



FOOD SCIENCE STUDENTS FINALISTS IN NATIONAL PRODUCT DEVELOPMENT COMPETITION



The Team in the lab. Left to right: Jihan Cepeda, Annette Hartzell, and Andres Doblado.

In 2011, a team of graduate students from the Department of Food Science and Technology at the University of Nebraska-Lincoln competed to bring healthy food into the diet of children. Rebecca Duar, Annette Hartzell, Andres Doblado, and Jihan Cepeda participated in the 2011 IFT Product Development Competition, which was sponsored by Disney Consumer Products, Inc. and the IFT Student Association.

Their process began in early 2011, when Rebecca discovered the Disney Nutritious Food for Kids Competition while navigating the Institute of Food Technologists Student Association website. Duar said, "We found this opportunity as a way to be involved in an activity in which we could apply our food science skills and create nutritious, fun, kid-friendly food products. We addressed our idea to Dr. Rose and he encouraged us to participate."

"We first had to come up with an idea of a retail product for kids under the age of 12 that incorporated a fruit, vegetable, low-fat dairy product and/or whole grains. We decided that we wanted to incorporate all in one product, and we started looking for molds in the shape of any Disney Character." They settled on the main character of the movie *Cars* and called their product, a whole wheat, pumpkin

and cornmeal flour crust stuffed with vegetables in tomato sauce and cheese, a Carszone.

"We submitted our preliminary proposal and a couple weeks later we were told that we were one of six finalist teams to show our product to judges at the IFT Annual Meeting and Food Expo." With this news, the team switched into high gear. They worked to reduce the size of their product to a kid-friendly, snack size. The team was able to make a silicone plastic mold using a toy released for *Cars 2*. After trying various recipes, they developed the final Carszone. Rebecca described it by saying, "The crust is made with whole wheat flour and pumpkin, colored red with natural beet extract. It is filled with tomatoes, apples, broccoli, corn, sweet peas, red peppers, carrots, black beans, and non-fat mozzarella cheese. One CarsZone contains 170 calories. The product is an excellent source of vitamins A, C and Iron, a good source of calcium and low fat, saturated fat and cholesterol free, contains one full serving of vegetables, and is rich in dietary fiber (14% DRI)." The group also had to submit a full product proposal including nutrition label, ingredient statement, shelf life estimate, HACCP plan, marketing plan, and relevant regulations.

The team from UNL took their product to the final competition at the 2011 IFT convention in New Orleans, but were ultimately unsuccessful. In feedback from the judges, they were informed that while concept and presentation were excellent, the product was too heavy and not sufficiently kid friendly. Although they didn't win their competition, the team did take 3rd place and gained valuable, hands-on experience in developing a new food product.

PRODUCT DEVELOPMENT CLASS EXPANDS SCOPE

Food Science and Technology's Product Development (PD) class has long served as a capstone for the food industry preparation offered by the Department. The course instructs students on the development and modification of commercially viable products. In 2011, the course's new professor, Dr. Devin Rose, decided to greatly expand the scope of industry experience the course provides.



Dr. Devin Rose

He explained, "In the PD class this year, I decided to have the students work with an outside company on their project. I hoped that this would give them a chance to make some industry contacts and hear what product developers are interested in in the real world. On the first day of class, the students were divided into four groups and each assigned an industry representative and an ingredient supplied by the company. The groups were challenged with identifying a new application or functional property of the ingredient. The idea behind this was to give them more of an industry experience, where PD projects are often assigned rather than generated solely by the product developer."

The group projects were a chocolate hazelnut spread using Vitacel Oat Fiber from JRS, a chocolate and peanut butter candy using TruBran from GPC, a frozen yogurt using Fibersym RW from MGP, and a fruit empanada using Sustagrain and Untragrain from ConAgra. Dr. Rose elaborated saying, "Three of the groups' industry representatives actually made the trip to UNL to evaluate the students' work. All of the representatives were very excited about the products and commended the students on their work. The representative from MGP was so impressed with the students working with his company's ingredient that he featured them in the company newsletter. He was excited to see that the students were able to identify some potential new functional properties of Fibersym RW that had not been identified by his company, namely Fibersym's potential for preventing moisture transfer in frozen foods."

Dr. Rose and his class were happy with the results. "Overall I received positive comments back from students on this new course format. I will continue to implement changes in the coming years to improve students' real-world experiences. Next year I plan to focus more on product evaluation and product scale-up."



SELECTED GRANTS

Donald Danforth Plant Science Center:

Richard Goodman

“Food Safety Training for Grand Challenge #9 Projects”

\$19,902 (1 year)

UNL Layman Fund:

Andréia Bianchini-Huebner

“Use of Essential Oils, Spices and Plant Extracts to Control Microbial Contamination in Pet Food Products”

\$10,000 (1 year)

UNL-ARD Life Sciences:

Jens Walter, Steve Taylor

“Exploration of the gut microbiome to identify bacterial systems that degrade immunotoxic gluten peptides”

\$127,428 (1 year)

Texas Woman’s University:

Jayne Stratton,

Andréia Bianchini-Huebner

“Risk Assessment and Intervention Strategies for the Emerging Food Safety Threat of Ochratoxin A in the U.S.”

