

2013 Annual Report
Agency 229



Partners for Progress
Growing Communities and Strengthening Lives



Contents

- 1 Message from the directors
- 2 Cleaning the watershed, protecting farmers' bottom lines
- 3 Keeping loggers and foresters trained
- 4 Virginia 4-H camping builds life skills
- 5 Teaming up with the community to fight obesity
- 6 Dairy research ensures healthier cows, more robust profits for farmers
- 7 Investigating life in the clouds
- 8 Using genetics to wipe out disease
- 9 Web-based site selection tool helps grape growers
- 10 Agency 229 is...
- 12 Virginia Agriculture Leaders Obtaining Results
- 12 New building will bring researchers together
- 13 Researcher hopes to create better vaccine against swine disease
- 14 Helping improve profits for Virginia's livestock producers
- 15 Improving on-farm energy efficiency
- 16 Biosecurity efforts support industry
- 17 Working to stop stink bugs in their tracks
- 18 Spanish-language training speaks to seafood industry needs
- 18 Helping families strengthen their financial management skills
- 19 Household water quality program empowers homeowners
- 20 Facts and Figures
- 21 Unraveling the mystery of how plants store energy



“Fueling economic growth in the Commonwealth of Virginia and around the region goes to the very heart of Virginia Tech’s land-grant mission. The collaborative efforts of the Virginia Agricultural Experiment Station and Virginia Cooperative Extension provide applied knowledge that impacts the state’s economy along with the health and well-being of all its citizens.”

— Mark G. McNamee, Senior Vice President and Provost, Virginia Tech

Partners for Progress

A message from the directors

Agriculture is by far Virginia's largest industry, contributing more than \$52 billion annually to the commonwealth's economy. The agriculture and forest industries together have a total economic impact of nearly \$70 billion and provide approximately 414,700 jobs.

But the importance of these industries extends well beyond the farm and forest.

A recent study conducted by Battelle, the world's largest nonprofit research and development organization, found that the growing agbioscience industry in the Southern region of the United States generates \$240 billion in regional economic activity and supports more than 2.2 million jobs with labor income totaling \$62 billion. Agbioscience encompasses a broad continuum of product development, agricultural production, and innovative use of plants and animals for food, health, fuel, and industrial applications.

The findings of the Battelle study underscore the importance of the contributions of our land-grant system. Virginia Tech, Virginia Cooperative Extension, and the Agricultural Experiment Station play an essential role in economic development. Together we are able to leverage advancements in modern science and technology to successfully address crucial state, regional, national, and global needs. We are transforming knowledge to practice and fueling economic growth and job creation across the commonwealth and beyond.

This report illustrates some of the ways we are doing this. Whether we are developing methods to protect crops from stink bugs, providing families financial education, researching ways to prevent disease by altering a mosquito's genetic makeup, or helping communities provide nutritious food for their citizens, our efforts continue to improve the standard of living and quality of life for Virginians — now and in the future.



Edwin J. Jones (left), associate dean and director of Virginia Cooperative Extension, and Saied Mostaghimi, associate dean and director of Virginia Agricultural Experiment Station.

Please take a moment to read about some of our accomplishments. We also encourage you to visit our websites — www.ext.vt.edu and www.vaes.vt.edu — to learn more about the research and programs that are making an impact in Virginia communities.

Sincerely,

Edwin J. Jones, Associate Dean and Director,
Virginia Cooperative Extension

Saied Mostaghimi, Associate Dean and Director,
Virginia Agricultural Experiment Station

Cleaning the watershed, protecting farmers' bottom lines

When farmers on Virginia's Eastern Shore were told they had to curb the amount of nitrogen and phosphorous seeping from their fields into the Chesapeake Bay, Zach Easton stepped in to find a solution. Easton, an assistant professor of biological systems engineering, may have found a way to save the bay while maintaining farmers' profits with the development of a bioreactor buried under the coast's fertile agricultural grounds.

"The ultimate hope is that this will be a cost-effective system that producers can use to protect water quality and help keep agriculture profitable in Virginia," said Easton, a Virginia Cooperative Extension specialist whose research is conducted at the Eastern Shore Agricultural Research and Extension Center in Painter.



Easton recently received a \$120,000 grant from Virginia's secretary of natural resources to test and demonstrate his bioreactor at four different sites around the state. The hope is to have the bioreactors ready for commercial use by 2017, when a new set of environmental regulations takes effect.

The rules mandate that farmers reduce the nitrogen and phosphorous reaching the bay by as much as 30 percent. Easton's new bioreactor far surpasses that by removing up to 90 percent of nitrogen and 45 percent of phosphorus. It costs about \$260 an acre — a one-time expense over its 15- to 20-year lifespan — which is much cheaper than some other solutions.

The bioreactor is a large, underground vat that is filled with wood chips. Water from the fields is funneled toward the container, where microorganisms feed off the wood chips and nutrients in the water. Because it is buried, there is little loss of productive land.

During the feeding process, the microorganisms convert nitrogen in the water into harmless nitrogen gas that makes up 78 percent of the atmosphere. They incorporate the phosphorus into their microbial biomass. The added substrate, biochar, can also remove phosphorus from the water.

"We believe this is an economic and viable solution to curb water pollution while protecting farmers' bottom lines," Easton said.

Zach Easton, left, an assistant professor of biological systems engineering, explains how his new bioreactor curbs pollution in the Chesapeake Bay to Mary Leigh Wolfe, head of BSE, and Saied Mostaghimi, the college's associate dean for research and graduate studies.

Keeping loggers and foresters trained

Sustainability and education are more important than ever, especially when it comes to our natural resources. In response to these demands, Virginia's Sustainable Harvesting and Resource Professional Logger Program is working to educate loggers and foresters across the state to help them operate in changing markets while implementing sustainable best management practices.

The SHARP Logger Program — working in cooperation with the Virginia Sustainable Forestry Initiative Implementation Committee — provides loggers and foresters with training in the principles of sustainable forestry, environmental protection, and workplace safety. Since it began in 1996, more than 3,500 loggers, foresters, and others have completed the SHARP Logger Program training provided by

Virginia Tech's College of Natural Resources and Environment, Virginia Cooperative Extension, the Virginia Department of Forestry, and others.

