FIGHTING MALARIA

Plant-Driven Designer
Safe Drinking Water
Stink Bugs
Collaborate (kə-ˈla-bə-rät)

1: to work jointly with others or together especially in an intellectual endeavor. 2: a practice common among College of Ag Sciences faculty and students.

“Teaching is a partnership,” says Dan Stearns, professor of landscape contracting. “The role of the teacher is to help students explore and to teach them to learn, to get them excited about learning.”

Professors like Dan Stearns make the difference in our education programs. With small class sizes and opportunities to work together on research projects, Dan is able to interact with and mentor his students on a personal level.

“My goal is to see each student graduate with a sense of self-worth and a high level of competence and confidence.”

After all, learning is a collaboration.

Find out what the College of Ag Sciences can do for you.

agsci.psu.edu
An Unfolding Future

A new year begins and the college faces a sea of change. What’s over the horizon is hard to predict.

What we do know is that the college, not unlike other organizations, is facing serious budget challenges, the magnitude of which will not be fully known until the Commonwealth passes its fiscal year 2011/12 budget.

The dean spoke to college staff late last semester about these challenges and acknowledged the uncertainty and fear associated with them. How all of this will affect people, programs, and day-to-day operations remains unknown until input from the Ag Futures teams and the University-wide reviews are complete. The dean reminded the group of the importance of what we contribute to society.

Challenging food-related challenges lie ahead for our country and the world that we are uniquely positioned to tackle. In the next 30 years, the rise in global population will require a doubling in the amount of food we produce. And we’ll have to do it with less water, less land, and less energy. “We don’t know how to do it,” says McPheron. “No one does. But we’ll figure it out.” Finding answers to short-term challenges today will fuel the solutions to bigger challenges tomorrow.

Despite economic uncertainties, there are bright spots. In spite of huge unemployment, demand for ag science graduates remains high. A USDA report notes that between 2010 and 2015, the U.S. economy will generate an estimated 54,400 annual openings in agricultural, food, and renewable natural resources fields. Individuals with degrees in food, renewable energy, and environmental specialties will be in demand.

Students are coming to our college in growing numbers. Since last year, enrollment has grown 10.2 percent, and over the past five years, enrollments have increased nearly 42 percent—a reflection of the importance of our work.

Serious issues are being confronted in the college. Researchers are working to unravel mysteries in the lab while administrators stay late to figure out how to keep the lights on amid a state and national economic crisis. We need to craft our own future, one that embraces the unprecedented opportunities to bring science to bear on the food system of the future. There lies our collective future.

The college has an important role as the future unfolds. Its success will depend on us working together to help inform decisions that will be made for the college today and tomorrow.

At the same time, the University is engaged in significant program reviews across all campuses. Recommendations as a result of those reviews will also touch the college.

Together, these factors make it clear the college will have to change. Planning to address that change is underway.

Last August, Dean McPheron put into place a process to help advance human and animal health, and much more.

The work done today and tomorrow.

Letters, and do mock interviews. This program helps prepare students for Career Day, which is when employers come to the college to recruit for positions and internships. Alumni rank mentoring this event as one of the most meaningful engagements they have with the college and the Ag Alumni Society.

SL: What is your day job?
CB: I am a marketing and communications specialist for the Pennsylvania Beef Council. I guess you could say I’m a beef promoter! In fact, in my early years at the Beef Council, I dressed up as a hamburger, named Patty Melt, and visited elementary schools to teach kids about food safety! I have always been interested in agriculture and the promotion of commodities. As a teen, I was a dairy princess tasked with promoting the dairy industry. I grew up on a dairy farm in northeast Pennsylvania that has been in my family since 1841, so I am the sixth generation of my family to be involved in agriculture. My family now produces raw-milk artisan cheeses with markets in New York City, Washington, D.C., and all over Pennsylvania.

SL: Why did you want to be president of the Ag Alumni Society?
CB: I enjoy staying connected to the college and helping other alumni stay connected as well. And I believe in what the society does. In fact, when I was a student here, I received one of the alumni society’s scholarships.

SL: How can alumni become members of the society and how much does it cost?
CB: Ag alumni automatically become members of the Penn State Alumni Association. It costs $50 a year, or $600 for a lifetime membership, to join the alumni society. To Join, visit agsci.psu.edu/alumni/get-involved/join.

Editor’s Note

Joining the Ag Alumni Society
An Interview with Carrie Bomgardner

Winter 2011/12 Budget

Winter/SPRING 2011 | AGSCIENCE
After decades of research investigating whether fish are capable of experiencing pain, whether humans cause them to suffer, and whether it even matters, Victoria Braithwaite examined this question in her new book, *Do Fish Feel Pain?*

A faculty member in the college and associate director of the Penn State Institute of Neurosciences, her research and the book have caused a firestorm of controversy among both devotees and opponents of angling. Braithwaite’s approach is dispassionate, balanced, and matter-of-fact—and she is quick to point out that she is not against sport fishing.

She cautions suggestions that she is a “tree hugger” or an animal-rights extremist. “I am not biased—they are my books, and my book is balanced,” she said. “I recognize how valuable the efforts of anglers have been historically for conserving many fish species, and putting many of them at risk of extinction.”

Braithwaite conceded, but we should not let our discomfort keep us from confronting the issue because the latest scientific evidence suggests that the protections currently given to birds and mammals should be widened to include fish.

“Do Fish Feel Pain? is published by Oxford University Press and is widely available at booksellers and online bookstores.”

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**Addressing Roundup-Resistant Weeds**

Weed scientist David Mortensen caused quite a stir last summer when he told a group of politicians that the government should restrict the use of herbicide-resistant crops and impose a tax on genetically engineered seeds to fund research and education programs for farmers.

Testifying before the Domestic Policy Subcommittee of the House Oversight and Government Reform Committee in July, the professor of weed ecology explained how the use of crops that are genetically engineered to resist glyphosate—the active ingredient in the herbicide Roundup—has caused certain weed plants to also evolve resistance to glyphosate.

According to Mortensen, 19 weed species have already evolved resistance to glyphosate since glyphosate-resistant crops were introduced in 1996, and these plants have infested up to 11.4 million acres in the United States. “In addition,” he said, “weeds are becoming more resistant to glyphosate, including weeds that are more resistant than Roundup.” The use of crops that are resistant to multiple herbicides could result in a 70 percent increase in the amount of herbicides that are used, he said, and even those products eventually will run into resistance problems if farmers aren’t careful.