\$56,372 (1 year)

Mississippi State University-SRDC:

Gayaneh Kyureghian

“The Food Desert Problem: Economic and Space Remedies”

\$34,990 (18 months)

UNL Anna Elliot Fund:

Vicki Schlegel

“Comprehensive phytochemical analysis of different cultivars of great northern and pinto beans grown in Western Nebraska”

\$28,227 (1 year)

A MESSAGE FROM DR. FLORES

Right: Dr. Rolando A. Flores

Greetings from the Department of Food Science and Technology and The Food Processing Center (FPC).

This summer, our faculty presented at numerous institutions and events. Among others, Dr. Rick Goodman spoke in Beijing on the allergenicity of genetically modified foods, Dr. Gayaneh Kyureghian presented on variable imputation in empirical research, and Dr. Andréia Bianchini and I both presented at a major workshop on grain quality in Guatemala. Dr. Andrew Benson presented before numerous groups on genetic research related to gut function, and Dr. Heather Hallen-Adams, our mold and mycotoxin specialist, also spoke on gut health, presenting to the Mycological Society of America on fungal profiling in the gut ecology. Dr. Jens Walter worked his way across Europe with lectures on *Lactobacillus reuteri* and other gastrointestinal bacteria.

Before heading into industry, our undergraduates are already on the job. Dozens of our undergraduates have been interning with companies in the food industry. Of special notice is ConAgra, who noted to us what an amazing job our interns performed. These students included Ashley Bernstein, Taylor Stelk, Katina Talley, Kristen Drvol, Travis Burger, and Maria Quintero (a PhD candidate).

The faculty of the Gut Function Initiative continue to move forward. We are seeking a new associate or assistant professor specializing in gastrointestinal biology, to fill the shoes of Dr. Daniel Peterson, who will be departing for John Hopkins University Medical School next year. Their expertise has been expanding in other ways as Drs. Heather Hallen-Adams and Devin Rose have begun to contribute due to the multi-disciplinary nature of the initiative. Finally, Dr. Benson has been given a generous grant by the USDA to begin study on *E. Coli O157:H7* “supershedders”. These are cattle which produce an abnormally, and inexplicably, large amount *E. Coli O157:H7* bacteria. Dr. Benson’s research builds upon previous research involving gnotobiology, and hopes to link “supershedders” to the presence of other microbiota. This research was commended in an editorial by the Omaha World-Herald

Dr. Susan Cuppett has long served as our in-house expert on sensory analysis. With her transition to emeritus faculty, we have distributed her extension and education responsibilities. FPC Food Product Developer Julie Reiling is managing usage, client and internal, of our sensory lab and so far is doing an excellent job. Dr. Devin Rose will be teaching our course on sensory analysis and recently taught product design. You can read about some of his innovations in this newsletter.

The FPC recently launched a new service called the New Food Profile. It’s a fast and affordable way to assess the uniqueness of a new product. Using proprietary data on consumer packaged goods (CPG) product introductions, we can deliver detailed profiles on previously launched products that match any new product concept; typically in just two to three days. Our New Food Profile report can help identify product space in terms of product pricing, promotion, packaging, ingredients, nutritional characteristics, and guide product develop and marketing of a new food item.

At The FPC, we’ve established two websites we’d like you to explore. First, after much development, we have updated the Center’s official website, www.fpc.unl.edu. Next, we are happy to present our new Food Processing Management Certification Program at www.fpc.unl.edu/fpm. This entirely web-based program can provide an entire course on practical knowledge for the food industry. If you want to give us feedback about these websites, or to make any inquiry at all, send us a message at fpc@unl.edu.

If you would prefer to receive your newsletter electronically, please send your email address to mstandley2@unl.edu. The University is trying to find ways to “go green” and this is an excellent way for us to do our part. Thank you.



AN ECLECTIC, ACADEMIC FOOD SCIENCE CAREER

Left: Dr. R. Shane Gold

Dr. R. Shane Gold, a professor at Brigham Young University-Hawaii, graduated from the Department of Food Science and Technology at UNL with a BS in 1982 and a Masters in 1984.

It was in high school that Dr. Gold found he had an interest in biology. He said, “I considered going into a traditional microbiology program through the Department of Biology, but Dr. John Rupnow, a professor in UNL’s Food Science Program, suggested that I consider a program in food microbiology. He pointed out that I would take the same basic classes and obtain the same basic education that I would through the Biology Department, but that in the Food Science Program I would have greater opportunities for personal interactions with the faculty and much higher chances to become involved in extra-curricular laboratory experiences. The one thing that really convinced me to study Food Science was the realization that whatever happens in the world economically, politically, or technologically, people will always need to eat.”