In order to become a SHARP Logger, participants must complete a core program of 18 hours of classroom and field training on such topics as sustainable forestry, logging safety, harvest planning, and best management practices for protecting water quality. Participants must then earn 12 hours of continuing education credits every three years in order to maintain their SHARP Logger standing.

"As markets evolve and the needs of forest industry and forest landowners change over time, training Virginia's logging workforce is important for sustainable forest management," said Scott Barrett, Extension associate and SHARP Program coordinator. "The SHARP Logger Program provides training opportunities to help logging businesses adapt to changing markets and sustainably harvest forest resources."

SHARP Logger training is provided at no cost to participants. It is funded by a voluntary assessment on each ton of logs and wood fiber produced annually by the companies that participate in the Sustainable Forestry Initiative Program in Virginia, plus an assessment on each acre of Virginia forestland managed by participating landowners.



“As markets evolve and the needs of forest industry and forest landowners change over time, training Virginia’s logging workforce is important for sustainable forest management.”

—Scott Barrett, Extension associate and SHARP Program coordinator

Bryan Wagner with the Forestry Mutual Insurance Company, demonstrates chain saw safety.

Companies that participate in the SFI Program are committed to supporting the SHARP Logger Program, ensuring that SFI standards are applied on their own lands and promoting sustainable forestry throughout the commonwealth, thereby ensuring that sustainable forestry principles are followed on the vast majority of timber harvest sites in Virginia.

As an example of how the SHARP Logger Program is impacting Virginia forestry, a partnership with MeadWestvaco and Enviva resulted in three con-

tinuing education workshops in 2012 that addressed biomass harvesting and included demonstrations of chippers and grinders from seven different manufacturers.

The workshops helped many Virginia logging businesses evaluate whether they can adapt their operations to utilize logging residues, such as limbs and tops previously left behind on harvest sites because there was no market for them. Six new renewable electricity facilities coming on board in Virginia will use such residues and other woody

biomass fuel to produce electricity. The new facilities will have a combined capacity to produce more than 300 megawatts of electricity — enough renewable energy to power more than 75,000 homes.

The Department of Forest Resources and Environmental Conservation in the College of Natural Resources and Environment maintains a database of current SHARP Loggers and training schedules for upcoming SHARP Logger Program classes. Visit www.sharplogger.vt.edu.



4-Hers at the Northern Virginia 4-H Educational Center learn about gardening, eating locally grown produce, and nutrition as part of camp.

Virginia 4-H camping builds life skills

2013 camper responses from pre- and post-survey evaluations



Each year, more than 27,000 young people participate in 4-H camping programs at Virginia Cooperative Extension's six 4-H educational centers.

Both residential and day camping programs have a rich history of providing educational programming to thousands of youth through hands-on, experiential learning.

The skills emphasized in Virginia's 4-H camping program include:

- Understanding self.
- Communicating and relating to others.
- Acquiring, analyzing, and using information.
- Problem-solving and decision-making.
- Managing resources.
- Working with others.

4-H camping teaches youth to make their own decisions, solve problems, and manage their resources without the help of family. Through involvement in the camping program, youth learn how to be more responsible, which gives them a better appreciation of their family members.

The 2013 camper evaluations — summarized in the bar graph — demonstrate the impact the 4-H camping experience has on its participants.



* 18 USC 707



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Teaming up with the community to fight obesity

The Dan River region of Virginia is one of the most health-disparate regions of the United States. The area that stretches from Patrick to Halifax counties has a diabetes rate that is almost 50 percent higher than the rest of the country and a 5 percent higher rate of obesity; 17 percent of the area's residents live below the federal poverty level. One in four do not have health insurance.

Fortunately, researchers in Virginia Tech's Department of Human Nutrition, Foods and Exercise are working on a solution to improve the health of the region.

Associate Professor Jamie Zoellner and Assistant Professor Jennie Hill are developing a program that aims to improve the health of those living in the Dan River area and could one day serve as a model to battle the obesity epidemic in similar communities across America.

Zoellner and Hill are helping to lead the Dan River Partnership for a Healthy Community, a community-academic partnership among Virginia Tech, Virginia Cooperative Extension, and

more than 50 local organizations, including churches, government offices, grassroots organizations, and health professionals.

The group's mission is to foster community partnerships to combat obesity in the Dan River region through healthy lifestyle initiatives, beginning with community-based participatory research — a process that engages local stakeholders in all aspects of the research process.

"We know there is no one thing that is going to solve the obesity epidemic, so we are using several strategies to approach this issue," said Hill. "We are engaging the entire community to address this problem from the ground up."

Bryan E. Price, chairman of the organization and health and wellness program director for Danville Parks and Recreation, said community members jumped at the chance to improve their lives.

"Healthier people are happier people, and in the long run, we feel that the improved health status will lead to an overall more successful Dan River region."

—Bryan E. Price, chairman of the Dan River Partnership for a Healthy Community, and health and wellness director for Danville Parks and Recreation



"In this program, locals are invested in working to break the cycle of unhealthy habits," he said. "Healthier people are happier people, and in the long run, we feel that the improved health status will lead to an overall more successful Dan River region."

In the early stages of partnership, the community identified key areas it wanted to work on to address obesity: nutrition through community gardens, a physical activity program, and the region's infrastructure.

Partners in the project say it is affecting the lives of participants.

"It makes a difference in their lives because the successes and failures of their gardens are based on the hard

work, attitudes, time, and effort that they put in," said Tadashi Totten, a 4-H youth development agent with Virginia Cooperative Extension.

So far, the program has had tremendous success with six community gardens planted, dozens of community groups participating, and a massive amount of data on the area that has never existed. In the long run, it might not help only the Dan River region; it could affect the nation if the model is expanded to other locations.

"America is in the midst of an obesity crisis, and we hope this model of academic partners such as Virginia Tech teaming up with local groups can be used to find solutions to solve the obesity epidemic around the U.S.," Zoellner said.

Dairy research ensures healthier cows, more robust profits for farmers

Cows produce more milk and cost farmers less in treatment costs when they are healthy. But a common bacterial infection, *Staphylococcus aureus*, can end up spreading disease among animals and whittling away dairy farmers' profits in record time.

