



UNL FOOD SCIENCE HOSTS UNIVERSITY OF PUERTO RICO STUDENTS

In the summer of 2011, the Food Science and Technology Department and The Food Processing Center hosted Maria Jose Perez Gonzalez and Nydia Muñoz Rodríguez as part of The FPC's student intern program. Both of the interns are Masters students from the University of Puerto Rico, Mayagüez Campus.

Both students were intrigued by UNL's Food Science program after Dr. Flores visited their university in 2010, and the pair sought different courses of research once at UNL. Maria was interested in seed and grain processing and Nydia in the mycotoxin expertise available in the Department. The pair was able to make good use of these resources.

Nydia made these observations on the differences between her home institution and UNL: "The Food Science and Technology graduate program at UNL is more diverse than the department of my university. This is because the UNL department is bigger and older in comparison with my department. At my university the Food Science Department was approved approximately 10 years ago and, until recently, did not have its own building. In UNL, teachers are active doing research in different areas. In my home institution, the teachers are dedicated 100% to class with the exception of one teacher who is engaged to be 50% research. In UNL, graduate students receive assistantships to work on their thesis research. At my university, graduate students have to work in other departments, in roles such as laboratory instructor in at least two laboratories per semester, in addition to thesis research. For that reason, our graduate students finish their master degrees in three or maybe four years."

Maria was able to expand her knowledge of microbiology and said, "The project I worked on was the inhibition of the growth of *Salmonella typhimurium* and *Penicillium roqueforti* by essential oils using the technique of optical density to measure the growth of the bacteria or mold using a microplate reader and a 96-well microplate. Among the results, as it was

expected, we see the eucalyptus oil inhibit the growth of *Salmonella*. It demonstrated a little inhibition by this oil and we also successfully established the technique for the mixing of the essential oil with the water-based media."

In summation of her experiences, Nydia said, "During my stay at UNL, my advisor was Dr. Jayne Stratton. Jayne and I worked, along with Laurie Keeler, Dr. Andréia Bianchini, and Dr. Hutkins, on the improvement of a fermented beverage. That was my main project. Two days a week I worked with Dr. Hallen-Adams performing molecular biology research about *Fusarium spp.*, this microorganism is able to produce mycotoxin. When working with Jayne, I learned to perform the qualitative test for *L. monocytogenes* and *Salmonella spp.* Similarly, the way Jayne's lab ran was great and admirable. I particularly like the tracking system that was implemented in the test materials. With Dr. Hallen-Adams, I learned several molecular and genetic techniques I didn't know. Almost everything was new to me except the PCR and gel techniques. Mostly, I learned that when I put my strongest desire and interests at work, I accomplish my goals and the feeling of satisfaction is beyond description. Definitely if I get the chance to study or work at UNL, I will come back."



The interns with their lab group. Left to right: Bismarck Martinez, Dr. Andréia Bianchini, Nydia Muñoz Rodríguez, Maria Jose Perez Gonzalez, Dr. Jayne Stratton, Robin Krokstrom

NEW ADDITION TO COURTESY FACULTY

Dr. Samodha C. Fernando began in UNL's Department of Animal Science in April of 2011. Due to his valuable contributions he has already been named courtesy faculty in the Department of Food Science and Technology.

Originally from Sri Lanka, Dr. Fernando came to the U.S. for his graduate studies at Oklahoma State University, where he received his doctorate in 2008. On his research at this time, he says, "I used meta-functional approaches to study the rumen microbiome. Then I went to MIT and did a post doc studying host-microbe interactions and microbial community structure-function relationships in corals and the model organism *Nematostella vectensis*."

Dr. Fernando has stated his research interests as understanding the role of the microbial food chain in methanogenesis and other metabolic disorders in ruminants; developing new animal models to study structure-function relationships in the human microbiome; understanding the influence of host-genotype, gut microbiota and environment towards pathogen colonization in humans and live stock; and uncovering the gut virome in ruminants and non-ruminants. These research topics overlap with Food Science's Gut Function Initiative, of which Dr. Fernando is now a member. "Currently, I am

collaborating with Drs. Andy Benson, Bob Hutkins and Jens Walter writing an USDA-AFRI proposal to understand the influence of host-genotype, gut microbiota, and environment towards *Salmonella* colonization in poultry."

Dr. Fernando looks forward to the opportunities offered by being courtesy faculty with Food Science, including what it means for the Animal Science Department, "I see my role as being instrumental in bringing the research programs in the two departments closer together. I also see myself contributing to the Department's teaching program by mentoring graduate students, and helping in teaching, if needed. I am really excited to be part of FDST and see myself bringing Food Science and Animal Science closer together to perform more interdisciplinary research."



Dr. Samodha C. Fernando



A MESSAGE FROM DR. FLORES

Right: Dr. Rolando A. Flores

Greetings from the Department of Food Science and Technology and The Food Processing Center at UNL! In this issue we highlight some of our students and faculty activities during the last months of 2011.

In September, the Food Science Club sold ice cream at the Applejack Festival in Nebraska City. The ice cream was sold out of their new trailer, purchased with funds from a grant of the Kimmell Foundation. Dean Elbert Dickey commended the club for helping to make the university's presence at the Apple Jack Festival a successful promotion of what university outreach can do. In October, three of our students, Brooke Grossenbacher, Ashley Bernstein, and Katina Talley, were appointed as CASNR student ambassadors for the 2011-2012 academic year.

This issue of the newsletter features a research article by Dr. Joe Baumert on food allergen quantitative risk assessment. Dr. Baumert himself was recently featured in an article by Food Chemical News on the challenges related to food allergens in labeling and processing. The article described him as being one of the leading experts on food allergens.

Dr. Jens Walter is continuing a successful collaboration with Dr. Nathalie Juge of the Institute of Food Research in Norwich, UK. Their studies of *Lactobacillus reuteri*/host interactions and the functional characterization of the enzymes of gut microbiota have already produced two outstanding publications. One of Dr. Walter's doctoral students, Kenzi Clark, is working with Dr. Juge in Norwich on these functional characterizations with an eye towards agricultural applications.