He was not disappointed with his decision. He said, “Once in the program I really came to love the amazing faculty I found there and the personal interactions I was able to enjoy with them. I had wonderful and memorable experiences working with Drs. Rupnow, Meagher, Hutkins, Taylor, Cuppett, Froning, Wehling, Zeece, and Bullerman. Each made me feel like I was a true member of a winning team, and I am sincerely grateful to each one for the encouragement they gave, the examples they set, and for the inspiration they were to me as I was involved in the program. They truly were the best teachers and friends I have ever had. Some of my best memories at UNL came from working in the laboratory; it was here that I developed my current love for the tools of molecular biology. I also have great memories from so many Food Science classes including Dr. Hutkins’ food processing classes, Dr. Froning’s eggs class, and Dr. Bullerman’s fungi class (learning more than I ever wanted to know about mold). I also have great memories of my involvement in the Food Science Club. Oh, and I should probably mention proposing to my wife in the UNL Dairy Store. . . I had a few minutes break from the lab and it seemed like a good time.”

Dr. Gold is now an associate professor of Biology at Brigham Young University-Hawaii, a four year, undergraduate college in Oahu, Hawaii. “When I am not out kayaking, swimming with dolphins, fishing, or hiking in the amazingly verdant mountains, most of my time is spent teaching classes in cell biology, molecular biology, immunology, bioinformatics, and pathogenic microbiology, and in mentoring students in a variety of research projects. Since we don’t have a Graduate program at BYUH most of my time is devoted to teaching.”



Above: Dr. Gold with a group of his students.

“My major ongoing research project deals with using the tools of molecular biology to study a shorebird known as the Pacific Golden Plover (*Pluvialis fulva*). This species makes some of the longest non-stop migrations, wintering throughout the Pacific (Hawaii, Samoa, Saipan, etc.) and then nesting during the summer months in Alaska and Siberia. My work takes me to the tundra north of Nome, Alaska and to various island paradises as we use molecular biology and geolocator technology to learn more about the migration patterns, relationships, and overall behavior of these amazing birds.”

On the impact of the Food Science Department, Dr. Gold said, “My experiences and education at UNL really prepared me for everything I do today. It instilled in me a love for science, an ability to perform meaningful research, and the confidence to stand in front of a classroom. I gained an excellent educational foundation for all the classes I teach and the ability to quickly gain understanding in new areas when a need arises for me to teach a new subject outside of my normal area of focus. My experiences at UNL truly were among the most meaningful and important influences of my life. While I don’t do much that is directly related to food science in my current position, I do occasionally sneak my BIOL 100 students into the lab to make yogurt or bake bread to help capture their interest and foster greater understanding when talking about general biological principles. I frequently find myself using the stories I heard from my Food Science professors to help explain difficult biological subjects.”

STUDENTS

GRADUATES OF THE B.S. PROGRAM

Angelo Bee Gallardo

GRADUATES OF THE M.S. PROGRAM

Pei Tze “Emily” Ang

Thesis title: “Adaptation and Validation of Existing Analytical Methods That Are Capable of Monitoring Prebiotics Present in Different Types of Processed Food Matrices”

Dr. Vicki Schlegel, Advisor

Julien Khalil

Thesis title: “Pulsed electric field (P.E.F) and pectinase for the extraction of polyphenols from grape pomace and peel”

Dr. Durward Smith, Advisor

NEW M.S. GRADUATE STUDENTS

Abbas Hajmusa

Robert Hutkins, Advisor

Vicente Silvestre

Robert Hutkins and Harshavadhan Thippareddi, Advisors

Hui Wang

Dr. Wajira Ratnayake, Advisor

NEW PhD GRADUATE STUDENTS

Nabaraj Banjara

Dr. Heather Hallen-Adams, Advisor

Mei Lu

Dr. Rick Goodman, Advisor

Maria Quintero

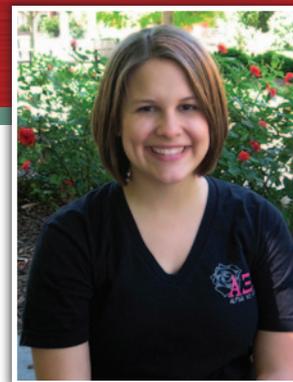
Dr. Robert Hutkins, Advisor

Bo Yuan

Dr. Milford Hanna, Advisor

UNDERGRADUATE BROOKE GROSSENBACHER

Right: Brooke Grossenbacher



Brooke Grossenbacher has a legacy at UNL. “My grandfather, Irvin Omtvedt was the Vice Chancellor of the Institute of Agriculture and Natural Resources here at the University of Nebraska–Lincoln, so I decided when looking at colleges that I would visit the University of Nebraska–Lincoln.”

