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LOUISIANA Agriculture

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Assuring Our Future Through Scientific Research and Education

Discovering
more power from food and nutrition



School of Nutrition and Food Sciences Transforms Lives

Gina E. Eubanks

Food helps your body work, grow and repair itself, while medicine is used to treat disease and illness. Food gives our bodies nutrients to function properly but should be consumed in moderation because too much or too little might put your body at risk for diet-related diseases, such as arthritis, diabetes and heart disease.

The School of Nutrition and Food Sciences was formed in 2012, combining the Division of Human Nutrition and Food and the Department of Food Science. Its mission is to prepare future professionals and support the community through discovery, education and the development of services and products that improve the health and well-being of individuals, families and communities in a complex and changing society. The school's mission also includes assisting local, national and global food industries. In 2014, the Animal and Food Sciences Laboratory Building was completed to support research for the school as well as for the School of Animal Sciences.

The school's strategic plan reflects three overarching goals:

IMPROVING HEALTH AND WELL-BEING

Addressing the nutrition and physical activity environment in Louisiana through a systemic community-based approach is the essence of the Healthy Communities Initiative. This initiative uses coalitions and partnerships, education, and policy, systems and environmental change strategies to determine and address concerns. Extension programs for the initiative include:

- **Flavors of Health.** This program provides classes and workshops on a variety of topics that empower individuals and families to make healthy food and fitness choices.
- **Expanded Food and Nutrition Education Program (EFNEP).** This program targets low-income populations and reduces nutrition insecurity of families and youth.
- **Supplemental Nutrition Assistance Program Education (SNAP-Ed).** This program improves the likelihood that persons eligible for food stamps will make healthy food and lifestyle choices that prevent obesity.
- **Centers for Disease Control High Obesity Program (HOP).** This community-driven program is in parishes with 40% obesity rates and addresses food and physical activity access through policy, systems and environmental change strategies to make the "healthy choice the easy choice."

ECONOMIC INNOVATION

Research areas in the school include functional foods, food microbiology, food safety, health effects of dietary fermentable fiber, ingredient development, product development, safe storage packaging, nutrition and exercise interventions. Research is needed to ensure the production of safe, wholesome healthful products. The LSU AgCenter Institute for Food Innovation, formerly the Food Incubator, is one such entity that will become a cross-disciplinary catalyst for incubation, research, education and community engagement. The new name is pending LSU Board of Supervisors and Louisiana Board of Regents approval. Because of faculty capacity to conduct shelf-life studies, create all-natural formulations and analyze sensory test profiles, this center will be pivotal in the AgCenter's efforts to strengthen economic development, expand existing businesses and stimulate entrepreneurship at all levels in Louisiana's food industry.

CAREER EXCELLENCE AND ENHANCEMENT

The School of Nutrition and Food Sciences offers undergraduate and graduate programs and provides basic knowledge required for specialization in one of four areas of concentration: dietetics; nutritional sciences/pre-medicine; nutrition, health and society; and food science and technology (with a pre-medicine option).

Teaching, research and extension in the land-grant system continue to provide access to higher education for everyone and to deploy knowledge that impacts the quality of life. The School of Nutrition and Food Sciences fully embraces and executes all facets of the land-grant university mission.

Gina E. Eubanks is the associate vice president and program leader for nutrition and food sciences.

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ON THE COVER: "Food is our medicine and medicine is our food" is an ancient aphorism, and LSU AgCenter scientists are confirming its truth today. They are unraveling many of the mysteries of how food and nutrition can make us healthier. Photo of Louisiana products by Olivia McClure and food styling by Sandra May

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Ruby Miller named 4-H national winner



A ruby is considered one of the most valuable gemstones in the world, and Ruby Miller, from Calcasieu Parish, has been recognized nationally as one of the greatest treasures to Louisiana 4-H for her more than 30 years of service to the organization. Miller, a retired 4-H agent and current volunteer with the LSU AgCenter, was inducted into the National 4-H Hall of Fame in Chevy Chase, Maryland, on Oct. 11, 2019.

Miller was a 4-H'er from the fourth grade through her graduation. As both an elementary and high school teacher in Cameron Parish, she voluntarily helped 4-H'ers with projects such as livestock, cooking, entomology and photography. She became the Cameron Parish 4-H agent in 2006. Under her leadership, Cameron Parish earned nearly \$25,000 in annual 4-H grants, fundraising profits and in-kind support. While youth have faced distractions and relentless competition for their attention, Miller helped Cameron Parish maintain one of the highest 4-H member retention rates in the state. She also built a successful 4-H shooting sports program that has served as a statewide model. Miller is now a member of the Louisiana 4-H Foundation Board of Trustees, where she makes appeals for financial support of 4-H programs.

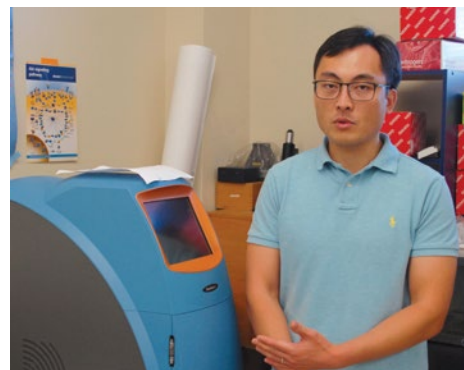
Researcher uses protein to control fat in animals

When you pick up a cut of beef in the supermarket, you see the ribbons of fat, or marbling, within the meat. This intramuscular fat contributes to the rich flavor of beef. Visceral fat, another major type of fat that's found in the abdominal cavity, can affect the development of intramuscular fat.

Xing Fu, a researcher in the LSU AgCenter School of Animal Sciences, is working on a project that promises to reduce the amount of visceral fat an animal produces. "We don't want visceral fat," he said. "It creates waste in meat and fat in people."

With a three-year, \$410,000 grant from the National Institutes of Health, Fu is exploring ways to control fat development in all stages of growth in animals and humans. Working with laboratory mice, Fu is looking for a way to manipulate the body's production of visceral fat. So far, he has found a potential way to control this process by "knocking out" or overexpressing a protein called Tcf21.

The result in cattle can lead to animals that don't carry a lot of body fat but still produce the intramuscular fat that provides the marbling in the meat. This will increase food efficiency and improve conversion of feed to meat. In humans, the process can reduce visceral fat and improve metabolic health. "We want to explore its therapeutic potential," Fu said.



LSU AgCenter researcher Xing Fu uses a FluorChem imager to capture DNA and protein gel images in his study of how a body produces fat. Photo by Rick Bogren

AgCenter team works on hemp production in Louisiana



The LSU AgCenter has formed a team to study topics related to industrial hemp production in Louisiana. Members of the team are, left to right, Steve Harrison, agronomist; Gerald Myers, agronomist; Jeb Fields, horticulturist; Babitha Jampala, research associate; Ted Gauthier, biotechnology researcher; Ashley Mullens, external and government affairs coordinator; and Jeff Davis, entomologist. Photo by Olivia McClure

High school students get hands-on genetics lesson



LSU AgCenter research associate Gavin Guidry, at right, helps Midland High School students examine rice plant leaves under a magnifying glass to determine which leaves are smooth or rough during a field trip to the LSU AgCenter H. Rouse Caffey Rice Research Station on Oct. 23, 2019. They were among 60 science students who learned about the applications of biotechnology in agriculture. "Their biggest take-away is that what we're doing over here and reading about on the internet isn't happening in some far-off university. It's happening in their backyard," said Chad Breaux, Midland High School biology teacher. Photo by Bruce Schultz



THE LSU AGCENTER

provides food and nutrition education and outreach in the areas of basic nutrition, food safety, youth programs, farm-to-consumer markets and commercial food production. In each area, AgCenter associates, agents and specialists provide research-based programming to assure Louisianians receive the best information and training possible. **The numbers of individuals and companies served in the past fiscal year are shown below.**

NUTRITION EDUCATION

- EFNEP – 1,728 adults
- SnapEd – 9,962 adults

FOOD SAFETY

- Trained 450 individuals

YOUTH PROGRAMS

- Reached 11,859 children and youth

PIZZA PARLOR

CAJUN BISTRO

FARM TO CONSUMER

- Served more than 200 producers and buyers

COMMERCIAL FOOD PRODUCERS

- Served more than 200 individuals and companies
- Reached 54,000 students in 335 schools through Harvest of the Month
- Hosted 170 individuals at the Farm to School Conference

--SUPERMARKET--

AgCenter food and nutrition programs serve LOUISIANIANS IN SEVERAL AREAS

TEAR OUT



Nutrition Education

The Expanded Food and Nutrition Education Program (EFNEP), celebrating its 50th anniversary, is a federal program to assist limited-resource audiences in acquiring the knowledge, skills, attitudes and behaviors necessary for nutritionally sound diets.

AgCenter associates and agents teach lessons on nutrition, diet and health, food buying, budgeting, food safety and gardening through SNAP-Ed (formerly food stamps).

Smart Choices is a community nutrition education program to help families improve their health.



Food Safety

The AgCenter Food Safety and Microbiology lab helps food processors, laboratories and individuals in microbiological and safety issues related to their food products. The AgCenter also offers certification courses in sanitation control procedures for fish and fishery products, HACCP (hazard analysis and critical control point) training for basic seafood, reduced oxygen packaging, and meat and poultry processing.

The AgCenter also offers training programs in safe agricultural practices for growers and others in the produce industry.



Youth Programs

The AgCenter provides youth nutrition instruction and training through a number of programs, including Teen Chef Camp and Back to School Chef Camp. The Expanded Food and Nutrition Education Program, EFNEP, provides nutrition instruction to enrolled youth. The Smart Choices for Youth community nutrition program serves children in grades five through eight. And the 4-H Food & Fitness Board provides opportunities for 4-H'ers to plan and conduct nutrition programs for their peers.



Farm-to-Consumer

MarketReady training for food producers and other stakeholders helps food producers expand their market reach to individual consumers as well as schools. The training includes meet-the-buyer events, farm-to-school programs and Harvest of the Month activities. The Louisiana Farm to School program links schools with farmers to provide fresh, local fruits and vegetables to school cafeterias and promotes a Harvest of the Month selection to bring local foods into schools.



Commercial Food Producer Support

The AgCenter Food Incubator has served 35 emerging companies to help them move their products from inspiration to the marketplace. The sensory lab provides opportunities for companies to gather product information through preference tests, acceptance tests and product comparison tests along with shelf-life testing and analytical product testing.

TEAR OUT

TEAR OUT

From Our SOCIAL MEDIA

Join the LSU AgCenter on social media. AgCenter researchers and extension agents reach out via the web with videos, articles and helpful hints on Facebook, YouTube, Twitter and Instagram.

Join the conversation by following the LSU AgCenter.



TWITTER

Follow the AgCenter at

twitter.com/LSUAgCenter.com



OCT 11 | Jorge Raul Rivera, an #LSU alum and three-time winner of the Cup of Excellence competition, spoke to students and faculty this afternoon about his specialty coffee operation in El Salvador. Highland Coffees brought samples of a few different coffees for participants to enjoy.



YOUTUBE

View these videos and our extensive

archive at youtube.com/user/LSUAgCenter.com

OCT 9 | While 4-H is widely known for its agricultural roots, the youth organization is making a concerted effort in science and engineering. As part of National 4-H Week, students learned about drones and piloted their first mission.



FACEBOOK

Follow the AgCenter on

Facebook at facebook.com/LSUAgCenter.com

SEPT 30 | More than 1 million arthropods (think insects, spiders) are housed in the Louisiana State Arthropod Museum in our Department of Entomology. They recently hosted a Night at the Museum to educate the public about the wonderful world of bugs.



OCT 12 | 4-H'ers from across northeast Louisiana participated in the Great Outdoors Camp at Honey Brake Lodge. They took part in kayaking, archery, fishing, trail riding and more. The camp allows youngsters to spend the weekend outdoors and connect with nature. **#NATIONAL4HWEEK #INSPIREKIDSTODO**

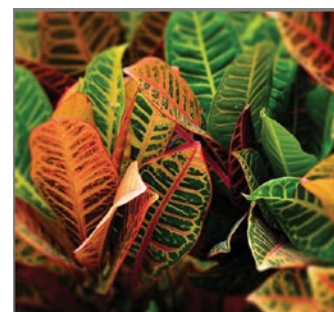


INSTAGRAM

Follow the AgCenter at

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OCT 3 | Nothing says fall like crotons. When we see them, they remind us of the splendor of the autumn season. They go wonderfully with ornamental gourds, pumpkins and chrysanthemums that we use to brighten our outdoor living area. **#CROTON #LSUAGCENTER #LOUISIANA**



Grain elevator, processing professionals endow scholarship

The Gulf South Chapter of the Grain Elevator and Processing Society (GEAPS) is endowing a scholarship in the LSU College of Agriculture.

The GEAPS-Gulf South Chapter has supported a scholarship in the college for four years. Roy Baker, chapter president and operations manager at Zen-Noh Grain Corporation, said the chapter recently had a surplus and decided the money would be best served helping students.

"Endowing a scholarship is a way to invest the money and help students that might impact our industry in the future," Baker said.

Benjamin Holden, a senior studying agricultural business, is a recipient of a GEAPS scholarship this year.

"I used the scholarship money to purchase my textbooks, which was a big help," Holden said, adding that he is looking into opportunities working for GEAPS in Houston.

Six companies operate export grain elevators south of Baton Rouge. Representatives from those companies are members of GEAPS, which has more than 2,800 members in more than 20 countries.

The Gulf South Chapter is the first to have an endowed scholarship at a university, Baker said. The chapter also was named the GEAPS 2018 Outstanding Chapter.

GEAPS meetings include professional development, discussions of industry issues, such as high water or trade wars, and networking. LSU College of Agriculture students are often invited to attend meetings to learn more about the grain elevator industry and job opportunities.

"We like to get students involved so they understand what the industry is about and learn how it works," Baker said.

Dauzats show support with endowed scholarship

Ruben and Laura Dauzat want young people to follow their path into agriculture — and to the LSU College of Agriculture.

Both third-generation farmers and long-time supporters of the college, they have endowed the Laura and Ruben Dauzat Scholarship in Agriculture.

"It's an honor for Laura and me to be able to do this," Ruben Dauzat said. "We've been blessed, and we want to share our blessing."

The Dauzats both graduated from the college. Ruben received a bachelor's in agriculture mechanization and master's in agricultural economics, and Laura earned her bachelor's degree in home economics. The pair met in college even though their hometowns were just 20 miles apart in Avoyelles Parish, where they reside now and grow row crops and cattle on their 1,200-acre Wayside Farms near Simmesport.

Their involvement with the LSU College of Agriculture and the LSU AgCenter didn't end with their degrees. Ruben said they kept learning through involvement in the AgCenter Agriculture Leadership Program and Master Farmer Program.

Ruben Dauzat said these programs have helped them become better stewards of their land and advocates for agriculture. He employs conservation methods on their farm and was recognized for his work by being named the Outstanding Master Farmer of the Year for 2014 and inducted into the Louisiana Agriculture Hall of Distinction in 2016.

The Dauzats raised three children on the farm, and all attended LSU.

