USDA
United States Department of Agriculture
Agricultural Research Service

DISCOVERIES 2020

The Impact of Agricultural Research Service

MISSION
ARS delivers scientific solutions to national and global agricultural challenges.

VISION
Global leadership in agricultural discoveries through scientific excellence.

CONTENTS

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INTRODUCTION

I am proud to welcome you to Scientific Discoveries, a compilation of impactful advancements and achievements from the Agricultural Research Service (ARS), the chief, in-house scientific research agency of the U.S. Department of Agriculture. For more than 60 years, ARS researchers have discovered innovative solutions to agricultural problems that affect Americans every day, from field to table.

As ARS Administrator, I am fortunate to be part of a dynamic organization whose scientific and technological achievements impact the lives of not just Americans, but citizens around the globe. Our researchers take great pride in delivering scientific solutions to national and global agricultural challenges with excellence and integrity.

In this 2020 edition of Scientific Discoveries, we take you inside ARS for a look at how we're supporting our nation's health, improving our livestock, protecting our crops, restoring our natural resources, and working with our global partners to tackle international agricultural challenges. Examples include using gene editing to engineer a vaccine for the deadly African swine fever, developing a new treatment for peanut allergy, creating a more efficient way to detect Zika virus in mosquitos, employing pheromones to mitigate the brown marmorated stink bug, surveying breeding habitats of sand flies for designing targeted control methods, and improving restoration practices to reduce wildfire threats. We also highlight a variety of ARS technologies that you can find in your home.

ARS researchers are global leaders in agricultural innovation and discoveries, and I would like to acknowledge the more than 8,000 employees of ARS, working in over 90 field locations, for their tireless dedication toward our core values: to support the nourishment and well-being of all people, sustain our nation's agroecosystems and natural resources, and ensure the economic competitiveness and excellence of our agriculture. You are the reason that ARS is a premier research organization. Thank you.

Chavonda Jacobs-Young

ARS BY THE NUMBERS

FUNDING

101 PROJECTS **$218** MILLION
Animal production and protection

159 PROJECTS **$328** MILLION
Nutrition, food safety and quality

307 PROJECTS **$500** MILLION
Crop production and protection

115 PROJECTS **$257** MILLION
Natural resources and sustainable agricultural systems

ARS NUMBERS AT A GLANCE

8,000
ARS Employees

90+
ARS Locations

65
Number of new patents issued

51
Number of new licenses

ARS STUDENT REACH

Students participating in ARS outreach events

51,000
School and community presentations

16,300
ARS location visits

17,000
Science fairs

10,400
Courses and demos

ARS trainees

2,225
Students and interns

400
Postdocs

97,325
Total number of students reached

NATIONAL PROGRAM AREAS

Improving Our Nation's Livestock

Jeffrey Silverstein

ARS's **Animal Production and Protection** (APP) program aims to improve the health, well-being, and efficiency of livestock, poultry, and aquatic food animals to ensure a productive and safe food supply. Emphasis is placed on germplasm characterization, improvement, and conservation; understanding the mechanisms of disease resistance; and the development of vaccines and tools to prevent, control, or eradicate diseases that threaten our food supply or public health.

Supporting Our Nation's Health

Pamela Starke-Reed

ARS's **Nutrition, Food Safety, and Quality** (NFSQ) program coordinates and leads ARS research to define the role of food and its components in optimizing health for all Americans. The NFSQ supports researchers who develop tests and processes that keep the food supply safe, reduce and control pathogens and toxins in agricultural products, and improve the economic viability and competitiveness of American agriculture.

Protecting Our Nation's Crops

Jack Okamuro

ARS's **Crop Production and Protection** (CPP) program helps ensure that Americans continue to enjoy the most abundant, affordable, safe, and nutritious food supply in history. The research done within CPP delivers science-based information, genetic resources, and technologies for increased crop productivity, economically and environmentally sustainable methods of crop production, and protection from plant diseases and pests.

Restoring Our Nation's Natural Resources

Marlen Eve

ARS's **Natural Resources and Sustainable Agricultural Systems** (NRSAS) program provides innovative solutions that ensure sustainable food production while also protecting our natural resources, leading to agricultural production systems that adapt to the changing climate. NRSAS supports researchers in developing the technologies and strategies needed to help farmers, ranchers, and other natural resource managers effectively steward the diverse agricultural ecosystems across the Nation.

Scientific Discoveries Abroad

Bryan Norrington

The **Office of International Research Engagement and Cooperation** (OIREC) coordinates ARS's international relationships and helps empower ARS researchers to develop new ideas, approaches, expertise, and resources beyond U.S. borders. OIREC leverages its extensive international network of experts in science, agriculture, politics, diplomacy, and security to help ARS scientists identify emerging ideas and solutions, increase the impact of research and development spending, and deliver new knowledge and technologies.

