

NEWSLETTER

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
THE FOOD PROCESSING CENTER



Department growth prompts move to Nebraska Innovation Campus

The Department of Food Science and Technology's move to Nebraska Innovation Campus will open the doors to new opportunities for researchers, faculty, students and the food industry. With the move into the Food Innovation Center at NIC, the department has gained double the available space for laboratories and classrooms than it had on East Campus – now totaling over 123,000 square feet. With a growing number of undergraduate and graduate students enrolled in the department, more space than ever is needed. The Food Innovation Center will give the department access to three new classrooms with a combined capacity of 220. Along with the large amount of classroom space, new audiovisual technology will allow instructors to teach in the classroom and online simultaneously.

"We're very lucky to have what we have here. There's no reason we can't have the best food science program in the country," said associate professor Devin Rose. "I'm really excited to be teaching here."

Faculty, undergraduate and graduate students now have access to new and improved laboratories, including a food product development and food chemistry laboratory. The food product

development laboratory has top-of-the-line appliances and work stations with individual gas ranges. The food chemistry lab can be used for both regular and advanced analysis.

In addition to new laboratory and classroom spaces, the Food Processing Center has moved into a new space in the Food Innovation Center. The Food Processing Center, established 32 years ago, helps entrepreneurs and small companies launch new food products. By filling the gap between basic research and applied research, the Center helps apply new discoveries in food science to actual food products on grocery store shelves. With the move to NIC, the Center will be able to increase its applied research capabilities and provide more workshops, short courses and online certificate programs for the university community and members of the food industry.

"The Center's skills and technical knowledge have progressed beyond providing basic support services. Now, we're doing bigger projects in applied research," said research associate professor Jayne Stratton. "We want to grow. We want to try to focus more on industry partnerships."



Greetings from the Department of Food Science and Technology and The Food Processing Center!

What an incredible year! We have crossed a historic milestone by moving to the Food Innovation Center at Nebraska Innovation Campus, the new home to the Department of Food Science and Technology and The Food Processing Center. I am so impressed by the flexibility and resilience of our team; our very successful move was completed in just 10 days, and 20 days later, our operation was running at 70% capacity.

The move itself was phenomenal. But, the reward is perhaps even greater. Now, we are thriving in perhaps the best facilities in the nation in food science and technology. And, not only do we enjoy the use of new facilities, but we also are able to leverage new services like the innovation clinical facility which we are managing in collaboration with the University of Nebraska Medical Center to conduct clinical studies that are expanding our understanding of our disciplines.

In fact, our move to the Food Innovation Center at Nebraska Innovation Campus is the culmination of so much recent positive momentum. For example, during the last seven years, our faculty roster has grown from 17 to 26, and we currently have three open positions in the search process stage. During the same period, the department's undergraduate enrollment has increased from 45 to 80 and graduate student enrollment has also blossomed - from 30 to 68. Our faculty has obtained \$11.8 million in grants

during the last five years. The Food Processing Center has grown with three new faculty members and four new pilot plants with more advanced processing equipment. The Food Allergy Research and Resource program has grown to 88 affiliated companies and expanded its services to industry with two additional faculty members dedicated to food allergen research.

Wait... there's more! In September, we welcomed the first freshman class (55 students) for the new 3+1 program with Northwest Agriculture and Forestry University (NWFU) in Yangling, China, and started the process of hiring faculty to fulfill the needs of this program. I enjoyed the opportunity to travel to China and welcomed the new students to the program, along with our partners at NWFU and their faculty members. The 3+1 program with NWFU is equivalent to our program at UNL. Here's how it works:

- 1st & 2nd Year - Students take classes at NWFU in China taught in English and Chinese.
- 3rd Year - UNL will send faculty to NWFU in China to teach the junior year.
- 4th Year - Students come to UNL to complete their senior year.

We could not do what we do without our outstanding faculty and staff. Three faculty have earned promotions in recent months.