Isis Kanevsky-Mullarky, an associate professor in Virginia Tech's Department of Dairy Science, leads a research team that is attempting to combat *S. aureus* infections in dairy herds and helping to ensure dairy cows are healthier by protecting them from developing the prevalent and painful bacterial infection in the first place.

Associate Professor Isis Kanevsky-Mullarky is working to develop a vaccine that will prevent *Staphylococcus aureus* in cows.

To that end, Kanevsky-Mullarky and her team are working to develop a vaccine that will boost bovine immunity to *S. aureus* infections that lead to mastitis, which is an inflammation of the mammary glands.

"Whatever we can do to enhance the immune function will allow the producer to save money in treatment because a healthier animal overcomes all those hurdles, whether it's mastitis, respiratory disease, or anything the animals encounter in their productive lifespan," said Kanevsky-Mullarky.

Mastitis caused by *S. aureus* is particularly problematic for dairy farmers because, unlike other types of mastitis, *S. aureus* is a very chronic and contagious condition in an animal, rendering an infected heifer untreatable if the infection does not clear up on its own. Staph-related mastitis costs the U.S. dairy industry as much as \$2 billion annually, which is about 11 percent of total U.S. milk production.

"Mastitis is the most costly disease to the dairy industry due to veterinary-associated costs, decreased production, and treatment of non-staph-related infections," she said. Currently, the only treatment for *S. aureus* infections is to isolate the infected cow and cull her from the herd.

Kanevsky-Mullarky's research has been supported by the U.S. Department of Agriculture's National Institute of Food and Agriculture due to the ubiquitous nature of the *S. aureus* infection problem throughout the industry.

"My number one goal is to help farmers make more money and have happier, healthier animals," she said.



Investigating life in the clouds



As children, we are taught about the beautiful simplicity of the water cycle. Precipitation cascades from the sky, falls onto plants and ponds and people, then evaporates back into the atmosphere and eventually descends back to Earth.

But what if it wasn't that simple? What if instead of just modest H₂O, there were also millions of microbes in the rain? What if these microbes then went back up into the atmosphere and became parts of clouds again? What if these bacteria and fungi and other tiny organisms actually contributed to the formation of rain itself?

Turns out, there is plenty of evidence for this.

"Clouds are actually teeming with microbial life," said David Schmale III, an associate professor in the Department of Plant Pathology, Physiology, and Weed Science. "But little is known about microbes in the rain."

Until now.

Schmale and Boris Vinatzer, an associate professor and geneticist in the same department, are part of an international team leading a first-ever study to examine and run DNA analyses on millions of microbes that hit the Earth with each passing raindrop.

Many of the bacteria will be characterized in detail by sequencing

their genomes and testing them for their ability to catalyze the formation of ice. This could lead to more accurate weather forecasting and could potentially help with cloud seeding — when clouds are injected with a material that encourages rain.

The work is being sponsored by a \$2 million grant from the National Science Foundation.

Vinatzer and Schmale are collecting samples of rain in buckets at Virginia Tech's Kentland Farm. Because rain serves as an excellent atmospheric

scrubber, Schmale will also gather precipitation from clouds using unmanned systems — drones — to collect untainted samples for testing.

In the coming years, samples will also be collected in Louisiana, Idaho, Montana, and France in order to glean a snapshot of microbial life in rain around the world. The team will also examine microbial diversity in glacial ice core samples to see if the atmospheric microbial makeup has changed since the 1700s.

David Schmale, associate professor of plant pathology, physiology, and weed science, and Kostya Chubinskiy, research associate, with a small hand-launched unmanned aerial vehicle (UAV) designed to collect microorganisms from the atmosphere.



“This technology allows us to pursue the same goals, namely, the generation of pathogen-resistant mosquitoes, through subtraction. For example, removing or altering a gene that is critical for pathogen replication.”

—Zach Adelman, associate professor of entomology in the College of Agriculture and Life Sciences

Using genetics to wipe out disease

Virginia Tech researchers successfully used a gene disruption technique to change the eye color of a mosquito — a critical step toward new genetic strategies aimed at disrupting the transmission of diseases such as dengue fever, which kills as many as 25,000 people annually.

Zach Adelman and Kevin Myles, both associate professors of entomology in the College of Agriculture and Life Sciences and affiliated researchers with the Fralin Life Science Institute, study the transmission of vector-borne diseases and develop novel methods of control, based on genetics.

In a groundbreaking study, the scientists used a pair of engineered proteins to cut DNA in a site-specific manner to disrupt a targeted gene

in the mosquito genome. The study was recently published by *Science* magazine, which heralded these transcription activator-like effector nuclease proteins, known as TALENs, as a major scientific breakthrough, nicknaming them “genomic cruise missiles” for their ability to allow researchers to target specific locations with great efficiency.

While TALENs have been used to edit the genomes of animal and human cell cultures, applying them to the mosquito genome is a new approach.

“With the development of this technology, our understanding of the genetic basis of many critical behaviors such as blood-feeding, host-seeking, and pathogen transmission should be greatly accelerated,” Adelman said.

To test the capability of TALENs to edit the mosquito genome, the scientists designed a pair of TALENs to target a gene whose protein product is essential to the production of eye pigmentation in *Aedes aegypti* — a mosquito species known for transmitting the viruses that cause dengue fever.

“To date, efforts to control dengue transmission through genetics have focused entirely on adding material to the mosquito genome. Ensuring that this added material is expressed properly and consistently has been a challenge,” Adelman said. “This technology allows us to pursue the same goals, namely, the generation of pathogen-resistant mosquitoes, through subtraction. For example, removing or altering a gene that is critical for pathogen replication.”





Web-based site selection tool helps *grape growers*

The commonwealth ranks as the fifth-largest of the wine-grape growing states in the nation — a distinction that generates \$747 million for Virginia's economy.

Long before grape juice is pressed, however, viticulturists must consider a staggering number of variables when deciding where to plant vines and which varieties are best-suited to a particular soil — which is where researchers around the state come into play.

Grape growers throughout the Eastern United States will soon have the ability to evaluate land for vineyard suitability using a simple Web-based application. The Eastern U.S. vineyard site evaluation app was funded by the Specialty Crops Research Initiative of the U.S. Department of Agriculture's National Institute for Food and Agriculture, through a grant to Virginia Tech and six other institutions, including North Carolina State University, University of Maryland, Ohio State University, Pennsylvania State University, Cornell University, and the Connecticut Agricultural Experiment Station.