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**Challenges in Biofuels Production**

Replacing fossil fuels with biofuels will require a major transformation of the agricultural, transportation, and energy sectors in the United States over the next decade, according to a paper published in the August 13, 2010, issue of the *Journal of Science.*

Fifteen billion metric tons of biomass—such as switchgrass, crop residues, and forest wastes—will be needed each year to reach the International Energy Agency’s 2050 target for producing energy from biomass, said the paper’s author Tom Richard, professor of agricultural and biological engineering and director of the Penn State Institutes of Energy and the Environment. Richard added that the challenges associated with meeting the challenges associated with meeting the International Energy Agency’s 2050 target for producing energy from biomass are formidable, ranging from 30 percent to near-100 percent in a variety of ways, including crop-to-fuel efficiency, feedstock availability, and pollution and degradation.

“Do Fish Feel Pain? is published by Oxford University Press and is widely available at booksellers and online bookstores.”

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**Investigating Alternative Pollinators**

High-value fruit, nut, and vegetable crops in Mid-Atlantic states are being affected by honey bee shortages. A $1.4 million grant from the USDA NIFA Specialty Crops Research Initiative (SCRI) program will look at the impact on fruit pollination and the development of alternative pollinators to supplement honey bees.

According to David Balgooyen, tree fruit entomologist at Penn State’s Fruit Research and Extension Center and a project co-director, the importance of native bees has probably been underestimated. “In a recent study, almost 50 species of native bees were shown to be key crop pollinators of several vegetable crops and were fully able to pollinate some of those crops without the aid of honey bees on the majority of the farms evaluated.” A two-year survey of 12 Pennsylvania apple orchards found more than 120 species of bees, as well as other pollinators, in honey bee numbers since 1997, wild bee numbers increased an average of three- to fivefold.

The new project will establish surveys and a monitoring program to identify the importance of wild pollinators to agricultural pollination, assess bee species collected during surveys to determine if they are efficient pollinators, and promote pollinator awareness through educational efforts.

For information, visit Penn State’s Center for Pollinator Research at ento.psu.edu/pollinators.

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**Endowment to Aid Honey Bee Research**

A gift of $100,000 will aid undergraduates in the College of Agricultural Sciences in their effort to understand Colony Collapse Disorder (CCD), a nationwide phenomenon in which adult honey bees disappear from their hives, often spelling death for the colony Honey distributor Dutch Gold Honey and William and Kitty Gabler of Lancaster, Pennsylvania, each contributed $50,000 to the endowment. The last four years, losses of bees due to CCD have ranged from 30 percent to nearly 100 percent in parishes with CCD symptoms. The disorder still is not fully understood.

The “forbearance and generosity of Dutch Gold Honey and the Gabler family emboldened in this endowment will help us train the next generation of scientists who will take the lead in future research to ensure the health of pollinators and their habitats,” said Bruce McPherson, dean of the College of Agricultural Sciences.

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**Analysis of Cacao Genome Could Yield Better Chocolate**

For thousands of years, humans have savored the complex flavors of chocolate. Now, having sequenced and analyzed a certain variety of the cacao tree—the plant that produces the beans from which chocolate is made—human-can appreciate the complex biology behind the confection as well.

An international team that included Professor of Plant Molecular Biology Mark Guilmant and Associate Professor of Horticulture Siela Maximova sequenced the genome of the ancient Criollo variety of cacao, which generally is considered to produce the world’s finest chocolate. The team also identified a number of gene families within the Criollo tree that may prove to be useful in enhancing the variety’s attributes and protecting it from fungal diseases and insects.

According to Guilmant, to his knowledge the cacao tree—scientifically termed *Theobroma cacao*, meaning “food of the gods”—is the first early domesticated tropical tree fruit crop to be sequenced. Cacao production began in Mesoamerica 3,000 years ago, and the Criollo variety was the first to be domesticated. Today, about 3.7 million tons of cacao are produced annually worldwide, contributing greatly to the income of small farmers.

“We hope our achievement will encourage greater investment in research of the cacao tree and, ultimately, benefit developing countries for which cacao is of high economic importance,” said Guilmant.
Although some contend that watching television rots young minds, junior wildlife and fisheries science major Melanie Torres argues the opposite. Watching television, she maintains, inspired her: “I’ve always loved animals,” said the Easton, Conn., native. “Watching Animal Planet and seeing the amazing things Steve Irwin and Jeff Corwin were able to experience inspired me to pursue this major.”

From hands-on experience with the education department at the Beakley Zoo in Bridgeport, Conn., to course loads alive with anthropology lectures and biology labs, Torres is driven to experience. For Torres, the route to gaining this experience at Penn State is the University’s Presidential Leadership Academy. The prestigious program, which welcomed 30 students from across the University’s academic colleges for its inaugural class in the fall 2009 semester, is composed of 30 students from across the University’s academic colleges.

“The goal of the academy, according to Penn State President Graham Spanier, is “to ensure that the next generation of leaders develops the critical thinking skills necessary to make decisions based on all angles of a complicated issue.”

Environmental protection is the issue on the mind of Torres—the only student from New York City or Washington, D.C., in her class. “The natural world is vital to our everyday lives, and it really does need to be protected,” she said. The academy provides its students with an opportunity to participate in several field experiences, such as trips to New York City and Washington, D.C. Each student in the academy is required to take a first-semester seminar taught by Spanier, as well as additional courses that integrate the goals of the academy, and, specifically, complete a semester-long capstone project.

Although her commitment to the academy, which lasts the duration of her time at Penn State, adds an extra workload of weekly blog writing and lecture sessions to her already demanding class schedule, Torres continues to embrace this opportunity. “I am honored for the chance to have these experiences,” said Torres. “I just being exposed to all of these unique perspectives is fascinating.”

Students in Hort 201, Applied Arboriculture, worked hard for their midterm exams. Instructor Jim Savage evaluated climbing skills as students worked their way up into the big trees between the HUB and Altshilton Hall to write exams attached to hanging clipboards.

The course description in the schedule of courses reads “overview of methods used to diagnose problems and provide for the long term care of large trees” and “emphasis will include accessing the upper parts of large trees; safety when working in and around large trees.” The description goes on to explain testing and evaluation but doesn’t mention how the exam will be conducted.

Students thought the course helped them address uncomfortable or challenging situations—something they felt would be an asset as they moved forward in their careers in business, science, and arboriculture.

Dean McPheron recently posted on his blog about growing enrollment in the college and how part of our success and strong reputation is due to our focus on experiential learning. The students climbing to take their exam is an excellent example.

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Students, faculty, extension educators, and staff interested in developing multimedia projects can now make use of a new digital media facility in the Agricultural and Industries Building. It’s the first partnership between Penn State Media Commons and the college.

Beginners and advanced users will have access to experienced consultants, training opportunities, and digital production facilities, including ten Apple computers loaded with multimedia software, two sound booths for podcasting, and a small studio with a green screen to shoot video. The facility is also designed to support teamwork and core course collaborations by enabling reconfiguration of furniture on wheels and equipment in ways supportive of individual project needs.