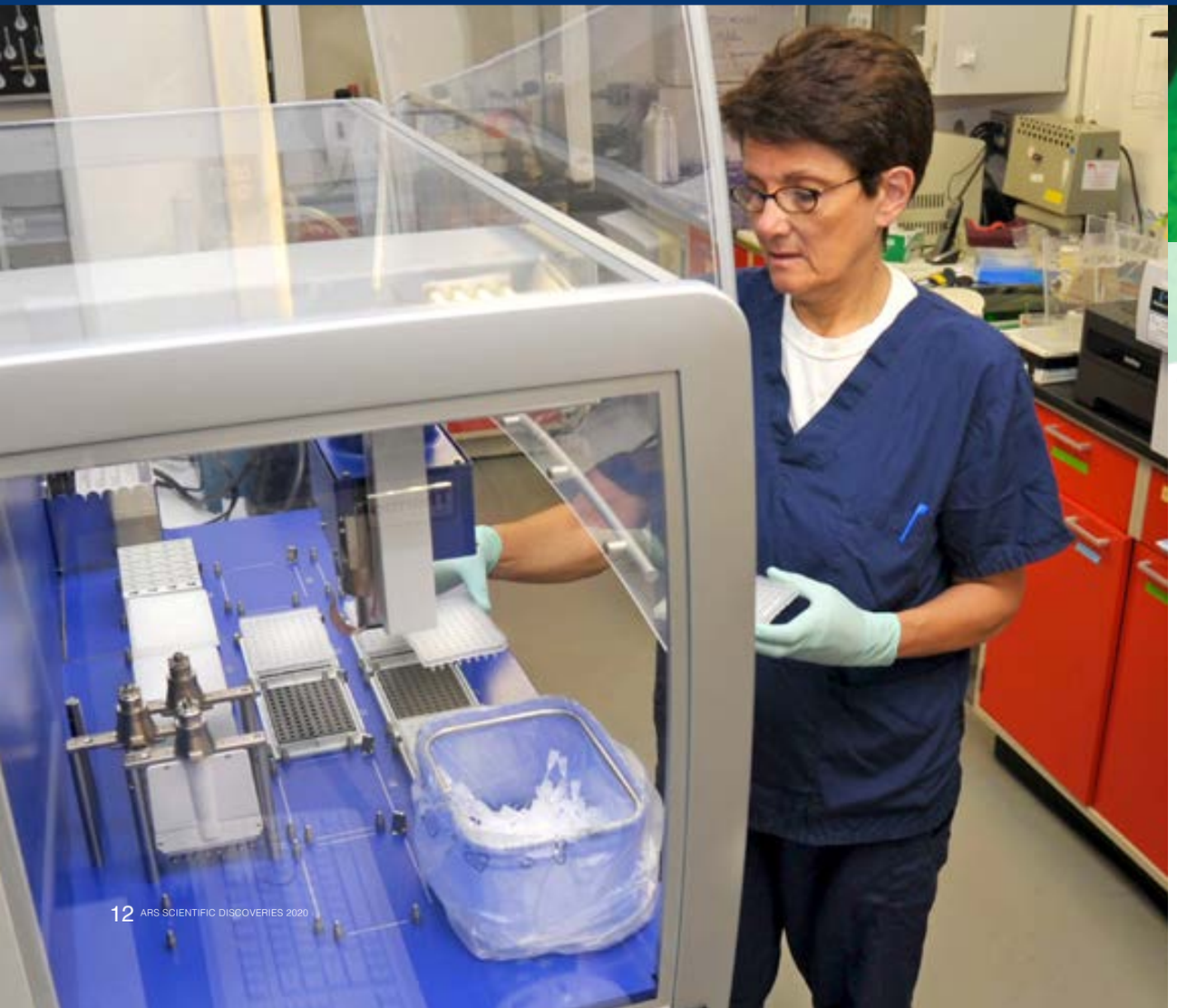
ANIMAL PRODUCTION & PROTECTION

Hops, flower clusters that look somewhat like pine cones, have been used for hundreds of years by brewers to limit bacterial growth in beer.

Bovine Beer Belly? It's Actually Better for Cows

Hops are normally too expensive to use in feed, but ARS researchers at the Forage-Animal Production Research Laboratory in Lexington, KY, found that hops that are too old for brewing beer, but still nutritious for cattle, may be available for coproduct development. New research has found that hops, an important ingredient in beer, may cause a cow to gain weight. Adding hops to feed also reduces overall cattle feed requirements, which decreases expenses for producers and helps the environment by reducing cow waste – and its resulting methane release, nitrogen loading, and ammonia runoff.

A natural compound in hops helps control gut bacteria that degrades protein in the rumen and releases ammonia that is eventually lost into the environment. The hop-assisted undegraded protein is now digestible, which increases the cow's growth, so producers need to provide less feed. The availability of surplus hops varies, but oftentimes brewers use only half the amount of harvested hops. Adding surplus hops to cattle feed not only saves cattle producers money and helps the environment, but it could provide a value-added income source to hops farmers.



Using Gene Editing To Develop an African Swine Vaccine

ARS scientists at the Plum Island Animal Disease Center in Orient Point, NY, are using gene editing to assist in the development of a vaccine for African swine fever (ASF). Some viral strains of ASF cause near-100-percent mortality in swine, and ASF outbreaks result in trade restrictions and significant economic losses globally.