Dr. Robert Hutkins has been writing a monthly column for the Lincoln Journal-Star as "the Food Doc". There he answers pressing questions about food safety, food science, and the technology behind food. You can view his columns at <http://go.unl.edu/ja8>.

Dr. Harshavardhan Thippareddi has recently been in Bogotá, Colombia; Santiago, Chile; and Mysore, India to participate in, or conduct, workshops and symposia on food safety and risk assessment.

In large part thanks to Dr. John Rupnow, the Department of Food Science and Technology has established collaborative partnerships through student exchanges with universities in Argentina, Colombia, Costa Rica, and Honduras. Students from these institutions are nominated to participate in one semester internships in our Department. Most recently we have hosted Lucia Miceli García, who is mentioned in our visiting scholars section.

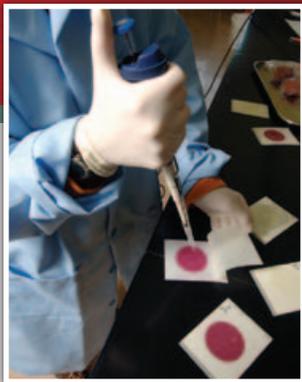
This has proven very beneficial to the students, home institutions, and the Food Science and Technology Department. Outstanding students such as Jihan Cepeda, Andrés Doblado Maldonado, María X. Maldonado-Gómez, and María Quintero participated in this internship and went on to pursue advanced degrees in our Department.

In the last few months, FPC personnel have done quite a bit of international traveling and world exposure for the benefit of UNL and Nebraska. In August, Dr. Andréia Bianchini and myself presented at the Universidad del Valle in Guatemala at the Grain Quality for Flour Manufacturing Workshop; Dr. Gordon Smith, adjunct professor, traveled with us and was part of the workshop. Also in August, Drs. Wajira Ratnayake, Vicki Schlegel, and Marilyn Schnepf presented at the Sino-U.S. Nutrition and Health Seminar in Beijing, China. In September, The FPC hosted the state of Nebraska's Reverse Trade Mission, which consisted of representatives from China, Japan, Europe, and South America. In November, FPC Product Developer Julie Reiling presented on food labeling requirements at the Food Industry Forum in San Juan, Puerto Rico. Since July, I have been serving on the advisory board of the Regional Virtual Food Inspection School in Central America and the Dominican Republic, which should be up and running by 2013. Just last month, I traveled with Vice Chancellor Green and an IANR team to Brazil to develop a strategic relationship with the Escola Superior de Agricultura "Luiz de Queiroz," part of the University of São Paulo in Piracicaba, Brazil; this should lead to exchanges of faculty, research and students and demonstrate the quality of our programs.

The FPC is also offering a new service. The Food Processing Management online course allows food industry professionals to receive top notch training from Food Science and FPC faculty and staff from anywhere on the globe. You can read about this program in this newsletter, and you can also visit the program's website at fpm.unl.edu.

In addition to these activities, the Department's talent is visible in recent grant funded projects. A selection of grants recently awarded to the Food Science and Technology Department and The Food Processing Center is on page three.

In this newsletter, we share more recent events and accomplishments. I hope you enjoy it, and I hope you'll get in touch with us. Our number is (402) 472-2831. We're always happy to hear from alumni and communicate their news.



FOOD SCIENCE AND TECHNOLOGY LEAVES ALUMNUS WELL PREPARED

Dr. Greg Knudsen recently received his PhD from the University of Nebraska Medical School. He credits his education in the Food Science and Technology Department at UNL for giving him the knowledge and discipline to succeed.

Originally from Laurel, Nebraska, Dr. Knudsen had decided to study food science before coming to UNL, “because of the many unique career opportunities it provides and my interest in the creative use of science and math.” With this in mind, Dr. Knudsen was drawn to UNL because of the dedication apparent in the program. “I visited UNL’s Food Science Program during high school and it was obvious that the faculty and students were truly passionate about the program. This passion, in addition to facilities such as The Food Processing Center and Dairy Store, interested me in UNL’s Food Science Program.”

While at UNL, Dr. Knudsen conducted his research with the Food Allergy Research and Resource Program (FARRP). “Specifically, I looked at the impact of the Food Allergen Labeling and Consumer Protection Act (FALCPA) on cookie labeling.”

Dr. Knudsen graduated from UNL with a B.S. in Food Science in 2007. From there he attended pharmacy school at the University of Nebraska Medical Center where he received a Doctor of Pharmacy Degree in May of 2011. He currently manages Clinic Pharmacy in Boone, Iowa. “During pharmacy school it was readily apparent how much my experiences at the Food Science Program were helping me succeed. Going into pharmacy school, I had a very strong chemistry, microbiology, and math/engineering background. This allowed me to spend less time on these areas and master pharmacy coursework less familiar to me. Lastly, my background in food allergies aided me in writing a continuing education article on drug allergies for the Nebraska Pharmacist’s Association’s bimonthly publication, the Nebraska Mortar & Pestle.”



SELECTED GRANTS

ConAgra

Dr. Jeyamkondan Subbiah

“Modeling of Interaction of Microwaves with Food and Packaging (Shielded)”

\$102,400 (6 months)

Kansas State University

Dr. Harshavardhan Thippareddi

“Development and Validation of Predictive Models for Growth of Shiga Toxin Producing *E. coli*”

\$43,999 (1 year)

Nebraska Department of Agriculture

Dr. Wajira Ratnayake, Dr. Devin Rose

“Great Northern Bean Flour as a Functional Ingredient in Gluten-Free Snack Foods”

\$44,907 (2 years)

Nebraska Department of Agriculture

Dr. Vicki Schlegel

“Ability of Pinto Beans and Great Northern Beans to Modulate DNA Conformation to Protect against Inflammation”

\$42,350 (1 year)

Nebraska Dry Bean Commission

Dr. Vicki Schlegel

“Development of Health Promoting Recipes using Dry Edible Beans-Hot Dogs (Phase 2)”

\$1800 (1 year)

Pioneer Hi-Bred International, Inc.