Jim Benefiel used the Virginia Tech tool to expand his Benevino Vineyards in Northern Virginia.

The tool has been in development for two years and is based on a similar Virginia-specific app created by researchers in Virginia Tech's Center for Geospatial Information Technology and viticulturists at the Alson H. Smith Jr. Agricultural Research and Extension Center in Winchester. The project is led by Tony Wolf, AREC director and viticulture Extension specialist, in partnership with Peter Sforza, director of the Center for Geospatial Information Technology.

"It's designed to provide a preliminary site assessment and to help match high-quality vineyard sites with the appropriate varieties suited to those sites," said Wolf.

The app is part of the \$3.8 million grant that includes research initiatives in variety evaluation, grapevine management practices, wine marketing studies, and a wide range of outreach and Extension education.

The original app — the Virginia Viticulture Suitability Investigative Tool — allows users to select features of potential land parcels, such as soil type, drainage capability, and nutrient status. Future iterations could analyze a plot of land for the possibility of a freak spring or fall frost. With a few mouse clicks, users can evaluate an area by first zooming in on an interactive map of the state and selecting the parcel

“Over the long haul, the tool can prevent you from making thousands of dollars in mistakes. I have seen several vineyards abandoned, principally because of an inappropriate location.”

—Jim Benefiel, former vice president of the Virginia Vineyards Association

using a polygon tool. Then a selection tool allows users to investigate specific points within the area and retrieve detailed information.

Jim Benefiel, former vice president of the Virginia Vineyards Association, used the Virginia-specific app to expand his own wine-grape operations in Northern Virginia, where he has two vineyards on 20 acres.

“Over the long haul, the tool can prevent you from making thousands of dollars in mistakes. I have seen several vineyards abandoned, principally because of an inappropriate location. An apparent increasing frequency of late spring frosts may cause others to be abandoned in the future,” said Benefiel. “We need to increase grape production, and we need more premium grapes, too. We'd like to carve out a little niche for ourselves, and hopefully tourists will come out to our wineries and enjoy the Virginia vistas.”



Virginia Tech • Virginia State University

A new look for Virginia Cooperative Extension

In 2013, Virginia Cooperative Extension unveiled its new visual identity and logo after a lengthy development process.

“We believe the new logo reflects a modern image that embodies the partnership between Virginia Tech and Virginia State University,” said Ed Jones, director of Virginia Cooperative Extension. “And while our look may be different, we are still focused on providing practical education to help people, businesses, and communities solve problems, develop skills, and build better futures.”

State and local Extension offices have been transitioning to the new visual identity during the past several months.

Agency 229 is...

Innovative research

Virginia Agricultural Experiment Station’s network of faculty members in Blacksburg represents three colleges — the College of Agriculture and Life Sciences, the College of Natural Resources and Environment, and the Virginia-Maryland Regional College of Veterinary Medicine. The 11 Agricultural Research and Extension Centers located across the state support basic and applied research activities on agricultural, environmental, natural, and community issues related to the future needs of Virginia, the nation, and the world.



Expanding education

Virginia Cooperative Extension helps lead the engagement mission of Virginia Tech and Virginia State University — the commonwealth’s land-grant universities. By building local relationships and collaborative partnerships, Extension provides practical education you can trust to help people, businesses, and communities solve problems, develop skills, and build better futures.



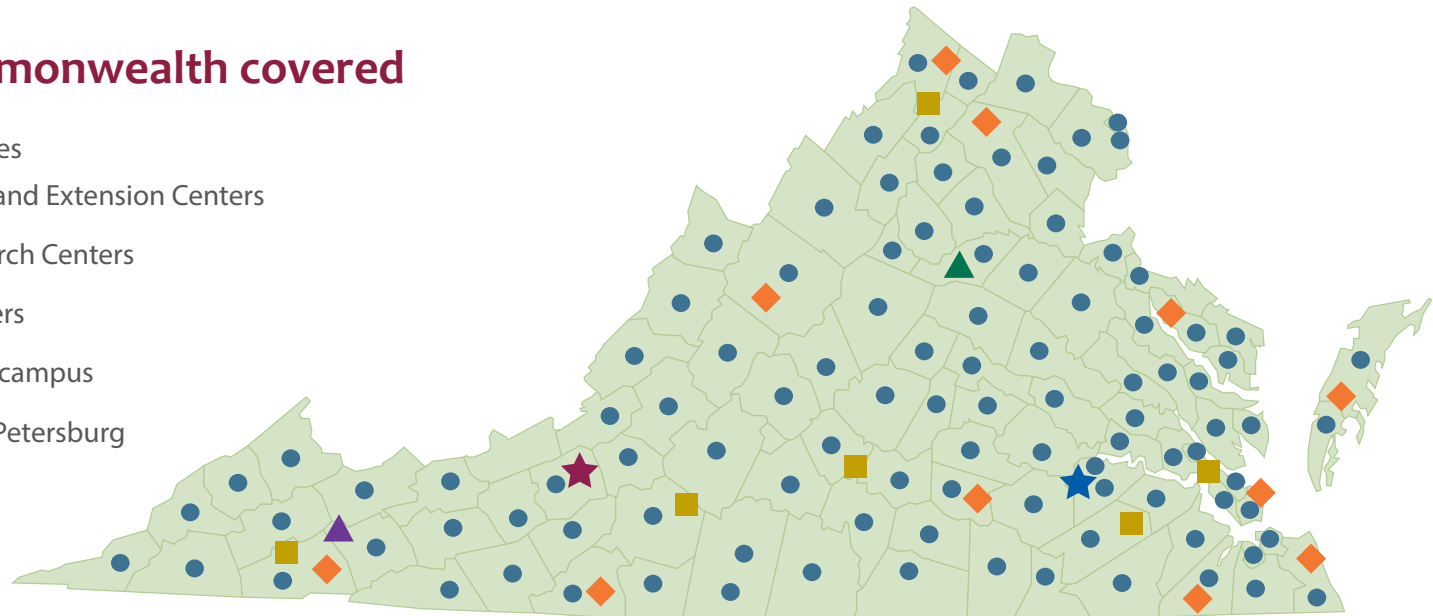
A local presence

Extension offers resources in 107 offices located in every county and 12 cities in Virginia. We are a product of cooperation among local, state, and federal governments in partnership with tens of thousands of citizens, who — through their local Extension Leadership Councils — help design, implement, and evaluate our needs-driven programs.