UNL and NWFU partner in new food science program

The 3+1 program is a joint effort between the University of Nebraska-Lincoln Department of Food Science and Technology and Northwest A&F University - the second largest agriculture university in China. Students enrolled in the program will have the opportunity to learn from both NWFU and UNL faculty and travel to Lincoln to continue their studies. NWFU will follow the same program of study as UNL's Department of Food Science and Technology. For the first two years, NWFU students are taught in English. In their third year, UNL faculty will travel to China to teach. In their fourth year, NWFU students will travel to UNL to complete their degrees. With continued collaboration, UNL and NWFU will be able to educate new generation of food scientists, who in turn, will have the power to make significant contributions to the food industries in both China and the United States.

Rolando Flores, head of the Department of Food Science and Technology at UNL, and a team of other staff and faculty members visited NWFU September 21-23, 2015. President Qixin Sun, Vice President Jun Luo and members of the NWFU faculty welcomed the UNL delegation. In the past 16 years, NWFU has experienced a rapid development in its campus facilities, faculty numbers and student enrollment and profile. Sun reflected on UNL chancellor Harvey Perlman's many visits, which have established close collaboration between the universities. NWFU hopes that continued collaboration will encourage more professors from UNL to visit NWFU and reform and improve the university's teaching methods and quality.

Joe Baumert and Devin Rose both earned tenure and are now associate professors. Jayne Stratton advanced as a research associate professor - a significant milestone because it's the first time a faculty member in The Food Processing Center has been promoted to this rank. I'm proud that we've created that avenue for advancement for those in applied research.

Three new faculty members have joined us since our last newsletter in May. We welcome assistant professor Yue Zhang as our first physical chemist in the department. She is teaching about 1/3 of our food chemistry course and is developing a course titled Physical Chemistry in Foods. Research assistant professors Zhong (Jason) Zhang and Changmou Xu join The Food Processing Center, with focuses in Raman spectrometry and eggs (Zhang) and bioactive compounds (Xu). Their hires represent the expansion of opportunities for applied research we've created to work on more projects to benefit Nebraska agriculture.

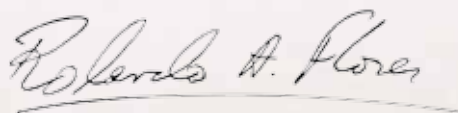
As thrilled as we are to work in our new facilities, we are also excited to invite you to see it for yourselves. Please watch for a date and time to be announced for a spring open house of the Food Innovation Center at Nebraska Innovation Campus. If you are unable to attend the open house, we invite you to visit us another time - please just contact Jill Gifford at gifford1@unl.edu to schedule your tour.

"This is an innovation of collaboration between two universities and also the first UNL international education program with China. Therefore, it is a big challenge for UNL," said Flores. "Nevertheless, UNL is ready to take this challenge and is committed to the success of the program."

At the meeting, the delegation from UNL shared information about the Food Science and Technology department and student life at UNL. They also discussed the 3+1 program in detail with officers from the NWAUFU Academic Affairs office, graduate school, and international center in an effort to carry out the new program. Fifty-five students are enrolled in the program and will be coming to UNL for their senior year in the fall of 2018.

Thank you for your support, and we hope to see you in 2016!

Best wishes,



Rolando A. Flores

*Professor and Head, Department of Food Science and Technology
Director, The Food Processing Center*



New faculty bring knowledge and experience to food science program

Yue Zhang, Zhong Zhang and **Changmou Xu** are among the newest members of the food science and technology faculty at UNL.

Yue Zhang, an assistant professor, received her bachelor's degree and Ph.D. from Wuhan University in China. After receiving her degrees, she completed her post doctoral research in food biophysics at the University of Tennessee.

Zhong (Jason) Zhang, a research assistant professor, received his bachelor's and master's degrees in food engineering from Jiangnan University and Ph.D. from the University of Missouri.

Changmou Xu, a research assistant professor, received his bachelor's degree in food Science and engineering from Jiangxi Agricultural University in China, master's degree in Food Biotechnology from China Agricultural University, Ph.D. in food science from the University of Florida and completed his post doctoral research in food science at the University of Florida.

What is the focus of your research?