Brooke’s decision to pursue Food Science was made on a campus visit from her high school in Overland Park, Kansas. “I was in Lincoln for a general campus visit when I noticed something called Food Science on the list of majors offered by the University of Nebraska–Lincoln. I toured the Food Science Department, and knew immediately that I wanted to major in Food Science and Technology at the UNL. My decision was made easier when I knew that I would be in the College of Agricultural Sciences and Natural Resources, which my grandfather had been such a big part of.”

So far, she has enjoyed the opportunities her major brings her, and said “I really enjoyed FDST 280, Contemporary Issues in Food Science. I took the class online, but was still made to feel I was part of the classroom. The class involved learning and discovering the importance of the contemporary issues in the area of Food Science. The class utilized a blog which was a unique way of interacting with the professor, Dr. Hutkins, as well as other students. With the blog student were able to bring up contemporary issues in Food Science or comment on issues posted by other students.”

In addition to her studies in Food Science, Brooke has been involved in the Food Science Club, Alpha Xi Delta, Sigma Alpha Lambda, the Cather Circle, and she has worked with IANR both as a student ambassador and as a student worker in the Dean’s Office. “I was surprised to find out how many opportunities there are for involvement and leadership here at the UNL, and more specifically within CASNR, and the Food Science Department. The Food Science Club was one of the first campus organizations I became involved with; from there I have discovered that my opportunities here at UNL are endless.”





GRADUATE STUDENT SPOTLIGHT: ANNETTE HARTZELL

Left: Annette Hartzell

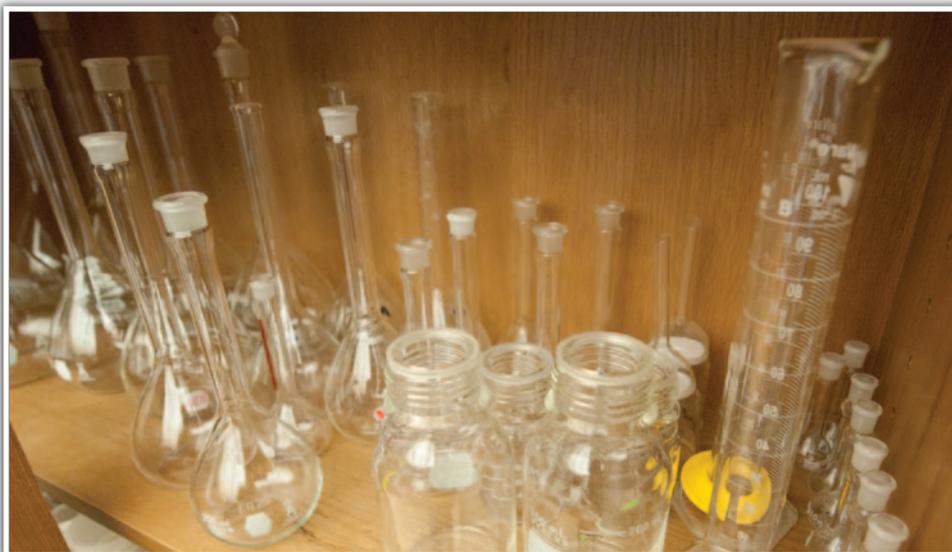
Graduate student Annette Hartzell is in the process of earning her Masters Degree at the Department of Food Science and Technology at UNL. She first heard about our program while doing her undergraduate work at Penn State. She said, “Dr. Benson came to give a seminar at Penn State. Research on the gut microbiota was a side of food microbiology that I had never heard of before, and I thought that gut health might be an interesting area of study to focus on in grad school. I like it that UNL has areas of research emphasis like the Gut Function Initiative and FARRP, where professors and students from different labs can collaborate on research.”

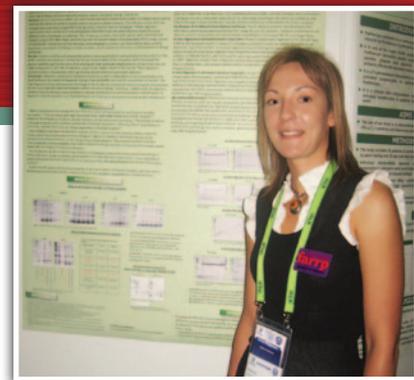
“After applying here for grad school, I was invited out to visit. The professors I met were genuinely interested in my goals, and wanted my input on what type of research I wanted to do.” She continued commending the faculty by saying, “I am co-advised by Dr. Rose and Dr. Hutkins and both of them are great to work with. Dr. Rose frequently works in the lab right along with us, so he’s there to help with any issues that arise with the day-to-day aspects of my research. I meet with Dr. Hutkins every week as well, and talking with him about my research helps me to think critically about what I am doing and why I am doing it.”