We have the commonwealth covered

- 107 Local Extension Offices
- ◆ 11 Agricultural Research and Extension Centers
- ▲ Two Departmental Research Centers
- Six 4-H Educational Centers
- ★ Virginia Tech, Blacksburg campus
- ★ Virginia State University, Petersburg



Virginia Agriculture Leaders Obtaining Results

Over the past year, the inaugural Virginia Agriculture Leaders Obtaining Results class has viewed farming and food policy in the state from just about every angle. They visited tomato farmers on the Eastern Shore, underwent media training at TV stations, discussed agricultural policy with Gov. Bob McDonnell, and glimpsed agriculture from a new perspective — that of the federal government.

The VALOR Program, led by faculty members in the Department of Agricultural and Extension Education, began in 2012 with the aim of giving agricultural professionals around the state the tools to be able to create collaborative solutions and promote the industry. The first class includes teachers, farmers, and bankers, among others. After the two-year program is over, VALOR Fellows will serve as advocates and ambassadors for agriculture — both within the industry and with the general public.

The program receives funding from participant fees, the College of Agriculture and Life Sciences, and Virginia Cooperative Extension, as well as from philanthropy from individual donors, industry organizations, and agribusinesses.

“This is an amazing opportunity to learn about decision-making at the state and federal level and to gain an understanding of how that affects producers and our country in general,” said Ken

Ryan, who received his B.S. in agricultural and applied economics from Virginia Tech in 2002. Ryan is a credit underwriter for MidAtlantic Farm Credit from Edinburg, Va.

For more information, visit
www.valor.aee.vt.edu.



New building will bring researchers together

This November, construction of the College of Agriculture and Life Sciences' newest building, Human and Agricultural Biosciences Building 1, will be complete. It is the first of four buildings planned for the new Bioscience Precinct.

The 93,860-square-foot building that is being constructed with state funds will be home to cutting-edge research that will provide practical solutions to some of the most pressing problems facing our planet.

Researchers from two departments — biological systems engineering and food science and technology — will be located in the building and will immerse themselves in nanotechnology, bioenergy, biomaterials, food safety, food packaging and processing, and environmental quality analysis, among other topics.

Having so many disciplines in one location will allow researchers to work collaboratively and combine their talents and interests. The research activities and discoveries that take place in HABB1 will become the cornerstone of programs that will directly benefit the citizens of the commonwealth and the agriculture, food, and health industries.

The 93,860-square-foot building that is being constructed with state funds will be home to cutting-edge research that will provide practical solutions to some of the most pressing problems facing our planet.

Researcher hopes to create better vaccine against swine disease

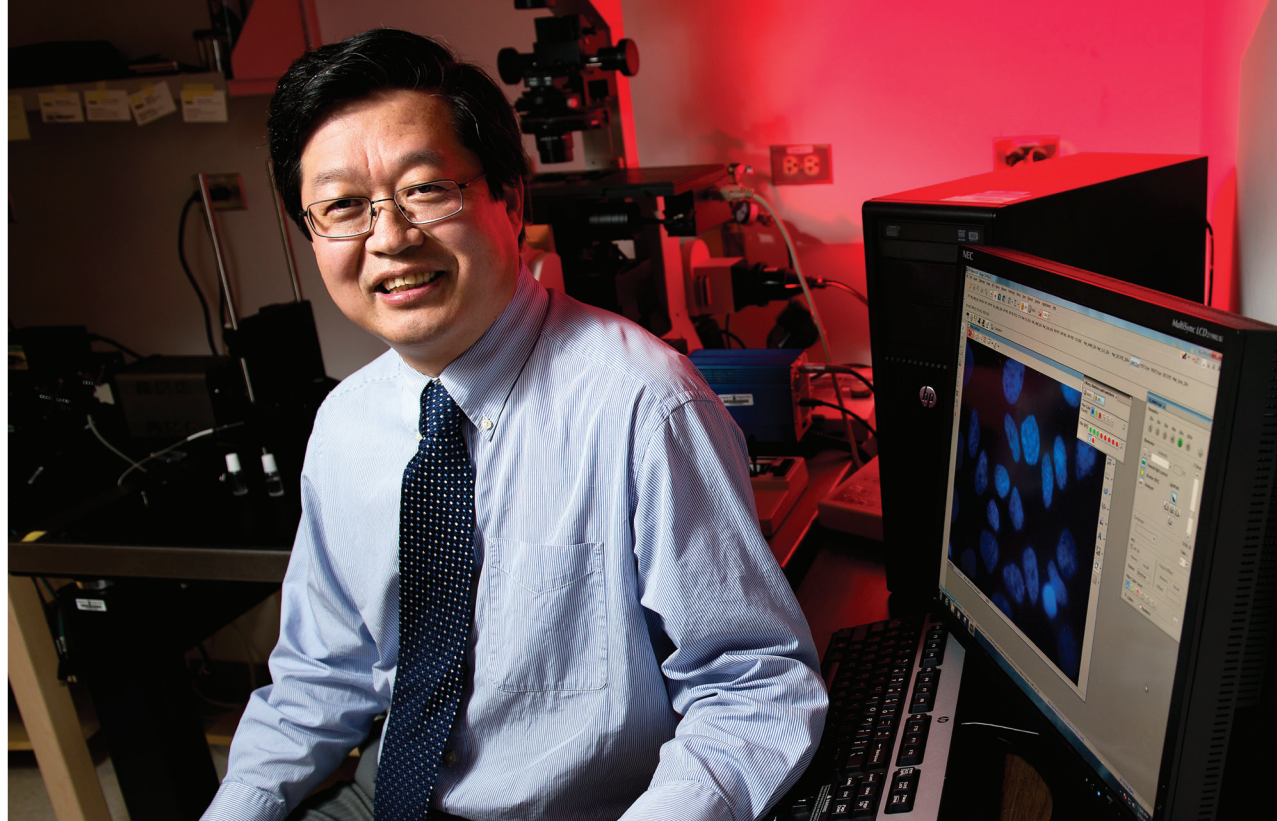
For decades, the swine industry has been battling a virus that affects sows and their young, and a team of researchers at the Virginia-Maryland College of Veterinary Medicine is on the front lines.