Y. Zhang: My research is focused on the fabrication and characterization of food-grade delivery systems of bioactive food components and additives, as well as the molecular interactions of biopolymers with other food components.

J. Zhang: My research is mainly focused on three areas: design production processes using new processing methods to improve food safety and ingredient functionality, using membrane filtration to purify functional oligosaccharides and separate functional ingredients from various materials, and using nanotechnology and Raman to design fast analytical methods for the contaminants, bacteria, allergens in foods.

Xu: My research program focuses on three aspects: functional ingredients in foods and their applications in food products, advanced instrumental analysis and the application of these techniques to solve food science problems, and value-added product development from the by-products of agricultural commodities.

Why is your research important? How will it make a difference to the food industry and consumers?

Y. Zhang: It is becoming a hot point to apply nanotechnologies in food applications. My research will provide strategies to build better delivery systems which are vital to the development of future foods.



Zhong Zhang



Changmou Xu



Yue Zhang

J. Zhang: Our ultimate goal is to explore and adopt the new technologies to improve food quality and enhance food safety for our consumers. Our fast analytical methods also enable the real-time monitoring of food contaminants in plant, which means we can discover the contaminated food faster and take immediate actions for contaminated foods.

Xu: My research is dedicated to developing healthy and nutritional foods for the food industry and consumers, such as food products with higher bioavailability and nutritional value, longer shelf life, better flavors and safety. This work will not only increase the economic value of agricultural commodities for the stakeholder and reduce environment contamination, it will also provide consumers with healthy foods.

Do you teach? If so, what do you hope your students learn?

Y. Zhang: I teach the protein portion of food chemistry, and I will teach Physical Chemistry in Food next year. I hope students can gain interest in physical chemistry from the course. I hope they will use the theories they have learned in my class as the strategies to help them find the solutions for specific problems in the food industry, and to be successful in their future career.

J. Zhang: I am planning to teach a class about how to do sensory evaluation of dairy products. I hope the students can learn how to evaluate various types of dairy products, correctly identify the off-flavor and off-taste, and learn how the raw ingredients, production process and storage conditions effect the sensory properties of dairy products.

Xu: I don't teach since I just started my position. I will teach next year, and will be part of the "3+1" international education program between UNL and the Northwest Agriculture and Forestry University, China. I hope that students will master the course content, think critically, and use the knowledge for application and judgment decisions.

Congratulations to several Department faculty members receiving promotion and tenure honors

Joseph Baumert was promoted to Associate Professor and granted tenure. Baumert's research interests focus on food allergens: detection, determination of minimal eliciting doses, their digestive stability and processing's effects on them.

Devin Rose was promoted to Associate Professor and granted tenure. Rose's research is aimed at improving the quality and health-promoting properties of cereal grains and their products, with emphasis on whole grains and dietary fibers.

Jayne Stratton was promoted to Research Associate Professor. Stratton's research areas include food safety microbiology, rapid detection methods for pathogens and evaluation of interventions for the reduction of pathogens.



Joseph Baumert



Devin Rose



Jayne Stratton

Food Processing Center announces upcoming workshops

The Food Processing Center will be hosting two workshops in 2016 for professionals in the food science industry – a food microbiology workshop and an extrusion workshop.

March 22-24, the Food Processing Center will host a food microbiology workshop. The course will cover the basics of food safety and microbiological testing methods used in the food industry for individuals with no formal training in microbiology. The workshop will be conducted in a classroom and laboratory format with demonstrations of the newest rapid pathogen detection equipment. Topics discussed in the workshop will include the ecology of microorganisms and pathogens in foods, measures used to prevent their growth and the importance of using validated testing methods.

May 17-19, the Food Processing Center will host an extrusion workshop. Extruded products such as cereals, snacks, pastas and pet foods and treats are available in grocery stores worldwide. This introductory and hands-on course will allow participants to gain knowledge in extrusion theory and techniques. The course also includes pilot plant demonstrations. Experts from Wenger Manufacturing and XIM Group of Sabetha, Kansas will work with UNL faculty and staff to present the lectures and interactive sessions.