Annette has made great use of the Department’s Gut Function Initiative to enrich her knowledge and research. “I especially enjoyed Dr. Walter’s gastrointestinal microbiology course. I think the best

way to describe this course is that instead of just learning a collection of facts, you really become educated on the subject. My research objective is to create a novel and improved delivery system for 5-aminosalicylic acid, the drug used to treat inflammatory bowel disease, by attaching it to prebiotic fibers. In this way, the patient gets the benefit of both the drug and the prebiotic.”

Among the opportunities she’s taken in Food Science, Annette mentions, “Dr. Rose gave me the opportunity to do the majority of the writing on a grant and a book chapter. I am really thankful that I had these opportunities so early on in my grad student career, and I think that the experience will be helpful to me in the future.”





GRADUATE STUDENT RESEARCH

Right: Jelena Spiric with her poster

In 2011, Food Science and Technology graduate students presented their research at conferences and meetings ranging from Istanbul, Turkey to Manhattan, Kansas.

Jelena Spiric presented a poster at the European Academy of Allergy and Clinical Immunology in Istanbul, Turkey in June on “Identification and characterization of digestion-resistant allergens in walnut and pecan species” and received a Junior Members and Affiliates Poster Session Award. Jelena is an M.S. student in the FARRP lab and is supervised by Dr. Joe Baumert.

Maria Ximena Maldonado-Gomez presented a poster at the 2011 IFT Annual meeting in New Orleans on “Inhibition of lectin adherence to tissue culture cells by prebiotic carbohydrates” and placed second in the Biotechnology Division Paper competition. Maria is an M.S. student in Dr. Robert Hutkins’ lab.

Also at IFT, Emily Ang, a recent M.S. graduate of Dr. Vicki Schlegel’s lab, presented the poster “Development of a dry bean snack”. At the same conference, Emily and Kristina Moore presented “Chemical and biological stability of prebiotics in processed foods”. Kristina is an M.S. student in the Hutkins lab.

Jihan Cepeda delivered an oral presentation at the 2011 American Society of Agricultural and Biological Engineers Annual International Meeting on “Modeling Heat Transfer During Cooling of Cooked Ready-to-eat Meats Using Three-Dimensional Finite Element Analysis” in Louisville, Kentucky. Jihan is a recent M.S. grad from Dr. Curtis Weller’s lab and a current Ph.D. student under Dr. Harshavardhan Thippareddi.

Krishnamoorthy Pitchai gave an oral presentation at the International Microwave Power Institute 45th Annual Conference on “Effect of Location of Small Loads on Heating rate and Uniformity in Domestic Ovens” in New Orleans. Krish is a Ph.D. student in Dr. Jeyam Subbiah’s lab.



Ben Remington had several presentations during 2011. At the 2011 IFT Annual meeting in New Orleans, Ben presented a poster on “Soy commodity contamination risk assessment in wheat flour” and placed second in the Toxicology Division Paper competition. Ben also presented an “Update on Food Allergy Thresholds and Risk Assessment” in “The emerging science of thresholds: next steps in allergen control” symposium at IFT. Earlier this year, in February, Ben was invited to speak on “From Start to Finish: Quantitative Risk Assessment of Foods Containing Peanut Advisory Labeling” at the European Academy of Allergy and Clinical Immunology Food Allergy and Anaphylaxis Meeting in Venice, Italy. In March, Ben presented a poster at the American Academy of Allergy, Asthma, and Immunology Annual Meeting in San Francisco, CA on “Risk Assessment of Soy Commodity Contamination in Wheat Flour”. Ben is a Ph.D. student in the FARRP lab and is supervised by Drs. Joe Baumert and Steve Taylor.

Rebecca Duar presented a poster at the 2011 American Association of Cereal Chemists International Young Cereal Chemists Meeting in July at Kansas State University. Her poster was titled “Adaptation and validation of existing analytical methods capable of monitoring prebiotics present in extruded ready-to-eat breakfast cereal”. Rebecca is an M.S. student in Dr. Schlegel’s lab.

Lin Li presented a poster at the 2011 International Association for Food Protection Meeting in Milwaukee, WI on “Inhibition of *C. perfringens* spore germination and outgrowth in reduced NaCl roast beef by lemon juice and vinegar product.” Lin is a Ph.D. student under Dr. Thippareddi.





THE EVER ACTIVE FOODS SCIENCE CLUB

A contingent of the Food Science Club.

Left to Right: Heather Berck, Kristen Drval, Taylor Stelk, Juliann Starman, and Brooke Grossenbacher

The Food Science Club has been remarkably productive in building a strong foundation for the next several years in food science education and student involvement. A common theme for our year was student outreach in places where historically the Food Science Club hasn't appeared. One of our biggest challenges came in the form of a catered event at the Strategic Air and Space Museum. Every year, the Nebraska Robotics Expo hosts hundreds of elementary, middle, and high school students as well as their parents to showcase and offer valuable hands on experiences in science, technology, and engineering. As an all day event, these 800+ attendees needed a satisfying lunch, which was provided by members of the Food Science Club. With countless hours of preparation, budgeting, and careful attention to food quality and safety, each attendee was served a delightful meal at an affordable price and with remarkable efficiency.