"Laura and I felt obligated to give back, and what better way than to reach a young person," Dauzat said.

They also hoped the scholarship would encourage young people to go into agriculture and even stay in Louisiana.

"The College of Agriculture prepared me for my career in agriculture, and it stayed with me," he said. "Without LSU and the College of Agriculture, I don't know where I would be."



Nearly \$10,000 raised for scholarships at Cocktails and Cuisine

Nearly \$10,000 was raised for College of Agriculture scholarships on Oct. 11, 2019, at the 6th annual Cocktails and Cuisine. More than 100 people attended the evening event at the Baton Rouge Gallery, which included a silent auction and music by John Gray's Continuum. Attending were, left to right, Stacia Haynie, LSU provost; Bill Richardson, LSU vice president



for agriculture and dean of the College of Agriculture; Martin Haymon, donor and retired executive in Petroleum Service Corporation; Lindsey Fussell, LSU AgCenter and College of Agriculture senior director of development; and Frankie Gould, LSU AgCenter associate vice president for strategic communications and outreach relations. Photo by Tobie Blanchard

New Faculty PROFILE

Circuitous path to dietetics helps Erin McKinley guide students

Tobie Blanchard

With a degree in business and marketing and a career in casinos, Erin McKinley took a circuitous path to nutrition and dietetics. McKinley, an assistant professor in the School of Nutrition and Food Sciences and director of the school's Didactic Program of Dietetics, started exploring the link between nutrition and health when she had health issues.

A Rhode Island native, McKinley moved to Las Vegas, where her family was residing, after she received an undergraduate degree from Methodist University in North Carolina. As the recession in the late 2000s hit, the casino industry took a downturn.

"I started looking at some alternative things that were of interest to me and encountered some people who were doing things in nutrition but they weren't necessarily the experts," McKinley said.

The more she learned, she realized she had a strong interest in being a registered dietitian, but that is not an easy fit for someone with a business degree. The University of Alabama allowed her to take the undergraduate requirements, complete her master's and do a dietetic internship.

"I did research for my master's and had really good mentors who saw something in me as far as being able to plan and organize the research," she said.

McKinley was offered a graduate assistantship to continue at the University of Alabama and pursue a Ph.D. Upon finishing her doctorate, she joined the faculty of the LSU College of Agriculture in March 2018.

By taking an indirect route to her career in dietetics, McKinley said she is well-suited to help students struggling with their own paths. "When students come to me and don't understand what's going on, I can tell them that I didn't either," she said.

The College of Agriculture has approximately 130 dietetics students. McKinley said one of her goals is to make sure students recognize the program's rigor. To work as a registered dietitian, students must complete a dietetic internship after they leave the LSU undergraduate program. McKinley said she is proud that LSU has a good match rate with 83% of students matching with one of the internships of their choice.

McKinley teaches two courses. One is professionalism in dietetics, which gives students some of the technical and soft skills they need in the dietetic profession. The other looks at community nutrition, which encompasses any type of nutrition that doesn't include hospital or food service.

McKinley also conducts research on the psychological aspects of making infant feeding decisions among pregnant women. As part of her doctoral research, she created a tool that measures prenatal breastfeeding self-efficacy among pregnant women.

"A doctor's office can use it to gauge the conversations they need to have with their patients or for a pregnant woman to see what areas she needs to work on prior to birth," McKinley said.

McKinley is fine-tuning the scale to see if breastfeeding initiation and later breastfeeding successes can be predicted.

When McKinley made the leap from collecting gambling debts to prescribing healthy diets, she was told she would never use any of the information from her undergraduate program.

"That is totally a lie," she said. "Running a program requires me to tap into all that I learned about marketing and selling because I'm not just keeping the program afloat as far as accreditation goes," McKinley said, adding that is also recruiting students and selling her program to potential students and donors as well.

McKinley also serves as chair of the University Council on Gender Equity at LSU and is the president of the Baton Rouge Academy of Nutrition and Dietetics.

Tobie Blanchard is the director of LSU AgCenter Communications and LSU College of Agriculture Communications.



Erin McKinley, far right, with dietetic students at the LSU College of Agriculture's Burger Bash on Aug. 30, 2019. The students, from left to right, are Meredith Giles, Lakelyn Lumpkin, Alexis Fraino, Austin Kowitz and Theresa LaForge. Photo by Tobie Blanchard

Helping Rural Louisiana Gain Access to Healthy Food

Denise Holston, Melissa Cater and Stephanie Broyles

People living in rural settings have significantly higher rates of nutrition-related chronic diseases and lower diet quality than those living in more urban settings. This may be due in part to lack of access to healthy, affordable foods, especially fruits and vegetables. Rural grocery stores tend to be few and far between, and those that are in rural areas tend not to carry quantities of fresh fruits and vegetables because of the high cost to obtain them and their short shelf life. Thus, adoption of preventative behaviors to meet dietary recommendations and to reduce chronic disease risk may be challenging in rural areas.

To address this dilemma of getting healthier foods into rural grocery stores and getting the people in the rural areas to buy these foods, the LSU AgCenter has embarked upon a long-range research project with multiple studies, funded through the Centers for Disease Control and Prevention. One three-year study, which began in 2015, involved a community-participatory, multilevel approach to obesity prevention in three rural Louisiana parishes — Madison, St. Helena and Tensas. These three parishes have high rates of poverty (range 25%-42%) and obesity (greater than 40%) (Table 1). Interventions within the three-year study, which involved working with local food stores, were designed to influence the policy, systems and environment that may ultimately influence dietary behaviors among citizens and make healthy choices easier among residents.

Table 1. Descriptive characteristics of target parishes.

	Madison	Tensas	St. Helena
Population	11,803	4,893	10,714
Obesity prevalence	41.9	40.8	41.7
% poverty	39.6	33.8	27.6

A variety of interventions were used, but all hinged on working closely with food store managers. Numerous meetings were held with these managers, providing them with retail marketing and technical assistance and encouraging them to stock more healthy foods and to better display the healthier food choices.

The other part of the strategy was to encourage consumers to buy more of these foods to increase demand so that the store managers would see that these new practices were good for business. Some of the techniques aimed at consumers were:

- Signs in the stores calling attention to good nutritional practices.
- Signs on shelves pointing to healthy foods, called “shelf talkers.”
- Food demonstrations at the stores, allowing people to taste healthy foods and then handing out recipe cards for these dishes.

The evaluation used a descriptive, mixed methods design that focused on first- and third-year project data related to a healthy retail program. Nutrition environments at the food stores were assessed using the Nutrition Environment Measurement Survey. Pre- and post-survey scores were compared to determine if healthy retail policy, systems and environment interventions were effective in improving the rural nutrition environment.

Overall, 48 food stores were assessed at baseline, while 45 food stores were assessed at follow-up. Different numbers between baseline and follow-up assessments are due to store closures/openings. Except for the grocery store in Madison Parish, the food environments were poor across the targeted parishes, with scores indicating a lack of healthy grocery items. With few exceptions, average scores generally increased slightly over the assessments, which is a positive trend; however, these positive changes did not result in the food retail environment moving from unhealthy to healthy (Table 2).



LSU AgCenter and Southern University Ag Center extension agents do food demonstrations at Doug's Market in Tallulah and other stores. Photo by Karol Osborne

Table 2. Average Nutrition Environment Measurement Survey scores by store type (baseline/ post comparison).

	Madison	Tensas	St. Helena
Grocery			
N (baseline, post)	2, 2	2, 2	2, 2
Baseline Score (mean)	28.4	19.3	19.9
Post Score (mean)	30.6	20.5	25.2
Convenience			
N (baseline, post)	17, 15	5, 6	11, 8
Baseline Score (mean)	4.7	4.7	5.6
Post Score (mean)	6.9	6.5	3.1
Variety (i.e., drug store, dollar store)			
N (baseline, post)	3, 3	3, 4	3, 3
Baseline Score (mean)	9.6	8.4	13.3
Post Score (mean)	12.2	12.9	12.6

Note: The highest possible score for a grocery store is 39.3. Values ranging from 25-39.3 are considered good, while values below 25 indicate a lack of healthy food items. The highest possible score for a convenience store is 33.2. Values ranging from 23.0 to 33.3 are considered good, while values below 23.0 indicate lack of healthy grocery items. The highest possible score for a variety store is 27.5. Values ranging from 18-27.5 are considered good, while values below 18 indicate a lack of healthy grocery items.

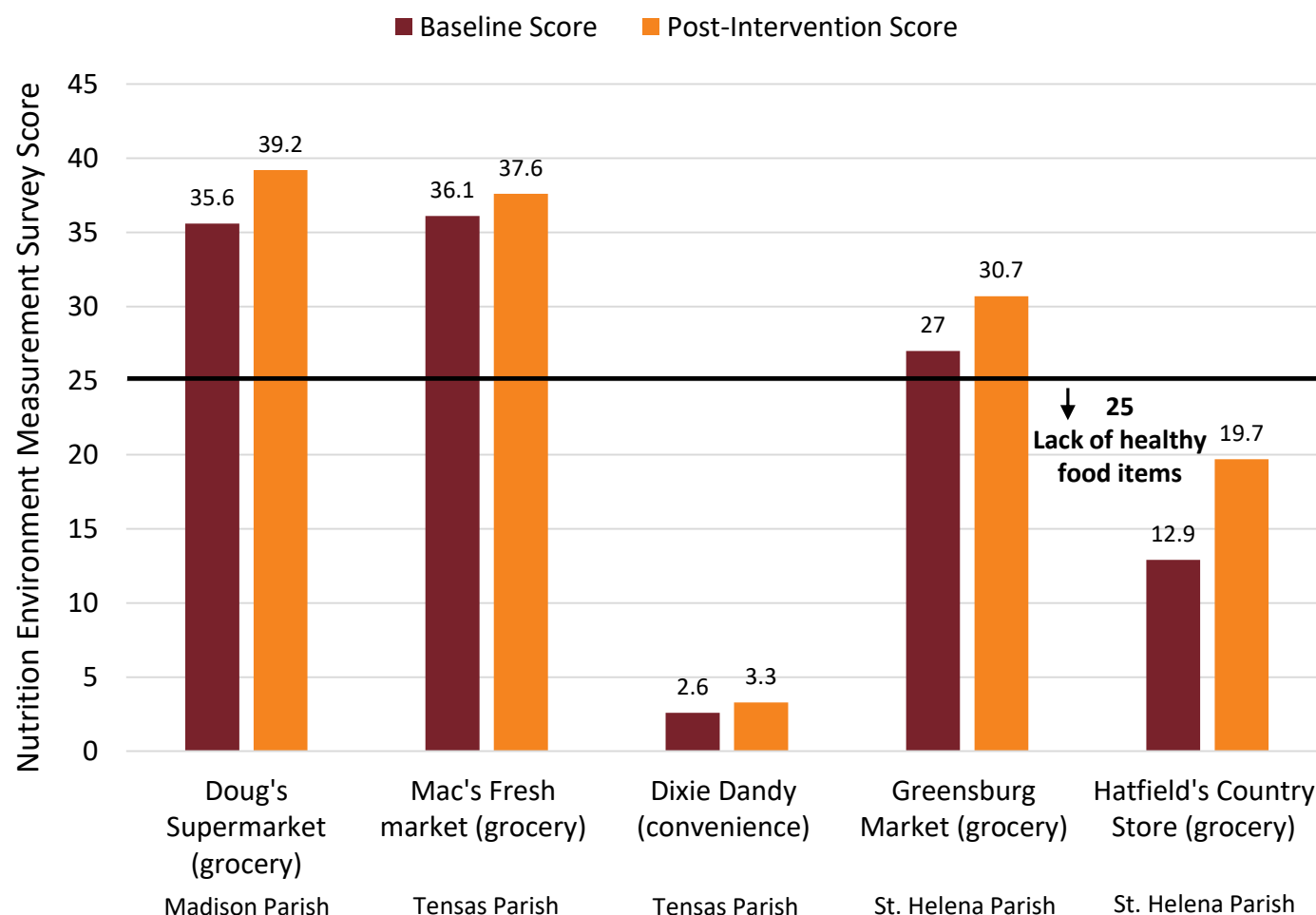


Figure 1. Nutrition Environment Measurement Survey scores at targeted sites

Note: The highest possible score for a grocery store is 39.3. Values ranging from 25-39.3 are considered good, while values below 25 indicate a lack of healthy food items. The highest possible score for a convenience store is 33.2. Values ranging from 23 to 33.3 are considered good, while values below 23.0 indicate lack of healthy grocery items.

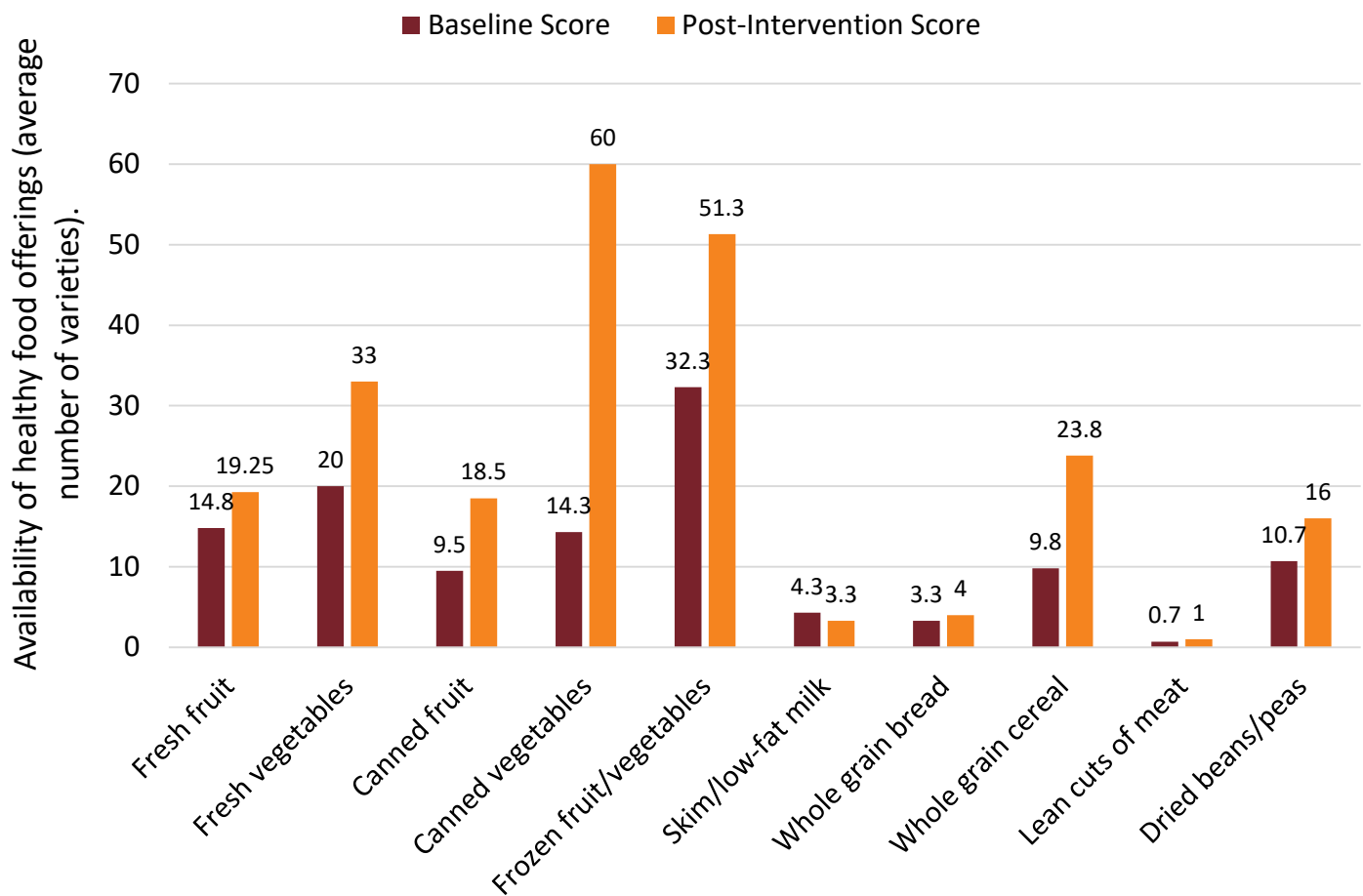


Figure 2. Baseline and post-intervention availability of healthy food offerings (average number of varieties) across partner stores.