The new facility will allow for the exploration of digital technologies and production of multimedia to enhance education and curriculum and refine technical skills to utilize these technologies.
Keeping Eggs Safe

August’s Salmo- toffia scare and subsequent egg recall caused many of the country’s consumers to think twice before diving into their breakfasts, but it turns out that people who purchased their eggs from Pennsylvania’s producers had little to worry about. That’s because Pennsylvania-produced eggs are safer to eat, according to eggs from Pennsylvania’s producers had little concern with Salmonella enteritidis contamination of eggs had been in place since 2005. "If the federal regulations to protect against Salmonella enteritidis contamination of eggs had been in place earlier, last summer’s outbreak and egg recall may not have occurred," said Patterson.

PEQAP eventually became the model for a national egg-safety program that was implemented in July. "If the federal regulations to protect against Salmonella enteritidis contamination of eggs had been in place earlier, last summer’s outbreak and egg recall may not have occurred," said Patterson.

Battling Childhood Obesity

Childhood obesity has reached epic proportions, with nearly one-third of American children now considered to be overweight, according to recent estimates. "Overweight kids have a higher risk of developing chronic diseases such as type 2 diabetes, high blood pressure, and heart problems," said Lynn James, a Penn State senior extension educator.

As the director of Penn State’s award-winning Family Fitness Program, an after-school course that targets children who are overweight or at risk of becoming overweight, James aims to curb childhood obesity in Pennsylvania by educating kids and their families about the benefits of exercise and healthful eating.

Calvin Named Director of Cooperative Extension

Dennis Calvin, who has served as interim director of Penn State Cooperative Extension since July 2009, has assumed the role of a permanent basis. Calvin joined Penn State as an assistant professor of entomology in 1985. From 1985 to 1996, he served as Penn State’s integrated pest management (IPM) coordinator, which enabled the development and coordination of IPM programs and acting as a liaison with national, regional, and state IPM groups.

He received a bachelor’s degree in agronomy and pest management from Iowa State University, and he earned his master’s and doctoral degrees in entomology from Kansas State University.

Tapping Into Feelings About Gas Exploration

While energy companies are searching beneath Pennsylvania and New York for natural gas, social scientists are tapping into residents’ feelings about the gas-exploration boom.

Kathy Berant, an assistant professor of rural sociology surveyed people in 19 Pennsylvania counties and eight New York counties to find out how much they know about efforts to extract natural gas from the Marcellus shale and whether or not they support such efforts.

“Our main objective was to establish baseline data so that we can track changes in people’s attitudes,” said Berant.

Based on the responses of nearly 2,000 participants, the survey revealed that a significant number of people have not yet formed opinions or have no knowledge about Marcellus shale drilling. Of those reporting knowledge about the issue, 45 percent said they support drilling, 33 percent said they neither support nor oppose drilling, and 21 percent said they oppose drilling.

Berant said that there was more opposition to drilling among respondents in New York (31 percent opposed) than in Pennsylvania (19 percent opposed), perhaps due to the fact that drilling has not yet been approved in New York.

According to Berant, concern about the environmental impacts of drilling was among the top reasons people cited for opposing drilling, while the promise of new jobs was given as a reason for supporting drilling.

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“If I’d been a good girl, I’d have done the science thing, gotten my Ph.D., become a professor, and done research on root hairs,” says Lauren Springer Ogden, garden designer, author, and 1989 graduate of the college.

Instead, armed with a sense of curiosity she says was “all over the map” and no desire to do the “focused thing,” Springer Ogden followed her own path after receiving her master’s degree, carving out a career working in and designing public and private gardens around the United States and the world, giving lectures, and writing.

Twenty years later, she is one of the most influential horticulturists of the twentieth and twenty-first centuries, says Panayoti Kelaidis, senior curator at the Denver Botanic Gardens who considers Springer Ogden “the premier garden designer in America.” Her most recent book, *Plant-Driven Design: Creating Gardens That Honor Plants, Place, and Spirit*, co-authored with her husband, Scott Ogden, is an “extraordinarily exciting concept,” he adds.

“I’ve always loved plants,” recalls Springer Ogden, curled up in an easy chair in her Fort Collins, Colorado, home. “I grew them on my mom’s windowsills. I spent summers hiking in the Alps, where I got interested in wildflowers. But I never knew you could make a living doing anything with plants.”

A Pennsylvania native, Springer Ogden got an undergraduate degree in Spanish and Latin American literature at the University of Pennsylvania. “A useless degree,” she laughs, “but a good liberal arts education.” A trip out west after college sent her in a new direction. “I came out here to visit, and I loved it. I’ve always loved being outdoors, so I thought, ‘Why not be a park ranger?’” She enrolled in the Penn State forestry program in the early 1980s, but soon realized job prospects for rangers were slim. A class in the horticulture of woody plants, however, sent her in yet another direction: a second undergraduate degree, this one in agriculture. She spent a few years working in nurseries and public gardens, then returned to Penn State for a master’s degree in horticulture. “It was a great program,” she says of her two years in grad school. “They really let me fly.” The faculty gave her a lot of freedom in building her academic program, allowing her...
to do a “lot of weird stuff,” including an internship in Ireland, independent studies, and writing classes. “It allowed me to explore my interest in the art of gardening.”

On returning to Colorado in 1989, Springer Ogden began working on her own garden, her first “laboratory.” As she wrote a garden column for the Denver Post as well as feature articles for national gardening magazines. The Undaunted Garden, her book about designing and maintaining that first garden in the harsh Colorado climate, was published in 1994. Kelaidis, who described the book as a “horticultural Chinook wind blasting stale ideas and clichés out of the way,” says the book made Springer Ogden a national star.

“What continental North Americans need are new models for their gardens,” she wrote. “The old garden design guidelines and formal arrangements.”

To drive home that point in lectures, Springer Ogden sometimes holds up the cover of a popular garden design magazine. “You can’t see any plants!” she says. “Call it an outdoor space, she says. “But don’t call it garden design. It’s not a garden. It has nothing to do with gardening!”

Sprunger Ogden believes that large public gardens are suffering as well, becoming more like outdoor museums and event centers. Too many garden designers, she writes, “simply avoid any intimacy with plants ... instead rely on a limited, proven palette and series of plant combinations that they trot out like familiar dinner recipes, again and again.”

In response to these distressing trends, Springer Ogden and her husband, Scott Ogden, also a horticulturist and garden designer, began speaking and writing about “plant-driven design.” Their most recent book, Plant-Driven Design: Creating Gardens That Honor Plants, Place, and Spirit, was published in 2008.

“Plant-driven design means you start off with the plants,” she explains, “not the patio, the furniture, the fountain. You can have something artistic, trendy, or modern, but the plants are the primary players.”