Dr. Richard Goodman

“*In Vitro* IgE Testing of a Biotech Soybean Event LEPI 2800”

\$200,470 (18 months)

USDA - FAS

Dr. Jeyamkondan Subbiah, Dr.

Harshavardhan Thippareddi

“Borlaug Fellowship Program - Asia 2011”

\$27,672 (1 year)

USDA - RBEG

Dr. Stephen Pharr, Mark Hutchison,

Suzanne Weeder Einspahr

“Growth Services for Rural Food Firms”

\$65,794 (1 year)

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.

STUDENTS

GRADUATES OF THE B.S. PROGRAM

Kong Hoong Chan
Ny Le
Alex Nelson
Richard Spinner

GRADUATES OF THE M.S. PROGRAM

Maria X. Maldonado-Gómez

Thesis: “Studies on the adherence properties of plant lectins and bacterial adhesins and their inhibition by prebiotics oligosaccharides and bovine colostrums fractions”

Dr. Robert Hutkins, Advisor

Kristina E. Moore

Thesis: “Biological Analysis of Prebiotics in Various Processed Food Matrices”

Dr. Robert Hutkins, Advisor

Mauricio Redondo Solano

Thesis: “Effect of sodium nitrite, sodium erythorbate and organic acid salts on germination and outgrowth of *Clostridium perfringens* spores in ham during cooling”

Dr. Harshavardhan Thippareddi, Advisor

Jelena Spiric

Thesis: “Identification and Characterization of Putative Allergens in Pecan Species”

Dr. Joseph Baumert, Advisor

NEW M.S. GRADUATE STUDENTS

Nirosh D. Aluthge

Advisor – Dr. Samodha Fernando

Yiwei Liu

Advisors – Drs. Wajira Ratnayake and Rolando Flores

Lucia Miceli García

Advisors – Drs. Wajira Ratnayake and Jayne Stratton

NEW PhD GRADUATE STUDENTS

Maria X. Maldonado-Gómez

Advisor – Dr. Robert Hutkins

KATY MERCKEL SHARES HER ENTHUSIASM

Right: Katy Merckel



Katy Merckel is an undergraduate in the Department of Food Science and Technology. Originally from Moravia, New York, she’s been planning to be here for quite some time. “In fifth grade we were each assigned a state to do a project on. I was assigned Nebraska. I had been fascinated with the state ever since. I had already decided on food science when I was looking at colleges, and noticed UNL had a really good program. I applied and it turned out to work the best for me!”

Her interest in food science is a more recent discovery. “In high school, I was invited to a program hosted by the Cornell Food Science Department. After that, I knew that it was exactly what I wanted to do. It was exciting and all of my classmates were jealous that I had found something to major in that I was so sure about.”

Katy began at UNL in fall 2009. She says her favorite class so far has been Food Science 101, Introduction to Food Science, “because it really affirmed that I had chosen the best major ever. I loved learning so much about something I use every day but never thought too much about. Dr. Cuppett has had a huge positive impact on my time here at UNL. She taught 101 and introduced me to all things food science, taught me how to write a good research paper, and always has an entertaining anecdote about how food was when she was a kid. Plus, she has awesome sweaters.”

“I have been working with Dr. Zeece on a UCARE project researching the presence of bio active proteins in fermented meat products. It’s a really good experience,” she said. On her future, Katy states, “I am currently planning on putting off graduation for a semester in order to study abroad, hopefully in Africa. I don’t think I will end up in industry . . . I am really interested in food crises, both in the US and abroad, and hope to do something to have a positive impact on that.”





MARÍA ELISA PÉREZ-MUÑOZ, NUTRITIONIST TURNED GNOTOBIOTIC RESEARCHER

Left: María Elisa Pérez-Muñoz

María Elisa Pérez-Muñoz is a PhD student at the Department of Food Science and Technology advised by Dr. Daniel Peterson. María Elisa is originally from Mayagüez, Puerto Rico, and became a clinical dietician after receiving a degree in Nutrition and Dietetics from the University of Puerto Rico, Río Piedras Campus. “The science of nutrition helps prevent diseases and promote health,” she said, “as it informs patients, and consumers in general, on how to modify their food intake to make it nutritionally balanced and to achieve health. Nutritional sciences go hand in hand with food sciences. You need to have knowledge in food composition, and methods of food processing and food preservation, to be able to recommend which foods are appropriate or inappropriate in the case of disease.”

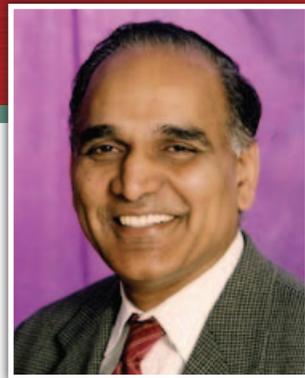
María Elisa initially chose to enroll in UNL’s Food Science program due to the gamut of specialties it offered. “The faculty members have very diverse academic backgrounds and research interests. This makes it a very comprehensive program, since every aspect of food science can be analyzed, from basic, traditional food processing methods, product development, and food safety and security, to food biochemistry, nutraceuticals, food allergens, and the interaction of

food components with the gut microbiota and the immune system. I particularly enjoyed the Gut Microbiology course taught by Dr. Jens Walter because it teaches you about current research on how the gut microbiota impacts health, and how diseases are related to changes in the gut microflora. The information Dr. Walter provided in this course was very relatable to my experiences as a registered dietitian.”

María Elisa’s research is intimately connected to the Gut Function Initiative and UNL’s gnotobiology laboratory. “At present, I am working with a mice model of ulcerative colitis, and the effect of bacterial mono-association in the development of the disease. In addition, I am trying to identify the peptide that T lymphocytes recognize in *Bacteroides sp.*, as some species of this bacterium have been related to the development of inflammatory bowel diseases.”

“Unfortunately, lab work does not allow a lot of time for extracurricular activities, but I always enjoy sharing time with friends I have met at UNL, who have come from different parts of the world. It’s an enriching and fun multicultural experience! So far, I have lots of good memories from UNL, but I think that the best is still to come.”