In 1987, pork producers first noticed a disease that causes reproductive failure in sows and respiratory diseases in piglets. Scientists later identified the cause: an emerging virus now known as porcine reproductive and respiratory syndrome virus. Dr. X.J. Meng, University Distinguished Professor of Molecular Virology, has been working to improve vaccines against the swine disease since the 1990s.

“Today, vaccines against porcine reproductive and respiratory syndrome virus are being used worldwide,” Meng said. “If the virus infecting a swine herd is genetically similar to the vaccine virus, then the vaccine performs well. Unfortunately, many strains of virus infecting pigs today are genetically different from the one used to create the vaccines.”

Scientists have known about this problem for some time. In 1991, researchers discovered that the virus infecting pigs in the United States was a variant strain of the virus causing similar problems in Europe. Recently, the virus has caused high fever diseases in pigs in China, leading to high mortality rates and significant economic losses.

“We need to develop a better and more efficacious vaccine against the virus,” Meng added.



The disease is now one of the most economically important for the global swine industry, causing pork producers to invest more money into raising pigs and reducing the number of piglets from the onset. Meng estimates that the virus has increased the cost of pork production by \$18 per head. This could mean up to \$4.4 million in annual profit losses for Virginia’s swine industry.

Meng hopes to not only improve existing vaccines against the virus but also to develop better preventative measures against the disease. His laboratory previously cloned the first U.S. strain of the virus to better understand its biology in order to develop a second-generation experimental vaccine against it.

“Today, vaccines against porcine reproductive and respiratory syndrome virus are being used worldwide. If the virus infecting a swine herd is genetically similar to the vaccine virus, then the vaccine performs well.”

—Dr. X.J. Meng, University Distinguished Professor of Molecular Virology

Helping improve profits for Virginia's livestock producers

Virginia's pork production legacy is well-known, but recently, the heavy demand for corn grain across industries, as well as in nonfood-producing endeavors such as ethanol production, has reduced profits for hog producers.

"A lot of the Mid-Atlantic States are grain-deficit, and they have to import grain to feed their livestock," said Gordon Groover, Extension economist and associate professor of agricultural and applied economics.

An increased demand for corn, both domestically and abroad, has increased total costs for end uses of corn. This — coupled with higher energy costs for transporting grain from the corn-belt states — has reduced the profitability of feeding hogs in Virginia.



But Virginia Tech researchers are exploring ways to boost the state's grain production, which will reduce the need to import grain for the swine industry.

That increase in grain supply may not come from corn — but from sorghum.

A research partnership with Murphy-Brown, a subsidiary of Smithfield Foods, is evaluating the viability of incorporating sorghum into the mix of crops farmers grow and the grains they feed their animals.

Extension researchers are helping to answer many questions, including the challenge of transporting, storing, and drying sorghum; soil affinity for the crop; and how to fit it into a crop rotation.

"Increasing grain production means we keep the hog industry in the state," said Wade Thomason, Extension grain specialist and associate professor of crop and soil environmental sciences. "It could mean that if there is expansion, it happens here instead of Iowa."

Tests conducted last year found that sorghum has 95 percent of the energy value of corn, according to Maria Balota, assistant professor of crop physiology and the principal investigator on the project.



“Increasing grain production means we keep the hog industry in the state.”

—Wade Thomason,
Extension grain specialist and
associate professor of crop and soil
environmental sciences

Balota, who performs her research at the Tidewater Agricultural Research and Extension Center in Suffolk, participates in several growers meetings each year to talk with farmers about sorghum varieties and production. Currently, several sorghum hybrids in Virginia yield more than 80 bushels per acre.

Given the increased demand for pork products, the sorghum research currently being conducted through Extension initiatives may just keep farmers in Virginia in the green — and the pink.

Improving on-farm energy efficiency

Dairy and poultry operations, greenhouse facilities, and flue-cured tobacco farms in Southside and Southwest Virginia are significant consumers of energy. Farmers are challenged with rising fuel and electricity expenses that increase the cost of production and reduce already tight operating margins. Fluctuations in energy costs make budgeting more difficult.

Virginia Cooperative Extension, with financial support from the Virginia Tobacco Indemnification and Revitalization Commission, implemented a pilot farm energy efficiency program. "The 2010-12 program focused the attention of agricultural producers on the cost of energy that they use, energy conservation options, and opportunities to cost-share projects to reduce farm energy consumption," said Martha Walker, Extension community viability specialist.

As part of the program, 71 farms requested on-farm energy audits and 58 completed the audit. Qualified energy auditors and trained data collectors from several firms used for the project conducted the audits.

As a result, more than \$1 million in energy savings was identified, including:

- **1,258,776 kWh electrical usage.**
- **603,315 gallons propane fuel.**
- **19,336 gallons fuel oil.**
- **63,298 million BTUs.**
- **4,315 MTCO₂e greenhouse gas emissions.**



Approximately 76 percent of the recommended energy conservation measures have a payback period shorter than five years.

"Farmers completing an on-farm energy audit were offered a 25 percent cost share, up to \$2,500 per farm, as an incentive to upgrade to energy-efficient equipment," said Walker. "Twenty-four farms implemented the cost-saving projects identified in the audits, and 14 farms applied for USDA REAP [Rural Energy for America Program] energy conservation grants, of which 11 were successful and will receive \$220,225 in funding."

The pilot project engaged multiple Virginia partners, including the Virginia Department of Mines, Minerals and Energy; USDA Natural Resources Conservation Services; USDA Rural Development; and Virginia Foundation for Agriculture, Innovation and Rural

Approximately 76 percent of the recommended energy conservation measures have a payback period shorter than five years.

Sustainability. Because the value of energy audits in identifying cost savings for agricultural producers was validated, Extension and its partners are applying for a second grant to launch an expanded project. Award notification is expected in January 2014.

Biosecurity efforts support industry

Virginia's poultry and egg industries provide a direct economic impact of more than \$3.6 billion to Virginia's economy, according to the Virginia Poultry Federation. With the continuing threat of disease outbreaks in the poultry industry, including the highly publicized avian influenza, poultry growers are taking no chances.

