see me one day and said, "Cawley, I need to talk to you. I've got a bit of a problem with my next-door neighbors." I said, "How does that involve me?" He said, "Well, they work for you." It was a couple who worked at the Foundation, international people. He said, "The issue is that my kids would come home from school and go to the back fence. My wife commented to me that over a course of time a large number of kids came over, looking into the neighbor's backyard. Finally, she wanted to know what was going on, so she looked into the neighbor's backyard

and she said that your employees were out in their backyard exercising, naked.”

I said, “Well I think you probably have a point.” At the time it was the most difficult thing I had to do was call them into my office. Clearly this was something that was appropriate in their culture and they thought that they were behind closed doors in their backyard. I shared with them the story, and they were just mortified.

They were so apologetic, and I think they even went over to that couple’s house and apologized to them. That was one funny experience, I will say that. This was also an example of the quality of our international people.

What stands out over the last decade?

The most important thing that happened here was attitude. We became a place where people came to work because there were incredible opportunities to make a difference. There are a number of people here today who could work in many different places around the world, but have picked here because they see an impact quicker than is possible at a lot of other places.

What do you think Lloyd Noble would think about today’s Noble Foundation?

I think history will show that the board has done an excellent job of abiding by Mr. Noble’s wishes. They have invested his money in a way that is true to his heritage and true to his legacy. I feel good about what we have done.

How did you come to your decision to retire?

All good organizations set in place a succession plan for the chief executive officer. This has been discussed at the Noble Foundation for some time. As I looked forward, I saw that two things

would happen in April 2012: I would turn 65, and I would finish 20 years of service as president. To me, that appeared to be the appropriate time to make a change.

What’s the thing you would change?

Everyone can look back and realize that there are things they could have done better or differently, but I won’t worry about it.

Has it sunk in yet?

It gets more real as I sit down and do things like this and talk about it. I feel good. I could get emotional, but I’m not going to. It’s time.

What are you most proud of?

I’m most proud that we are doing what Lloyd Noble wanted done. We’re staying true to his mission and adding to his legacy.

What is your best memory?

The people. I have thousands of good memories and they all involve the people. One of the things I’ve loved the most about my job is working with people from around the world. I appreciate all those who travel from around the world to contribute to this organization.

What are you going to do after you retire?

I really think it’s important that I spend some time with my grandchildren. I’ve seen the impact that grandparents have on grandkids. Betty Jane and I both agree that we really want to play a role in the lives of these kids. You don’t get to know these kids by visiting once or twice a year; you’ve got to spend some time with them.

How many grandkids do you have?

I have six now. Kristen just adopted a little girl from China. Five of them are 3

years old and under. (He pauses). Maybe I should stay here until they get a little older. (He laughs).

What do they call you?

They all call me Doc.

Any other plans?

I enjoy playing golf, but I’m not one of those guys who has to play in 100 degree heat. I’ve accumulated a stack of books that I cannot wait to read. Betty Jane and I want to travel some, too.

Any special destinations?

Probably wherever Mrs. Cawley wants to go. I’d like to make sure that we get into every state before we call it quits.

What do you see when you look into the future of the Noble Foundation?

Success will continue at the Noble Foundation because of talented people who take pride in their work and because of the mission. Things will happen at the Noble Foundation in the next 10 or 15 years that we could have never comprehended a decade ago. I think that there is opportunity for the Noble Foundation to be a leader in the world when it comes to feeding people. There are opportunities for us to develop forage grasses that are going to impact people all over the world. Our science and technology are going to have incredible impact. I hope I live a long time so I can just watch what happens out here.

What would you say to all the employees who have worked for you?