These gardens have more plants, more types of plants, she continues. “And the plants are allowed to get away with more. We let them do what they are going to do in the garden until they get in the way of walking or they really look like hell. We don’t know what they are going to do, and we know plants pretty well. They are creatures, they do their own thing.”

Plant-Driven Design was published after three years of work by Springer Ogden and her husband. “The single most essential element in any garden is not some particular object, plant, or tool,” they wrote in the preface. “What’s vital is a gardener who loves it. . . Unfortunately, much of what is promoted as or called a garden in North America is nothing more than a landscape installation. Love has nothing to do with it . . . making plants the main focus of design returns garden design to being about a relationship between plants and people. That relationship should be a happy one.”

“Plant-Driven Design turned garden design on its head,” says Tom Fischer, editor-in-chief at Springer Ogden’s publisher, Timber Press, and her former editor at Horticulture magazine. “The party line for decades has been that you start with the landscape elements—the walls, paths, fences, arbors, any part of the garden that is not alive,” he explains. The plants came second and often not many of them. “Many landscape architects end up with a palette of ten plants that they use over and over,” says Fischer. “Lauren and Scott encouraged people to broaden their plant knowledge, to see what they can do if they work with dozens of different types of plants.” Indeed, Springer Ogden’s Fort Collins garden boasts more than 3,000 species.

Kelaidis agrees Plant-Driven Design was groundbreaking. “It challenged all presumptions of traditional architecture and landscape design,” he says. “Many landscape architecture programs don’t even teach plants anymore.”

“If you are a gardener, you have a relationship with your plants,” Springer Ogden explains, heading outside to walk through her garden. “You have a relationship with nature. You notice cycles, insects, birds. You can’t help but be connected to nature. If you make just an outdoor room, you are not going to have that.” She worries that children who have no plants in their lives will grow up unaware of nature and environmental issues. “If another five million acres get swallowed up by suburbia, they are going to say, ‘Yeah, so what?’ They won’t even know what they have lost!”

Walking through her garden, where the plants do all seem to do their own thing, growing over paths, climbing up to the front door, blocking the front door to her house, Springer Ogden happily describes the wildlife that visits her suburban yard: multitudes of birds, several raccoons who gorge themselves on grapes, and at least one bear who tried to climb up to the grapes, leaving behind deep claw marks on a tree. “I love hanging out here. It’s gorgeous, it’s serene.”

Gardens that want their own plant-driven gardens needn’t wait. Just jump in, she advises. “Be okay with falling in love with plants and indulging yourself in trying them in the garden,” she says. “Don’t get nervous about whether they are going to die, and don’t worry about having it all figured out before you put something in. Keep finding plants that interest you and find ways to put them in your garden where they look good, thrive, and show off their best qualities. Allow that to inform your design.”  ■
Researchers in the college attack the problem of malaria.

It’s a warm day, but suddenly you begin to shake uncontrollably. Minutes later, beads of sweat appear on your face. When next you begin to vomit, you decide to go to the hospital. A nurse asks if you’ve recently eaten or done anything out of the ordinary. “Just last week I returned home from a trip to Nepal,” you say. “Ah, that may explain it,” says the nurse. “I bet you have malaria.”

Luckily, as an American, you have access to powerful drugs that can eliminate the malaria parasite from your body. Lucky you.

Each year malaria infects up to 500 million people worldwide, and as many as one million people die from the disease. Those who die often do so because they cannot afford to be treated. “In many cases, malaria is not difficult to treat,” says Liwung Cui, a Penn State professor of entomology, “but we are talking about the poorest of the poor regions.”

These places, he adds, are where malaria is most rampant.

Cui is one of several researchers in the college who are studying malaria, a disease caused by Plasmodium parasites that are carried by Anopheles mosquitoes. He also is one of three researchers in the college to be involved in a recent $14 million grant funded by the U.S. National Institutes of Health (NIH) to address the problem of malaria by creating 10 malaria research centers around the world. Cui will serve as the principal investigator for the Southeast Asia Malaria Research Center, while entomologists Matthew Thomas and Andrew Read will serve as co-investigators for the Center for the Study of Complex Malaria in India.

Killing the Parasite

Efforts to eradicate malaria most often target either the parasite or the mosquito. Cui focuses on the parasite. In particular, he is using molecular techniques to identify the species of Plasmodium parasites that occur in different regions of Southeast Asia. “Southeast Asia accounts for 30 percent of the world’s malaria infections and 8 percent of the world’s deaths from malaria,” he says. “Part of the problem is that in Southeast Asia four different species of mosquito carry a variety of forms of the malaria parasite, and each form of the parasite requires a different treatment.” To treat malaria effectively with the correct drugs, he adds, it’s important to start with an accurate diagnosis.

Cui also is investigating how various species of parasites respond to drugs. In Southeast Asia, Plasmodium falciparum causes the most serious form of malaria. Although drugs to treat this form of the parasite are available, the microorganism is evolving resistance to some of them. Cui uses molecular techniques to examine how the parasites respond to drugs. “If we find a resistant parasite, we look at its genome,” he says. “Once we know its genetic background, we can see how it changed genetically to become resistant to the drug, and this helps us figure out why drug resistance happens.”
Finally, Cui is addressing the problem of counterfeit drugs. “Many of the drugs circulating in these regions are fake,” he says. “There’s no government regulation, so people buy whatever they can get, and these fake drugs do no good at all. As we develop improved diagnostic methods and strategies to control drug resistance, we also want to find ways to identify counterfeit drugs.”

While Cui is focusing on drug resistance among various forms of Plasmodium parasites and on counterfeit drugs, Thomas, a professor of entomology, and Read, a professor of biology and of entomology, are investigating how environmental factors influence the life cycle of Plasmodium and, therefore, the intensity of malaria transmission.

According to Thomas, entomologists have long known that Plasmodium’s life cycle depends on a variety of climate factors, including rainfall, humidity, and especially temperature. Below certain temperatures, the parasite cannot complete its life cycle fast enough to be transmitted to humans. Since few mosquitoes survive beyond two weeks, not complete its life cycle fast enough to be transmitted to humans. Since few mosquitoes survive beyond two weeks, few mosquitoes survive beyond two weeks, short-term temperature variations can have a big impact on the malaria parasite, “According to Thomas, a professor of entomology, and Read, a professor of biology and of entomology, are investigating how environmental factors influence the life cycle of Plasmodium and, therefore, the intensity of malaria transmission.

A key figure in the college’s long history of malaria research, Knipe, who graduated from Penn State in 1917 with a bachelor’s degree in agronomy, worked as a malaria-control engineer for the Rockefeller Foundation during the 1920s. The foundation—known for its commitment to meeting social, economic, health, and environmental challenges — assigned him to the Balkans, where he was tasked with helping to identify and eradicate mosquito breeding grounds.