DR. SAM RAO APPOINTED TO ADJUNCT FACULTY

Right: Dr. Sam Rao

In June 2011, Dr. Sam Rao was appointed as an adjunct faculty member in the UNL Food Science and Technology Department. Dr. Rao's extensive food industry experience includes over 20 years at ConAgra and, currently, working as a consultant and senior partner with Svenka Consulting, which assists companies making healthy food products.

"When I left Conagra, I was vice president of Research and Development in the Food Ingredients group. I also was responsible for the 'healthy food ingredients' category. I ran a department that is involved in quality control, quality assurance, product development, and technical assistance to customers." While leading the Food Ingredients division, Dr. Rao spearheaded an effort to streamline the quality control, quality assurance, and product development programs. This included new food safety early warning measures.

"I was involved in development of whole grain products in wheat and barley, and also developing probiotics/prebiotics and food grade fibers. Also, I was involved with Healthy Choice products at ConAgra." In addition to collaborating with the research and development personnel in the Healthy Choice line, Dr. Rao's department developed Healthy Choice Bread. Dr. Rao was also key to the creation of several functional food ingredients. He is responsible for Culturelle, a leading probiotic supplement; Sustagrain, a high beta-glucan barley with 3 times more fiber than whole oats and a low glycemic index ranking; and Ultragrain, a novel whole grain ingredient.

"Before that I worked in Brazil for 6 years." In Brazil, Dr. Rao quickly rose through the ranks of the Food Science and Technology Department at Universidade Estadual do Paraná. This culminated with two years as department head.

"Right now, I'm in independent consulting. I work exclusively on healthy food ingredients. I'm currently working on a project with a company called NuTek Salt, making a healthier salt substitute." Dr. Rao's work on a healthier salt alternative is indicative of a strong drive in his career to improve public health through healthy foods. "I am a strong believer in functional foods as a complement to medical intervention. Ingredients with clinically proven benefits could help in the management of diseases such as obesity, cardio-vascular diseases, type II diabetes and certain cancers. This is the area I am focusing on for my consulting work."

Dr. Rao's appointment to adjunct faculty is another chapter in a long history of cooperation with Food Science. "I've done work with the Department in the past. I've been a customer of The FPC for the past 5 years, using it as a place for clients from my consulting work. It's a mutually beneficial arrangement."

"I appreciate this opportunity to work with the staff and faculty here. They are very talented people and I can bring my industrial experience to compliment this. Now as adjunct, I want to cooperate with the staff and, hopefully bring some business to the Department. Time will tell."





FOOD SCIENCE AND TECHNOLOGY CONTINUES COOPERATION IN INDIA

Left: Dr. S. Gnanalakshmi, Dr. B. Dhanalakshmi, Dr. A. Elango, Dr. R. Flores (UNL), Dr. H. Thippareddi (UNL), Dr. C. Naresh Kumar and Dr. Padmanabha Reddy Velugoti (S.V. Veterinary University, Tirupathi, Andhra Pradesh state) at TANUVAS

Amidst growing University of Nebraska dedication to involvement in India, the Department of Food Science and Technology continues rewarding relationships with Indian government and academic institutions. Department Head Rolando Flores elaborated by saying, “India is very important. President Milliken has identified India as a major focus for the University. We already have quite a bit of momentum with the work by Drs. Thippareddi and Subbiah. Food Processing Center (FPC) providers and Food Science faculty members have visited. For example, last year we had the International Conference on Food Technology, in Thanjavur, India, which saw the participation of Laurie Keeler, Dr. John Rupnow, Dr. Gordon Smith, Dr. Rolando Flores, Dr. Jeyamkondan Subbiah and others from our Department. This was a major conference on food science in India.”

The Food Science Department currently has a broad spectrum of collaborations in India. The Department has been working under memorandums of understanding established with the Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), the Sri Venkateswara Veterinary University (SVVU), and the Indian Institute of Crop Processing Technology (IICPT). On TANUVAS, UNL Food Science and Technology Associate Professor Harshavardhan Thippareddi said, “We’ve established a student exchange program with them. Selected students will come here during their final year for performing their capstone project at UNL as a part of the requirement for earning their Bachelor of Science in food science and technology in India. We have also been jointly developing workshops with TANUVAS.” This exchange is two-way; two UNL students studied at TANUVAS in 2009 with more scheduled to follow.

Dr. Jeyamkondan Subbiah, a UNL faculty member with dual appointments in Food Science and Biological Systems Engineering (BSE), states the primary institution he has been working with is the IICPT. “Our focus has been on crop and food processing, more focused on crops, grains, and meats. We have had student exchanges and scientist exchanges. Two scientists came here with spans from 6 months to 1 year each, and 3 students for about 4 months. We currently have one doctoral student spending about a year here, John Diamond Raj.” The visiting scientists work in separate departments at UNL, with two assigned to BSE and one to The FPC.

Dr. Subbiah continued, saying “We are putting forward two international proposals with them. One is the National Science Foundation’s BREAD (Basic Research to Enable Agricultural Development) program. The IICPT will be our partners in that one. We are proposing to enhance evaporated cooling systems using

carbon nano-tubes to increase the cooling rate of harvested produce. With limited refrigeration infrastructure and unreliable power supply, cooling produce is fairly hard which leads to post-harvest loss. We also submitted a proposal to the Obama-Singh Initiative (OSI) to improve food security. Several disciplines from UNL are involved. In food processing, we are collaborating with the Institute of Crop Processing Technology and the Central Institute of Agricultural Engineering (CIAE) to reduce post-harvest losses. This will involve exchanges of graduate students and research.” In 2010, Dr. Subbiah



Dr. Jeyam Subbiah and students of the IICPT in Thanjavur for the 2010 International Conference on Food Technology

hosted Dr. Nachiket Kotwaliwale, a senior scientist from CIAE, and, in December, 2011, conducted a 1-week, hands-on workshop on image processing for food quality inspection for 12 selected scientists from all over India.