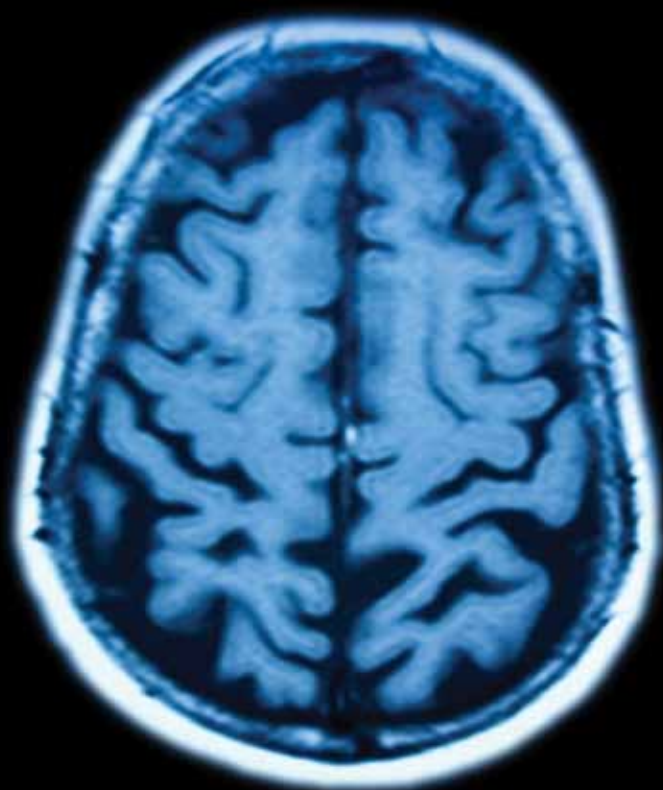
Thank you. They mean more to me than they could possibly imagine. And I’d tell them to take advantage of this opportunity. There just aren’t many places like the Noble Foundation that offer a chance to impact society. I know I’ll never forget my time here. ■



(top) Cawley poses with a road grader during the groundbreaking of the \$100 million campus expansion. During Cawley's tenure, the Noble Foundation experienced its largest growth in infrastructure and programs.

(bottom left) Cawley meets with Ann Noble Brown, daughter of Lloyd Noble, and Jim Day, longtime members of the board of trustees.

(bottom right) Cawley talks with Baxter Black, a presenter at the Noble Foundation's 2005 Profiles and Perspectives speaker series. Cawley helped found Profiles and Perspectives as a community enrichment activity.



Grape Expectations

Noble Foundation scientists join Mount Sinai in researching cure for Alzheimer's disease

by Laura Beil

In 2007, Richard Dixon, D.Phil., took a phone call from a man who identified himself as Giulio Pasinetti, M.D., Ph.D., a professor in the psychiatry and neuro-science department at Mount Sinai School of Medicine in New York. Pasinetti told Dixon he wanted to collaborate with The Samuel Roberts Noble Foundation to find a treatment for Alzheimer's disease. Dixon drew the obvious conclusion: this man had dialed the wrong number. The Noble Foundation is a research center, but for plants, not people.

Moments later, Dixon realized that Pasinetti had indeed come to the right place. The New York researcher had gathered early data in animals that suggested that some chemical ingredient of grape seeds might counteract the devastating mental erosion of Alzheimer's disease. But Pasinetti needed a laboratory that could analyze and supply the plant's individual chemical components. He needed the scientists at Noble.

Almost four years later, the Mount Sinai-Noble Foundation collaboration is on the verge of planning its first human trials. If the human experiments play out as hoped – and it is still too

early to know what will happen – Noble may play a role in combating a disease predicted to strike as many as 16 million Americans by 2050. The achievement would be personally gratifying for Dixon, who watched his mother suffer the unforgiving decline of Alzheimer's until her death. "Without that experience, I might have been less likely to get involved in this project," said Dixon, who serves as senior vice president and director of the Plant Biology Division.

As Dixon and others well know, Alzheimer's has no cure and no known cause apart from age. It occurs



A cross section of a brain scan (top) and a grape (bottom) may not seem to have anything in common, but researchers at Mount Sinai and the Noble Foundation believe that chemicals in grape seed extract may be able to delay Alzheimer's disease.



Mount Sinai researcher Giulio Pasinetti described the Noble Foundation as the “top research group in the world in plant physiology” because of the organization’s history of working with polyphenols, specifically tannins in alfalfa (above).

when the brain starts to produce abnormal proteins that accumulate in and around brain cells in misshapen twists and clumps. These protein deposits, called plaques and tangles, eventually cause nerve cells to malfunction and die.

Since the 1990s, studies have suggested that people who consume red wine have a lower risk of Alzheimer’s disease. But what’s the magic of merlot? Pasinetti’s laboratory has found in experiments with mice that particular compounds in grapes, called polyphenols, may be responsible for the protection.

Polyphenols are naturally occurring molecules in many plants. One variety of polyphenol, called condensed tannins, appeared to be involved in protecting the brain. Grapes are known to contain these molecules in abundance, with a high concentration in the seeds and skins. (Probably,

Dixon said, because tannins can protect the seeds and give the fruit a bitter taste to discourage herbivores.)

Noble scientists have specific expertise in the area of tannins. For almost a decade, Noble researchers have worked to develop an alfalfa that produces tannins in the plant’s stems and leaves. For grazing animals, such a development would prevent the occurrence of a condition known as “pasture bloat” that commonly afflicts animals that graze protein-rich forages such as alfalfa.