Following our Club's first ever mass catering experience at the Nebraska Robotics Expo, it was time to focus on our activity within IFT. As a statement of the dedication and support for our students, a record number of 19 students traveled to the University of Minnesota to compete and support our team in the Area College Bowl competition in which our program was ably represented. As a major part of our Club's success through IFT, we were recognized as one of six finalists for national Chapter of the Year!

Certainly, the National recognition is greatly appreciated after such a busy and productive year. However, we are not about to look backward and become satisfied. One more stone we are about to place on the path toward financial stability is the unveiling of a brand new trailer to sell ice cream. As followers of our organization might recall, we embarked on our first venture to the Apple Jack Festival in Nebraska City last year. There we were introduced to the Kimmel Educational & Research Foundation, and were encouraged to apply for various charitable grants that promote research and science education. As a prime applicant for this funding, we were ecstatic to accept a grant of approximately \$31,000 to be used toward the purchase of a new, more portable trailer. Scheduled to arrive this fall, we are excited to jump on and begin selling ice cream throughout this next year whenever and wherever possible. Certainly, a return to the Apple Jack Festival is in order, but further events are certainly in the trailer's capability. The 2011-2012 year looks to be an excellent year once again of high student involvement followed by innovative ideas and upgrades for the future of the program.

Taylor Stelk

President, Food Science Club

University of Nebraska-Lincoln





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Ninety-four years. That kind of tradition does not happen by chance. The Dairy Store at the University of Nebraska-Lincoln is extremely proud to serve alumni, family and friends our very best ice creams, cheeses

and confections – always hand-made with premium ingredients. The next time you're on East Campus or City Campus, stop by to discover or perhaps rediscover the best way to get a taste of Husker pride.

Located at 38th & Holdrege on East Campus & in the Nebraska Union on City Campus | The Food Processing Center
marketplace.unl.edu/dairystore



THE DAIRY STORE PROVIDES TASTE OF NEBRASKA

On April 30, 2011, the Nebraska Society of New York held their Taste of Nebraska fundraiser. The event provides attendees with food that originated in Nebraska, such as Dairy Store ice cream. Kiersten Runnels, treasurer of the Nebraska Society of New York and an organizer for the fundraiser, said “ This year we had 750 Runzas, 100 Valentino’s pizzas, UNL Dairy Store Ice Cream, Fairbury hotdogs, Dorothy Lynch Dressing, Baker’s Chocolates, and Kool-Aid, just to name a few! The UNL Dairy Store generously donated gift boxes of cheese, as well as tubs of ice cream. We also purchased additional tubs of Scarlet and Cream ice cream for the event. ”

All of this is for a good cause. The Nebraska Society of New York contributes to the UNL Alumni Association Scholarship which gives a scholarship for a student in New York to go to school at UNL. Funds for the scholarship are raised through admissions to Taste of Nebraska among other sources.

Originally held in 1980, the event was revived in 2009 as a semi-annual event and seems to be a continuing concern. Runnels hopes to work again with the Dairy Store, and its manager Bryan Scherbarth, and said, “Working with Bryan at the Dairy Store has always been such a pleasure, and we appreciate all of the support!”



HELP OTHERS WHO SHARE YOUR HUNGER FOR FOOD SCIENCE.

Donations to the Food Science and Technology Fund are used in scholarships to enhance undergraduate recruitment. To contribute online, go to www.nufoundation.org/foodscience. To learn more, please contact Ann Bruntz, IANR Director of Development, University of Nebraska Foundation, 402-458-1176, or e-mail her at abruntz@nufoundation.org.



DEPARTMENT OF
FOOD SCIENCE
AND TECHNOLOGY





EVALUATION AND ANALYSIS OF MEAT PRODUCTS CONTAMINATED BY LOW LEVELS OF AMMONIA

RESEARCH BY DR. RANDY L. WEHLING AND SELY PRAJITNA¹

Right: Dr. Nancy Wehling

Ammonia is the most commonly used refrigerant in food processing and storage facilities. Ammonia leaks in food processing facilities have occurred in past years, resulting in contamination of food products. This contamination can cause undesirable changes in the flavor and quality of foods (1), and high levels of contamination can even cause illness among consumers who accidentally ingest these foods (2). Therefore, a rapid and simple, yet accurate, method is needed for on-site ammonia testing of foods, in order to ensure that the food is safe. Recent research in our laboratory has improved on an existing ion-selective electrode method for measuring the ammonia content in red meats exposed to ammonia-contaminated air (3). Ion-selective electrode (ISE) methods are relatively fast and inexpensive, and are simple enough for use in the quality assurance laboratory of a food processing facility.