Dr. Thippareddi explained why it’s important that the Department is involved in India now, “India is undergoing a transformation similar to what happened in the U.S. in the 1960s and 70s, a transition to a large food industry that provides prepared and convenience foods. The technology needs are completely different now. There is a need in India to transfer to new processing technology and adapt it to suit India’s specific product needs. Food safety is critical. One lapse could affect a large amount of the population, similar to the recent *Listeria* outbreak in cantaloupes and outbreaks of *Salmonella* in peanut butter and poultry. So there is a need to improve shelf-life and process safety. This will be better for the country to improve food

Continued on page 10



DEVELOPMENT OF QUANTITATIVE RISK ASSESSMENT APPROACHES FOR FOOD ALLERGENS

Right: Dr. Joseph Baumert and Dr. Stephen Taylor

*Research by **Joseph L. Baumert**, Ph.D., Assistant Professor, Department of Food Science & Technology, jbaumert2@unl.edu and **Stephen L. Taylor**, Ph.D., Professor, Department of Food Science & Technology, staylor2@unl.edu*

Allergists have known for many years that food-allergic individuals can and do react adversely to exposure to small quantities (low mg quantities) of the offending food. However, the reports were largely anecdotal and quite incomplete. Until recently, analytical methods did not exist that allowed estimates of the concentration of allergenic food residues in the incriminated product. Several of the first analytical methods for detection of allergenic food residue were developed in the Department of Food Science and Technology at the University of Nebraska-Lincoln by faculty and staff of the Food Allergy Research and Resource Program (FARRP). Also, it was usually unclear how much of the implicated product was consumed. Thus, the actual exposure dose in these incidents is almost never available or even estimated. Furthermore, until very recently, there was no understanding of the percentage of food-allergic consumers who were potentially reactive to ingestion of very low doses of the offending food. While double-blind, placebo-controlled food challenges have been conducted for several decades as part of the diagnosis of food allergy, the starting doses for most challenges was 500 mg (low but not really a trace amount) and individuals with histories of severe reactions were typically excluded from clinical challenges for safety reasons. Thus, we have not known how many food-allergic consumers are at-risk from very low dose exposures, we do not understand how exposure dose relates to the likelihood or severity of reactions, and we do not know the size of the exposure dose in the anecdotal cases that have been described. As a consequence, allergists and other clinicians have been conservative and advised food-allergic patients to completely exclude the allergenic food in all forms from their diets; a de facto zero threshold approach. With this paucity of information, the packaged foods industry has also been very conservative, and a proliferation of precautionary/advisory labels (e.g. may contain X and similar) has been the result.

The regulatory and legislative approach with respect of the labeling of allergenic foods has also been conservative. In addition to other provisions, the Food Allergen Labeling & Consumer Protection Act of 2004 required that all direct ingredients derived from commonly allergenic foods be declared by source (e.g. Contains X or other allowable approaches). This provision included flavorings, processing aids, and other ingredients that had not previously been specifically declared and/or declared by source. In some cases, the amount of exposure to the allergenic food and its allergenic protein component would be extremely low and may not pose a health risk to allergic consumers.

With all of these conservative decisions on the part of clinicians, the food industry, and the government, the food-allergic consumer is faced with a daunting task. The implementation of a specific avoidance

diet requires the exclusion of an ever increasing number of foods due to the source labeling provisions of FALCPA and the proliferation of advisory labeling. Research clearly indicates that the quality-of-life of food-allergic consumers suffers partly as a result of the angst associated with maintaining the zero-threshold diet (Flokstra-de Blok et al., 2010). Research has also documented that some U.S. food-allergic consumers are increasingly ignoring food ingredient labels especially advisory labels (Hefle et al., 2007). More thorough research on this type of behavior by food-allergic consumers is sorely needed in the U.S., but the existing research definitely shows that the food label has become confusing rather than helpful to the food-allergic consumer.

The establishment of regulatory thresholds or action levels would likely correct the existing situation. The FDA has recognized the potential regulatory value of thresholds that could be used to set action levels for food allergens which food industry and other stakeholders could use as a guide for labeling decisions. One of the most impactful documents in this regard was the 2006 report of the Threshold Working Group of the FDA (Threshold Working Group, 2008). This group concluded that thresholds would be useful and that a statistical quantitative risk assessment approach would be the strongest and most transparent approach to the development of regulatory action levels. The key question that arose from the FDA report was whether or not there were sufficient threshold data available to conduct a statistically sound quantitative risk assessment for food allergens. The establishment of regulatory thresholds or action levels would have great value to many different stakeholders (Crevel et al., 2008) but surely the food-allergic consumer is the most important of these stakeholders.

Regulatory action levels would need to be based upon population thresholds for individual food allergens to determine exposure levels below which an extremely small percentage of food-allergic consumers would be expected to experience adverse reactions (Taylor and Hourihane, 2008). To determine population thresholds, clinical data are needed on the individual threshold doses for a reasonably large and representative segment of the population allergic to each specific food. The individual thresholds could then be used to model the distribution of threshold doses to estimate the population threshold (Crevel et al., 2007).

University of Nebraska-Lincoln faculty and staff (Dr. Steve Taylor, Dr. Joe Baumert, Jamie Kabourek, and a Ph.D. student, Ben Remington) along with colleagues at TNO Life Sciences in the Netherlands have been leading an international effort to assemble clinical threshold data for allergenic foods that can be used for development of quantitative risk assessment models. Data has been gleaned from peer-reviewed clinical publications containing threshold data for food allergens along with

unpublished threshold data from clinical studies or diagnostic data from groups in the United States and Europe. This effort has resulted in the curation of the largest food allergen threshold database in the world containing over 1780 individual threshold values from 11 different allergenic foods including peanut, milk, egg, hazelnut, soybean, wheat, cashew, mustard, lupin, sesame, and shrimp.

The initial research by our group at the University of Nebraska focusing on threshold values for peanut has been published (Taylor et al., 2009; Taylor et al., 2010). A very wide range of individual threshold doses was identified among peanut-allergic individuals ranging from a little as 0.4 mg of whole peanut (approximately 1/1000th of a peanut) up to 10 g of whole peanut. A population dose-distribution model was statistically derived from the individual threshold points. This dose-distribution could allow regulators to determine the level of risk associated with any particular exposure to peanut. Thus, establishment of a regulatory action level could be considered as the risk could be predicted. Furthermore, since a large number of peanut-allergic subjects were challenged in a single center, the Nancy France clinic, a comparison between individuals with histories of severe reactions to peanuts to individuals with histories of less severe reactions was made and it was found that the doses at which 10% of peanut-allergic individuals would react upon consumption (ED10 values) were quite similar (10.4 mg vs. 10.2 mg of whole peanut) for these two groups. This finding indicates that individuals with histories of severe reactions to peanuts are not at greater risk from exposure to low doses of peanuts but rather likely reflects that these individuals suffered severe reactions due to exposure to comparatively large amounts of peanut.