Since the introduction of this disease in the Republic of Georgia in 2007, 16 countries have reported new ASF outbreaks, including Belgium and China in 2018.

The risk of ASF introduction into the United States cannot be underestimated. There is no commercially available vaccine to prevent ASF, and there are no molecular tools to help develop a safe and effective live recombinant vaccine.

Gene editing is a new type of genetic engineering in which DNA can be directly inserted, deleted, modified, or replaced in the genome of a living organism. Unlike early genetic engineering techniques, gene editing directs the modification to specific sites. ARS scientists investigated the use of the "CRISPR-Cas9" gene-editing system as a potentially more efficient system to produce live (but attenuated) recombinant ASF viruses. These attenuated viruses are candidate vaccines. Compared to traditional genetic engineering techniques, the CRISPR-Cas9 system resulted in the successful development of a recombinant ASF virus in record time. These results demonstrate the potential advantage of using CRISPR/Cas9 over traditional methods and should significantly improve the ability to develop a first-generation modified live ASF vaccine.

NUTRITION, FOOD SAFETY & QUALITY

Infections caused by antibiotic-resistant germs are difficult, and sometimes impossible, to treat.

Science Shows Less Can Equal More

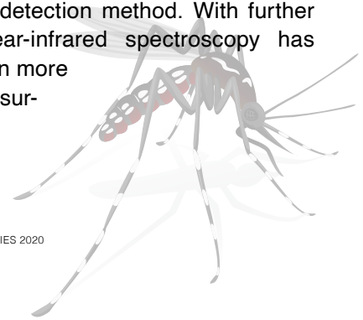
ARS scientists at the Meat Safety and Quality Research Laboratory in Clay Center, NE, researched whether raising beef cattle without antibiotics would reduce levels of antimicrobial resistance (AMR), compared to conventional production using antibiotics. Researchers compared fecal AMR levels between beef cattle raised without antibiotics and cattle raised conventionally with no restrictions on antibiotic use other than regulatory compliance. In nearly 75 percent of cases, there was no biologically significant difference between AMR levels in the production systems, according to the study.

Moreover, cattle raised without antibiotics typically grow more slowly, so they may be fed 50 days longer and thus produce more than a ton of extra manure per cow. Consequently, cattle raised without antibiotics may actually increase the total amount of AMR input into the environment.