The extraction procedure plays an important part in acquiring good recovery and reproducible results for an ISE method. Different extraction procedures were tested in our laboratory to optimize ISE performance for determining ammonia in fresh beef. Blending and vortexing were evaluated as extraction methods, and results showed that blending sample and solvent with a Waring blender gave better reproducibility for extracting ammonia into the solvent. Different solvents, with or without pH adjustment, were also tested to optimize the performance of the ISE method. When extracting from ammonia-spiked meat samples with acidic solvent (i.e., 3 M perchloric acid), recoveries of ammonia in the meat extracts were >100%, indicating that some decomposition of the sample occurred. Using deionized water adjusted to pH 3, 4, 5, or 6 as the solvent gave more reliable recoveries, with pH 6 water giving the best results. Extracting ammonia using a pH 6 0.01M potassium phosphate buffer as the solvent further decreased the variation in ammonia recovery compared to using water as the solvent. The pH 6 0.01M potassium phosphate buffer gave recoveries >90%, with coefficients of variation ranging from 3.6 to 14.2% for ammonia concentrations ranging from 10 to 200 ppm in spiked beef samples. Lower ammonia concentrations yielded higher coefficients of variation, as these concentrations approached the minimum level of detection for the method. The levels of recovery and reproducibility achieved are acceptable for use as a quality assurance method.

A high water content makes beef and other red meats susceptible to

contamination from ammonia leaks. Using the ISE method developed in our laboratory, we monitored the rate of ammonia uptake by fresh and frozen beef samples exposed to 200ppm ammonia in air at selected times and temperatures. Fresh beef (top round) samples exposed at ambient (20-25°C) and refrigeration (3-5°C) temperatures had rapid rates of ammonia uptake (Figure 1). The rate of ammonia uptake by fresh meat at 20-25°C was 58.4±7.1 ppm per hour over a 6 hour exposure time, and 56.4±5.8 ppm per hour at 3-5°C over a 9 hour exposure time. The level of ammonia contamination in fresh meat had a positive linear relationship with

duration of exposure, prior to reaching saturation. Signs of saturation were observed after exposing fresh meat for more than 9 hours at 3-5°C, as the rate of uptake began to decline at longer times. The concentration of ammonia in exposed fresh meat exceeded the 200 ppm concentration of ammonia gas in the surrounding air when meat samples were exposed for 4 hours or longer. This indicates that proteins or other components in the meat actively absorb and bind the ammonia. Unlike

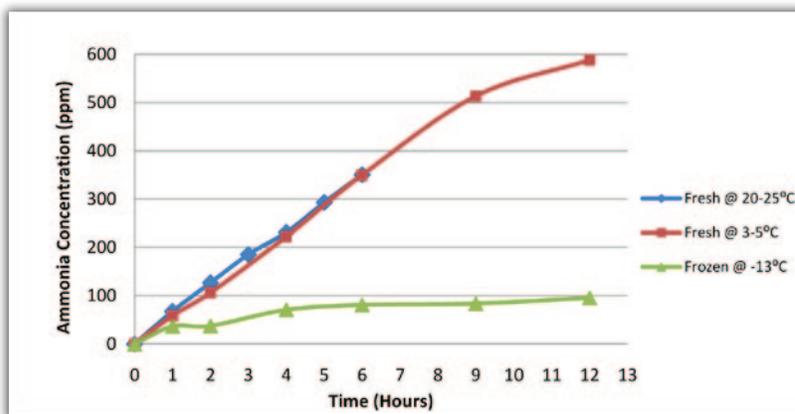


Figure 1. Ammonia concentration (ppm) in fresh meat at ambient (20-25°C) and refrigeration (3-5°C) temperatures, and frozen meat at freezer temperature (-13°C), at varying exposure times.

fresh meat, frozen meat had a slower ammonia uptake rate (Figure 1). After 12 hours exposure at freezing temperature (-13°C), the average ammonia concentration in frozen meat samples was only 96.0±5.4 ppm, which was approximately 6 times lower than the ammonia concentration in fresh meat (586.7±14.2ppm).

The effect of packaging on the rate of ammonia uptake was also investigated. Vacuum packaging top round samples in 2.4mil Cryovac type B6620 bags, made of a multi-layer polyolefin material, provided a good barrier to ammonia gas. No significant difference (P<0.05) was observed in ammonia concentration (ppm) between non-exposed (control) and vacuum-packaged meat samples exposed to 200 ppm ammonia at 3-5°C for 12 hours. This study also tested three potential methods (air flushing, vacuum treatment, and rinsing with dilute acetic acid) for reducing ammonia contamination levels in beef. All three methods tested were ineffective at reducing ammonia concentration in contaminated meat, as they reduced the level of contamination by less than 10%. Vacuum treatment and rinsing may be effective at decreasing the surface concentration, but ammonia that had diffused into the meat matrix was not removed.