But Noble’s study of tannins may also benefit people. In 2008, Pasinetti described a study showing that mice with an Alzheimer’s-like condition which consumed grape-derived polyphenols were able to improve on tests of cognitive function and memory. Many members of the scientific community were skeptical of the results, Pasinetti said, believing

that polyphenol molecules were too bulky to pass through the wall of the intestine. Pasinetti wanted a closer look. “Nobody had tested the possibility that maybe a subfraction of the polyphenols was able to become bio-available and reach a sufficient concentration in the bloodstream,” he said. That was about the time Pasinetti turned to Noble. He needed experts who could separate the complex makeup of grape seed into its individual parts, and the Noble Foundation “is the top research group in the world in plant physiology.”

On some counts, the skeptics were right. Many tannins are too large to make it into the bloodstream. But the molecules come in lots of different sizes. “There are literally hundreds of compounds in the grape seed,” said Jack Blount, a researcher in Dixon’s laboratory who is working on the project. “You want to find out which



Richard Dixon, D.Phil., D.Sc., discusses the Noble Foundation's role in Alzheimer's research being conducted at Mount Sinai. Noble researchers assist the primary researchers at Mount Sinai by separating the complex makeup of grape seeds.

one or group is improving cognitive function. That's the complexity of this type of research." Noble researchers are like bakers in reverse, taking cake batter and trying to extract the flour.

The Noble scientists divided the grape seed tannins into three groups of different sizes. The process starts with a sample of concentrated grape seed being shipped to Noble's Ardmore, Okla., campus in large batches where it is broken apart with different kinds of solvents and columns, and the solution is then dried. If it sounds straightforward, it's not. This phase of the process alone takes months to get enough material for one feeding experiment.

In the end, once the Noble researchers have made a concentrated powder of the three groups of polyphenols, they pack the products in dry ice and ship them overnight to Pasinetti's laboratory.

There the Mount Sinai research team will sprinkle the compound into the mice's water.

In a series of experiments in mice, the researchers have been able to determine that only a handful of the smaller tannins can pass through the intestine. They are not completely identical to the molecules in the plant; these tannins become slightly modified as they pass through the gut wall and liver.

Nonetheless, they are found in the blood and, most significantly, in the brain. "That is the most remarkable thing – that a small fraction of the molecules can get into the brain," Pasinetti says. Since the compounds found in the brain are a modified version of those found in the plant, the Noble scientists must synthesize these new compounds in the lab for further studies.

The work has now narrowed down

to one molecule that appears to be the most promising of the bunch.

Last year, Pasinetti and his team published the most tantalizing findings yet. Upon autopsy, the mice which had consumed one of the compounds synthesized at Noble were found to have less of the brain abnormalities that form the hallmarks of Alzheimer's.

Nonetheless, all the scientists involved in this research can list many promising experiments in the past that have failed to hold up in later tests. The compound may not work in people, or it may not work unless it has some modification or some companion molecule.

The studies in people will be the ultimate test. "I feel really good about where the research is going," Blount said. "But until you get the final results, you don't put on the party hat." ■

The Next Mendels

Plant breeding offers benefits
to environment, growing
global population

by Arthur Dixon

Lloyd Noble's decision to establish The Samuel Roberts Noble Foundation was inspired by the plight of Oklahomans during the Dust Bowl – a decade-long agricultural catastrophe caused by drought and wind erosion of the virgin topsoil of the Great Plains. Regional farmers unwittingly aided this disaster by foregoing cover crops and crop rotation in favor of less environmentally friendly farming strategies. The Dust Bowl forced an exodus of “Okies” to move west in search of work and livelihood.

Today, scientists at the Noble Foundation are working to prevent such tragedies in the future by breeding crops that will actively improve their agricultural environments.

“At its most basic form, plant breeding is the scientific improvement of crop plants,” said Charlie Brummer, Ph.D., director of the Noble Foundation's Forage Improvement Division. “It requires the identification of superior plants, hybridization of those plants and the generation of new combinations of genes that provide the variability from which a breeder can select for the next wave of breeding. There are countless potential uses for plant breeding, but improving the environment is a particularly important goal.”

The most significant impact plant breeding can have on the environment is through the creation and promotion of perennial crops, which grow back each year without being replanted, saving time, energy and disruption to the soil. Perennials also develop deep root systems that hold the soil together and effectively prevent erosion.