Within the program, five stores were targeted to implement a healthy retail program. All of the partner stores' scores improved from baseline to post-intervention (Figure 1). Further, of the partner stores, the average number of healthy foods available increased in all categories, except skim or low-fat milk, from baseline to post-intervention (Figure 2).

Findings from baseline indicate that the nutrition environment in these high-poverty, high-obesity, rural parishes can present challenges to individuals attempting to meet preventative health recommendations. Community-driven policy, systems and environment interventions can improve the nutrition environment in these locations, but more research is needed to determine the appropriate strategies that will influence residents' behavioral and health outcomes.

The research begun with this study will continue and be expanded to four more parishes — Assumption, Claiborne, East Carroll and Morehouse — under a new five-year, \$5 million grant from the Centers for Disease Control and Preven-

tion Division of Nutrition, Physical Activity and Obesity, which was awarded to the AgCenter in 2018. The AgCenter agents will be working with the food stores in the parishes, along with restaurants, to develop collective purchasing from food distributors to make it worth their while to deliver healthier foods to rural Louisiana. They will also be expanding their strategies to encourage the residents to demand healthier food options.

Denise Holston is an assistant professor in the School of Nutrition and Food Sciences and a nutrition specialist; Melissa Cater is an evaluation specialist and director of the Northeast Region; Stephanie Broyles is an associate professor at the Pennington Biomedical Research Center, Baton Rouge.

Acknowledgements: This study, which is part of the LSU AgCenter's Healthy Access, Behaviors, Communities (Healthy ABCs) program, was partially funded through a three-year, \$2.27 million grant from the Centers for Disease Control High Obesity Program. Research partners included Southern University Agricultural Research and Extension Center, LSU's Pennington Biomedical Research Center and the Louisiana Department of Health and Hospitals.



Doug Curtis, owner of Doug's Market in Tallulah, offers healthy snack options in a recently installed refrigerated snack bar and point-of-purchase aisle rack. Curtis is a member of the Madison Parish Healthy Communities coalition that is working to improve access to healthy foods for local consumers

Photo by Karol Osborne

Building Coalitions to Foster Healthy Louisiana Communities

Denise Holston, Melissa Cater and Gina E. Eubanks

Contributing to the health and well-being of everybody in Louisiana has always been the goal of the LSU AgCenter nutrition education program. Helping people eat healthier, lose weight and exercise more goes a long way toward disease prevention and intervention. This will help hold down health care costs, improve workforce productivity and enhance the quality of life for everyone.

Instead of the more traditional model of teaching classes and working with families one-on-one, the new approach is to work with the entire community and determine changes to be made to make it easier for people to live a healthier lifestyle. The new model began in 2013 with the establishment of the Healthy Communities program in West Carroll Parish. This effort, which included the Southern University Agricultural Research and Extension Center and the Pennington Biomedical Research Center as partners, involved extensive outreach and coalition building among all segments of the community. The success in West Carroll Parish then served as a model for expanding the Healthy Communities program into more parishes and obtaining ever-increasing amounts of grant money from local, state and federal sources, including in 2018 a \$5 million, five-year grant from the Centers for Disease Control and Prevention Division of Nutrition, Physical Activity and Obesity.

A key aspect of the program is community mobilization, which occurs by engaging community coalitions and stakeholders to plan, develop, implement and evaluate strategies and approaches that address barriers and facilitators to healthy behaviors. Community mobilization is important because it creates opportunities, resources and partnerships, which enhance community buy-in.

To launch the initiative, the AgCenter agent first organizes and facilitates a community parish-level forum. The community forums serve to build awareness and gather community support. In addition to assisting in stakeholder engagement, the community forums are a first step in conducting needs assessments in the local community or parish. Forum attendees share information and perspectives on the assets and health challenges in the community and discuss the most beneficial and readily implementable changes. The forums are designed to be a structured group consensus meeting where facilitators ask participants about the perceived overall health status of adults and children in their parish; reasons for good or poor health; the strengths, weaknesses, opportunities and threats related to improving health; as well as their vision for a healthy community. At the end of the forum, attendees have the option of joining the local Healthy Communities

coalition. The AgCenter agent selects coalition members to be representative of the demographics and sectors of the target community.

After the coalition is assembled, the AgCenter agent presents forum results at the first coalition meeting in each parish, which generally guides the direction of the coalition's planning. Community coalition membership generally includes representatives from schools, local government, managed care organizations, faith-based organizations, businesses, nonprofit organizations, health care organizations, youth and community residents. Members contribute to the coalitions by helping to decide strategy, leveraging resources such as donations from business owners, volunteer labor, in-kind donations, and by raising awareness of community health needs through each coalition partner's social and professional networks. See Table 1 for a list of the partnerships statewide as a result of the Healthy Communities program in three parishes — Madison, St. Helena and Tensas.

Over time, the AgCenter agent will work with the community coalition to consider the relevant information to select, plan and implement policy, systems and environmental approaches to make the healthy choice the easy choice. Examples of projects being implemented include:

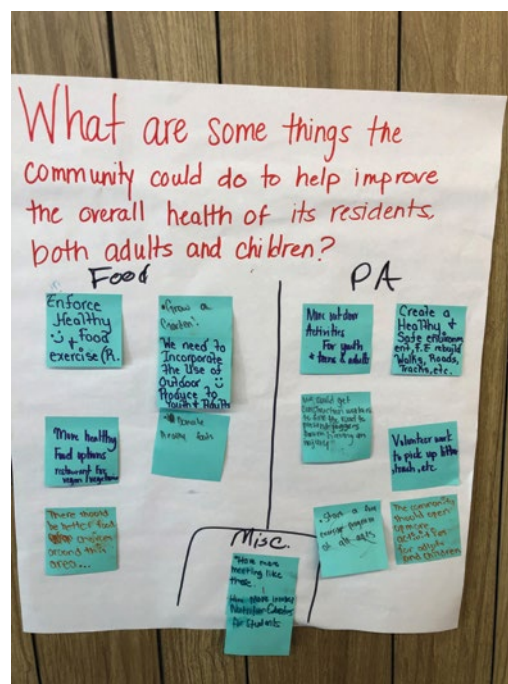
- Painted play spaces. AgCenter agents and community members identify public places that can be permanently stenciled to create opportunities for physical activity for children. Stenciled play spaces include games such as hopscotch, mirror me, and even basketball courts.
- Community and school gardens. These have been developed in communities around the state. In Terrebonne Parish, the coalition is working to develop a community garden that will serve to provide fruit and vegetables to needy students and families. As part of their commitment, local businesses, groups and individuals sponsor gardens.
- Smarter school lunch rooms. This is an intervention in the school cafeteria intended to reduce plate waste and promote healthy foods through printed reminders.
- Walkability to everyday destinations. These interventions seek to make it easier to walk places in towns and communities. This may include painting or repainting of crosswalks.
- Farmers markets. Several communities are establishing farmers markets where they have not had them before. For those communities that have an existing market, the focus is on promoting the market, which may include

farmers market tours, cooking demonstrations and taste tests.

- Faithful Families. This is a faith-based intervention developed in North Carolina that “builds on the connection between health and faith at multiple levels of the socioecological model through individuals, interpersonal relationships, organizational policies and practices and environment, and the broader community.”
- Healthy retail. Interventions include food demonstrations, signage, healthy food stocking and taste testing at grocery stores and other business establishments that sell food.

The collection of evaluation data is still in the early stages, but results indicate that members believe that the planning carried out by their groups has led to better targeting of services and programs. Members also expressed a sense of group cohesion, which is an important element of group success. When people feel connected to a group, they are better able to discuss issues and achieve consensus.

Denise Holston is an assistant professor in the School of Nutrition and Food Sciences; Melissa Cater is director for the LSU AgCenter Northeast Region as well as associate professor and an extension evaluation specialist; Gina E. Eubanks is an associate vice president and program leader of nutrition and food sciences.



As members discuss issues, they make notes on wall posters around the room. This poster is about food and physical activity (PA). They use sticky notes to organize priorities. Photo provided by Denise Holston



Joy Sims, an AgCenter agent in Madison and Tensas parishes, center to the left of the banner, poses with members of the Healthy Communities coalition in Madison Parish. Photo provided by Denise Holston

A Case for Chitosan:

Can Crustacean Waste Be Used to Preserve Foods?

Nancy Katherine Rubio, Marlene Janes, Zhimin Xu and Witoon Prinyawiwatkul



■ Nancy Katherine Rubio inoculates seafood with *L. monocytogenes*.

Chitosan, a natural substance created from the shells of shrimp and other crustaceans, has gained popularity as a dietary supplement. LSU AgCenter researchers are studying another use for the natural biopolymer. They are researching whether this abundant natural resource may be used as a food preservative or coating material to help keep foods safe and prevent them from spoiling.

Chitosan has received increased attention for its commercial applications in the biomedical, food and chemical industries. The use of chitosan in the food industry is growing because of its distinctive biological activities and functional properties. The market need for chitosan is projected to grow at a compound annual growth rate of 17.7% in 2020, at which point it is expected to reach \$4.2 billion. Additionally, the market for antimicrobial coatings for food should grow at a compound annual growth rate of 9% until 2020, reaching \$5 billion.

The antimicrobial activity and film-forming property of chitosan make it a potential source for a food preservative or coating material of natural origin that can be used to improve the storability of perishable foods and potentially prevent illness from spoiled foods.

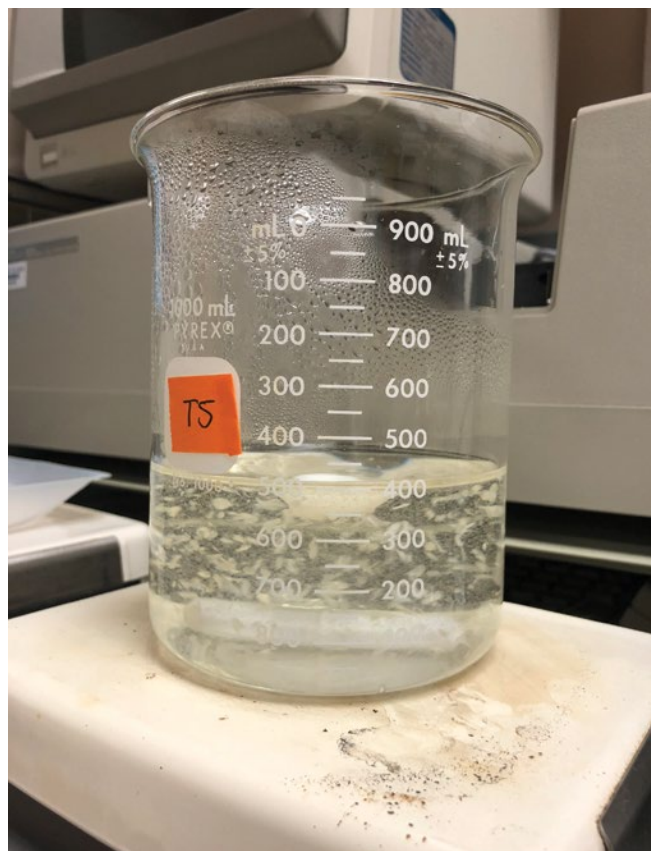
The enormous amount of crustacean shell waste from Louisiana shrimp, crab and crawfish processing can be used to produce chitosan, which would help reduce costs for handling shell waste and also reduce environmental pollution. Chitosan can be produced with various molecular weights, which determine whether it is water soluble. Molecular weight affects the functionality and end usage of chitosan. For example, compared with low-molecular-weight chitosan, the high-molecular-weight chitosan exhibits better tensile strength and elongation properties when used as a functional film. However, the poor water solubility of high-molecular-weight chitosan limits its applications.

LSU AgCenter researchers invented a simple preparation procedure for fast-dissolving high-molecular-weight chitosan without any chemical modifications, eliminating its pungent acid odor. Also, the fast dissolving and redissolving time for the freshly prepared high-molecular-weight chitosan solution or the dried high-molecular-weight chitosan powder will reduce the cost of production. Additionally, much higher concentrations of water-soluble high-molecular-weight chitosan solutions can be obtained, which is not possible with the current technology.

AgCenter food microbiologists applied water-soluble high-molecular-weight chitosan solutions as coatings and dipping solutions. To analyze the antimicrobial activity of these high-molecular-weight chitosan coatings, this chitosan was coated onto the surface of ready-to-eat chicken, raw catfish and shucked oysters that were inoculated with different foodborne pathogens. Then the food products were stored at refrigerated temperatures. The bacterial counts of samples were enumerated during the shelf life study. The results demonstrated that high-molecular-weight chitosan coatings were effective against some foodborne pathogens. The antibacterial activity of high-molecular-weight chitosan differed depending on the concentration of chitosan solution, the solvent used to dissolve the chitosan, the bacteria tested and the product that was tested. More research is being conducted.



These oysters have been dipped in chitosan solutions. Photo by Nancy Katherine Rubio



A beaker of chitosan in the lab. Photo by Nancy Katherine Rubio

Nancy Katherine Rubio is a former doctoral student in the School of Nutrition and Food Sciences. Marlene Janes and Zhimin Xu are professors, and Witoon Prinyawiwatkul holds the Horace J. Davis Endowed Professorship in Food Science and Technology.

Spicing Up Louisiana with Hot Sauce

Evelyn Watts

Louisiana is one of the biggest hot sauce producers in the U.S. with more than 35 different brands available in the market. Hot pepper sauce is made from red hot peppers and used for cooking and seasoning because of its unique pungent flavor. The most popular pepper species used for hot sauce production is tabasco peppers; however, habanero, jalapeno, cayenne and other bell chilies are also popular among processors. Hot sauce in Louisiana is mainly produced in the New Iberia, St. Martinville and Lafayette areas.