Audrey McElroy, poultry Extension specialist, and her colleagues have helped poultry producers establish a biosecurity audit program to help prevent and lower the risk of disease transmission.

Following an outbreak of avian influenza in 2002 that infected more than 190 Virginia farms and resulted in the depopulation of more than 4.7 million chickens and turkeys in the Shenandoah Valley, the Virginia Poultry Federation formed a poultry disease task force to address the increasing threat of biosecurity issues. The task force — made up of representatives from the major poultry companies, the Virginia Department of Agriculture and Consumer Services, the Department of Environmental Quality, and other public health groups — recommended the development of the biosecurity audit program.

The audit program has been in place since 2004 and all major poultry and egg companies in Virginia currently participate in it. Twice a year, McElroy assesses all segments of live production for commercial broiler, turkey, and egg producers to identify biosecurity risks and opportunities for improvements in control of disease outbreaks or spread.

Companies are required to participate in two audits per year and an external auditor must conduct at least one of them. Each audit consists of on-site visits to three to four farms covering all aspects of the operation, including the hatchery, feed mill, transportation, and service personnel. Face-to-face interviews are conducted with individual growers, and the company must also answer questions about its biosecurity protocol.

On completion of the audit, a report is provided to each company with its results. Company management has indicated that as a result of the audit reports, company personnel and growers were educated on identified biosecurity risks, corrective measures were taken by company personnel and growers, and awareness of biosecurity practices was increased.



Virginia's poultry and egg industries provide a direct economic impact of more than \$3.6 billion to Virginia's economy, according to the Virginia Poultry Federation.

"Since the audits were initiated, the average audit score of those companies participating every year has improved from 84.8 percent in 2004 to 96 percent in 2012," said McElroy.



Working to **stop** stink bugs in their tracks



Ames Herbert,
Extension
entomologist, scouts
for stink bugs in
a soybean field in
Tidewater, Va.

In the 13 years since the brown marmorated stink bug was discovered in Pennsylvania, the voracious insect has made a slow and steady march toward Virginia. It was found in the commonwealth in 2004, and it has caused millions of dollars in damage as it destroyed apples and grapes in the Shenandoah Valley, pierced soybeans in north-central fields, and sucked the proteins and carbohydrates out of corn, tomato, green bean, and pepper plants in other parts of the state.

Stink bugs were discovered in 20 counties in Virginia last year, and they are expected to continue to spread throughout the state, infecting more localities than ever before.

A team of Virginia Tech researchers is working to not only find a way to control the stink bug, but also to stop its spread in Virginia and farther south where it could continue its damaging rampage.

"It's not pretty," said Ames Herbert, professor of entomology and Virginia Cooperative Extension entomologist. "If they can make it to Coastal Virginia,

they can make it anywhere in the Eastern United States."

The stink bug's appetite is as varied as it is voracious. "This is the one insect that has been all-encompassing in the sheer variety of plants it attacks," said Virginia Tech Professor Tom Kuhar, Extension entomologist. "We have very few agricultural commodities that this bug does not attack."

Virginia Tech researchers and Extension agents are working with farmers and scientists around the Mid-Atlantic States to monitor the spread of stink bugs and share ideas on how to minimize their damage.

"We are putting lots of resources into going deeper into this and trying to learn how to manage this pest," Herbert said.

At the Alson H. Smith Jr. Agricultural Research and Extension Center in Winchester, Professor Chris Bergh, Extension entomologist, helped develop a weapon in the fight against



the stink bug. Bergh researched the insecticide dinotefuran to determine its effectiveness. When he established it was a good tool, he worked to get it into the hands of farmers.

In 2011, he spearheaded a multi-state effort to get an emergency exemption of dinotefuran from the Environmental Protection Agency. He successfully applied for permit extensions in subsequent years so farmers could fight off the pest — and hold on to their profits.

"This pest can wreak havoc on farmers and severely affect their bottom line," Bergh said. "We want to find as many weapons as possible to assist farmers in this battle against the stink bug."

“This is the one insect that has been all-encompassing in the sheer variety of plants it attacks. We have very few agricultural commodities that this bug does not attack.”

—Tom Kuhar, Virginia Tech professor and Extension entomologist

Spanish-language training speaks to seafood industry needs

Virginia's seafood industry is characterized by succulent and diverse fruits de mer. But behind the gastronomic delicacies is also a nimble industry that meets the demands of consumers in not only production, but also in food safety.

The Virginia Seafood Agricultural Research and Extension Center in Hampton is an important partner in ensuring that seafood is processed safely. The AREC offers Hazard Analysis and Critical Control Points systems training to employees of commercial seafood processors — guidelines that are a worldwide standard for commercial food processing.

In 2007, the AREC began offering HACCP classroom training in Spanish in an effort to assist producers that employ an increasingly Spanish-speaking workforce.

To date, 108 employees have had HACCP Spanish training.

“Even though employees’ level of expertise may be high, aspects of some procedures may get lost in translation,” said Abigail Villalba, food safety Extension specialist at the Virginia Seafood AREC. “By participating in these trainings, processors can control their hazards and remain competitive by manufacturing products that are safe and wholesome.”



Helping families strengthen their financial management skills

The past few years have brought financial challenges to many people throughout the commonwealth. One in every nine Virginians lives at or below the poverty level and the current economic climate has only emphasized the need for additional financial education.

Virginia Cooperative Extension has taken steps to help fill this need through its Master Financial Education Volunteer Program. The MFEV program focuses on helping families build their financial capability through classes on topics such as managing money, planning for home ownership, getting out of debt, retirement planning, and preventing identity theft. The program also provides one-on-one mentoring.

Master Financial Education Volunteers receive a minimum of 20 hours of classroom instruction and, in return, commit to contribute an additional 40 hours of service to the community in the 12 months following training.

Volunteer educators partner with local Extension agents to provide individual counseling sessions; assist at Reality Store, Kids Marketplace, and poverty simulations; teach money management workshops to youth; and lead adult financial management classes.



Tom Miller, a volunteer from Harrisonburg, enjoys helping others and making clients aware that there are things they can do to improve their financial situations.

“Often clients feel desperate about their situations. As a financial mentor, I don’t tell them what to do, but provide them information about options from which they can choose. I focus on what they can do differently from this point forward,” said Miller. “I’ve benefited from the information I learned and understand how others can benefit as well.”