When the dose-distribution of allergen thresholds is coupled with data from the analysis of foods for allergenic residues and estimates of the frequency of consumption of those specific foods (as shown in Figure 1), the risks can be quantified with reasonable accuracy (Spanjersberg et al., 2007). For example, an analytical survey conducted at the University of Nebraska on packaged foods bearing advisory labels for peanuts from 2005 indicated that only 10% of such products had detectable

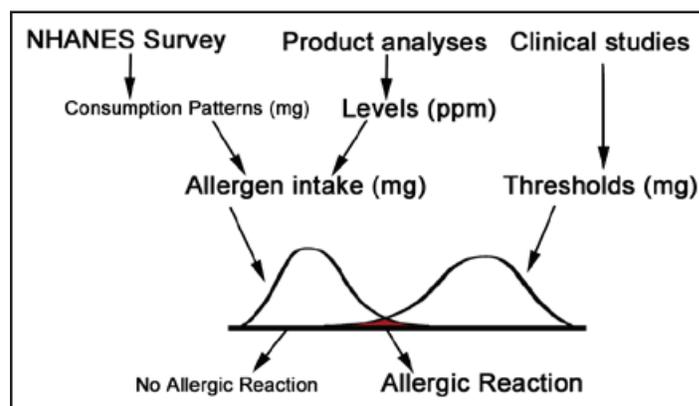


Figure 1. Quantitative Risk Assessment Model for Food Allergy Using Probabilistic Modeling.

residues of peanut (>2.5 mg/kg) (Hefle et al., 2007). Recently, this survey was repeated for 2009 food products and similar results were found (Remington et al., 2010). By coupling this analytical information with consumption patterns from the National Health and Nutrition Examination Survey (NHANES) for nutrition bars (the packaged food with the highest level and frequency of detectable peanut and assuming a very conservative 40% probability that peanut-allergic consumers will ignore the advisory label), the risk of experiencing a reaction within the peanut-allergic population is 4 per 100,000 eating occasions. While we still advocate that peanut-allergic consumers should avoid ingestion of foods with advisory labels for peanut, this analysis clearly indicates that the use of advisory labeling is excessive, that the risk of consuming such product is quite low, and that the use of this labeling approach has lost its meaningfulness. The adoption of regulatory action levels for allergenic foods would provide the food industry with guidance on the use of advisory labeling and the adequacy of allergen control programs. Hopefully, that would limit the over-use of advisory labels and improve the quality of life of food-allergic consumers.

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VISITING SCHOLARS AND FACULTY

Lucia Miceli García visited the Stratton lab from the Instituto Tecnológico de Monterrey in Mexico. She began the UNL Food Science and Technology Masters program in January 2012.

Dr. Nan Ju Alice Lee of the University of New South Wales in Australia visited the FARRP Lab while on sabbatical this autumn.

John Diamond Raj, a doctoral student from the Indian Institute of Crop Processing Technology in Thanjavur, India has been working in the Subbiah lab since February, 2011.

Continued from page 7

safety and food security. The Department can play a critical role in training the food industry and also collaborating with institutions with food technology programs to prepare the future workers for the food industry.”

“After the Green Revolution,” Dr. Thippareddi continued, “India no longer had to be dependent on other countries; it could now be self sufficient. Increasing populations leads to the need for a second revolution because 25%-50% of food is lost due to spoilage or pests “

Dr. Subbiah added, “Post-harvest loss in India is about 20% in grain and 40-50% in fruits and vegetables. Anything we can do to minimize this loss will improve food security. You make a tremendous impact.”

“There is a huge focus for food processing in India.” Dr. Subbiah stated, “It’s in an infant stage right now. In India, there are fundamentally strong faculty and grad students but the infrastructure is not that great. We have a great infrastructure and are always looking for good quality students. We’re a good match there.”

Dr. Flores said, “In academic areas, such interaction must always be a two-way street. We learn a lot and they learn a lot. When Laurie went over, she presented on the work she does, but she also experienced the food industry in India, found out how it works, and learned about agriculture, different food products, and new ingredients. It is also important that our students get exposed to the technology, products, research, and market of India. India is a major player, the second fastest growing economy in the world. Our international involvement is simply a matter of fact. We must be involved. Our students need to be very well prepared to participate in the global market. When our students gain, Nebraska gains too.”



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





VISITING PROFESSOR'S SABBATICAL SPENT WITH FARRP

Left: Dr. Nan Ju Alice Lee

For four months in 2011, Dr. Nan Ju Alice Lee visited UNL while on sabbatical from the University of New South Wales (UNSW) in Sydney, Australia. While here, she conducted research with the allergen experts of the Food Science and Technology Department including the Food Allergy Research and Resource Program (FARRP).

Dr. Lee states her research interests as thus, "I am interested in food security in general, especially in food and environmental safety. This has led me to the food allergen area. My research encompasses three interlinked areas: food safety (e.g., chemical contaminants, mycotoxins and food allergens), food bioactives (e.g., antioxidants) and immunodiagnosics technology and nanomaterials for food analysis."

The strong food allergy program is what attracted Dr. Lee to UNL's Food Science Department. "Professor Steve Taylor is a pioneer in the field of food allergens and FARRP has been doing fantastic work with the food industry in the management of food allergens. For example,

the food allergen workshops that FARRP has been running are something that would be very useful for the small to medium size food companies in the Australia and Asia-Pacific region. I am hoping to adopt this model to assist the food industry in the Australasian region to manage food allergen labeling." She also stated the research into digestion-resistant allergens conducted by Drs. Baumert and Goodman interested her in visiting.