Louisiana hot sauces are manufactured using slightly different processes. In general, their production requires the fermentation of a hot red chili pepper mash in wooden or plastic barrels for a period between two weeks and three years. The exact procedure to produce hot sauce varies among companies and is considered a guarded trade secret. The main differences among products are the amount of salt added, the fermentation time, the degree of grinding and the percentage of added vinegar.

In the fermentation of most food products, the prevailing microbial groups are lactic acid bacteria and yeast, the relative population of which defines the characteristics of the final product. Lactic acid bacteria are widely distributed in nature and are typically involved in various food fermentation processes.

Consumers often base their overall impression and choice of food on flavor and aroma. There are more than 125 volatile compounds identified in fresh and processed red hot chili peppers. A volatile compounds evaluation determines if the fermentation process has been achieved in producing the desired final product. Changes in volatile compounds of chili peppers take place during ripening stages and fermentation.

LSU AgCenter scientists have conducted research to help the hot sauce industry understand the fermentation process of pepper mash. The purpose of this study was to identify the main microorganisms involved in pepper fermentation and its impact in acidity, flavor, aroma and color. During a 550-day period, pepper mash was fermented, mimicking natural conditions. The mash was sampled to analyze microbiological and physical and chemical changes.

The research team found that red hot chili pepper mash fermentation occurred in four stages where a symbiosis between lactic acid bacteria and yeast makes possible the fermentation of the mash. Subsequently, the fermentation process intensifies volatile compounds important for the quality of aroma and flavor of hot sauce. The primary lactic acid bacteria identified during the different stages of pepper

mash fermentation were *Lactobacillus plantarum* and *Lactococcus spp.* The primary yeast involved was *Candida spp.* These lactic acid bacteria and yeast have also been identified in other fermented products and are related to the production of aroma-causing compounds.

During the fermentation, an increase in acidity and slight changes in color in the mash were observed (Figure 1). Changes in concentration of volatile compounds were observed, which affected characteristic flavors and aromas in the production of hot sauce (Figure 2). Six main volatile compounds were identified during this study (Table 1). At the end of the fermentation process, a reduction of lactic acid bacteria and the yeast population was observed along with the presence of aerobic microorganisms. Under natural fermentation conditions, which were simulated in this study, the team recommends stopping mash fermentation after 550 days because conditions observed in the mash at this time could lead to growth of spoilage microorganisms.

Evelyn Watts is an assistant professor in the School of Nutrition and Food Sciences and an AgCenter and Louisiana Sea Grant seafood extension specialist.

Table 1. Six main volatile compounds identified during the 550 days of natural fermentation of red hot chili pepper mash.

Chemical Name	Compound Characteristics
n-hexanol	Organic alcohol with green and herbaceous, woody or sweet organoleptic properties.
4-methyl-1-pentyl-isobutyrate	Ester predominant in fruit aromas and contributes to the overall aroma of Tabasco peppers.
(Z)-3-hexenyl isopentanoate	Ester, colorless liquid insoluble in water, with organoleptic characteristics including a powerful, sweet, buttery and green odor of apple. It occurs naturally in mint and Tabasco peppers.
Heptyl isobutanoate	Ester, colorless liquid insoluble in water, has a characteristic woody odor distinctly herbaceous, sweet aroma, and has been characterized as having a fruity and slightly warm floral taste. It occurs naturally in the essential oil of hops.
Heptyl pentanoate	Ester, colorless to pale yellow liquid with a fruity aroma.
3,3-dimethylcyclohexanol	Organic alcohol described as having a "fried onion" aroma.

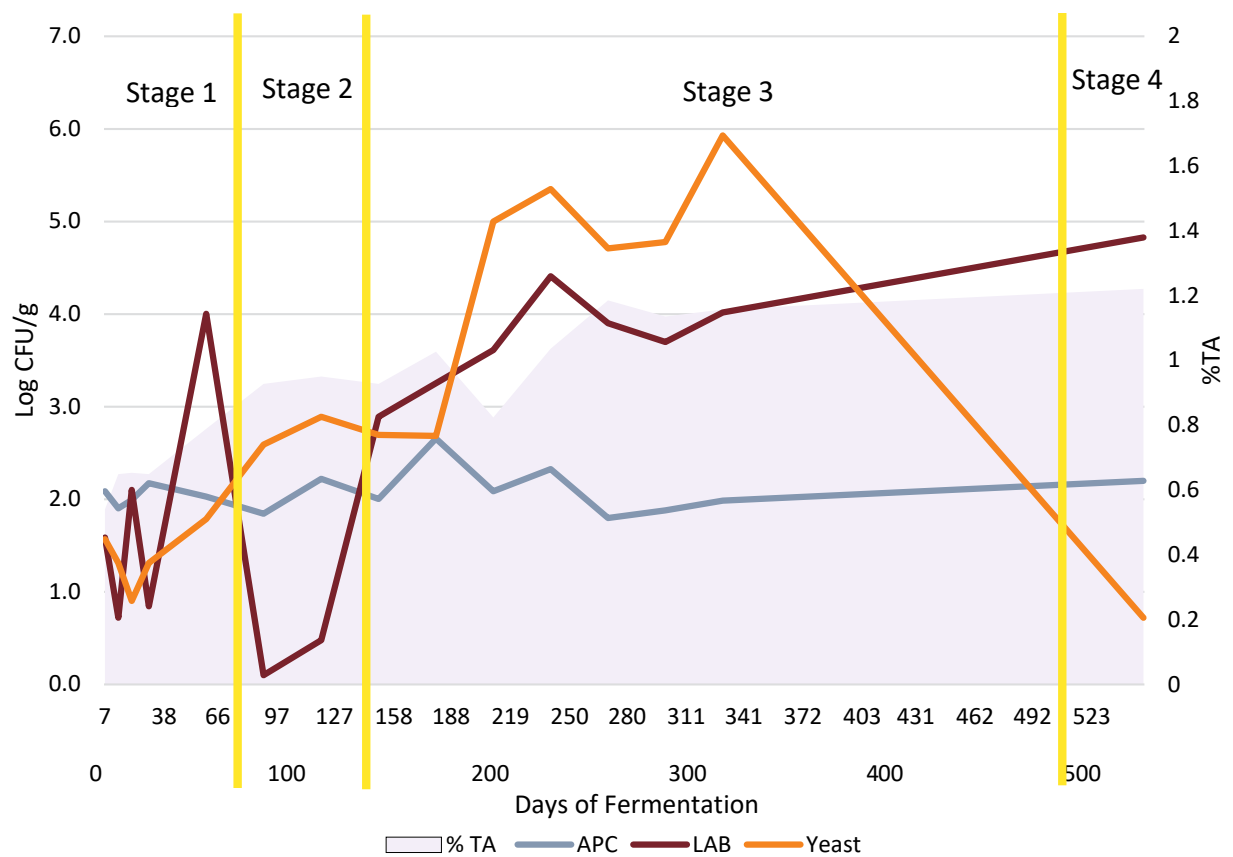


Figure 1. Aerobic plate count (APC), lactic acid bacteria counts (LAB), yeast counts, tritatable acidity (%TA), and stages during 550 days of red hot chili pepper fermentation. Yellow vertical lines separate stages during pepper mash fermentation.

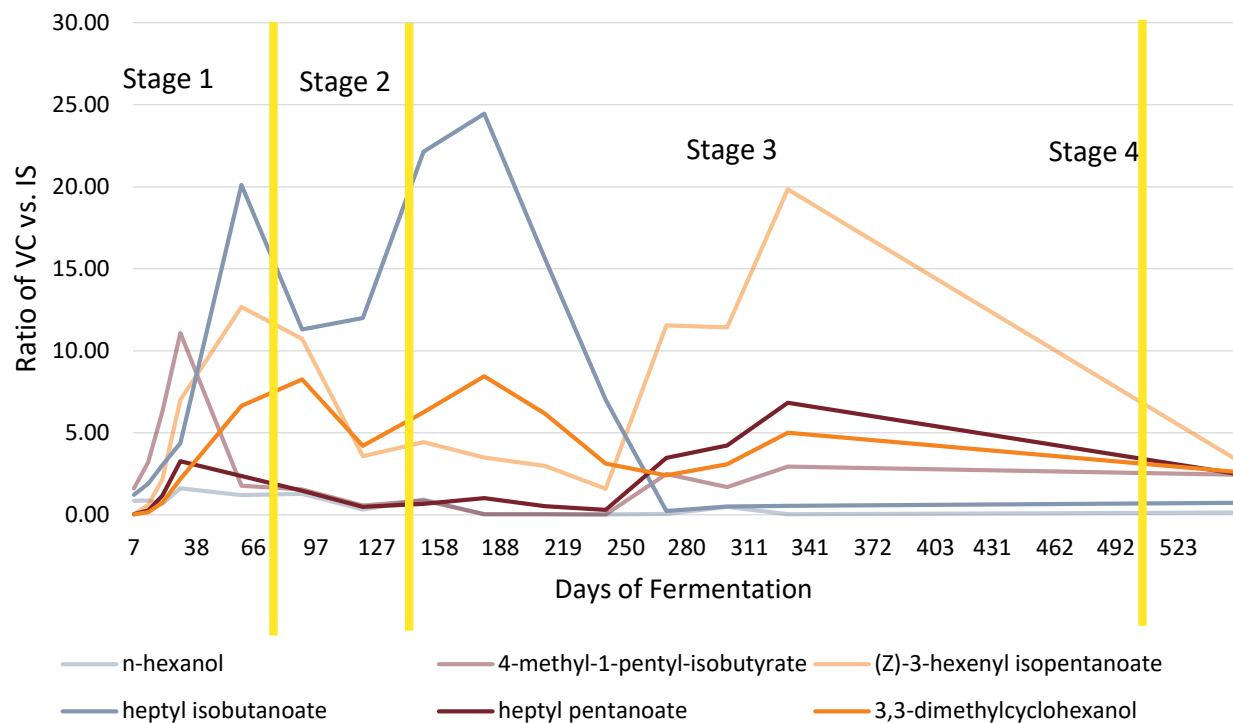


Figure 2. Changes in volatile compounds during 550 days of natural fermentation of red hot chili pepper mash (a ratio of volatile compound vs. internal standard; VC vs. IS). Yellow lines separate stages during pepper mash fermentation.

Developing Food Products with **More Fiber and Protein**

Joan M. King, Christopher Ringuette and Gabriella Paz

Food products with higher fiber — equal or greater than 20% of the daily value — and high protein are in demand by consumers in the United States, with 63% of consumers trying to add fiber and 60% of consumers trying to add protein to their diets. The U.S. Department of Agriculture recommends a daily fiber intake of 25 to 34 grams. The recommended diet for consumers ages 65 and older consists of foods with high fiber, high protein and low glycemic loads to increase health and minimize digestion problems and diabetes, as well as to achieve the recommended daily intake.

LSU AgCenter researchers undertook a study to determine which grocery store foods had high levels of dietary fiber and a low glycemic index, which is the number that estimates how much a food will raise the blood glucose level, and then to make pasta with a lower glycemic index and higher fiber content.

A market survey of approximately 400 items in grocery stores in the greater Baton Rouge area showed that prepared meals with high levels of dietary fiber and low glycemic loads were rare. Most pasta items in grocery stores were found to have low or medium fiber contents and high glycemic levels. Therefore, a part of this research focused on developing a healthier ravioli by substituting bean flour — a good source of dietary fiber and protein — for a portion of the wheat

flour. Raviolis with 50% and 75% navy bean flour added had a 14% to 21% daily value increase in dietary fiber and a 7 to 10 gram decrease in glycemic load. The color, texture, aroma, appearance and liking preferences by consumers were not significantly changed by substituting navy bean flour by 50%. Therefore, an acceptable higher fiber, lower glycemic index bean-wheat flour ravioli was produced.

GLUTEN-FREE FOOD PRODUCTS

Many people, and not just those with celiac disease, are now seeking gluten-free products because they are perceived as being healthier. This has resulted in increased use of rice and other alternatives to wheat in food products. Gluten-free products, however, are typically low in protein. Although rice is not a good source of protein, there are varieties being produced that have higher protein content than traditional rice. A high-protein rice line developed at the LSU AgCenter H. Rouse Caffey Rice Research Station has around 10.6% protein. Using a high-protein rice is one way to increase protein without extra fortification or processing. The focus of another AgCenter study was to identify which grocery products used rice flour as an ingredient and to develop a gluten-free, higher-protein rice flour muffin.

Christopher Ringuette, former master's student in the School of Nutrition and Food Sciences, prepares a higher-fiber, lower-glycemic fettucine with bean flour.
Photo by Westin Cobb



A market survey of products made with rice flour indicated that snacks were the main category at 36%, while breads were at 13%. Baked snacks had the lowest protein content at 1.3 grams per serving. Muffins were chosen as the focus for developing a higher-protein, rice-flour-based product. Muffins made with high-protein brown rice flour and high-protein white rice flour were compared to muffins made with commercial brown rice flour. The high-protein brown rice flour muffins contained about 5 grams of protein, and the high-protein white rice flour muffins had 4 grams of protein.

In sensory acceptability studies, the color of the high-protein white rice flour muffins was favored over the other samples. Other attributes were not statistically different among the three treatments; the high-protein rice flour muffins were judged to be just as good as muffins made with commercial flours. Although not statistically different, acceptability ratings of the high-protein rice muffins tended to be greater than those for the commercial brown rice muffins. Muffin crumbliness, moistness and softness for each sample were found to be just about right for most panelists, with the high-protein rice flour muffins having greater frequencies of appropriate levels than the commercial control. Commercial brown rice muffins were least acceptable across the board.

Purchase intent was greater for both high-protein rice flour muffins than for commercial brown rice muffins. After a message was displayed stating the products were gluten-free and that the high-protein rice flour muffins were made with a rice flour naturally higher in protein, purchase intent increased by 9% and 12% for the high-protein rice muffins and by only 5% for the commercial brown rice muffins. Therefore, the addition of higher-protein rice flour resulted in an even larger increase in purchase intent beyond the gluten-free message alone.

Any food or ingredient company could use this information to market their products if claims made are related to increased protein and nongluten-containing ingredients. These results show that replacing commercial rice flour with higher-protein rice flour has a positive effect on consumer acceptance of gluten-free muffins.

Joan M. King is a professor, and Christopher Ringuette and Gabriella Paz are master's degree graduates in the School of Nutrition and Food Sciences.

Enhancing Probiotic Characteristics of Probiotic and Culture Bacteria

Tanuja Muramalla, Luis Vargas, Behannis Mena, Olga Cueva, Najim Najim and Kayanush Aryana

Yogurt is a cultured dairy product that has a healthy image because of its nutritive value and beneficial bacteria. According to the legal description of yogurt, as described in the Code of Federal Regulations, *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are two culture bacteria required in yogurt manufacture. In addition to their role in making yogurt, both bacteria impart several health benefits, including improving lactose digestion, providing immunostimulatory effects, and exhibiting anti-tumoral and anti-mutagenic activity, which is important in the treatment of cancer.

Lactobacillus acidophilus is a widely used probiotic bacterium with several health benefits, which include lowering cholesterol, reducing the occurrence of diarrhea in humans, providing immune support for infections or cancer and replacing bacteria in the intestinal tract following antibiotic therapy, and improving the symptoms of lactose intolerance. *Lactobacillus acidophilus* is used in approximately 80% of the yogurts manufactured in the United States.