Early registration for both workshop is required due to limited space. For more information or to register for one of the workshops, contact Jill Gifford, 402-472-2819 or jgifford1@unl.edu.

fpc.unl.edu/training

Global trends signal “green” opportunities in lipid chemistry and processing

Ozan N. Ciftci

Global trends indicate that the food industry needs more natural healthy food ingredients and alternative green technologies. The emerging trend of “green” consumerism, which has negatively impacted the acceptability of foods containing artificial ingredients, as well as the increased prevalence of diet-related illnesses such as obesity, cardiovascular disease, and cancer, have led the food industry to prioritize the development of natural foods that utilize bioactives. However, many of these bioactives are water insoluble (lipophilic), meaning they have limited ability to function as food and beverage additives; they have limited water solubility, and result in poor absorption through gastrointestinal tract and limited bioavailability. In addition, many of these bioactives are chemically sensitive, prone to degradation when exposed to light, oxygen, and heat during processing and storage. Therefore, effectively including lipophilic bioactives in foods to develop health and wellness promoting foods is a major challenge for the food industry.

Our lab is working on the design and development of novel lipid-based bioactive delivery systems that can be used to develop health- and wellness-promoting foods and beverages. One challenge of working with lipids is the need for toxic organic solvents for many processes. My lab combines green chemistry and green technologies for “lipid particle formation” while eliminating toxic organic solvents and chemicals, decreasing

water consumption and eliminating waste generation. We have been developing novel green methods based on supercritical fluid technology for lipid-based particle formation to make inclusion of lipophilic bioactives in foods and beverages possible. We are using carbon dioxide as supercritical fluid because it is non-toxic, non-flammable, inexpensive and abundant. Also, it easily separates from the product without any residue, lipid oxidation is prevented, and high quality clean products can be obtained. Supercritical fluids are the fluids that are above their critical pressure and temperature on their phase diagram, and their properties are between those of liquids and gases. Supercritical CO₂ (SC-CO₂) is a miracle material for lipid processing. In our lab, we are using SC-CO₂ as solvent for lipid extraction, as antisolvent and atomizer for nanoparticle formation, as dryer for nanoporous material formation, and as expander for biocatalytic lipid modification reactions.

Most of the current focus in our lab is on lipid particle formation. We have two approaches for lipid particle formation to develop lipid-based bioactive delivery systems. First approach is forming hollow solid lipid nanospheres to develop natural food ingredients with nutraceutical, antimicrobial, and antioxidant properties that will make inclusion of lipophilic bioactives into foods and beverages possible and maximize product quality and health effects. We have developed a novel simple and green

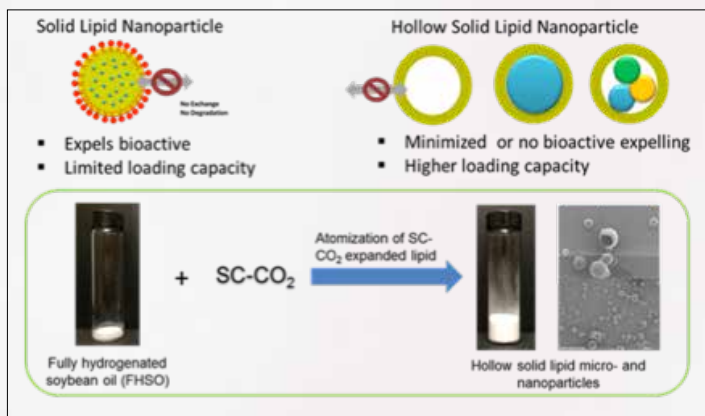


Fig. 1. Formation of hollow solid lipid nanospheres (nanoparticles) from fully hydrogenated soybean oil using supercritical fluid technology.

method based on rapid depressurization of CO_2 -expanded lipid phase to form hollow solid lipid nanospheres. Using these lipid nanospheres, we can deliver more bioactives because the hollow structure provides higher bioactive loading capacity, we can protect loaded bioactives better because solid lipid shell provides protection and also controlled release to the bioactive, and we can prepare beverages using lipophilic bioactives because the sedimentation and the phase separation is prevented due to nano size. This novel process allows us to control the size, shell thickness, and polymorphic form of the solid lipid nanospheres, meaning we can control some important properties, such as controlled release of the bioactive, melting point, and loading capacity, by only changing the processing conditions. We formed essential oil-loaded lipid nanoparticles to develop antimicrobial lipid particles than can be used as natural food preservatives; can be sprayed onto fresh produce to protect them from microbial decay; and can be used as natural feed ingredients for animals or natural pesticides when loaded with suitable bioactives.