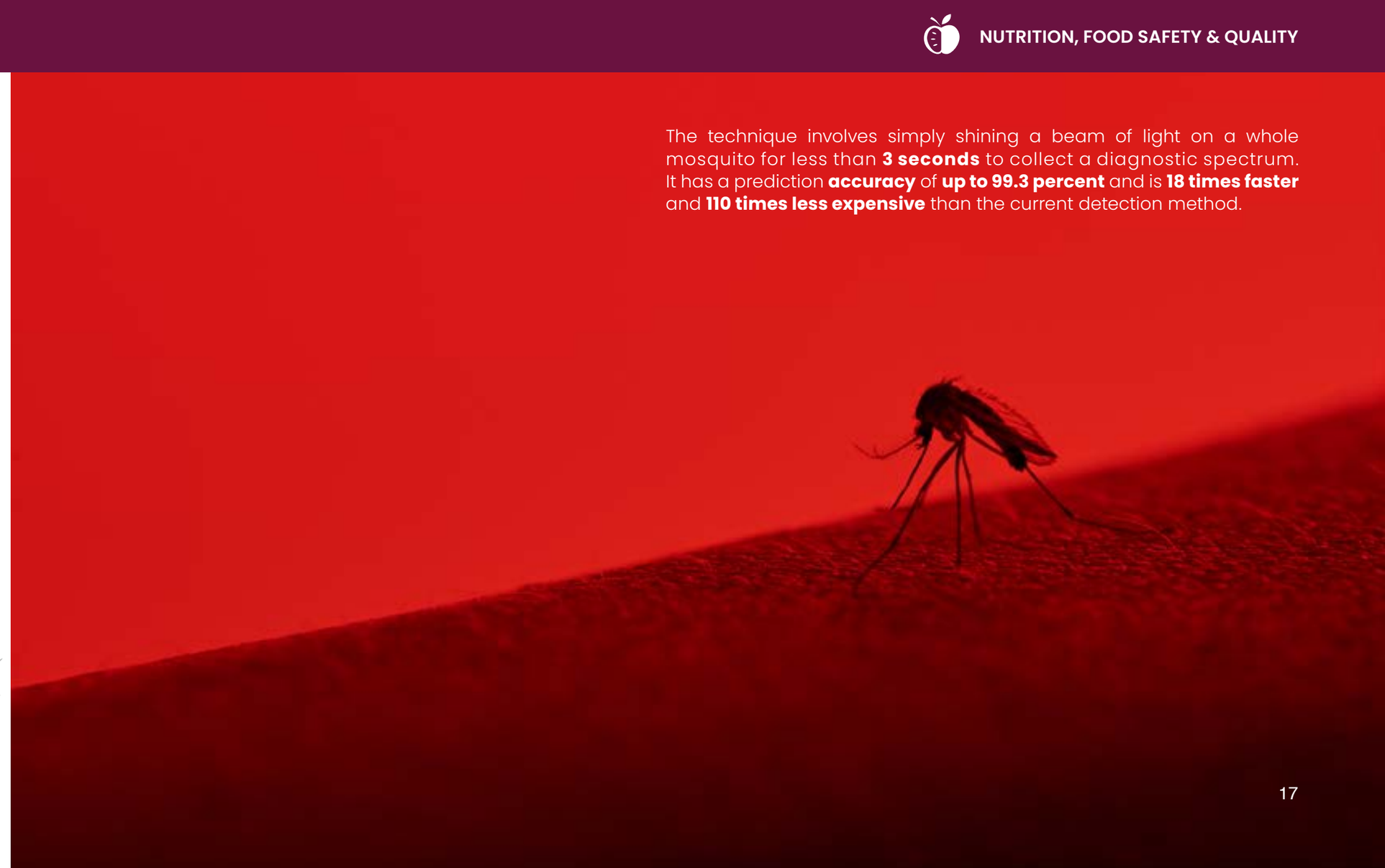
A Quick Way To Spot Zika in Mosquitoes

ARS scientists at the Stored Product Insect and Engineering Research Unit in Manhattan, KS, and their collaborators have developed a new test to quickly detect Zika virus in mosquitos. Zika virus became a household name in 2016, when reports of infected newborns with abnormally small heads (microcephaly) began making news. Discovered in Uganda in the 1940s, Zika virus is spread by *Aedes aegypti* mosquitoes. In addition to birth defects, Zika virus can cause fever, rash, headache, and joint pain—or sometimes no symptoms at all. A major barrier to anticipating Zika outbreaks has been the lack of a rapid, affordable test to detect infected mosquitoes.

The team of scientists showed that near-infrared spectroscopy is a fast way to detect Zika in mosquitoes. The technique involves simply shining a beam of light on a whole mosquito for less than 3 seconds to collect a diagnostic spectrum. It has a prediction accuracy of up to 99.3 percent and is 18 times faster and 110 times less expensive than the current detection method. With further development, near-infrared spectroscopy has potential for use in more widespread virus surveillance efforts.



The technique involves simply shining a beam of light on a whole mosquito for less than **3 seconds** to collect a diagnostic spectrum. It has a prediction **accuracy** of **up to 99.3 percent** and is **18 times faster** and **110 times less expensive** than the current detection method.



A Treatment for Peanut Allergy

A team of researchers, including ARS scientists at the Food Processing and Sensory Quality Research Laboratory in New Orleans, LA, is on the cusp of releasing the world's first treatment for peanut allergy. For some, the mere mention of peanuts may cause the mouth to water, while for others it may elicit a cold sweat. According to Food Allergy Research & Education, approximately 4 percent of adults and 8 percent of children are allergic to some type of foods, including peanuts, and could suffer from anaphylaxis, a potentially fatal reaction.

In an effort to reduce peanut allergies, the team of researchers developed an oral immunotherapy drug, which has passed Phase 3 clinical trials and is nearing final approval by the U.S. Food and Drug Administration.

The therapy drug desensitizes patients so they will not have an allergic reaction to small amounts of peanuts over time. Patients receive capsules that contain specific amounts of peanut powder, minuscule at first, but increasing gradually until they can tolerate 300 milligrams, roughly equal to one peanut. This therapy is effective *only* for peanut allergies.

An estimated 9 million, or 4%, of adults have food allergies. Nearly 6 million, or 8%, of children have food allergies, with young children affected most.

The Radio Frequency Pasteurization process shoots radio frequencies into an egg while the egg spins under a stream of water to prevent from overheating.

Taking Pasteurized Shell Eggs to a New Level

ARS scientists at the Food Safety and Intervention Technologies Laboratory in Wyndmoor, PA, have hatched a way to produce safer eggs without jeopardizing quality. The Centers for Disease Control and Prevention estimates that about 1.2 million Americans are sickened with *Salmonella* each year. Working with industry partners, the researchers are improving upon ARS's previously patented radio frequency pasteurization (RFP) process to kill *Salmonella* bacteria in shell eggs. RFP involves shooting radio frequencies of about the same power as a microwave oven into the egg while the egg spins under a stream of water to prevent it from overheating. In essence, RFP pokes holes in the membranes of bacteria inside the egg.

The team has moved beyond a small-scale prototype that required manual egg spinning under ionized water and successfully tested a larger scale RFP unit that automatically turns the eggs and uses tap water, thus paving the way for a commercial-scale unit. The modifications will help prevent a significant source of foodborne illness while saving $10,000 to $100,000 per RFP unit, making it more economical to pasteurize shell eggs.

Waste Not, Want Not

Good food going bad is a sad thing when many people are going hungry, but ARS researchers at the Healthy Processed Foods Research Laboratory in Albany, CA, have addressed that issue with a common food waste to make more healthful foods available. The researchers developed an ultraviolet-B light treatment to transform mushroom-stalk waste into a new vegetarian ingredient with a high level of vitamin D. When applied as a film coating to fruit bars and fresh-cut melons, the colorless, tasteless, edible powder helps preserve quality and safety and increases shelf life.