One of the basic requirements for a culture to be called probiotic is the ability to survive the acid and bile conditions, which readily kill these beneficial bacteria, in the gastrointestinal (GI) tract. Hence, acid tolerance and bile tolerance are important probiotic characteristics. Enhancing these probiotic characteristics would facilitate more of these favorable bacterial cells to reach the lower GI tract "alive" to confer the health benefit upon the human host. Maintaining the functionality of bacterial cultures under GI tract conditions (acid and bile) has been one of the major challenges in developing probiotic products.

Two important aspects in creating new food products are ingredients and processing. Among the various dairy food ingredients, there has been an emphasis on proteins in diets. In milk, there are two types of proteins: caseins and whey proteins. Whey proteins are preferred over caseins because they are easier to digest because of their relatively smaller size, and they help in muscle building. In milk, the main component of total solids is lactose or milk sugar. Sugars are also known to facilitate microbial growth. LSU AgCenter researchers are studying how whey proteins and lactose enhance probiotic characteristics.

For processing foods, food safety needs to be considered. In dairy foods processing, pasteurization and ultra-high temperature treatments are commonly used. High temperatures alter the cell structure in bacteria, making it harder for them to live. Some of the other processes known to control microbial growth are high-pressure homogenization and pulsed electric fields. Application of high pressures mechanically disrupts the bacterial cell, thereby destroying it. Pulsed electric fields use short (less than 1 second) high-voltage pulses, which induce pores or holes in microbial cells, causing microbial inactivation. Just as high temperatures are used to kill pathogenic microorganisms and mild temperatures as in incubations are used to grow culture bacteria, AgCenter researchers are studying how "mild" homogenization pressures and "mild" pulsed electric fields enhance probiotic characteristics.

In conclusion, bacteria can accordingly be pre-treated prior to use for enhancing a targeted probiotic characteristic. Certain ingredient and processing treatments can help enhance probiotic characteristics.

Tanuja Muramalla, Luis Vargas, Behannis Mena and Olga Cueva are former students of Kayanush Aryana, who holds the Doyle Chambers Professorship in Animal Sciences. Najim Najim was a visiting scientist on a one-year sabbatical in the School of Nutrition and Food Sciences.

Functional Dairy Foods Offer Health Benefits

Emily Mouton, Olga Cueva, Marvin Moncada, Brad Trammell, Ingrid Osorio, Charles Boeneke and Kayanush Aryana

Functional dairy foods are dairy foods that provide health benefits beyond the traditional nutrients they contain. LSU AgCenter researchers are investigating the effects of numerous health beneficial components — including carotenoids, immune enhancers, antioxidants, probiotics (health-beneficial bacteria), prebiotics (food for health-beneficial bacteria), fibers, omega-3 fatty acids, and vitamins and minerals — on key quality attributes of dairy products such as yogurts, cheeses and ice creams. Findings, in brief, from these studies are as follows:

PREBIOTIC AND PROBIOTIC YOGURTS

Probiotics are health-beneficial bacteria that colonize in the lower gastrointestinal tract before they can confer health benefits on the host. Inulin is a prebiotic that increases the activity of the probiotic *Lactobacillus acidophilus* and increases calcium absorption. It also is a good source of dietary fiber. Yogurts were made with probiotic *L. acidophilus* and prebiotic inulins of various chain lengths (short, medium and long). Probiotic yogurts containing short-chain inulin had a significantly lower pH than the remaining yogurts, higher flavor scores than the yogurt containing long-chain inulin, and comparable flavor scores with the control. The yogurts containing long-chain inulin had less released serum than the control and better body and texture than the remaining yogurts. Yogurts containing prebiotics of different chain lengths had comparable *L. acidophilus* counts with each other but higher counts than the control.

PROBIOTIC ICE CREAM

Probiotic, fat-free, no-sugar ice creams were manufactured. Vanilla ice creams with intermediate and high levels of probiotics had lower flavor, body and texture scores compared to the lowest amount of probiotic use and the control.

YOGURT AND CANCER

Arabinogalactan is a biopolymer of two monosaccharides, arabinose and galactose. Arabinogalactans contribute to immune-enhancing activities and are important adjuncts to cancer treatment because of their capability to stimulate Natural Killer Cell toxicity, stimulate the immune system and block metastasis of tumor cells to the liver. Arabinogalactans were incorporated into yogurt in varying amounts, and although they made yogurts darker, they did not significantly influence the product thickness, microbial counts, released serum and flavor of the yogurts. Hence, arabinogalactan immune enhancer yogurts can successfully be manufactured.

ICE CREAM AND CANCER

Colostrum is the first milk produced by mammals. It contains antibodies to protect the newborn against diseases. Because of its immune factors, colostrum helps the body fight off harmful invaders such as viruses, bacteria, yeast and fungi. A lowered immune system function precedes or accompanies the onset of most infectious and degenerative diseases such as cancer. Powerful immune factors, such as immunoglobulins, lactoferrin and cytokines, are present in colostrum and work to restore immune function. Ice creams were manufactured with varying amounts of colostrum. Colostrum increased aerobic microbial counts and thickness (apparent viscosity) of the ice cream mix, but decreased meltdown, resulting in slower melting of the ice creams. Colostrum had no influence on flavor. In an attempt to make healthier ice creams, colostrum incorporation can be recommended in ice cream manufacture.

YOGURT WITH ADDED HEART-HEALTHY NUTRIENTS

Six heart-healthy nutrients — thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), folic acid (vitamin B9), manganese and magnesium — were added to yogurt to test the effects on the physico-chemical, microbiological and sensory characteristics. Fiber was added at a constant rate in all the treatments. Total solids in the control were kept constant with nonfat dry milk. Incorporation of the heart healthy nutrients at 30%, 60% and 90% of their respective daily values significantly decreased released serum, pH and lightness. The incorporation of heart healthy vitamins and minerals at any of the studied rates in yogurts did not significantly affect microbial counts, flavor, appearance, body and texture of the product. Although there were subtle yet significant changes in color and viscosity as detected by instruments, these slight changes could not be detected by sensory evaluation. Yogurts can successfully be manufactured with heart healthy nutrients.

PROTECTING EYES WITH LUTEIN IN STRAWBERRY YOGURT

Vision loss, especially in elderly people, is commonly caused by age-related macular degeneration (AMD). Onset of AMD can be delayed by the dietary factor lutein, which is an efficient inducer of intercellular gap junction communication. Other protective effects of lutein accumulation are the ability to absorb light in the blue wavelengths that impinge directly on the fovea of the retina, and the special ability of

carotenoids to quench singlet oxygen and other reactive oxygen species. Hence, the macular cells get protected during a lifetime of oxidative stress. Nonfat yogurts were prepared with lutein as an ingredient. The lutein was incorporated prior to homogenization of the yogurt mix. Because lutein is a carotenoid, it imparted redness to the plain yogurts, but in strawberry yogurt, it was not noticed. Lutein levels remained above target throughout the five-week storage study. Lutein did not affect viscosity, pH, released serum, lightness and yellowness-blueness values, flavor, body, texture, appearance and color scores. These results suggested that lutein was suitable for inclusion in yogurts.

Different ingredients influence different characteristics of products in different manners. Just because an ingredient is good for health, use of too much of it in a product can adversely influence the overall quality of the product. Optimum usage levels of health-beneficial ingredients need to be identified for a particular product and process to make a desirable functional dairy food.

Emily Mouton, Cueva Olga, Marvin Moncada, Brad Trammel and Ingrid Osorio are former students of Kayanush Aryana, who holds the Doyle Chambers Professorship in Animal Sciences. Charles Boeneke is an associate professor in the School of Nutrition and Food Sciences.

Improving Processing Attributes of Culture and Probiotic Bacteria

Rachael Brown, Emilio Ernesto, Douglas Olson and Kayanush Aryana

LSU AgCenter researchers are studying how to increase the tolerance of beneficial bacteria to the high temperatures required in manufacturing processed cheese. They are also testing methods for improving salt tolerance of health beneficial bacteria.

HIGHER TEMPERATURE TOLERANCE

Lactococcus lactis is used in the manufacture of most natural cheeses and is a mesophilic culture, which grows best at moderate temperatures between 45 and 113 degrees Fahrenheit. Natural cheese can be converted into processed cheese, which has more versatility of use, such as individually wrapped slices for sandwiches. Processed cheese is made by mixing and heating several lots of natural cheese with suitable emulsifying agents into a hot, melted homogeneous mass. The temperatures involved in this process range from 167 to 185 degrees Fahrenheit, which kills these mesophilic cultures.

These mesophilic cultures (*L. lactis*) provide several health benefits, including the treatment and prevention of irritable bowel diseases and Crohn's disease. If the heat tolerance of these mesophilic cultures can be improved, then a new generation of healthier process cheese with natural cheese microflora is possible.

Researchers at the LSU AgCenter exposed *L. lactis* to various mild temperatures for various lengths of time and then grew these preheated cells in broth and repeated the process for the second-generation cells, which were then subjected to higher temperatures. Cultures survived the higher temperatures that had earlier killed them. Heat tolerance in this mesophilic culture was thus enhanced.

IMPROVED SALT TOLERANCE

Salt has been used as a preservative in foods since ancient times. Salt kills most microorganisms through osmosis by drawing water out of the bacterial cell. Salt is a low-cost ingredient, and in third world countries, because of the poor hygienic environments in food manufacturing, salt is relied upon to kill microorganisms in foods to make them safe.

Use of excessive salt has been linked with high blood pressure and stroke. Therefore, researchers around the world have tried several approaches to reduce salt including: a) using several salt substitutes, b) altering tastes to emphasize sourness rather than saltiness, and c) nano-sizing salt particles to increase salt surface area for less use of salt on the surface of salted foods. On supermarket shelves, there are a range of food products with reduced salt.

In certain foods such as cheeses, salt is multifunctional, having a role other than just flavoring. Salt helps in the release of whey during cheese manufacture and regulates microbial growth during manufacture and cheese ripening. Salt is the single ingredient that plays a key role in boosting cheesy flavor in cheeses.

Improving salt tolerances of health beneficial bacteria, such as *Lactococcus lactis* and probiotic *Lactobacillus acidophilus* can increase its use in salt-containing products, such as cheeses and canned foods, such as beans, fish and vegetables, in salt solutions. LSU AgCenter researchers have found that the salt tolerance was enhanced with exposure to mild heat, low hydrogen peroxide and low ethanol concentrations.

Rachael Brown and Emilio Ernesto are former students of Kayanush Aryana, who holds the Doyle Chambers Professorship in Animal Sciences; Douglas Olson is a research associate in the School of Nutrition and Food Sciences.

Food Incubator and Sensory Services Lab: Improving Louisiana Business and Economic Potential

Ashley Gutierrez, Gaye Sandoz and Witoon Prinyawiwatkul

FOOD INCUBATOR

The LSU AgCenter Food Incubator is growing as fast as the companies that it assists. The food incubator is an Economic Development Program that has helped more than 50 tenants start their food businesses.



The current Food Incubator bottling facility can bottle up to **7,000 BOTTLES** per day. A new bottling facility, slated for completion at the end of 2019, will house a **\$1.2 MILLION** fully automatic bottling line capable of bottling **25,000 BOTTLES** a day. This will allow some larger incubator tenants to continue to process their products here.

The incubator has received a \$2.5 million grant and more than \$100,000 in grants from the Louisiana Economic Development and Louisiana Business Incubator Association program. We anticipate continued growth as we seek to expand our services to local and national food companies and restaurant chains.



The Food Incubator started an innovative technical service center that has assisted more than **400 COMPANIES** and restaurants with research and development, nutrition facts panel preparation, shelf life studies and creating processing authority letters required by the Louisiana Department of Health.



SENSORY SERVICES LAB

The LSU AgCenter Sensory Services lab is a state-of-the-art facility housed in the Animal and Food Sciences Laboratories Building. Since 2014, this lab has provided consultations, services and education to food and nonfood industries.

Services include sensory evaluation and consumer research on flavor, texture, appearance, acceptance or product liking of foods and ingredients. In the past five years, we have tested many food products, including coffee, hot sauce, steak, hot dogs and even king cake!



A food company may require sensory testing for a variety of different reasons. When developing a new product, a company may be interested in learning if consumers like the product. Or, the company may be switching one ingredient or flavor in the product and wants to make sure consumers cannot tell the difference. Ultimately, the **GOAL** of sensory science is to **REDUCE RISKS** in decision making about potential products.

TIGER TASTERS

In many cases, when a food company requires sensory testing, it has a particular target demographic for a particular product. In 2015, this need led to the launch of the Tiger Tasters program, which gathers consumers from around the Baton Rouge area who meet certain requirements specified by a company in order to participate in a taste test. This program has been wildly successful, with new consumers joining the program after each sensory study. In the future, the goal is to have about **3,000 CONSUMERS** in the database.



Ashley Gutierrez is a research and development food scientist and the manager for the Food Incubator and the Sensory Services Lab; Gaye Sandoz is the director of the Food Incubator; and Witoon Prinyawiwatkul holds the Horace J. Davis Endowed Professorship in Food Science and Technology.

Developing a Probiotics Delivery System for Improving Gut Health

Subramaniam Sathivel, Arranee Chotiko, Chen Liu, Emmanuel Kyereh, Bennett Dzandu and Mike Keenan

Probiotics are known for beneficial health effects, such as the improvement of gut microbial composition, protection against pathogenic bacteria and modulation of immune systems. Probiotics have been incorporated into various food products, including dairy products, such as yogurt, cheese and ice cream, and nondairy products, such as cereals and juices.

Attempting the introduction of probiotics via foods, however, may result in the probiotics not surviving during processing and passage through the gastrointestinal tract. Losses of probiotic cells could result from not only unfavorable conditions of food processing, such as heating, freezing, dehydration and acidification, but also digestive system environments that contain gastric fluids, bile salts and bile enzymes. Providing probiotics with a physical barrier can be an approach to resist harmful environments and improve probiotic viability and delivery through the stomach to the large intestine.

LSU AgCenter researchers have developed immobilization and encapsulation techniques that provide protection of probiotic bacteria cells and can be incorporated into delivery systems for probiotics to provide protection for bacteria cells. Dietary fibers may be used to immobilize bacterial cells throughout the fiber matrix. They provide surfaces for bacteria to attach onto, and they function as a protective agent against physiochemical changes because of adverse pH levels, temperature and bile.

The researchers have conducted studies on the extraction and use of rice bran fibers. The lab team has demonstrated that rice bran fiber acts as a protectant for probiotics during freezing and freeze drying, spray drying and storage. Probiotics immobilized in rice bran fibers were tested, and they had higher survival rates in gastrointestinal juice conditions compared to nonimmobilized probiotics without rice bran fiber.

TESTING ON RATS

The researchers have tested the immobilized probiotics on rice bran fiber in a rat model. They fed rats with the immobilized probiotics for a 31-day period. Feeding continued with a diet containing 10% rice bran fiber and no probiotics for an additional 11 days after the ingestion period. This preliminary study

showed that probiotics immobilized in rice bran fiber colonized in the gut. This is significant because there is good evidence that probiotics are beneficial for good health if taken daily. However, it would be more convenient, and thus preferable, if probiotics could colonize the gut, change the microbiota for better health, and not need to be taken repeatedly to maintain their effectiveness.