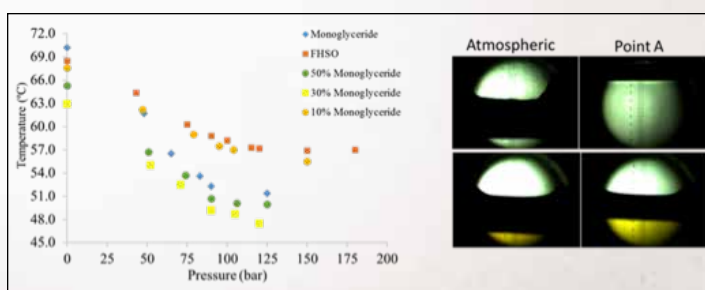


Fig. 2. Melting behavior and volumetric expansion of solid lipids in pressurized CO_2 .

We are also very interested in the fundamentals associated with the novel process development. We have shown that the melting point of the solid lipids decreases in the pressurized CO_2 . We are investigating the effect of partial glycerides, fatty acid type,

and the location of the fatty acid on the triacylglycerol molecule on the melting point depression in pressurized CO_2 . We use this new information to optimize our lipid particle formation process. The discovered melting point depression will help us reduce energy consumption and protect heat sensitive bioactives.

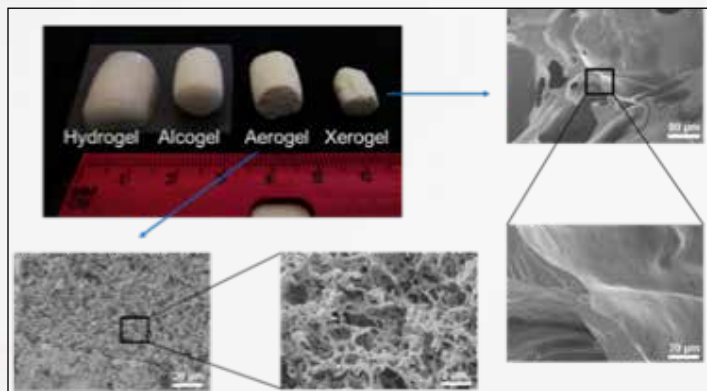


Fig. 3. Nanoporous starch aerogels developed to deliver bioactive lipid components.

Our second approach to deliver healthy lipids and minor lipid components such as phytosterols, tocopherols, and carotenoids is forming nanoporous aerogels using starch. We have successfully developed nanoporous starch aerogels with very high surface area using supercritical fluid drying. The average pore size of the aerogels is 18 nm, and the surface area of one gram of this material is around 60 m^2 . We use these aerogels to increase the solubility of water insoluble lipophilic bioactives and to protect the bioactives during storage. Large surface area provides improved solubility, and the nanoporous structure provides better protection from storage conditions and better bioavailability. We load the developed aerogels with several bioactives using our novel supercritical impregnation methods. These aerogels offer many possibilities in food industry, and we are very excited to explore them.

In addition to particle formation research, we do research on the extraction of omega-3 oils from alternative sources, separation of the minor lipid bioactives, and biocatalytic conversion of the lipids to improve their physicochemical properties such as oxidative stability, nutritional properties, and melting properties.

Lipid-based bioactive carrier systems are promising clean ingredients that can be used to develop healthy foods. Developed methods are green and simple; they can easily be scaled up and targets new opportunities in food industry. I would like to thank my graduate students Junsi Yang (solid lipid nanosphere research), Ali Ubeyitogullari (nanoporous aerogel research), and Henok Belayneh (omega-3 oil extraction and conversion research) for their great contributions.