In 2012, agents trained 73 new volunteers, who contributed more than 200 hours of service and helped more than 2,000 individuals improve their financial skills.

“The Master Financial Education Volunteer Program has helped to expand Extension’s capacity to reach more people and helped secure healthy financial futures for Virginia’s families,” said Brian Calhoun, associate director for family and consumer sciences.

Household water quality program empowers homeowners

The average person uses as much as 100 gallons of water a day. Imagine having to regularly test water quality and maintain your own water system.

This is an issue 1.7 million Virginians with private water supplies have to deal with. Sharon Beasley is one of many who is concerned with her home's water quality.

Beasley, a Roanoke County resident, has been relying on water from a household well for years. With a husband and two children, she needs to ensure her family's health and make sure her well water is not full of harmful contaminants. Fortunately for Beasley, she found out about a water quality clinic in her community.

"I thought it was too good to be true," Beasley said. "For a reasonable cost, I was able to gain practical knowledge about my well system and have my water quality tested by a professional lab at Virginia Tech."

The Virginia Household Water Quality Program conducted by Virginia Cooperative Extension works to improve the water quality and health of Virginians with private water supplies such as wells, springs, and cisterns. Drinking water clinics are held across the state to give people with private



“Our goal is to provide Virginians reliant on wells and springs with objective information about their water quality and the care and maintenance of their water systems.”

—Erin Ling,
senior Extension associate in the
Department of Biological
Systems Engineering

water systems access to affordable water testing, help interpret their test results, and provide the resources to address problems, if needed.

“Our goal is to provide Virginians reliant on wells and springs with objective information about their water quality and the care and maintenance of their water systems,” said Erin Ling, senior Extension associate in the Department of Biological Systems Engineering. “We hope this will empower them to be better-informed consumers and better able to make good decisions when it comes to regular testing, water treatment, and system care, and ultimately, protect their health and property values.”



Sharon Beasley of Roanoke County participated in one of Virginia Cooperative Extension's drinking water clinics held across the state.

Clinics begin with a kickoff meeting that gives an introduction to household water system care. Key points are water quality risk factors and proper maintenance. Extension agents then train participants to collect their own water samples with provided testing kits.

“Each step in the process was thoroughly explained,” Beasley said. “There were also a lot of instructors on hand to answer questions and work with participants on an individual basis.”

After participants collect their water samples, the samples are taken to the Biological Systems Engineering Water Quality Lab at Virginia Tech to be tested. An interpretation meeting is held to

review each participant's results with them.

“I was fortunate and did not have any major issues with my water supply,” Beasley said. “I am, however, thankful for the information and the peace of mind I have gained from the program. I can't tell you how good it feels to know my family is using clean water.”

Since 2008, Extension has conducted 63 drinking water clinics with participants from 81 Virginia counties and tested water samples for about 8,200 people. For more information, including upcoming clinics, visit the Virginia Household Water Quality Program website at www.wellwater.bse.vt.edu/clinics.php.

By the numbers

Extension and Research Funding

(funding sources for FY 2013)

Virginia Cooperative Extension and the Agricultural Experiment Station received

\$178.2 million

from federal, state, and local governments, as well as from grants and contracts and other sources.



8.4%

Funds from local government



35.3%

State general funds



8.0%

Federal formula funds



48.3%

Grants and contracts + other funds

Return on Investment

For every \$1 invested by the state, Agency 229 generates an additional

\$1.83

Extension and Research Effort

(full-time-equivalent employees)

Total number of faculty and staff members for research and Extension

790 FTEs

Extension

69.7%

Virginia Agricultural Experiment Station

30.3%

Location of Research and Extension Faculty

District offices

2.5%

Virginia Tech campus

35.7%

Agricultural research and extension centers

8.7%

4-H educational centers

3.3%

City and county offices

49.8%

Value of Volunteers

In 2012, Virginia Cooperative Extension had

26,679
volunteers

who assisted Extension staff in delivering educational programs.

They contributed

859,421
hours

of service that is valued at

\$19,680,740.*

* Based on a rate of \$22.90 per hour, according to the Independent Sector.



Youth Programs

More than

193,900

Virginia youth enrolled in 4-H in 2012.

* 18 USC 707

Unraveling the mystery of how plants store energy

Anyone who has dabbled in the most basic gardening or even pondered a field of wildflowers has taken for granted that plants turn light into energy. And though science has accepted this fact for years, researchers have only just begun to unravel the mystery of how plants regulate energy to grow and thrive.

Scientists now know there is an innate energy-sensing system at work in the structure of plant life.

“Plants utilize some of the same energy sensing and metabolic processes that we do,” said Glenda Gillaspy, professor of biochemistry in the College of Agriculture and Life Sciences. Gillaspy’s focus is on the main energy expenditure for plants — creating cellulose. Plant cell walls are composed of cellulose, which is where energy made from light is stored. Her research builds upon what scientists now know, that plants don’t continually store energy; they go through periods of energy deprivation and surpluses, just like animals and other complex organisms, even humans.

The similarity between humans and plants lies in one of the major controlling proteins that occurs in plant signaling — the same protein found in animals and yeast.



This protein interacts with the fuel gauge that regulates how much energy the plant uses. The fuel gauge talks to the signaling network, and there is crosstalk that happens that indicates to the plant how it should spend its energy. Researchers still don’t know how, they just know it occurs.

Consider the importance of the 10 a.m. coffee break for someone who hasn’t eaten breakfast.

While a plant is not going to raid the break room for a donut, an intricate level of signaling that turns certain cell responses on and off means plants experience metabolic changes in much the same way as humans.

Ultimately Gillaspy’s work could help engineer plants that can adapt to an increasingly warming world plagued by drought and nutrient-poor soil.

By discovering more about how to manipulate a plant’s ability to synthesize cellulose for energy use, we’ll certainly learn a lot about our own biological processes, and the concrete connection between all living organisms as well.

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This publication was produced by the College of Agriculture and Life Sciences, Office of Communications and Marketing (MC 0904), 230 Smyth Hall, 185 Ag Quad Lane, Blacksburg, VA 24061, 540-231-0447.

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VT/0913/2500/VCE-196

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