In the Balkan countries, including Bulgaria, Yugoslavia, Albania, and Greece, Knipe drained vast fields of stagnant water, which involved using dynamite to build levees, ditches, and canals. “It was tedious work, all done by hand with picks and shovels,” says Fred’s son Fritz Knipe. “After the dynamite blast, hand laborers cleaned up the passageways for drainage.”

After his work in the Balkans ended in the early 1930s, he was assigned to India to continue his work on malaria control. On the flatlands in the village of Pattukkottai, he once again focused on draining swamps and constructing canals. He also developed new spray equipment that could be used to kill both adult mosquitoes in homes and larvae in bodies of water. Knipe was known for his invention of more efficient spray nozzles for applying insecticides such as DDT and pyrethrum.

Fritz remembers his family’s time in India. “Because the plains of Pattukottai where Dad was working were extremely hot, most of the time my mother, my brother Dan, and I stayed in the cooler hills nearby. We lived in the beautiful hill station called Kodakannal. I remember when we would visit Dad on the plains, the temperature was rarely under 100 degrees. Our home in Pattukottai was very primitive, with sod walls and three or four coconut palms growing right through the house!”

During the 1940s, when malaria became a concern for U.S. troops, Knipe was reassigned to India and was instrumental in setting up the Malaria Institute of India. He also served on the World Health Organization’s Expert Committee on Insecticides from 1948 until 1955. After that he returned to Penn State, where for several years he conducted research on the eradication of cockroaches and flies for the agronomy department.

Knipe died in 1983, at the age of 88, after an illustrious career in malaria control. His four sons—Dan, Fritz, Robert, and James—all live in California. “We’re proud of the work my dad did,” says Fritz. “He would be very pleased to know that malaria research continues in the college today.” — by Krista Weidner
mosquitoes that die can’t lay eggs or bite someone later and spread the disease,” he says. “But the mosquitoes that survive quickly reproduce, and before long, you have a mosquito population dominated by insecticide resistance.”

Thomas and Read are developing a biological insecticide, or biopesticide, that has the potential to be “evolution proof” because it reduces the selection pressure for resistance by killing the mosquito more slowly. Here’s how it works: After a mosquito feeds on a person who is infected with malaria, it picks up the parasite. Roughly 12 days later, when the parasite has fully developed inside the mosquito, the mosquito can infect someone else. Biopesticides allow the mosquito to survive for those 12 days, during which it can continue to feed and lay eggs—essentially doing what it’s programmed to do. Traditional insecticides, on the other hand, kill the mosquito soon after contact. “With the biopesticide, instead of dying and having no reproductive output, a mosquito has the chance to lay a few batches of eggs,” Thomas explains. “But if the mosquito doesn’t die within 12 days or so, it’s going to transmit malaria. So we need a balance of allowing a mosquito to breed as much as possible, but then stopping it before it can spread the disease. We believe the biopesticide we’re working on can achieve that balance.”

While biopesticides show promise for malaria control, another way to improve insecticide use is to apply existing technology in new ways. Matthew Thomas stands in the hallway that leads to large, walk-in environmental chambers. “These senior faculty members and their associated research teams will use this space to culture mosquito species. The new insectary is one of the most advanced in the United States.”

Matthew Thomas stands in the hallway that leads to large, walk-in environmental chambers. Three senior faculty members and their associated research teams will use this space to culture mosquito species. The new insectary is one of the most advanced in the United States.

**THOMAS AND READ ARE DEVELOPING A BIOPESTICIDE THAT HAS THE POTENTIAL TO BE EVOLUTION PROOF.**

“Theres a story that circulates in the scientific and funding communities,” says Rachel Smith, assistant professor of communication arts and sciences (College of Liberal Arts) and member of the Huck Institutes of the Life Sciences. “In a few studies, researchers introduced bed nets for malaria control, and when they returned a month later they found that some nets were being used for fishing, some were covering plants, and one had been made into a wedding dress. So the mythology began: don’t try to put anything out there in which humans are involved because they will resist it. We believe otherwise.”

Smith and economist Jill Findeis, Distinguished Professor in the College of Agricultural Sciences, are working with Matt Thomas and Andrew Read to investigate methods for delivering their biopesticide in East Africa. “While the biggest biological challenge for malaria control is the development of mosquito resistance, one of the biggest problems for delivering the technology is perceived user resistance,” Findeis explains. “Matt and Andrew are developing the biopesticide in their lab, but for it to succeed in rural villages not typically targeted for mass spraying, user compliance must be high. How can we use social science to ensure that happens?”

A team of social scientists led by Findeis and Smith is working with researchers in Africa to understand economic, communication, and social forces influencing the uptake of two innovations under development: the biopesticide, and phoshorus-efficient legumes being developed by plant nutritionist Jonathan Lynch. For the biopesticide, Findeis and Smith want to know, for example, are households willing to dip a cloth into an insecticide mixture periodically to maintain its effectiveness? At what times of year can poor rural households afford the biopesticide, which, paradoxically, may not coincide with the malaria season? Would they prefer certain colors or shapes for the cloth? What they’ve observed is encouraging. “People will re-dip the cloth,” says Findeis. “In rural Mozambique where malaria is endemic, there certainly is great interest. Local people ask, ‘Will this control malaria here? When can we get it? Where can we get it?’”

“When great about this work is that the science is still flexible at this stage,” Smith adds. “Normally, social scientists are brought in after a product is finalized to develop strategies to encourage adoption of the product with all of its faults and challenges. But Matt and Andrew are open to adapting the technology during product development to increase chances that people will use it. For example, when Andrew learned that the biopesticide’s smell could be important, he said they would search for fungal isolates that smell like cookies! Kidding aside, though, we’re all learning what it will take. “We have this great collaboration in which we’re willing to consider multiple perspectives. That wouldn’t happen if we were worried about keeping our science to ourselves.” — by Krista Weidner

89 PERCENT OF MALARIA DEATHS WORLDWIDE OCCUR IN AFRICA.

As the development of the biological insecticide moves forward, we’re working on the science to improve its widespread use.

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PHOTO: © TONY KARUMBA, GETTY IMAGES
insecticides differently. A traditional goal of malaria control efforts has been to kill all the mosquitoes (no mosquitoes, no malaria), but Thomas and Read believe that killing only old, infectious mosquitoes may prevent transmission. “Older mosquitoes—those that are at least 12 days old—are the only ones that are infectious because it takes at least 12 days for the Plasmodium parasite to develop,” says Thomas. “We believe that by waiting to kill mosquitoes until after they’ve bred and laid eggs, we can wipe out malaria mosquitoes without triggering selection pressure for resistance.”