Gilbreth, UNL '98, '03, leads food safety efforts for WhiteWave Foods



Stefanie Gilbreth

The job: protect consumers and in doing so, protect your brand. In a world in which hardly a month goes by without a headline related to foodborne issues, directing food safety at a leading packaged food and beverage company is a tall task.

Stefanie Gilbreth, who earned a B.S. in biology and Ph.D. in food science and technology at UNL, serves in that role for Colorado-based WhiteWave Foods, parent company of well-known brands Silk®, International Delight®, Horizon Organic® and Earthbound Farm®. On the heels of the most sweeping reform of our food safety laws in the U.S. in 70 years, Gilbreth's task has escalated.

"My team has been very focused on getting our programs up-to-speed to meet the FDA's Food Safety Modernization Act (FSMA) regulations," Gilbreth said. "We've approved 33 food safety

plans in about a 2-month timeframe since the regulation got published. Ultimately, our goal is to operate our facilities and programs at a level higher than the FDA's FSMA regulations."

The work isn't over. Still more documentation and updated programs will be needed, and then there are also international regulations for the countries with WhiteWave Foods operations. But, Gilbreth is proud of what her team has accomplished in the last quarter.

The job isn't entirely devoted to meeting regulations, though. Gilbreth said the food safety group regularly works with R&D to provide subject-matter expertise on new products, including the recent introduction to market of Horizon Organic fruit snacks: coconut chips and apple crunchers.

Support those with a hunger for learning.

Young and intelligent with an insatiable appetite for knowledge, the students in the Food Science and Technology program are working hard to improve all things related to food. Your donation will help them receive the scholarships they need to make it happen. Make a gift that feeds young minds.

Contact Josh Egley at josh.egley@nufoundation.org or 402-458-1202 or give online at nufoundation.org/foodscience.

OUR
STUDENTS
OUR
FUTURE



Allie Tobin, Food Science Technology undergraduate



Had Gilbreth pursued her initial interest when she came to UNL, it would have been more likely that she would be treating someone with a foodborne illness than preventing it from occurring in the first place. She majored in biology to pursue medicine, but she considers herself lucky that while doing undergraduate research in biology, her professor tipped her off to an opportunity to work with Andy Benson and Robert Hutkins in food science and technology.

A USDA fellowship led to her Ph.D., which led to a postdoctoral position with the USDA in Philadelphia.

"I was concerned at that time because not as many people had come directly from graduate work into industry jobs," she said. "It has gotten better since, and the industry offers more

internships now, too. Current students should take advantage of them."


Gilbreth is happy with the path she has taken with her UNL degrees, and the work she does on behalf of consumers is gratifying.

"It's exciting to deliver on what consumers are asking for: shorter ingredient lists and more natural ingredients. A lot of the questions that our consumers are asking end up on my desk, and it's amazing how sophisticated they are," Gilbreth said. "I like that we are serving them well and have a strong focus on sustainability, which is so important in the world we live in."



Season's Eatings

Nothing warms us up like time with family and friends. As long as we're getting together, it's a good idea to have delicious food to share. Like our Varsity Basket, with eight different cheeses, two flavors of summer sausage, gourmet crackers and honey - all in a handcrafted Nebraska-shaped basket. Get one soon. Unlike the Dairy Store, which has been around since 1917, they don't last.



Undergraduate student finds passion in food science



Ava Peterson

When Ava Peterson, a junior food science and technology major from Spokane, Washington, was getting ready to come to college, she wasn't sure what she wanted to study. She enjoyed taking cooking and chemistry classes in high school, so when her mom found food science in a book of college majors, she encouraged her daughter to look into it.

She has found that the best part about studying food science is that it has a relevant and practical application. "We eat food everyday, so the concepts that we are taught in class can be seen on an everyday basis," Peterson said. One of the classes that Peterson has found especially valuable is Introduction to Botany. "I wasn't sure what area of food science I wanted to pursue, but because of this class, I think I'm going to pursue

working with fruits, vegetables or spices," Peterson said. "Botany opened my eyes to an area I previously didn't think I had any interest in."