Continued on next page.

In summary, we have developed a rapid, reliable and practical ion-selective electrode method for measuring ammonia contamination in meat products. Exposure of fresh meat to ammonia contaminated air can result in elevated ammonia levels in the meat; however, packaging films can act as an excellent barrier to ammonia contamination.

The authors wish to express their appreciation to the American Meat Industry Foundation for the financial support that made this research possible. The authors also thank Drs. Michael Zeece and Harshavardhan Thippareddi for their assistance.

¹Professor and Graduate Research Assistant, respectively

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DR. FLORES RECEIVES TECH TRANSFER AWARD

On June 14, 2011, a team of scientists from government, industry, and academia received the national 2010 ARS Technology Transfer award for the 10-year process of developing winter barley as both a cash crop and a biofuel source for the U.S. Mid-Atlantic region. Among those receiving recognition was Dr. Rolando A. Flores, head of the Department of Food Science and Technology and director of The Food Processing Center, for work he began while at the USDA's Eastern Regional Research Center (ERRC).

The research for this effort began in 2001 at Virginia Tech, where researchers hypothesized that winter barley might be an excellent resource for Mid-Atlantic regional ethanol plants. The project was worked on by a variety of researchers, who gradually added milestones such as the identification of optimal lines for breeding, the enhancement of barley ethanol conversion methods, and the optimization of the nutritional value of barley as feedstock.

Dr. Flores first became involved with this project in 2003. He stated: "I was in charge of the dry fractionation component of the project. I developed lower cost methods that allowed for the isolation of the nonfermentable fractions so that they could be used for food and applications other than ethanol production. The dry fractionation allowed for more purified and fermentable fractions that increased the fermentation rates."

The dry fractionation process increases the efficiency of barley utilization in ethanol. The dry fractionation enhancement that Dr. Flores devised was a whole new stage in the process. Though Dr. Flores left the ERRC in 2006, his collaboration on the project continued. He has since participated in four articles that have been accepted for publication based on this research.

"This award is a recognition of the importance of particle size reduction and fractionation in the biofuel and food industries. It is important to see this team effort being recognized, but ultimately the major reward is that the results of this research are being put into practice in biorefineries. This research looks at the utilization of agriculture projects from the perspective of a biorefinery. By applying fractionation, we are able to remove fractions usable as food. As food scientists and engineers, we are always trying to obtain a more efficient and complete use of agricultural raw materials."



Left to Right: Dr. Edward Knipling, ARS administrator; Dr. Rolando A. Flores; Catherine Woteki, undersecretary of Agriculture for Research, Education, and Economics; Dr. Richard Brenner, assistant administrator at the Office of Technology Transfer; and Dariusz Swietlik, NAA area director

VISITING SCHOLARS



Left to right: Dr. Gayaneh Kyureghian, Bismarck Martinez, Maria Jose Perez Gonzalez, Nydia Munoz Rodriguez, Laurie Keeler, Dr. Jayne Stratton, Bavatharini Sekar, Robin Krokstrom, Steve Weier, and Lori Byrne

This summer, Dr. Hutkins hosted undergraduate Jasmine Brooks who studied the microbiological safety of cheese made from raw milk. Jasmine is from North Carolina Agricultural and Technical State University and is visiting under the Research Experience for Undergraduates program.

María José Pérez González and Nydia Muñoz Rodríguez, Masters students, completed two month internships at UNL-FPC in food safety microbiology. They studied at UNL as part of an exchange with the Food Science and Technology University of Puerto Rico, Mayaguez Campus.

Orla Robertson, a recent graduate of University College Cork in Cork, Ireland, studied in the Food Science Department for nine weeks this summer. Orla learned ELISA testing in Dr. Taylor's lab and was able to test food products purchased in Ireland. This is part of continuing collaboration with Prof. Jonathan Hourihane of the Department of Pediatrics at University College Cork.

Bavatharini Sekar and Nirosha Venugopal completed a three week externship program at UNL-FPC from Food Science Department, Tamil Nadu Veterinary and Animal Sciences University, Institute of Food and Dairy Technology Campus, Chennai. These undergraduate students worked in product development, food safety, dairy processing, and extrusion technology.

CONFERENCES & WORKSHOPS

Food Allergens Issue and Solutions for the Food Product Manufacturer	September 28-29 – Rosemont, Illinois
Better Process Control School	October 4-7, 2011 – Lincoln, NE
Extrusion Workshop	October 11-13, 2011 – Lincoln, NE
FEAP seminar	October 22 – Lincoln, NE

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Department of Food Science and Technology • 143 Filley Hall, UNL, Lincoln, NE 68583-0919
Phone: (402) 472-2381 Fax: (402) 472-1693 • Twitter: UNL_FOODSCIENCE