Thomas admits that this approach might be counterintuitive. After all, allowing younger mosquitoes to live will result in more mosquitoes and more mosquito bites. But he and his colleagues argue that getting more mosquitoes won’t result in more mosquitoes and more mosquito bites. “Presumably, the Plasmodium parasite was changing the odors that affect mosquito attraction and disease transmission,” says Mescher. “We think this difference in perception might be to encourage the mosquito to bite the infectious person so it can spread the parasite to someone else.”

De Moraes and Mescher normally focus their research on plant volatiles—chemical cues that plants emit to communicate with other plants or insects. In their work with Read, they are monitoring the volatiles of both healthy mice and those that are infected with malaria. They follow the disease’s progression, taking samples at regular intervals to determine the number of parasites and then analyzing the volatiles to see if they change as malaria progresses. “We want to see if we can relate volatile differences to attraction to mosquitoes,” De Moraes says. “If we can do that—if we can identify particular signals that a mosquito might be using to identify an infectious person—it could lead to some exciting applications.” For example, researchers could develop a repellent that disrupts or masks the signal that’s attracting the mosquito, thus preventing the mosquito from biting an infected person. Another potential application could be a diagnostic tool for malaria screening. Current screening techniques are invasive and impractical, requiring blood tests and lab analyses. A quick and simple test that could measure and detect the chemical compound that attracts mosquitoes—say a cotton swab rubbed onto the skin—could confirm the presence of the malaria parasite. “That would be a fantastic tool,” says Mescher. “Because people with low-level infections can be spreading malaria without even knowing they have it. If we want to eradicate malaria, it’s really important to find the people who are asymptomatic but may be spreading the disease. Once we identify them, we can treat them and stop further transmission.”

Whether by directly treating people who already carry the disease or by preventing them from being bitten in the first place, researchers at Penn State are doing their best to solve the problem of malaria. “This research on malaria is an example of something we do very well in the college, which is to bring together people with different skills to solve a problem,” says Thomas. “We have some really productive synergies in place that promise to significantly advance malaria research.”
Finding Answers
by Lisa Duchene

Out of Sight, Out of Mind

Three million people, about one-quarter of Pennsylvania’s population, rely on some private source of drinking water. Each year, about 20,000 new wells are drilled statewide.

But no state regulations govern well construction, location, or testing of private water supplies, says Bryan Swistock, senior extension associate who oversees the Water Quality Extension program. Pennsylvania and Alaska are the only two states without any rules involving private water supplies.

Often, people don’t realize they have a problem, says Swistock, until, like Johns, they have been sick and start looking for answers. Or, sometimes people are sick and blame food poisoning or a stomach flu, never realizing the problem was their well water.

“Some problems are obvious,” says Swistock. “If you have iron in your water, you know you have iron. You see it and taste it. If your water is hard, you know it and you see it. But, many of these obvious problems don’t cause you any harm. The water problems that can affect your health usually aren’t apparent. The water may look, smell, and taste good yet be unsafe to drink. That’s when water testing becomes important.”

Penn State Cooperative Extension has been working to ensure that people with private water sources have clean, safe drinking water since the early 1980s, when then College of Agriculture faculty member Bill Sharpe identified the need for education. He helped spearhead extension’s first safe drinking water clinic in 1984. “Bill Sharpe understood how important private water supplies are in Pennsylvania and his early research and education really laid the groundwork for everything that we do today,” added Swistock.

But Johns didn’t know where to go from there, what to do, what the problem meant, or how to fix it until her online search turned up Penn State Cooperative Extension’s Web site on drinking water (extension.psu.edu/water/drinking-water). There, in addition to information about water testing options, water treatment, how best to construct a private well, how to make sense of water test results, and how to protect drinking water from nearby Marcellus shale gas drilling, Johns found the phone number for her local Cumberland County extension office.

She called Tom McCarty, a water quality extension educator and one of about a dozen extension staff statewide who help people safeguard drinking water from their wells, private springs, or cisterns.

McCarty explained what her test results meant and advised her to install a device in her basement that uses ultraviolet (UV) radiation to kill bacteria at the main waterline before it reaches the rest of the house’s plumbing. He helped her find the right unit with the right features, like an automatic shutoff of the water if the UV unit malfunctions. He walked her through chlorine-shocking the house’s plumbing with bleach to kill any bacteria lingering in the pipes.

McCarty suspects dog waste from Johns’s yard is somehow infiltrating and contaminating her well. The long-term solution, he’s advised Johns, is for her to hire someone to dig around the area of the buried wellhead to find it and inspect it for cracks. She should also move the dogs as far away from the well area as she can, says McCarty.

“I didn’t know what to do,” says Johns of when she first received the water test results. “I didn’t know where to go. Until I found Penn State and Tom, I was going crazy. When I found him it was like an answer to a prayer, I’ll tell you. He walked me through everything. He e-mailed me. He called me.”

Almost 100 people turned out in Tunkhannock, Pennsylvania, to hear Bryan Swistock explain how well owners living near natural gas drilling sites should take steps to monitor their drinking water.

Now, water quality extension specialists and educators like Swistock and McCarty educate private well owners with publications, fact sheets, in-person workshops, webinars, volunteers, and one-on-one troubleshooting.

In 2004, Sharpe and Swistock secured funding to create the Master Well Owner Network, a network of 400 volunteers patterned after the Master Gardener program. The well-trained, private-well-savvy volunteers serve as “boots on the ground” to help create awareness of basic private water management issues in their respective communities. “Once they learn about their own situation, they want to teach others,” says Swistock. In the past six years, the Master Well Owners have educated
about 30,000 people—many more than had turned out at workshops over the drinking water program’s first 15 years.

Shouting Guidance into the Wind—Until Marcellus

Penn State recommends an annual wa- ter test for coliform bacteria and a test for pH, total dissolved solids, and any local pollutants every three years. Kim for the Center for Drinking Water testing lab at Penn State are available at most county extension offices.

For new wells, Penn State also rec- ommends including a great seal around the metal or plastic casing. A 10-inch wide hole is dug for a 6-inch well pipe. The 2 inches surrounding the pipe are filled with bentonite clay to form a seal, protecting it from exposure to contaminants above. Without that cut- ter seal, the pipe can be a conduit for bacteria-laden surface water to reach the clean well water below, explains Swistock. “It’s like a straw and [contami- nated water] just runs along the edge of the straw right down into the [well water],” he says.

Penn State also suggests people take extra care with what they apply to the land in a 100-foot radius around the wellhead. Well owners should not use fertilizers, chemicals, or pesticides or al- low animal waste anywhere in that area, says Swistock.

About half of the state’s private well owners have never properly tested their well water and about 41 percent of wells tested failed to meet at least one of the health-based drinking water standards, according to a January 2009 study by the Center for Rural Pennsyl- vania conducted by Swistock, Sharpe, and Stephanie Clemens from the Mas- ter Well Owners. Fourteen percent of the 701 private wells sam- pled throughout the state contained E. coli bacteria. But concern over the impact of gas drilling is changing everything, says Swistock.