On her goals, Dr. Lee said, "I would like to complete as much of the small project on cashew allergen as I can before I leave here. I also would like to initiate collaborative activities that could lead to future research collaboration between FARRP/UNL and UNSW?"



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Food Processing ONLINE MANAGEMENT CERTIFICATE

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The Food Processing Center

Who is this program for?

The Food Processing Management Certificate program provides practical training and education to professionals working in, or who aspire to work in, the food processing industry. It will provide the knowledge and skills needed to increase effectiveness and management potential. This program is ideal for:

- Food processing plant workers, supervisors and managers
- Quality control and assurance personnel
- Supervisors and managers in related supplier and distributor firms
- Government regulators
- Professionals seeking a career in the food industry

Why should I choose the University of Nebraska-Lincoln's (UNL) online program?

Since 1983, The Food Processing Center at UNL has been assisting, training, and advancing the food manufacturing industry throughout the world. UNL is internationally recognized for its research on food safety, food chemistry, and food engineering. The award-winning and internationally respected faculty bring knowledge and expertise to a variety of fields within the food processing industry. UNL has been delivering distance education to students for over 100 years.

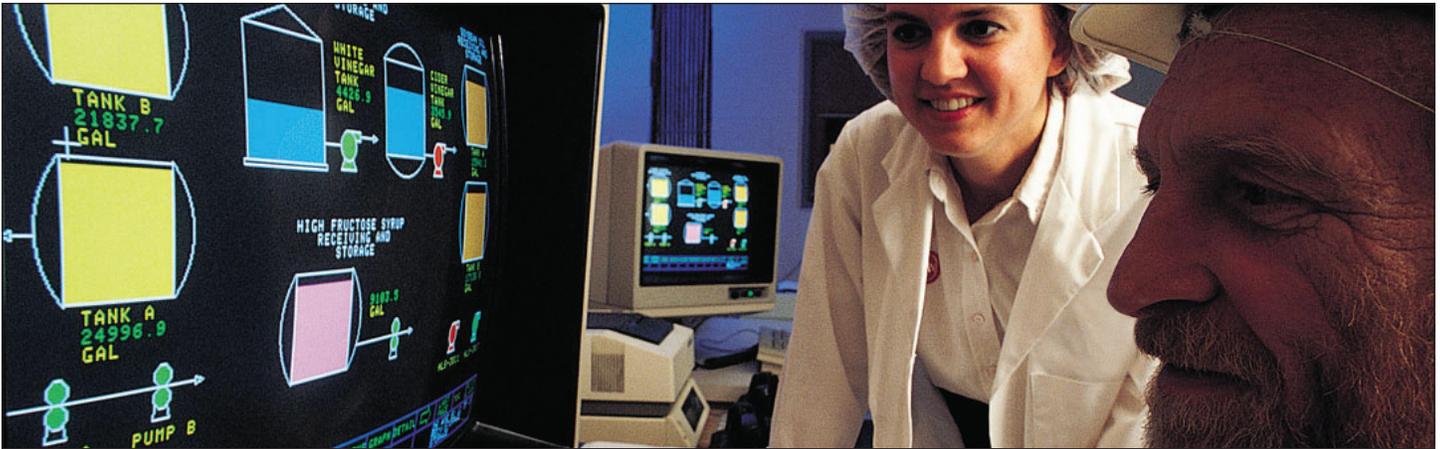
What benefits and advantages are offered?

Employers will benefit from increased productivity, and improved problem solving and communications.

Employees will benefit by enhancing their career options. Other advantages include:

- **Convenience** – Work at your own pace from anywhere you have high-speed Internet access. Submit homework electronically, and take exams online after completing each lesson.
- **Superior Content** – Get the 'big picture' view from experienced food processing practitioners. Learn from responsive instructors, and interact with fellow online students around the world.
- **Affordable** – Save money, time and hassle by eliminating travel to a busy campus. Your employer may even help cover the cost.





PROGRAM OVERVIEW

This is a self-paced online program which requires the completion of three sequential modules. Content is presented as pre-recorded video lectures and PowerPoint presentations, and students may contact course instructors for additional assistance.

Leading to Personal
and Market
SUCCESS

Module 1

Food Safety

- Chemical, physical & biological hazards
- Basic microbiology
- Pathogens, viruses, parasites
- Allergens, including labeling
- Hygiene and sanitation

Quality Control/Assurance

- Quality parameters
- GMP, HACCP, SQF
- Regulations and food law
- Shelf life/Sourcing safe ingredients
- Food safety from Farm to Fork

Quality Control & Employee Safety

- Product testing/Auditing/Inspections
- Inventory storage and management
- Recalls
- Injury prevention/OSHA regulations

Module 2

Processing

- Plant layout and production flow
- Equipment and instrumentation
- Unit operations
- Sanitary equipment
- Automated controls and record keeping
- Production scheduling
- Lean manufacturing practices

Product Development

- Concept and development
- Ingredients
- Sensory Analysis
- Packaging
- Product costing
- Scaling up/Plant layout
- Managing proprietary information

Module 3

Growth Strategies

- Market research
- Marketing (promotion, IMC)
- Distribution and logistics
- Managing expansion of production capacity
- Financial planning and rollout

Human Resources

- Leadership
- Communications
- Job training
- Employee relations
- Labor laws/Compliance
- Labor scheduling
- Diversity on the work force
- Employee recruitment and retention
- Conflict resolution

**FOOD
FROM
THOUGHT**

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THE FOOD PROCESSING CENTER

ONLINE FOOD PROCESSING MANAGEMENT CERTIFICATE PROGRAM

The Food Processing Center (FPC) is launching an online certificate program targeted to mid-size food processors seeking to develop the management potential in their own workers. Workforce development has long been cited as an issue both in rural Nebraska and throughout the food industry. Many firms have loyal and ambitious personnel who simply lack the formal education and training needed to excel as managers. Beginning in January 2011, these employees can learn the same industry best practices that degreed professionals at the largest and most profitable food manufacturing companies employ. This practical training and education will provide the knowledge and skills needed to increase employees' effectiveness and management potential.