Outside of class, Peterson works at the front desk at the Department of Food Science and Technology and assists with research in the Food Allergy Research and Resource Program. She is also a student ambassador for the department, a co-publicity chair of the Food Science Club and an athlete in intramural sports.

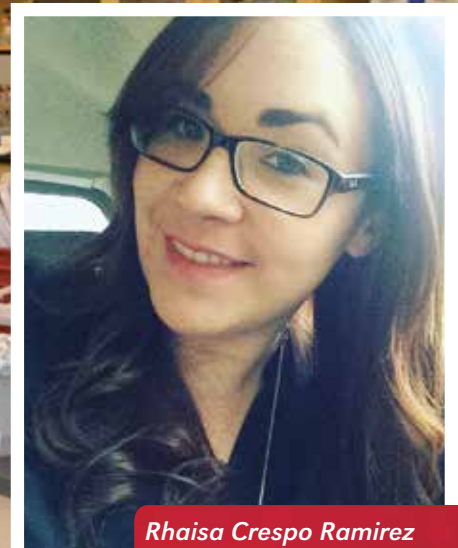
Peterson hopes to attend grad school and find a job in the food science industry after graduation. Her long-term goal is to work for a company that will allow her to work or travel overseas.

OPEN HOUSE

Watch for Spring Date TBD

You're invited to see the Food Innovation Center, the new home of the Department of Food Science/Food Processing Center, this spring. We will be providing guided tours of the facility, opportunities to hear from department and/or guest speakers and free ice cream. This event is being planned for food manufacturers, members of the UNL community and alumni, and the general public is welcome. Please watch for a spring date to be announced early in 2016.

Graduate student from Puerto Rico thrives at UNL



Rhaisa Crespo Ramirez

For graduate student Rhaisa Crespo Ramirez, her journey to UNL started as an undergraduate student at the University of Puerto Rico, Mayagüez Campus. While pursuing her bachelor's degree in industrial microbiology, Ramirez was selected to participate in an advanced class in which participants had to develop a product and commercialize it. The course covered everything from receiving the materials to getting the product on the shelf. Her professor gave her the the push that she needed to continue her education.

"It was my professor Dr. Fernando Pérez who introduced me to the food science and technology program that UNL offers," said Ramirez. "Due to the solid reputation of the program, my love for food science and my desire to excel in the field, I decided to come to UNL to pursue my graduate studies - I've loved every minute of it."

Ramirez's research is focused on understanding the genetic basis of a food yeast that can kill pathogenic gut fungal species with a specific toxin. This organism that she is researching has both medical and food applications such as controlling spoilage organisms in the food industry. Along with her research, she is also interested in food product development.

When not in class or researching, Ramirez enjoys outdoor activities and taking advantage of the many trails and parks that Lincoln has to offer. She will be graduating with a master's degree in May and is hoping to complete her PhD in the future.



To see more pictures of our new building, go to fpc.unl.edu.

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We'd love to hear from you! For any feedback or story contributions you'd like to see in future issues, email us at FOODSCI@UNL.EDU.

The importance of alumni contributions

Private support is essential to recruit outstanding undergraduate and graduate students, provide timely and applicable research, and expand our outreach to small businesses and entrepreneurs across the state. In these times of shrinking budgets and decreasing state support, donations from our alumni and friends are critical. We hope you will consider making a gift to assist us in these efforts. Contact the University of Nebraska Foundation to contribute to the following funds:

Food Science & Technology Student Scholarship

Fund No. 1359: This fund provides much needed financial support to our undergraduate students, an invaluable aid to our recruitment and retention efforts.

Food Science & Technology Research Fund No.

1452: This fund sponsors research activities with the Department, including undergraduate student research and travel support for graduate students to attend scientific meetings.

Food Science & Technology Development Fund

No. 4312: This fund provides general support to the Department and is specifically used to enhance undergraduate student recruitment efforts (high school visitations, etc.)

To make a gift, contact Ann Bruntz, 402-458-1176, abruntz@nufoundation.org.

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