“We could greatly benefit agricultural environments by transitioning from annual crops to perennials,” said Brummer, who recently published a paper in *Frontiers in Ecology and the Environment* on the benefits of plant breeding to the environment. “Rather than planting and replanting annual wheat, we can breed a perennial wheat that's always in the ground, holding down the soil. We can also breed better forage crops so livestock can gain weight on a perennial crop like alfalfa instead of requiring costly feedlot corn.”

Charlie Brummer, Ph.D., discusses the progress of alfalfa breeding with Yanling Wei, Ph.D., a senior research associate in Brummer's laboratory.





Along with perennializing crops, plant breeding can decrease the necessity for fertilizers and pesticides, thus reducing the spread of chemicals into nearby bodies of water. It can bolster a plant's ability to fix nitrogen in the soil, maintaining a fertile environment for future farming, and it can improve the efficiency of a plant's conversion of harmful airborne carbon dioxide into oxygen. "Only time can tell how far plant breeding will go to improve the agricultural environments on which we all rely," Brummer said.

But modern plant breeders are not only concerned with the environment; they are also working to prevent the potential demographic crises of in the future.

Feeding 9 billion

Recent studies indicate that in the next 40 years, global population will increase from 6.8 billion to more than 9.3 billion. This monumental upturn will dramatically increase pressure on the farmers and ranchers who work to produce food, feed and fiber for the world. The effects will be more pronounced as humans continue to encroach on agricultural environments (a process called urban sprawl) and continue to consume other invaluable resources such as soil and water.

Plant breeding has the ability to make a dramatic impact as the need for agricultural products increases. It allows for the production of crops that can withstand varying climates that are prone to drought or heavy rains.

"All indications are that we're getting more extreme weather events," Brummer said. "There's always been extreme weather, but now you often get more variability in climatic conditions and that can be difficult for crop production to handle. Part of the goal of breeding, especially breeding for growing populations, is trying to generate plants that have some measure of stability in the face of variable climate."

Breeding can also help farmers grow a greater yield on a smaller area with less necessity for inputs like water, fertilizer and pesticide. These advances make it

easier and cheaper to produce crops on a large scale, especially in economically depressed regions of the world where agricultural inputs are expensive or fertile fields are rare.

Modern plant breeding can bolster

viable," said Zeng-Yu Wang, Noble Foundation professor, who focuses on genetic transformation.

Through genetic engineering, alterations that would have taken many years in the past can be made rapidly and

"Plant breeding will play an ever increasing role in providing supplies for the world's growing population."

Zeng-Yu Wang

agricultural production around the globe, and upon examination of the field's deep historical roots, this is by no means a surprise.

Back to the future

Plant breeding is an ancient science. Early civilized humans realized that it made sense to plant the biggest and hardiest food crops, and since then plant breeders have constructed their craft upon that simple foundation. The basic goals of modern plant breeders are not so different from those pursued by their predecessors in the distant past. "We still follow the same pattern as the early breeders," Brummer said. "We put plants in the field and see how they perform."

But while modern plant breeding stays true to its original purpose, new scientific breakthroughs mean that this field now has more potential than ever to make a positive impact on our planet and its people. New techniques such as genetic engineering can increase the scope and speed of plant breeding research. "Genetic engineering is useful either when a desirable trait is not present at all, when it isn't present in any species you could hybridize, or when it's present at a level that isn't economically or environmentally

efficiently. These changes can allow for increased yield of a desired agricultural product, greater adaptability to different climatic conditions or diminished need for potentially harmful chemicals to ensure productive crop growth. "It will be necessary for advances like these to be made quickly in the future," Wang said. "Plant breeding will play an ever increasing role in providing supplies for the world's growing population."

Molecular markers can also enhance the resources available to plant breeders. "Molecular markers are dramatically changing the pace of breeding," Brummer said. "We are now able to select indirectly using a molecular marker rather than waiting five years to see if a plant survives in the field. Nevertheless, the basic principle of picking the best plants and recombining them is the same."

Although research and technology are critical components of plant breeding, they are not the only ones. The corporate world also plays an important role in the perpetuation of the field.

To the market

Cooperation between the nonprofit and commercial sectors is essential for successful plant breeding. Private companies must ultimately market the



Fescue (pictured above) remains an important forage crop for agricultural producers in the southeastern portions of the United States and a primary component of the Noble Foundation's plant breeding program.

seeds of an improved crop that a plant breeder develops. "The commercial sector is vitally important in any kind of breeding," Brummer said. "You can breed a new grass that is drought tolerant, but if you can't find anybody to market it, then farmers will not have access to it and may fail to adopt it."