Three years ago, maybe 10 or 20 people out of thousands of private well owners in any given county would show up to learn about interpreting water test results. Now, hundreds attend meetings to hear Penn State’s advice on protect- ing private water supplies from potential drilling-related problems, says Swistock.

“[Marcellus shale] has created a real teachable moment for us,” says Swhi- tock. “People now come to the meeting because they want to learn about Mar- cellus, and while they’re there we can push home some of this basic information about private water system manage- ment that is very surprising to them.”

Gas well drilling has the potential to threaten private wells and springs be- cause wells are drilled through ground- water to access the natural gas. Drilling produces hundreds of thousands of gal- lons of waste fluids.

In the hydrofracturing process used to access Marcellus-shale gas, high-pres- sure fluids—several million gallons of freshwater with chemical additives— break rock to allow the flow of gas. An average of 10 to 20 percent of the pressure-propelled water returns to the surface as “flow back” waste fluid. That waste fluid is then often stored in pits on the site, another cause for ground- water concern.

Concerned private water supply owners, therefore, have many questions. For answers, they can turn to several fact sheets published by Penn State Cooperative Extension. (available at extension.psu.edu/water/marcellus- shale or from your local extension of- fice) reflecting Swistock’s research into the gas-drilling process, contaminants, and what owners should do if private water under Pennsylvania’s Oil and Gas Act, private well owners who live within 1,000 feet of gas drilling re- ceive special protection. “Gas drilling companies are ‘nearly presumed responsible’ for pollution of drinking water sup- plies within 1,000 feet of their drilling site for six months after drilling,” says Swistock. This means that the company must prove that it is not responsible for any changes in these water supplies or face the legal re- sponsibility and cost to provide a home with safe drinking water.

However, in different circumstanc- es—if the water supply is more than 1,000 feet away from a drill site or six months has passed since the well was drilled—the burden of proof lies with the homeowner.

Prior to drilling, gas companies will take a baseline test of all the private water supplies within 1,000 feet of the well, sometimes more. A water testing lab or consultant representing the gas company will likely contact the private well owner to collect predrilling water samples. Essentially, the gas company is collecting the water samples. “This is called ‘chain-of-custody’ water testing,” says Swistock, “which is critical to ensure that the results are ac- curate and legally valid. This testing will provide a legal baseline to document any changes in the water supply due to drilling.”

Homeowners who don’t have pre- drilling water test data can have a more difficult time proving that gas drilling damaged their water supply. “If the wa- ter is fouled due to gas drilling, you may have to prove it in a court of law. Just showing that the water is bad after drill- ing has occurred is often not enough. Ideally, you want to be able to show that it was good and now it’s bad and that the bad things are related to that activity,” Swistock says.

The gas company’s test is free to the homeowner. Swistock recommends homeowners ask what will be tested and arrange to receive the testing re- sults so they can decide whether to do their own test.

For homeowners, here is another critical detail: those who want to pur- chase their own water test should al- ways contract with a state-licensed water testing laboratory and arrange for an “unbiased professional,” typically a laboratory employee or consultant, to do the testing.

“Obviously, not everyone can afford a $1,000 water test, but the more test- ing you do, the more protection you will have should any problems occur,” he says.

Extension’s goal is to not only cor- rect health-threatening problems with drinking water from private sources and help improve water quality but to pro- vide information and build awareness to prevent them in the first place. Emily Krafjack is making the most of the information the college has published on protecting drinking wa- ter supplies in the face of the Marcel- lus shale gas drilling boom (extension.psu.edu/water/marcellus-shale). If Krafjack has a problem, she will have plenty of data. Every day, Kraf- jack, who lives in Melohoppy Town- ship about an hour from Scranton, tests the water in her private well for simple signs of changes due to gas drilling. She learned the dangers of contaminated well water in a previous home after she, her husband, and dog were all sickened by coliform bacteria.

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Homeowners who don’t have pre-drilling water test data can have a more difficult time proving that gas drilling damaged their water supply. “If the water is fouled due to gas drilling, you may have to prove it in a court of law. Just showing that the water is bad after drilling has occurred is often not enough. Ideally, you want to be able to show that it was good and now it’s bad and that the bad things are related to that activity,” Swistock says.

Krafjack thinks of the steps she’s tak- ing as an investment in peace of mind. For those who have no hospital supply from the gas company and know she has the data behind her: “I’m hoping I’m never going to make those phone calls, but if I have to, I’ll rather be prepared.”

Emily Krafjack
Job Opportunities Abound for Ag Grads

With the statewide unemployment rate hovering above 9 percent, many new and recent college graduates are struggling to find jobs in their chosen fields. But graduates in food, agricultural, and environmental sciences are in demand, according to Associate Dean of the College of Agricultural Sciences Marcos Fernandez.

Citing a recently released study by the U.S. Department of Agriculture, Fernandez, who was a consultant for the study, noted that about 54,400 jobs will be available each year between 2010 and 2015 for individuals with degrees related to food, renewable energy, and the environment. However, there will only be enough agriculture and natural resources graduates to fill 54 percent of these positions.

“This means that employers will have to turn to graduates in allied fields such as biological and health sciences, engineering, business, and communications to fill most of the remaining openings,” said Fernandez.

Of the 54,400 projected annual agriculture-related jobs, 74 percent will be in business and science occupations, 15 percent will be in agriculture and forestry production occupations, and 11 percent will be in education, communication, and governmental services occupations, according to the study.

Fernandez said that this diversity of career opportunities and the need for well-prepared graduates with a solid grounding in science has begun to attract more students to the College of Agricultural Sciences. “After a decade of declining enrollments, the college has seen a roughly 30 percent increase in the number of undergraduates since 2005,” he said. “Our students know that we can prepare them to take what they learn here and apply it to real-world situations to help people and improve their communities and the world around them.”

Around the College

Grace Appointed Penn State Goddard Chair

James Grace, Ph.D. ’78, has been appointed the new Maurice K. Goddard Chair in Forestry and Environmental Resources Conservation, a three-year term in which he will provide leadership on public-policy issues related to natural resources.

As the former deputy secretary of the Pennsylvania Department of Conservation and Natural Resources (2007–2010), Grace directed the Bureau of State Parks, of Forestry, and of Facility Design and Construction. Under his leadership, Pennsylvania’s state parks were awarded the 2009 National Gold Medal Award for Excellence in Park and Recreation Management.

During his tenure as director of the Pennsylvania Bureau of Forestry (1994–2007), the bureau incorporated the principles of ecosystem management and a landscape approach to forest management. In addition, the bureau provided more than $5 million for research and extension activities and added more than 106,000 acres to the state forest system.