Human clinical trials proved the bioavailability of vitamin D in these mushroom films. Many commercial companies are using this process and are even selling mushroom powders to consumers as a healthy source of vitamin D.

ARS researchers are using an ultraviolet-B light treatment to transform mushroom-stalk waste into a new vegetarian ingredient rich in vitamin D.

Newly Discovered Hormone Controls Our Desire To Eat

Scientists at ARS's Children's Nutrition Research Center in Houston, TX, may have found a breakthrough for one of the biggest health concerns in the United States. According to the Centers for Disease Control and Prevention, over 90 million U.S. adults were obese in 2015-16. Obesity is related to heart disease, stroke, type 2 diabetes, and certain types of cancer. ARS scientists have found that asprosin, a recently discovered hormone, enters the brain and activates nerves that stimulate appetite and increase body fat and weight.

Over 90 MILLION U.S. adults were obese in 2015-16

Asprosin is produced by fat cells and induced by fasting, and it circulates in the blood and targets the liver to produce glucose. Researchers found that obese humans and mice have elevated asprosin levels in their bloodstream, and blocking asprosin in mice reduced appetite and weight. ARS scientists are now studying whether controlling asprosin levels in the bloodstream could prevent obesity and type 2 diabetes in humans.

Walking to Better Health

As we age and become less active, we lose mobility, which could lead to falls or even hip fractures. But take heart! ARS-funded researchers at the Jean Mayer USDA Human Nutrition Research Center on Aging in Boston, MA, took part in a study that showed that previously inactive people in their 70s and 80s can improve their mobility and function by walking 30 minutes a day, combined with about 25 minutes of muscle and balance training, for 5 days a week. The Lifestyle Interventions and Independence for Elders (LIFE) study compared the effects of moderate-intensity physical activity with an established health education program that did not include exercise.

The researchers found that participants in the exercise group who walked as part of their program increased their walking speed and distance and experienced less decline in mobility compared with those participating in a program that did not include walking. Encouraging seniors to walk and maintain muscle strength and balance for several hours per week may improve their quality of life and reduce their overall healthcare costs.

Inactive people in their 70s and 80s can improve their mobility and function by walking 30 minutes a day.

Courtesy photo // Alonso Nichols-Tufts University

Keeping Almonds Safe and Dry

ARS scientists at the Western Regional Research Center in Albany, CA, have developed an effective, energy-saving technology to help keep microbes and mycotoxins off almonds. As a snack, in trail mix or baked goods, or made into almond milk and almond flour, the humble almond's popularity continues to grow. To help meet the demand, California produces 80 percent of the world's almonds, with a value of more than $5.33 billion. But when rain falls during harvest season, the wet almonds are more susceptible to contamination with microbes, like *Salmonella*, which can result in the complete loss of an almond crop. Rains also contribute to the growth of molds that can produce toxic compounds called mycotoxins.

To help keep almonds safe to eat and to save growers' crops, ARS scientists used sequential infrared heat and hot air to simultaneously dry and decontaminate wet whole almonds. The results of their research were provided to industry and contributed to the ARS team receiving the 2018 Research and Development Award from the Institute of Food Technologists.

CROP PRODUCTION & PROTECTION

Luring Stink Bugs to Their Doom

A team of ARS scientists from the Invasive Insect Biocontrol and Behavior Laboratory in Beltsville, MD, and the Appalachian Fruit Research Station in Kearneysville, WV, is looking into "attractive" ways to kill brown marmorated stink bugs (BMSB). As well as being household pests, these invasive bugs from Asia have a voracious appetite for fruit and vegetable crops and can cause significant destruction. In 2010, they caused $37 million in damage to apples alone because there are few, if any, natural enemies here to keep the pests under control.

The ARS team identified the BMSB pheromone and a "synergist," which enhances attraction of the pheromone, and with university collaborators around the country, they developed lures that are now commercially available. The lures can be used with crop-compatible trap designs to measure BMSB presence, relative abundance, and seasonal activity. The biological information generated by these baited traps enables growers to better manage BMSB on their farms. These pheromone lures are also part of an attract-and-kill system that ARS researchers at Kearneysville are developing. When paired with a BMSB host plant, like an apple tree, these lures attract and trap the bugs. This enables growers to treat only the baited trees rather than the entire orchard – reducing the area treated by over 90 percent.

New Peanut a 'Contender' for Export Markets

Big, crunchy, flavorful Virginia-type peanuts are a snackable favorite, and ARS scientists at the Wheat, Peanut, and Other Field Crops Research Unit in Stillwater, OK, recently released a new heavyweight to the peanut family. 'Contender' is a new Virginia-type peanut that contains high amounts of oleic fatty acids, which can promote cardiovascular health and extend peanut product shelf life. Peanuts normally have a 1.5-to-1 ratio of oleic acid to linoleic acid, but 'Contender' has a ratio of 30 to 1.