The private sector is responsible for distributing the products of plant breeding, but public and nonprofit institutes are the roots of the research behind these modified crops. The Noble Foundation is unique among these institutes in that its Forage Improvement Division functions

alongside the Plant Biology Division and the Agricultural Division as part of a combined effort to improve agriculture, moving research from the lab to the field. The Forage Improvement Division interacts directly with Plant Biology in the areas of genetic engineering and molecular markers, radically increasing the speed and efficiency of its research.

At the same time, scientists from Forage can receive practical feedback from the consultants of the Agricultural Division, gaining an informed perspective on the needs of local farmers. This forms a continuum the Noble Foundation

scientists have deemed the "research pipeline," an interaction that is unique to the organization.

The interactions between the Noble Foundation's divisions, specifically in the field of plant breeding, continue to become essential to providing practical solutions to the pressing problems of the next generation. "Our goal as plant breeders is to produce something new that genuinely helps people," Brummer said. "Even though we are required to jump a few hurdles along the way, it is rewarding to know that we're contributing to the benefit of mankind." ■

Something to write home about

by J. Adam Calaway

Dickie Howard's letter arrived on my desk in a pile of promotional pamphlets, brightly colored ads and postcards that were all destined for the recycling bin.

In fact, I flipped through the seemingly worthless stack of mail with such disregard that I actually flung his letter toward the trash before I saw the handwritten address. I recovered the letter, feeling the heft of its multiple pages, and thought how odd it was to receive real mail.

As a writer, I admit to possessing a great snobbery when it comes to penning powerful prose, but Howard hooked me with his first two lines: "Late in 1977 going into the spring semester of 1978, I received a scholarship from the Noble Foundation. My instructor advised that I send a thank you note, and I've been intending to do so for 32 years."

Howard's thank you letter detailed how the Noble Foundation's gift redirected his life. In 1977, Howard was a 19-year-old welder with a young bride and a new mortgage, and was attempting to finish a trade school certification. He was one semester shy of completing his certification when the money ran out. "It was over. I was done," he wrote. Then the Noble Foundation awarded him a \$150 scholarship that allowed him to finish school.

Through the course of five pages, Howard detailed every major event in his life and tied it back to the scholarship. As a result of his education, he earned a job at a local tire manufacturing facility (what is now Michelin).

Without the job at Michelin, he would have continued as an hourly welder who would have been laid off during the oil bust of the 1980s. Instead, Howard had a full career at Michelin, enjoyed family vacations, taught others his trade and fulfilled a lifelong dream of participating in humanitarian work in China and Russia. As his passion filled the pages, Howard ended almost every paragraph with the phrase "... which the Noble



Foundation scholarship allowed me to do."

I ate up each word, not knowing that Howard's story ended with a twist. Apparently a few years ago, Howard's future stepson stood at a similar crossroads – attempting to finish school despite financial woes. Howard secretly helped provide him with the funds to wrap up his college education.

Today, this young man is a Noble Foundation employee. "That is your gift coming back to you," Howard said. "I've always dreamed that maybe in 30 years this young man might have the same opportunity to keep the gift going with some other person facing the same plight. The gift that was started with a Noble Foundation scholarship could continue on and on."

When I finished reading Howard's letter, I thought about all the people whose lives have been forever altered by the Noble Foundation. I remember the numerous farmers and ranchers who talk about rebounding from near bankrupt circumstances because of the guidance of Noble's agricultural consultants. These are the toughest, most genuine men I've ever met, and some have openly wept in appreciation.

I think about all the countless individuals, who have grown (and will continue to grow) better crops and forages or have more food because of our plant breeding and scientific research. And more importantly – I wonder how all of these people will, in turn, impact the rest of humanity. I wonder how many more Dickie Howards are out there, helping change a life because someone showed them grace.

I don't believe our founder, Lloyd Noble, ever imagined his organization would have a global impact. He just wanted to help his fellow man. He just wanted to help the Dickie Howards of the world. As for Howard, he concluded his letter with 14 of the most hopeful words I've ever read: "I look forward with great anticipation at what still waits us in the future."

So do I, Dickie. So do I. ■



(above) Area farmers and ranchers take part in an early Noble Foundation field day. Since its inception in 1945, the Noble Foundation has conducted field days, seminars and events as a way to provide quality education and promote land stewardship to regional agricultural producers. Today, the Noble Foundation offers more than 60 educational events each year, reaching thousands of producers.



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(below) Noble Summer Research Scholar Scarlett Hao grinds frozen plant material that will be used for further analysis in DNA or RNA extractions. All of the Noble Foundation's summer interns in science and agriculture conduct their own projects under the guidance of some of the world's best plant scientists and agricultural consultants.