From 1987 to 1993, Grace served as a deputy secretary for the Pennsylvania Department of Environmental Resources. Prior to that he was a faculty member at Rutgers University and at Penn State. He earned a Ph.D. in forest resources from Penn State in 1978.

The Goddard Chair was established in 1983 to honor Maurice “Doc” Goddard, Pennsylvania’s “father of state parks.”

Tickamyer Leads Ag Economics and Rural Sociology

Ann Tickamyer, an award-winning researcher and rural sociologist, has been appointed head of the Department of Agricultural Economics and Rural Sociology. She succeeds the retiring Stephen M. Smith as department head.

Tickamyer comes to the college from Ohio University, where she served as professor and chair of the Department of Sociology and Anthropology. For several years Tickamyer also held the position of director of international development studies at Ohio University. During that time, she did extensive research in Indonesia, including an ongoing project on rural villages in Yogyakarta.

Her research interests include poverty, livelihood practices, and welfare provision in rural Appalachia and Indonesia. She is interested in gender equity issues within the contexts of work, economic development, poverty, and disaster relief. At Penn State she is working with colleague Leif Jensen on a national study of the informal economy — under-the-table work that is not taxed or regulated.

Tickamyer has authored more than 60 journal articles, book chapters, and books, and is most recently co-editor of the book Economic Restructuring and Family Work (Rural America, published by Penn State Press and slated for publication in 2011. She is past president of the Rural Sociological Society and past editor of the journal Rural Sociology. She earned bachelor’s and master’s degrees in sociology from the University of Maryland and a Ph.D. from the University of North Carolina.

“Ann brings proven leadership and excellent scholarship to the position of department head here in the college,” says Bruce McPherson, dean of the College of Agricultural Sciences. “She has had an impact in rural sociology and in international perspectives through her own research and teaching, and in facilitating the success of colleagues through her past administrative roles. We are delighted to have her join the college.”

Tickamyer is looking forward to moving the department into the future. “We have some amazing research projects going on, and I’m excited about the success and growth of our instructional programs, both undergraduate and graduate,” she says. “This is a complex, vibrant, exciting department filled with active, productive people.”
Stink Bug Primer

In warm weather, homes and orchards across Pennsylvania are bat-
tened by the brown marmorated stink bug, the latest invasive insect to find
its way into the United States from Asia. Experts haven’t yet identified
any good solutions for managing or eradicating the pest.

Stink bug adults are about three-
quaters of an inch long and are
shades of brown on both the upper
and lower body surfaces. They are
almost as wide as they are long, and
their “shield” shape is typical of other
stink bugs. The name “stink bug”
refers to the scent glands that emit
a distinctive odor when the insect is
disturbed or crushed. They are not
known to bite people or spread dis-
eases.

This variety of stink bug first
was found in the United States in
Lehigh County in 1998, and it since
has become a perennial nuisance to
homeowners as the bugs seek winter
shelter—sometimes by the thousands
—in and around homes and other
structures. This past year the problem
was worse as stink bugs reproduced at
a faster pace thanks to a warm spring
and early summer. Normally, there
would be one generation of stink
bugs per growing season, but this past
year there were at least two genera-
tions, leading to higher and faster-
spreading populations.

Homeowners fighting an inva-
sion of stink bugs have few options.
Mechanical exclusion is the best
method to keep stink bugs from en-
tering homes and buildings. Caulk
cracks around windows, doors, siding,
utility pipes, behind chimneys, and
underneath the wood fascia and other
openings. Damaged screens on doors
and windows should be repaired or
replaced.

If bugs are found
inside the house, try
to identify their entry
path and seal it off. A
vacuum cleaner can
be used to remove live
dead stink bugs, but be aware that
the vacuum may take on the smell of
the insects for a period of time.

Most pesticides will not stop a
home infestation, and it is not rec-
ommended that homeowners apply
insecticides to kill stink bugs indoors.

Seek professional extermination help
if mechanical exclusion fails.

In 2010 stink bugs became a seri-
ous agricultural pest, causing exten-
sive damage in some Pennsylvania
apple and peach orchards and feeding
on blackberry, sweet corn, field corn,
and soybeans. In neighboring states,
they have also damaged tomato, lime
bean, and green pepper crops. In all,
they can attack an estimated 300
host-plant species.

There are few if any natural en-
emies in the United States to help
control stink bug populations. Pesti-
cides are not a particularly good op-
tion for growers, some of whom have
lost 40 to 50 percent of their crops to
stink bugs.

The broad-spectrum pesticides
that work best on stink bugs will also
kill the beneficial insects growers rely
on as part of integrated pest manage-
ment, or IPM, programs. It would also
upset the balance in the orchard eco-
system—allowing other pests to be-
come more of a problem—and could
reverse much of the progress made in
IPM, which has helped Pennsylvania
growers reduce pesticide use by as
much as 75 percent in recent decades.

Stink bugs do their damage by
inserting mouthparts under the skin
of the fruit, injecting saliva, and suck-
ing out the juices. While not harmful
to people, this feeding leaves exterior
dimpling and dried, corklike areas in
the fruit, making it unmarketable at
the retail level.

Economic impact is high and puts
growing operations at risk. Damaged
fruit sold for processing or juice may
bring $7 to $10 per bushel, compared
to anywhere from $20 to $60 per
bushel on the fresh-fruit market.

Researchers in the college, other uni-
versities, and the U.S. Department of
Agriculture are studying the brown
marmorated stink bug with an eye to-
ward developing monitoring systems
and management tactics. Because this
is a new pest in the United States,
it will take additional resources and
time before the problem can be ad-
dressed effectively.

Cut this out
and save it for stink bug season.

A Penn State fact sheet about the
brown marmorated stink bug is
available online at ento.psu.edu/
extension/factsheets/brown-
marmorated-stink-bug.

Youth (’yüth)
1: the time of life when one is young; especially : the early period between
crudity and maturity. 2: the early period of existence, growth, or development. 3: one of more than 170,000 4-H’ers in
Pennsylvania who learn life skills through Penn State Cooperative Extension’s youth development programs.

In the College of Ag Sciences, we know investing in
our youth is an investment in Pennsylvania’s future.

Just ask Raisa Gregor. Raisa, an avid 4-H’er, keeps
finding new interests to add to her list of activities. Last
year, amid growing her own vegetables and competing
with her ceramic, macramé, and tie-dye creations,
Raisa and her club took on rocketry. This year,
Raisa will add archery and showing Holland
Lop rabbits, all while serving as vice president
of her club.

Through 4-H, Raisa has learned responsibility,
time management, and leadership. She’s also
increased her knowledge of science and learned
to express her creativity. You’re only young once.
Make it count.

Find out what the College
of Ag Sciences can do for you.
extension.psu.edu/4-H

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