The researchers conducted another small pilot study with three rats per group to test whether immobilized probiotics would improve gut immunity. The immobilized probiotics reduced gut inflammation in rats. The researchers also found that some pathogen species present in the older rat gut had been reduced and that some beneficial bacteria increased in rats fed with the immobilized probiotics. This small study, although indicative, is not sufficient to be definitive. Therefore, the researchers are planning to conduct a larger, more robust preclinical study.

AgCenter researchers conducted another preliminary study with colonic mucosal alterations induced by *Citrobacter rodentium* (mice pathogen) infection in mice. The pathogen promotes intestinal inflammation, or colitis, in mice. Mice were infected with *Citrobacter rodentium* and then treated with probiotics for three days. After the probiotics treatment, the *C. rodentium* damage had been reduced. The researchers also investigated the in vitro and in vivo (mouse model) efficacy of probiotic bacteria incorporated in tomato juice for reducing colitis. They found that probiotics may modulate the gastrointestinal microbiota and immune response to help relieve complications of colitis or diarrhea.

In summary, the AgCenter research demonstrated that rice bran fibers could have potential as a delivery system for probiotics, and the delivery of the probiotics increased the population and diversity of beneficial bacteria in gut microbiota. The study indicated that the successful delivery of probiotics to the gut could improve gut health via immune system regulation and modulation of the microbiota.

Subramaniam Sathivel is a professor in the Department of Biological and Agricultural Engineering and the School of Nutrition and Food Sciences; Arranee Chotiko, Chen Liu, Emmanuel Kyereh and Bennett Dzandu are former graduate students working with Sathivel; and Mike Keenan is a professor in the School of Nutrition and Food Sciences.





LSU AgCenter researchers have incorporated probiotics into rice bran. Sample No. 1 includes the strain *Pediococcus acidilactici* RS2-10, and No. 3 includes the strain *Lactococcus lactis* subsp. *lactis* ATCC 11454. Photo by Olivia McClure

Insects As New Food Sources

Ryan Ardoin, Yupeng Gao, Cristhiam Gurdian and Witoon Prinyawiwatkul

With the world's population expected to reach 9 billion people by the year 2050, LSU AgCenter food scientists are working to address the challenge of ensuring global food security and sustainability. Finding new food sources may be a key because production methods seem unsustainable. One potential solution being evaluated at the LSU School of Nutrition and Food Sciences is edible insects as a food source for humans, a concept called "entomophagy." The AgCenter scientists are testing recipes using protein from bugs — specifically crickets.

While edible insects are part of many traditional Eastern diets and are consumed by around 2 billion people worldwide, this food source is yet to be widely accepted in Western countries. One of the most common concerns people have about eating insects is unfamiliarity. Some people have an extreme dislike to anything unfamiliar, a condition called neophobia, while others find insects unappealing and still others find them outright disgusting.

The interest in this food source continues, however, because insects are safe to eat — although if people have a shellfish allergy they should avoid eating crickets — and are packed with high quality protein and other nutrients. In fact, the cricket flour being used in School of Nutrition and Food Sciences kitchens contains about 70% protein, which is comparable to whey protein concentrates on the market. But the most important reason for testing insect foods is the benefit of sustainability.

The amount of land, water and feed required to produce each pound of edible cricket is only a fraction of what is needed to get the same amount of chicken, pork or beef. To illustrate this point, consider this: The same 100 gallons

of water necessary to product 6 grams of beef or 19 grams of chicken would yield 71 grams of cricket. Additionally, compared to traditional livestock, crickets require minimal space for growth and emit negligible amounts of greenhouse gasses. This is significant because approximately 80% of agricultural land in the world is used as pasture for grazing, feed and fodder, and cattle are major contributors to global greenhouse gas emissions.

The first step to making entomophagy more approachable is understanding consumer perceptions. To figure out which insect-containing foods people might be willing to try, AgCenter scientists surveyed consumers and found that topping the list were protein bars and shakes, chips and baked goods. The scientists found that people who are ready to consume crickets are high in "sensation seeking" emotions, which include feeling adventurous, energetic and interested. In an AgCenter study in which consumers evaluated brownies made with cricket protein, the results demonstrated a positive effect on product acceptance after informing consumers about the benefits of entomophagy.

So far, the AgCenter team has developed tortilla chips, chocolate chip cookies, brownies and beer bread all formulated with cricket protein. Some commercial cricket products are already on the grocery store shelf, such as protein bars and chips. As research continues and the U.S. market for edible insects becomes better understood, a wider range of foods made with these six-legged protein providers will be available.

Ryan Ardoin, Yupeng Gao and Cristhiam Gurdian are doctoral students under Witoon Prinyawiwatkul, who holds the Horace J. Davis Endowed Professorship in Food Science and Technology.



Ingredients in the cricket chips. Photo courtesy of LSU



Students in the School of Nutrition and Food Sciences created a new product: A chip with cricket protein. They administered a taste test with about 75 people and designed the packaging for this high-protein snack. Photo courtesy of LSU



Doctoral students, left to right, Karuna Kharel from Nepal, Katheryn Parraga Estrada from Ecuador and Cristhiam Guardian Curran from Nicaragua were among the scientists in the School of Nutrition and Food Sciences who developed the cricket protein chip. Photo courtesy of LSU



Cricket chips. Photo courtesy of LSU

Strategies on Salt Reduction

Ryan Ardoin, Jose Alonso, Pitchayapat Chonpracha and Witoon Prinyawiwatkul

Salt makes our food taste good, but excessive sodium intake, most of which is in the form of table salt (sodium chloride), is a major contributor to high blood pressure and strokes.

In the U.S., the average daily sodium intake is more than 3,400 milligrams (equivalent to 8.5 grams of salt), while the recommended intake is less than 2,300 milligrams sodium or 5.8 grams of salt per day, according to the U.S. Department of Agriculture. The salt we add to our food at the dinner table is not the problem. Rather, it is the “hidden” salt that is already in the foods we buy at the grocery store or eat in restaurants. Because of this, sodium has been called the “silent killer.” More than 40% comes from 10 types of foods, the top five being bread and rolls, cold cuts and cured meats, pizza, fresh and processed poultry, and soups.

LSU AgCenter researchers have been testing strategies for reducing sodium, but removing salt from food is not as simple as it may seem. Salt is a natural flavor enhancer and is the most-used food additive in the world. Perhaps most important, consumers have come to expect the salty taste associated with their favorite foods. So how can food companies make low-sodium products that people will still want to eat? Researchers in the AgCenter Sensory Services Lab use sensory science as a tool to explore answers to this question, using chemical, cognitive and food structure modification approaches to reduce sodium in foods.

One strategy, based on a phenomenon known as multisensory perception, is to get other senses, such as sight and smell, involved in the tasting experience. In this cognitive approach, consumers may use color, for example, to recall past experiences to determine how a food should taste. In a study with low-sodium barbecue sauces, research demonstrated that consumers expected darker-colored barbecue sauces to be saltier than lighter-colored ones, and these expectations influenced actual perceptions of salty taste. Other research found similar results with chicken soup. Seeing a more intense brown color generated higher saltiness ratings from consumers when the

chemical difference was not there. Researchers also have shown the aroma of tasteless soy sauce can enhance the perception of salty taste.

Another chemical-related approach uses so-called “salt substitutes” to reduce sodium in food. One such ingredient, potassium chloride, can deliver salty taste without the sodium. The problem with potassium chloride is its bitter and metallic aftertaste. To counter this, researchers combined potassium chloride with a bitterness blocker to coat roasted peanuts. They were able to replace up to 90% of the sodium chloride on low-sodium roasted peanuts with potassium chloride without compromising product acceptance. A health benefit statement regarding sodium reduction significantly improved consumer liking and purchase intent of the peanuts.

In another study, sensory optimisation with cheddar cheese used a salt, salt substitute and bitterness blocker mixture. An acceptable low-sodium cheddar cheese was obtained by using up to 60% potassium chloride in the mixture.

Altering the structure of foods can also affect taste perception. Scientists used a technique called foam-mat drying to decrease the density and size of commercial salt crystals. These smaller particles, in combination with soy sauce aroma, increased the perception of saltiness in roasted peanuts using slightly less sodium. By increasing the level of oil in emulsions (mayonnaise and salad dressings), reduced levels of sodium chloride and potassium chloride could still be perceived as saltier.

Overall, about 2,000 consumers have participated in sodium reduction research at the Sensory Services Lab. This area of study is important as sodium overconsumption presents an urgent public health concern. By exploring innovative solutions to this problem, AgCenter researchers have shed light on potential strategies to effectively lower dietary sodium without compromising taste.

Ryan Ardoin is a graduate student, Jose Alonso and Pitchayapat Chonpracha are former graduate students, and Witoon Prinyawiwatkul is the Horace J. Davis Endowed Professor in Food Science in the School of Nutrition and Food Sciences.



■ Consumers taste food under different lighting at the LSU AgCenter Sensory Services Lab, where researchers explore the influence of color on salty taste.

Photo by Olivia McClure



Improving Irrigation Water Safety for Strawberries Using Surfactant-Modified Zeolite Filtration

Jose L. Brandao Delgado, Kathryn K. Fontenot, Achyut Adhikari and Marlene Janes

The Louisiana strawberry industry, which contributed \$13.6 million to the state's economy in 2017, according to the LSU AgCenter Ag Summary, is one of the most popular industries in the state. This industry now faces new regulations with the introduction of the Food Safety Modernization Act Produce Safety Rule that requires farmers to comply with higher microbial water quality standards than before. This rule aims to guarantee that the water used for pre- and post-harvest activities with produce should be of adequate sanitary quality. To address this new regulation for farmers who use surface water, LSU AgCenter researchers developed a new filtration system.

The new method uses a surfactant-modified zeolite, an aluminum-silicate mineral. The modified zeolite allows bacteria to attach to the surface, and the surfactant kills the bacteria. The modification is carried out by heating a mix of zeolite with a surfactant and then drying it.

To test the surfactant-modified zeolite's ability to remove bacteria from irrigation water, a field test was conducted at the LSU AgCenter Botanic Gardens at Burden in Baton Rouge.

The treatments were a control with no filtration system, a sand filtration system using agricultural sand and a sand filtration system with surfactant-modified zeolite. Surface irrigation water inoculated with generic *E. coli* was passed through a filter filled with 50 pounds of sand or through a surfactant-modified zeolite filter system composed of two filters, one with 50 pounds of sand and the other with 25 pounds of surfactant-modified zeolite. The treated water was used to irrigate strawberries.

Once a month the water was spiked with the generic *E. coli* during the harvesting season of February, March and April for two years. Water samples were collected before and after each monthly treatment and tested for generic *E. coli*. Three samples were taken at each sampling point. Fruit samples were harvested when matured and tested for generic *E. coli* levels the first year.

The surfactant-modified zeolite filtration system significantly reduced the *E. coli* in the pond irrigation water compared to the control and sand treatment (Figure 1). The initial generic *E. coli* counts inoculated into the pond water were

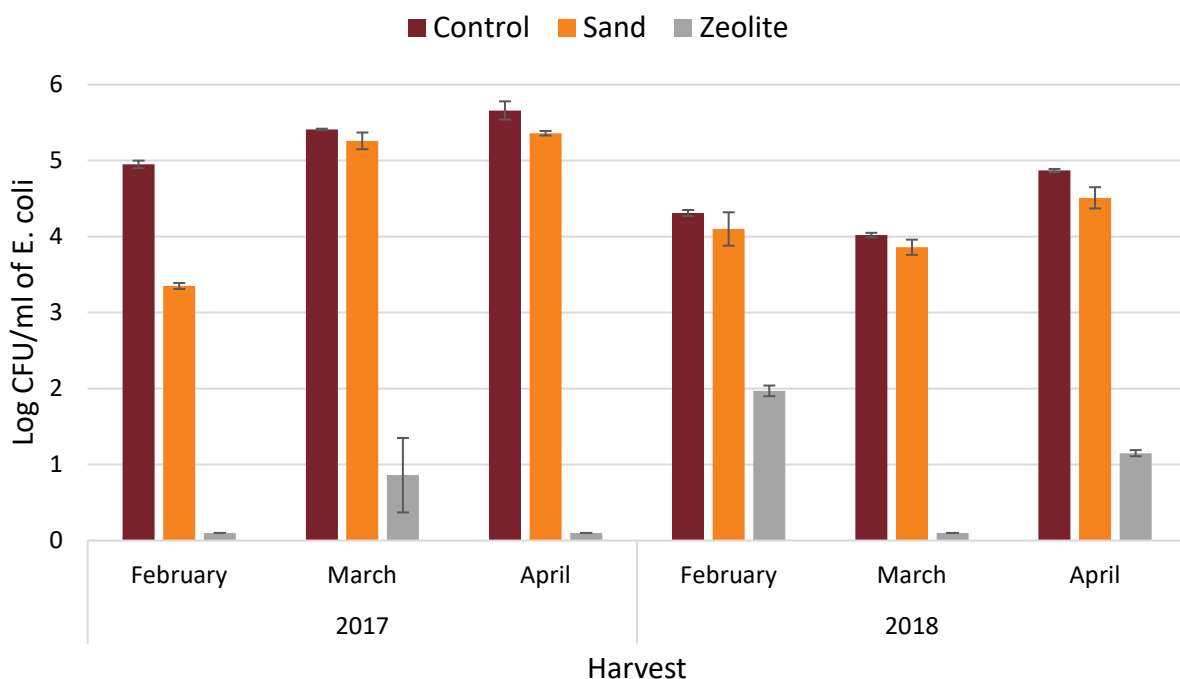


Figure 1. *E. coli* counts of inoculated pond water after filtered through sand or surfactant-modified zeolite during field testing on strawberry plants.

about 5 Log CFU *E. coli* counts per milliliter of irrigation water, and after filtration through the surfactant-modified zeolite filtration system, the *E. coli* counts ranged from 1.31 Log CFU *E. coli* counts per milliliter of irrigation water to nondetectable levels over the two-year growing season. Generic *E. coli* counts for the inoculated irrigation water filtered through the sand were not significantly different from the control. After irrigation with the surfactant-modified, zeolite-treated pond water, *E. coli* counts on the strawberries were not significantly different from the control.

LSU AgCenter researchers developed a surfactant-modified zeolite filter system capable of reducing the risk associated with foodborne pathogens from irrigation water. Currently, most growers do not treat their surface irrigation water. The results from the on-farm study will provide growers with information to assess the potential benefits of using the surfactant-modified zeolite filtration system for pathogen risk reduction and comply with the proposed FSMA produce safety rule agricultural water requirements.

Jose L. Brandao Delgado is a former graduate student in the School of Nutrition and Food Sciences; Kathryn K. Fontenot is an associate professor and extension specialist in the School of Plant, Environmental, and Soil Sciences; Achyut Adhikari is an assistant professor and Marlene Janes is a professor in the School of Nutrition and Food Sciences.