ARS previously released a high-oleic peanut, but it and similar cultivars didn't have the market characteristics required by the export market—such as large pods and seeds. 'Contender' has large, bright pods (averaging 9 pods per ounce) and a large seed size (up to 3.7 ounces per 100 seeds). Virginia-type peanuts are grown for export on about 35 percent of the peanut acreage in Oklahoma and Texas, and 'Contender' was bred specifically to thrive in this region. Its production and export are expected to contribute $20 million annually to the U.S. economy.

Strawberry Fields Forever

Nobody likes to see gray mold growing on the strawberries they just bought, including scientists at the ARS Appalachian Fruit Research Station in Kearneysville, WV. Fortunately, the scientists developed a way to control the mold while keeping the strawberries fresh and tasty. Gray mold is caused by the fungus *Botrytis cinerea*. Other common fungal diseases of strawberry include powdery mildew and anthracnose. These diseases have posed big problems for strawberry growers, and fungicides aren't always an option—or always effective.

The scientists effectively killed the microbes by exposing the plants to low levels of ultraviolet C irradiation, followed by a specific period of darkness and an application of two biocontrol yeasts. Their system, called PhylloLux, is safe to use on strawberries, and it can also control the two-spotted spider mite and the greenhouse white fly. The technology has potential use for other fruit and vegetable crops as well as ornamental plants and nursery stocks. The scientists are currently working to automate the technology for large-scale applications. The PhylloLux system would greatly reduce product loss to strawberry growers and processors and reduce pesticide use. It would also benefit consumers who lose strawberries to mold before they can eat the entire package.

Disrupting Borer Mating To Protect Peach Trees

ARS researchers at the Southeastern Fruit and Tree Nut Research Laboratory in Byron, GA, worked with a collaborator to fend off peach tree pests. The peach tree borer and the lesser peach tree borer both cause serious damage to peach, cherry, plum, nectarine, and apricot trees. Hungry larvae kill young trees when they feed on growing tissue, and they severely reduce fruit production when they eat older trees. Conventional control of these insect pests has been difficult due to changes in insecticide labeling and the long season—up to 9 months—during which these pests must be controlled.

ARS researchers and their collaborator have demonstrated that an areawide mating disruption approach could control these pests and prevent larval establishment before feeding begins. Mating disruption is a management technique that releases pheromones in quantities to throw off the males and disrupt their mating, thereby reducing or eliminating future larva generations. The success of the project has led southeastern U.S. peach growers to adopt this mating disruption strategy for effective pest control. In 2018, mating disruption management was used on 3,500 acres of commercial peach acres.

When twisted onto a peach tree branch, the pheromone dispenser disrupts the activity of peachtree borers.

Distinguishing Jekyll from Hyde in Citrus Disease

ARS researchers at the Crop Diseases, Pests and Genetics Research Unit in Parlier, CA, have found a way to distinguish between two citrus diseases that are similar in appearance, but dangerously different.

The bacterium *Spiroplasma citri* causes citrus stubborn disease (CSD), which has symptoms that are easily mistaken for those of Huanglongbing (HLB), also known as citrus greening disease, caused by *Candidatus* Liberibacter asiaticus. CSD is fairly widespread in California but is manageable. HLB, on the other hand, is a devastating citrus disease subject to quarantine and immediate removal of the infected trees.

HLB threatens the survival of Florida citrus and is a potential threat to the entire U.S. citrus industry. ARS researchers have developed a sensitive procedure to identify and quantitate these two different bacteria in citrus tissue and vector material using the droplet digital PCR technique. This process is more sensitive and reliable than the standard molecular technique when pathogen counts in the test samples are low. The droplet digital PCR test provides a robust method to test symptomatic and non-symptomatic citrus samples for CSD and HLB in a single test, saving time and money. The test can also be used by regulatory agencies as an improved testing procedure to differentiate between deadly HLB and the more benign CSD.

NATURAL RESOURCES & SUSTAINABLE AGRICULTURAL SYSTEMS

Capturing and Recycling Nitrate Pollution

Nitrate runoff is a common problem, but ARS researchers at the Soil and Water Management Research Laboratory in St. Paul, MN, have found a way to capture and recycle excess nitrates. Nitrate runoff is caused by agricultural fertilizer runoff, and nitrate contamination of surface and ground water is a risk to human health and contributes to eutrophication – the excess growth of aquatic plant life that kills marine animals due to lack of oxygen. Most mitigation efforts employ microbes to convert nitrates into nitrogen, which returns it to the atmosphere.

By using electrodialysis – passing electricity through a series of membranes – ARS scientists captured nearly half of the nitrates from water passing through them. They then used the nitrate-concentrated water as fertilizer. Electrodialysis benefits farmers by recovering and reusing lost nitrogen and benefits society by reducing nitrate contamination in streams, wells, ponds, lakes, and rivers. Research indicates that this novel approach is most feasible where nitrate concentrations are well above environmental standards for extended periods.

Electrodialysis may not only benefit farmers, but also the environment by reducing nitrogen runoff from farms.