Harnessing Health Benefits of Tart Cherries

Jack Losso, Johana Coronel, Diana Coulon, Michael Keenan and Frank Greenway

The tart cherry (*Prunus cerasus*) has been found to be healthful not only as a food and its juice as a beverage but also as a dietary supplement for the treatment of inflammatory diseases. The Montmorency tart cherry is the most commonly grown cherry and the variety most widely used. These cherries are low-calorie and sources of vitamins C and A, carotenoids and anthocyanins as well as melatonin and tryptophan.

LSU AgCenter scientists are conducting research on how cherries can improve several health conditions. A few clinical trials have reported health benefits of cherries.

SLEEP: Insufficient sleep affects immune and hormone systems and increases the risk of inflammatory diseases, including obesity, high blood pressure, diabetes, cardiovascular disease, atherosclerosis, depression and cognitive dysfunction. Individuals with these diseases have difficulty sleeping. Sleeping pills in contrast to cherry juice improve sleep with the sedation associated with falls in the elderly. Two servings of cherry juice, one in the morning and one in the afternoon for two weeks, given to a group of adults over 50 years old (N=8) with insomnia, increased sleep duration by a mean of 84 minutes and improved quality of sleep. Cherry juice protects tryptophan from breakdown by the gastrointestinal enzyme indoleamine 2,3-dioxygenase and enhances the secretion of serotonin. This study did not include individuals with diabetes because one serving of cherry juice contains 36 grams of sugar. Two servings of the juice, given to adults (N=10) with sleep apnea, improved the biomarkers of inflammation including C-reactive protein and neopterin.

INFLAMMATORY BOWEL DISEASE: Chronic inflammation of the digestive tract involves two main types, ulcerative colitis and Crohn's disease. One or two servings of whole cherries given as a smoothie to rats with ulcerative colitis improved the disease activity index and inhibited the major biomarkers of inflammation. Human trials with tart cherries are yet to be conducted.

Although many health benefits of cherry are known, there is more to learn, and larger and longer follow-up studies are needed to confirm identified health benefits of cherries.

Jack Losso, is a professor in the School of Nutrition and Food Sciences; Johana Coronel, a graduate student at the University of Illinois at Urbana-Champaign, Illinois; Diana Coulon is an instructor in the LSU AgCenter Biotechnology Laboratory; Michael Keenan is a professor in the School of Nutrition and Food Sciences; and Frank Greenway is an M.D. and professor in the outpatient clinic at the Pennington Biomedical Research Center.



Photo by Leif Kurth, <https://www.flickr.com/photos/152376767@N03/35211992024>

Evolution of a Healthy Lifestyle: Small Changes – Healthy Habits – Lasting Behaviors

Elizabeth Gollub and Sandra May

A healthy lifestyle doesn't just happen. It requires effort, attention and time to evolve and take root. There is a new emphasis within the LSU AgCenter School of Nutrition and Food Sciences on the value and effectiveness of small changes and healthy habits as a way to realize and normalize healthy eating and physical activity. Extension nutrition agents are working within Louisiana communities to provide education and skills to Louisianians and to guide their transition to a healthy lifestyle.

WHAT IS A HEALTHY LIFESTYLE?

In general, a healthy lifestyle is a way of living that promotes a sense of well-being, reduces risk of preventable diseases and increases life expectancy. A healthy diet and ample physical activity are two of five areas — along with healthy body weight, not smoking and moderate alcohol consumption — that have the greatest impact on health and longevity.

WHY IS THIS PROGRAM NEEDED?

More than 35% of Louisiana's adults are obese and another 34% are overweight. In fact, most American adults are overweight such that being overweight seems normal. Obesity and overweight are major risk factors for diabetes, hypertension and other chronic diseases and conditions. Being obese or overweight also affects quality of life and well-being. There is a growing interest in developing healthier eating and physical activity habits.

FLAVORS OF HEALTH

Flavors of Health is an LSU AgCenter community nutrition and health education program led by a core group of 10

nutrition agents, most of whom have received Health Coach Certification training to prepare for this program. These agents provide expertise on a wide variety of topics that support healthy eating, including how to set realistic goals, make small changes in daily behaviors, transform healthy behaviors into healthy habits and select healthful foods. Flavors of Health teaches basic cooking skills and strategies to increase exercise and physical activity. It also provides information on healthful eating patterns and on nutrients, processed foods, weight management, chronic disease prevention and other food and nutrition issues.

Flavors of Health is launching a new Small Changes/Healthy Habits curriculum designed to help Louisiana adults establish healthier eating and physical activity habits through small changes in their food and fitness-related behaviors. Beginning in fall 2019, all 10 agents will offer this practical, four-session, hands-on curriculum in their parishes.

Flavors of Health and the new Small Changes/Healthy Habits curriculum will be good for Louisiana. After all, healthy eating and physical activity habits are cornerstones of a healthy lifestyle. People with a healthier lifestyle are healthier people. Healthier people foster healthier communities. It takes time to establish new habits. It begins with small changes. That's the evolution of a healthy lifestyle.

Elizabeth Gollub is an assistant professor in the School of Nutrition and Food Sciences, and Sandra May is an extension associate and curriculum coordinator.

Acknowledgements Creating the Small Changes/Healthy Habits curriculum has been a team effort that includes Abigail McAlister, nutrition agent in the Northwest Region; Becky Gautreaux and Mandy Armentor, nutrition agents in the Southwest Region; and Quincy Vidrine, nutrition agent in the Central Region, Elizabeth Gollub and Sandra May.

Alligator Byproducts: A Reservoir of Hyaluronic Acid for Biomedical and Cosmetic Applications

Jack Losso and Jose Daniel Estrada-Andino

Hyaluronic acid was first obtained from the combs of roosters to use in cosmetics and medical treatments. Because of supply and demand, other sources, including microbial fermentations, were developed to obtain hyaluronic acid. LSU AgCenter researchers have identified for the first time the presence of high levels of hyaluronic acid in different body parts of the alligator (*Alligator Mississippiensis*). The levels are so high that alligators can be considered as a reservoir of hyaluronic acid. AgCenter researchers analyzed the alligator back strap, eye, feet and carcass for hyaluronic content. The back strap was the animal part with the highest levels, followed by the feet and eyeball. These results are equivalent to about 0.73 tons per year in Louisiana.

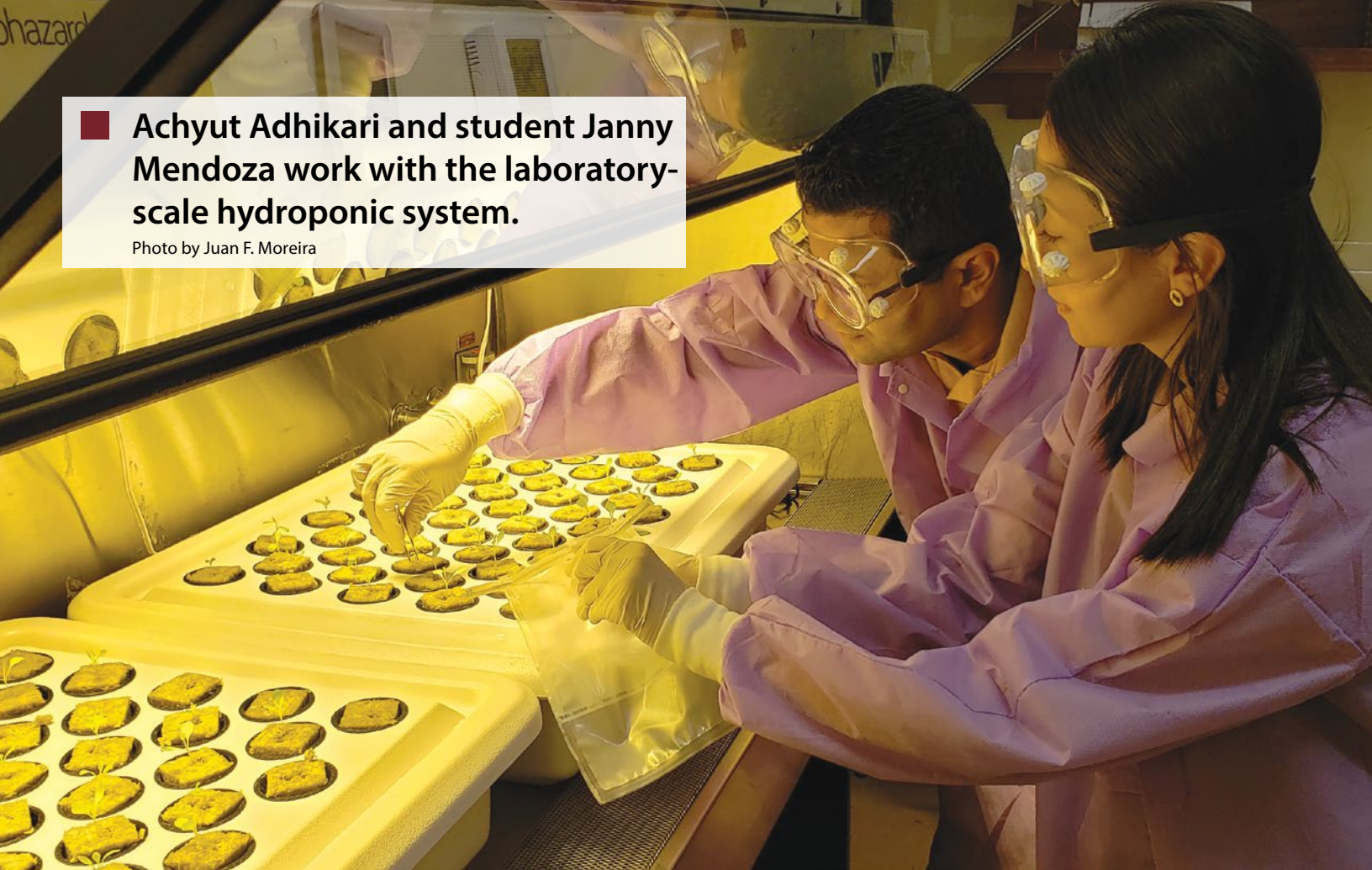
Cystic fibrosis is a genetic disorder with a median survival age of 40.7 years. Chronic airway inflammation and dehydration are critical features of cystic fibrosis. Hyaluronic acid has a plethora of size and structure-dependent biological functions including hydration and regulation of inflammation.

AgCenter studies indicate that hyaluronic acid has the potential to regulate the expression of genes that may aid in recovering the protease/anti-protease balance, reducing inflammation, and regulating airway surface liquid osmotic homeostasis. Alligator hyaluronic acid may aid in the treatment of other inflammatory conditions, such as wound healing and arthritis in humans and animals.

Hyaluronic acid from alligators may one day find its applications in cosmetics. Work is in progress to unravel the potentials of crocodilian hyaluronic acid.

Jack Losso is a professor in the School of Nutrition and Food Sciences, and Jose Daniel Estrada-Andino is a senior research scientist at General Mills, Minneapolis, Minnesota.





Achyut Adhikari and student Janny Mendoza work with the laboratory-scale hydroponic system.

Photo by Juan F. Moreira

Managing Food Safety Risk with Hydroponic Systems

Janny Mendoza and Achyut Adhikari

Hydroponic systems are a method to grow crops in which water-soluble fertilizers in solution without soil are used to provide nutrients to plants. Several specialty crops such as lettuce, cucumbers, spinach, strawberries, beans and tomatoes are popular in hydroponic production. Hydroponic systems in greenhouses or indoors minimize the potential risk of contamination from environmental factors that are difficult to control in the soil culture of traditional farming systems.

Hydroponic vegetable production in Louisiana is a growing and diverse industry. Operations report revenues ranging from a minimum of \$6.67 per square foot to \$42.86 per square foot, averaging at around \$21.15 per square foot. This, together with high productivity and the increasing demand for fresh, locally grown produce, has increased the popularity of hydroponic vegetable production systems among Louisiana producers.

Water is important in a hydroponic system. Hydroponic systems use less water (4 gallons per square foot per year) than other vegetable production systems, such as aquaponics (10 gallons per square foot per year) and soil-based production (8 gallons per square foot per year). However, recirculating fertilized water may provide favorable conditions for the growth of pathogenic microorganisms because of the available nutrients for growth and toxin formation. Currently several methods for treating the water include chlorine, ozone, filtration and ultraviolet (UV) treatment, but not all are validated for a hydroponic system. In a hydroponic system, technologies need to maintain the levels of beneficial microorganisms to improve the quality and productivity of the crops but should reduce the incidence of pathogenic bacteria.

Most hydroponic farms in Louisiana are small or mid-sized, and the farmers have limited resources and cannot risk the loss from a foodborne disease outbreak. While no foodborne



Fresh produce grown in a hydroponic system. Photo by Achyut Adhikari

disease has been traced back to hydroponically grown fresh produce, such an outbreak could economically devastate the industry through loss of income due to recalls, loss of consumer confidence and liability issues, all leading to loss of ability to procure production loans.

The LSU AgCenter food safety team is working on understanding the fate of pathogens in a hydroponic system and on developing control strategies to mitigate foodborne hazards. The team conducted a study to examine the effect of pH of the hydroponic fertilizer solutions on the growth and survival of *Listeria monocytogenes*. Lettuce, strawberry and tomato fertilizer solutions were dissolved in distilled water adjusted for electrical conductivity and pH. The fertilizer solutions were inoculated with four strains of *L. monocytogenes*, and their growth was examined at zero, 6, 18, 24, 48 and 72 hours at 70 degrees Fahrenheit. The research indicated that the fertilizer solutions are favorable for the growth of bacterial pathogens;

however, the growth could significantly be reduced if the pH is maintained at 5. The tomato fertilizer solution was not favorable for the growth of pathogens at the tested pH range. Currently, work is focusing on understanding the interaction of bacterial pathogens with lettuce, strawberries and tomatoes in a laboratory-scale hydroponic system and identifying methods to minimize the risk of contamination.

The outcomes of this project will help build the knowledge of food safety risk associated with hydroponic systems and optimize disinfection techniques for fertilizer solutions. Appropriate tools and resources will be identified to enable hydroponic producers to implement risk mitigation techniques. Timely development of good agriculture practices for hydroponic systems will establish Louisiana growers at the forefront of hydroponic farming in the United States.

Janny Mendoza is a graduate student and Achyut Adhikari is an assistant professor in the School of Nutrition and Food Sciences.

Stable on My Table

Foods for Health and Convenience

Louise Wicker

Imagine a quick gumbo that does not need refrigeration and can be heated in the microwave for a delicious meal in a few minutes.

Imagine a sweet potato dish as an after-school snack, a naturally sweet, fiber-rich treat full of vitamin C and vitamin A that can be a replacement for vanilla- and chocolate-flavored pudding cups.

Imagine Louisiana Gulf Coast shrimp as part of a lunch kit or a high protein snack and stored in your book bag.

Imagine pre-cooked rice ready for the microwave to go with pre-cooked beans spiced to Cajun perfection for a healthy beans and rice meal that is ready in minutes.

These are examples of shelf-stable foods preserved only with heat and pressure that can be kept for months or longer in the pantry. Nutritious, tasty and easy to prepare, they are packaged in cans, glass, rigid plastic or flexible pouches. The technology is not new, but it is continuously improving.