Restoring rangelands to a healthy mix of plants increases the productivity and sustainability of agriculture.

Cheating Cheatgrass

ARS scientists at the Great Basin Rangelands Research Unit in Reno, NV, have found success using pre-emergent herbicides as part of an integrated management plan to control cheatgrass, an aggressive, invasive weed from central Asia. Cheatgrass outcompetes native plants for nutrients and water and deprives animals of dietary variety and quality as well as habitat. The accidental introduction and subsequent invasion of cheatgrass into Great Basin rangelands also increased the frequency, intensity, and acreage of wildfires, which cost millions of dollars annually to fight. Millions more are then spent on efforts to restore these devastated lands.

Researchers tested pre-emergent herbicides to control germinating cheatgrass seeds. They later seeded the treated area with selected perennial species, including some developed specifically for rangeland restoration by scientists at the ARS Forage and Range Research Unit in Logan, UT. These plants have the ability to establish and persist in competition with cheatgrass. Over the 10-year study period, the strategy resulted in more than a nine-fold increase in perennial grass densities as well as increased shrub and forb growth. This significantly reduced the chance, rate, spread, and season of wildfires. Restoring rangelands to a healthy mix of plants increases the productivity and sustainability of agriculture in the Great Basin while also supporting wildlife and reducing wildfires.

SCIENTIFIC DISCOVERIES ABROAD

Using Genetics To Take On the Whitefly

ARS scientists, in collaboration with scientists from the International Institute of Tropical Agriculture (IITA) in Tanzania and Kenya, have developed novel RNA interference (RNAi) technology that interrupts or suppresses the expression of critical whitefly genes, leading to whitefly mortality. Whitefly, known scientifically as *Bemisia tabaci*, ranks among the top scourges of agriculture. The prolific pest feeds on more than 500 plant species in 74 families, ranging from specialty crops to field and horticultural crops. In addition to harming the plants it feeds upon, whiteflies are notorious carriers of agricultural diseases, including viruses that cause cassava brown streak disease. The United Nations' Food and Agriculture Organization estimates this disease infects between 15 and 37 percent of roots that produce cassava (yucca), a starchy food similar to yam and potato that accounts for nearly one-third of the calorie intake in some sub-Saharan African countries.

In the United States, whitefly transmits several devastating viruses to numerous crops, including tomatoes, melons, sweetpotatoes, and others. ARS and its partners produced the first draft genome of the whitefly, which characterized the whitefly's genes and profiled gene activity during virus transmission. This knowledge, coupled with the RNAi technology, may significantly reduce whitefly populations and improve management of whitefly and whitefly-transmitted diseases both in the United States and throughout the world.

Although the African continent contains most of the global cassava growing area, cassava productivity in Africa is much lower than the world average due, in large part, to diseases delivered by the whitefly and other insects.

Surveying Sand Fly Breeding Habitats

ARS researchers at the European Biological Control Laboratory in Thessaloniki, Greece, have developed a molecular method that could revolutionize the way we approach surveillance of sand flies as well as other arthropod vectors whose immature stages also breed in soil. Leishmaniasis, a parasitic disease found in parts of the tropics, subtropics, and southern Europe, is caused by a protozoan parasite transmitted by the bite of a female sand fly (*Phlebotomus* sp.). Approximately 1.3 million new cases of leishmaniasis and 20,000-30,000 deaths occur annually. Though leishmaniasis is not common in the United States, it poses a major threat to the U.S. military deployed overseas. To develop an efficient strategy to control *Phlebotomus* sp., it is important to address where immature stages of the *Phlebotomus* sp. occur in nature.

Using this molecular method, ARS researchers successfully detected and quantified *Phlebotomus* sp. larvae from different types of soil sampled from a variety of animal shelters (chicken, horse, goat, sheep, rabbit, goose, and pig). It can be adapted to detect other arthropods of medical and veterinary importance whose immature stages also breed in soil, such as ticks. This method will increase our knowledge of insect ecology for designing targeted control methods against the immature insect stages. It could also become a risk assessment tool to determine the threat of vector-borne diseases affecting wildlife, livestock, and public health.

BRINGING SCIENCE HOME

Mojdeh Bahar
Assistant Administrator,
Office of Technology Transfer

ARS's **Office of Technology Transfer** (OTT) is, in essence, the bridge that connects ARS scientific technologies to homes across the Nation. Every year, ARS scientists discover technological breakthroughs and advancements in agriculture – from new varieties of fruits and vegetables to farming equipment that makes harvesting safer and more efficient. OTT works with ARS scientists to bring their technological advancements to the marketplace through patents, licenses, and partnerships with commercial businesses.

LabTech Brings Science from the Lab to the Home

Federal research and technological advances touch the lives of all Americans. In fact, there's a good chance that many items in your kitchen, bathroom, living room, even garage were developed in a federal laboratory or grown in a field with the help of federal researchers and scientists. See firsthand how everyday household items are influenced by federal research by checking out LabTech in Your Life. This website provides a virtual tour of a home to discover some of the many commercialized federal technologies that have become common household items. Each of the technologies represents years of federal laboratory research and development and successful partnerships in a wide range of scientific areas.