LSU AgCenter researchers are studying shelf-stable foods that help consumers get wholesome, delicious meals on the

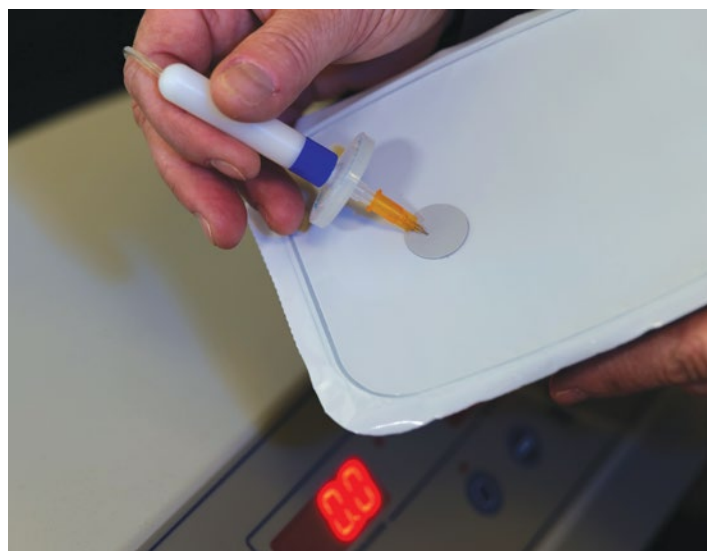
table in minutes with minimal preparation time. The AgCenter food scientists are using technology that applies heat and pressure in a controlled way to kill pathogens and spoilage organisms but retains nutrients, flavor and texture. Their laboratory includes equipment called the Allpax 2402 SHAKA research and development retort, which works something like a large, commercial InstaPot.

The food science team has garnered the interest of the thermal process and packaging industries and others interested in food security and food sustainability. Interest in shelf-stable foods is driven not only by the need for food security after natural disasters but also by interest in more sustainable food production, processing and distribution. Choices of preservation and packaging methods will provide more sustainable food choices in the future.

Louise Wicker is a professor in the School of Nutrition and Food Sciences.



A package of food is sealed using the Control GMC PL200 package sealer. This is the beginning of a research process testing ways to create shelf-stable foods. Photo by Randy LaBauve



Packages are probed to determine the headspace analysis for oxygen. Too much oxygen in the package could shorten the shelf life. Photo by Randy LaBauve



■ Sharon Hymel, project coordinator, loads package platens into the Allpax 2402 SHAKA research and development retort to create shelf-stable foods.

Photo by Randy LaBauve

Strengthening the Last Line of Defense for Foodborne Illness

Wenqing Xu

We live in a society where we covet a multitude of things. Sometimes, often unconsciously, our desires oppose one another. Consumer needs that pertain to food are no exception. We want to revisit our ancestors' diet and consume more raw food. At the same time, we want our raw food to be as safe as fully processed foods. We enjoy the convenience and diversity provided by a global food supply, but we fear the emerging food safety issues because of diverse origins of food and longer transportation times. We want to eliminate additives and preservatives in our food, yet we require a longer shelf life so mail-order foods traveling across the country arrive as if they were processed locally.

Consumers want one thing while demanding the opposite. These opposing demands generate tremendous challenges for consumer food safety education. Consumers blame the food industry or government for lacking better regulations or practices to provide safer foods while we overlook personal responsibility as the last defense

line for foodborne illness. Individuals must pay attention to food recalls, avoid time-temperature abuse, prevent cross-contamination and keep good personal hygiene when handling food.

The LSU AgCenter consumer food safety program is designed to balance consumers' opposing needs. Without balance, knowledge cannot be conveyed effectively for the end user to retain or lead to a positive change in behavior. This balance is deeply rooted in all research and extension projects. Some of them are:

- Collaborating with Woman's Hospital in Baton Rouge to offer food safety education for pregnant women. While acknowledging the discomfort that moms-to-be go through with changes in appetites during pregnancy, AgCenter educators are on board to suggest avoiding high-risk food and promote better food safety practices.
- Collaborating with Our Lady of the Lake Regional Medical Center and other cancer treatment sites to pro-

mote patient health and satisfaction while addressing food safety practices to reduce their exposure to foodborne illnesses.

- Training volunteers who serve their communities after natural disasters by focusing on the differences between cooking for an individual family and preparing food for 300-plus people.
- Working with summer feeding sites that serve children to address the challenge of serving nutritionally balanced and safe meals on tight budgets. Programs consider each individual situation to enhance compliance with food safety practices.
- Teaching people that cooking to the safe temperature does not sacrifice food quality.

Wenqing Xu, assistant professor, is the consumer food safety specialist and faculty liaison for internships in the School of Nutrition and Food Sciences.

The Value of Internships

Wenqing Xu

Internships are valuable to students in helping them connect their classroom learning experiences with the real world and, most importantly, in helping them find jobs when they graduate. The School of Nutrition and Food Sciences, through the LSU College of Agriculture, has stepped up its efforts to provide internships for its students. Wenqing Xu, assistant professor, is in charge of coordinating the school's internships. Here is her first-person account of the program in action:

It was a typical hot August day in Louisiana. Even before dawn at 5 a.m., the air felt sticky. We took a van and departed from the LSU AgCenter, heading toward Summit, Mississippi. The director of the internship program for the College of Agriculture, another faculty member and I were on

our way to Sanderson Farms for a day of summer intern presentations and a lunch banquet. It was a three-hour drive, and I was nervous during the entire trip. Two of my undergraduate students participated in the summer intern program and had been with the company for 12 weeks. What made me nervous was that neither of them was outspoken in class and one was even a little shy. It is not easy to present in front of a company leadership team, about 80 fellow interns from 16 surrounding universities and colleges, and a dozen faculty members from those institutions.

The students went one-by-one on stage to present what they learned during the internship. Some students had PowerPoint presentations. Some read from prepared notes, while others seemed uncomfortable in the moment and had diffi-

culty addressing so many people. Guest faculty from the students' home universities showed support with shouts of encouragement. During this time I sat in anticipation with my fingers crossed, hoping my students would deliver a solid presentation, which later turned out to be worrying for nothing.

Both students walked to the podium with contagious confidence. Slides were professionally done, and the speeches were intriguing. They talked about their experience at the food processing plant where they learned how to apply classroom knowledge to the real world. They talked about the communication skills they learned that enabled them to work with supervisors and fellow employees. They talked about one or two moments when they had to make decisions, which gave them a taste of leadership. I was completely blown away. They demonstrated everything we taught them in school: solid food science knowledge and processing techniques, clear and effective communication, being a team player and being a leader. Proud cannot describe how I felt at that moment. It was the internship experience that provided the opportunity to put what they have learned through higher education to practice and refine. They polished up their knowledge and skills to make them shine.

It was a beyond amazing feeling when the CEO of the company sought me out at the lunch banquet and told me how great these two students were. The company not only promised them job opportunities when they graduated, but also decided to offer LSU students housing support from now on to attract more "motivated students like these two girls to join the summer internship program." As you can imagine, my three-hour drive home was filled with happiness and pride.

Wenqing Xu, assistant professor, is the consumer food safety specialist and faculty liaison for internships in the School of Nutrition and Food Sciences.



Wenqing Xu, assistant professor and coordinator of internships in the School of Nutrition and Food Science, center, arranged the internships and attended the final presentations of these two students — Metabell Bowser, left, and Andanté Price — during the summer of 2017 internship at Sanderson Farms in Summit, Mississippi. Photo provided by Wenqing Xu

Weaving Real-world Experience with Higher Education Developing Skills Through Internship

Wenqing Xu

The School of Nutrition and Food Sciences offers a multidisciplinary and practical curriculum, training students in the quality, processing and safety of foods for the multibillion-dollar food industry and preparing them to help people improve their health and well-being. Intentionally and proactively weaving real-world experience with higher education greatly benefits students. The internship experience not only has proven to be a powerful career enhancer but also has a significant effect on subsequent academic performance.

In 2016, the school's internship program was re-energized and aligned to the expanding internship program offered through the College of Agriculture. To assess students' exposure to and decision-making about internships, a benchmark needs assessment was conducted. Results showed that 90% of students believed that an internship would be helpful for their future careers, and 65% planned to do an internship before graduation. Despite the optimistic data showing that students were on board with the internship program, only 22% were working or had worked as an intern.

Student motivation to take an internship was also evaluated. Results showed that 73% of the students are looking for private industry internship opportunities. Sixty-nine percent require the internship to be a paid opportunity while 23% would accept volunteer positions. Summer is the most preferred time of year for students to complete an internship, and most prefer the position to be close by.

In the past three years, the school and college have identified approximately 70 opportunities targeting nutrition and food sciences students, most of which were paid, private industry summer positions. The faculty liaison in the school worked relentlessly on sharing these resources with specific groups of students to enhance proper placement. During this process, communication was crucial. The challenge was how to get the right opportunities to the right students because so many other things on campus compete for their attention.

A multifaceted communication strategy was applied. Job descriptions were shared in nutrition and food science classes. For positions with specific duties, such as a food safety intern, the job descriptions were shared with faculty advisors and then passed to students with specific skill sets. Emails, flyers, Twitter and the Food Science Club Facebook page have all been used.

Since the school started the internship program, students as well as employers have provided feedback. Students demonstrated many good qualities, such as increasing knowledge and technical skills, clear and effective communication, being a team player and leadership. Some companies provided housing for the students; some offered full-time job opportunities, and some asked for more student interns. The program is ongoing.

Wenqing Xu, assistant professor, is the consumer food safety specialist and faculty liaison for internships in the School of Nutrition and Food Sciences.

Nutrition Education Program Celebrates 50 Years

Started during the War on Poverty, EFNEP endures

Johnny Morgan

The LSU AgCenter hosted events around Louisiana during the fall of 2019 to celebrate the 50th anniversary of the Expanded Food and Nutrition Education Program, commonly known as EFNEP.

The national program, which began as a pilot program in Alabama in 1968, and then was rolled out nationwide in 1969, has educated limited-resource families and youth in Louisiana to make healthy lifestyle changes that will lead to improved diets and nutritional well-being.

“ Through EFNEP’s hands-on approach, participants learn to make behavioral changes and improve the nutritional quality of meals for their families. –Sharman Charles ”

“Through EFNEP’s hands-on approach, participants learn to make behavioral changes and improve the nutritional quality of meals for their families,” said Sharman Charles, EFNEP program director with the AgCenter.

People who receive some type of governmental assistance or who are eligible for free or reduced-price school lunches are eligible to participate in EFNEP.

EFNEP is administered by the U.S. Department of Agriculture National Institute of Food and Agriculture. It is delivered to participants through the extension services of the nation’s 76 land-grant universities, including the AgCenter.

Since 1969, the program has reached more than 33 million low-income families and youth, Charles said.

AgCenter nutrition agent Bertina McGhee said EFNEP arose out of a societal concern for the millions of Americans who were facing poverty, hunger and food insecurity in the 1960s.

“Today, EFNEP is active in all 50 states, Guam, Puerto Rico, the Virgin Islands, Micronesia and American Samoa,” she said.

EFNEP focuses on limited-resource families with an emphasis on parents and other adult caregivers who have the primary responsibility for feeding young children. It also offers specialized programs for moms-to-be, new parents and youth between the ages of 5 and 19.

Through hard work and the tireless dedication of the EFNEP nutrition educators and local agents that supervise the program, more than 1,700 adults and 11,000 youth were enrolled and received a series of nutrition education lessons in 12 parishes throughout Louisiana in the current fiscal year.

Gina E. Eubanks, AgCenter associate vice president and program leader for food and nutrition, said the EFNEP pro-

gram is successful because of the “three P’s: partnership, program and people.”

At an anniversary celebration in Orleans Parish on Oct. 18, New Orleans City Councilwoman Cyndi Nguyen reflected on the partnership between EFNEP and VIET, a nonprofit organization focusing on Vietnamese residents in New Orleans East.

“When I started the nonprofit as a way of working with children, we were interested in improving our community, but our children were eating fried chicken and burgers, and I thought that was OK,” she said. “But by partnering with EFNEP, you showed us a better way, and you taught us how to prepare nutritional foods.”

Things have changed quite a bit since those early days of EFNEP, McGhee said.

Nutrition aides, as they were called during the early years, were hired part-time, working 24 hours per week.

“The wage for a part-time nutrition aide was \$1.88 per hour, according to Lillie Mae Stokes, one of the surviving Orleans EFNEP educators, who started in 1970 and was in attendance for this celebration,” McGhee said.

During that time, EFNEP nutrition aides had to live in the communities where they worked.

“Food demonstrations were conducted using commodity foods such as cheese, rice, oatmeal, flour, canned beef and pork,” she said. “The focus was on teaching families how to use what they had available to feed their family and stretching the food dollar.”

Those meetings were conducted in clients’ homes, while youth meetings were held after school in nutrition aides’ homes.

“ More than 1,700 adults and 11,000 youth were enrolled and received a series of nutrition education lessons in 12 parishes throughout Louisiana in the current fiscal year. ”

“At that time, there were about 10 part-time nutrition aides in Orleans Parish, and each was required to enroll 50 homemakers, as the EFNEP adult clients were called,” she said.

The celebration events around the state highlighted the program’s history and recognized former and current staff and community partners. Other locations where celebrations were held during September and October were Shreveport, Baton Rouge, Rayville and Oak Grove.

Johnny Morgan is a communications specialist with LSU AgCenter Communications.



Bertina McGhee, LSU AgCenter nutrition agent in Orleans Parish, who knows the history of EFNEP, said the program arose out of society concern for the millions of Americans who were facing poverty and hunger during the 1960s. Photo by Johnny Morgan



Sharman Charles, at right, is the EFNEP program director with the LSU AgCenter. She said the program focuses on limited-resource families with an emphasis on parents and other adult caregivers, who have responsibility for feeding young children. Photo by Johnny Morgan



New Orleans City Councilwoman Cyndi Nguyen reflected on the partnership between EFNEP and VIET, a nonprofit organization focusing on Vietnamese residents in New Orleans East, during a recognition ceremony in Orleans Parish. She said because of EFNEP, her community has been taught a better way of living by learning to prepare nutritional foods. Photo by Johnny Morgan

Inside:

The new model for teaching nutrition is to work with the entire community and determine changes to be made to make it easier for people to live a healthier lifestyle.

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Pasta made with high-protein navy bean flour and muffins made with a high-protein rice flour turned out to be acceptable to consumers.

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LSU AgCenter scientists are studying the effects of numerous health beneficial components, including antioxidants, probiotics and prebiotics, on key quality attributes of yogurt, cheese and ice cream.

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Internships prove valuable for the student, the company or agency they work for, and reflect well on the LSU AgCenter and the College of Agriculture.

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It's a matter of taste

LSU AgCenter Sensory Services Lab



LSUAgCenter.com

The LSU AgCenter Sensory Services Lab works with companies from around the world to improve the way consumers experience food. The lab's services include sensory evaluation and consumer research on the flavor, texture and appearance of foods and beverages as well as consumers' feelings and emotions.



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