ARS has 17 technologies throughout the virtual house – see if you can spot them all (hint: they are not all in the kitchen). Take the tour and discover how ARS research impacts your everyday life.

BRINGING SCIENCE TO THE WORLD

Paul Wester, Jr.
Director,
National Agricultural Library

The **National Agricultural Library** (NAL) provides access to millions of journal articles and other publications, as well as rare books and manuscript materials in its Special Collections unit. NAL is also a leader in scientific data management, benefiting USDA-funded researchers and scientists everywhere. NAL houses FoodData Central, an integrated data system that provides expanded nutrient profile data and links to related agricultural and experimental research.

National Agricultural Library: Science at Your Fingertips

The National Agricultural Library (NAL) is a treasure trove of information on all things agriculture, and not all that long ago, researchers and the public had to travel to Beltsville, MD, to use the library's vast resources. But today, much of the information is available at your fingertips, thanks to ongoing efforts to digitize the library's holdings. NAL has greatly increased access to journal articles and other publications, special collections, and rare materials. This year, the library put together onsite and online exhibits showcasing rare Smokey Bear artwork and artifacts to celebrate the 75th anniversary of the wildfire-prevention mascot. The library also hired its first Wikipedian-in-Residence to ensure that its entries on Wikipedia are accurate and thorough.

NAL is a leader in scientific data management, benefiting researchers everywhere. A research study generates a lot of data, and publishing that data fosters trust and speeds progress on new science. NAL updated its data-management tool, "Ag Data Commons," with a fresh design for ease of use. Ag Data Commons curators help researchers prepare high-quality data-management plans that ensure that dollars spent on research have the largest possible impact. There's something new for the consumer, too: FoodData Central is an integrated data system that provides expanded nutrient profile data and links to related agricultural and experimental research.

ARS PRESTIGIOUS AWARD WINNERS

ARS Prestigious Award Winners

Since its establishment in 1953, ARS has attracted some of the best and brightest minds to fill its scientific ranks and put their considerable talents to work addressing agricultural issues of high national importance. This year, ARS is proud to highlight the achievements of Elizabeth Ainsworth, Heather Allen, Jo Anne Crouch, and Sara Lupton.

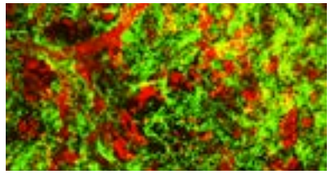
Ainsworth, an ARS molecular biologist at the Global Change and Photosynthesis Research Unit in Urbana, IL, and a lead investigator of SoyFACE Global Change Research, was awarded the 2019 National Academy of Sciences Prize in Food and Agriculture Sciences for her groundbreaking work on addressing future challenges of feeding the world in the face of global climate change. Ainsworth's scientific focus is to identify and utilize genetic variation within crop species to better adapt them for future environmental conditions. Her research efforts include measuring crop responses to global climate changes from the molecular to the agronomic scale and determining the genetic underpinnings of those varieties that are more tolerant of higher concentrations of atmospheric ozone and more responsive to higher carbon dioxide. According to her and her collaborator's studies, exposure to ozone pollution over the past 30 years has reduced corn yields by about 10 percent and soybean yields by about 5 percent. They also found significant differences in ozone tolerance among the varieties. This shows the potential for breeding more ozone-tolerant varieties. Ainsworth received a medal and a $100,000 prize, endowed through gifts from the Foundation for Food and Agriculture Research and the Bill & Melinda Gates Foundation.

Three ARS scientists received the Presidential Early Career Award for Scientists and Engineers (PECASE): Heather Allen at the National Animal Disease Center in Ames, IA; Jo Anne Crouch at the Mycology and Nematology Genetic Diversity and Biology Laboratory in Beltsville, MD; and Sara Lupton at the Edward T. Schafer Agricultural Research Center in Fargo, ND. The PECASE is the highest honor bestowed by the U.S. government to outstanding scientists and engineers who are beginning their research careers and who show exceptional promise for leadership in science and technology.

Allen was a microbiologist and an international expert on antibiotic resistance gene ecology and swine gut microbial communities. Her work significantly increased our understanding of the effects of agricultural practices on foodborne pathogens and antibiotic resistance genes in food-producing animals. Allen, who passed away in March 2020, discovered that regardless of the antibiotic treatment administered, swine gut microbiota harbor diverse antibiotic resistance genes.

Lupton is a research chemist and is internationally recognized for her research on chemical contaminants in cattle, swine, and poultry, as well as their byproducts, waste systems, and feed sources. Her contributions have informed decision-making by regulatory agencies and promoted consumer confidence in the food supply and domestic milk and meat production practices.

Crouch is a molecular biologist whose research has been key to understanding the global diversity of fungal pathogens affecting horticultural plants, turfgrass, and cereal crops. She has developed molecular markers, diagnostic assays, genome tools, and taxonomic resources to combat downy mildews, boxwood blight, dollar spot, and other plant diseases.



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