The genesis for the program began in the Fall of 2010 with the establishment of an FPC/FST Department committee designed to identify and facilitate development of distance education opportunities in the food industry. The need for multi-disciplinary food processing management training was identified. In collaboration and with support from Dr. John Rupnow, Professor, Food Science and Technology (FST), Institute of Agriculture and Natural Resources (IANR) administration and Apollidon Learning, the development of the certificate program was undertaken.

Apollidon Learning, a private sector firm providing worldwide marketing and student recruitment for distance education courses, conducted a thorough market analysis prior to development. The FPC Advisory Board also weighed in with very positive feedback for the program's market potential. Dr. Rolando Flores, FPC Director and head of Food Science and Technology, is excited about the program and its potential to strongly establish The FPC as a source for quality food science and food business distance education, saying "This is a great opportunity to receive basic training in areas of great demand from one of the best schools in the country."

The Food Processing Center staff, along with Food Science Professors Rupnow, Heather Hallen-Adams and Devin Rose are developing the curriculum for the course, which will be delivered via a series of video lectures and short quizzes. In addition to the potential revenue to be provided by the series, The FPC will benefit from the visibility the program will bring to the rest of The FPC's activities and services.

The program includes topics in quality control and assurance, food safety, food processing, food product development, business growth strategies, and human resource management.

For more information, please visit fpm.unl.edu or contact Dr. Andréia Bianchini at abianchini2@unl.edu.

NEBRASKA VS. WISCONSIN

In the Shadow of the October 1, 2011 football matchup between the University of Nebraska-Lincoln and the University of Wisconsin, there was another Big Ten contest taking place. Ice creams from the UNL and UW dairy stores were engaged in a competition called the "Berry Beatdown".

On game day, a taste test was held at UW's Babcock Hall Dairy Store. The combatants were UW's signature flavor Berry Alvarez, a mixture of blueberry, raspberry, and strawberry with a mixed berry flavored base ice cream, and UNL's Scarlet and Cream, a strawberry swirl ice cream with a vanilla base. Patrons were asked to try both ice creams and then vote on their preferences.

In the end, the University of Wisconsin's ice cream triumphed, 109 to 47, thanks to heavy UW



Scarlet and Cream

voting. Despite the loss, voting patrons had uniformly stated that Scarlet and Cream was creamier with a more pleasant texture. UNL Dairy Store Manager Bryan Scherbarth said, "I really appreciated all the Husker fans that made the trek, the UW Dairy Store is not very close to the stadium. I think it was just another example of Nebraska having the best fans in the nation."



Berry Alvarez

On a possible return engagement, Scherbarth said, "Wisconsin plans to return ship ice cream here next fall, and we plan on hosting a similar contest when NU hosts the Badgers on September 29th, 2012. We are hoping to see a similar interest in the promotion next year."

FPC INTERNATIONAL ACTIVITIES

2011 has seen The FPC engage in several exchanges with foreign institutions. These exchanges included site visits to The FPC, presentations at instructional workshops, exchange student training, and other activities.

In August, Drs. Andréia Bianchini, Rolando Flores, and Gordon Smith presented at the Universidad del Valle in Guatemala at the Grain Quality for Flour Manufacturing Workshop. While there, The FPC delegation met with lauded food scientist Dr. Ricardo Bressani, a prominent Guatemalan who has spent the last 60 years addressing malnutrition in Central and South America. As a result of The FPC's participation in this workshop, the Universidad del Valle has proposed establishing research, teaching, and training collaborations in the area of food chemistry with our Department.

Also in August, The FPC's Dr. Wajira Ratnayake traveled to China, along with Dr. Vicki Schlegel, Dr. Marilyn Schnepf, and Vice Chancellor Ronnie Green, to present at the Sino-U.S. Nutrition and Health Seminar-Application of Dry Beans in Food Manufacturing in Beijing, China. The delegation visited China in assistance to the Nebraska Department of Agriculture in its efforts to promote Nebraska dry beans in China. The event complimented the activities of the UNL

Wheat and Dry Bean Initiative, and paved the way for future research and extension collaborations.

Dr. Rolando Flores has, since July, been part of an advisory group for the new Regional Food Inspectors School, sponsored by the Inter-American Institute for Cooperation on Agriculture. The food inspectors school's goal is to provide the region with a foundation for food safety equal to any developed nation. The region has been troubled in the past by foodborne disease due to inadequate inspection. In addition to increasing food safety in the region, the enhancement this school provides will allow Central American nations to create and maintain food-export markets.

Other recent events include visits by delegations from Guatemala and Colombia, hands-on training of students from India and Puerto Rico, workshop presentations in Puerto Rico and Colombia, and participating in Nebraska's 2011 reverse trade mission. On recent international interactions, Dr. Flores said, "Things will happen if we act or don't act. If we don't get involved, someone else will. With our activities we extend benefits to the state of Nebraska by insuring that it has a presence."



Top left: Dr. Vicki Schlegel (left) and Dr. Wajira Ratnayake (right) in Beijing. Middle left: Ana Silvia Colmenares and Patricia Palacios de Palomo from the Universidad del Valle meet with Dr. Andréia Bianchini, Laurie Keeler, and Bethany Jackson at The FPC. Bottom left: (left to right) Dr. Thais M. F. S. Vieira, professor of oils and fats, and Dr. Solange Guidolin Canniatti Brazaca, professor in nutraceuticals, of the Food Science Department at the University of São Paulo in Piracicaba, Escola Superior de Agricultura Luiz de Queiroz conduct planning with Dr. Rolando Flores. Right: (left to right) Drs. Andréia Bianchini, Ricardo Bressani, Gordon Smith, and Rolando Flores in Guatemala.

CONFERENCES & WORKSHOPS

REGISTER AT FPC.UNL.EDU

Food Entrepreneur Program Workshops

March 16, 2012 – Lincoln, NE
April 27, 2012 – Chicago, IL
May 11, 2012 – Lincoln, NE
August 10, 2012 – Lincoln, NE
November 3, 2012 – Lincoln, NE

National Small Food Manufacturer Conference

April 2-3, 2012 – Omaha, NE

Better Process Control School for Acidified or Low-Acid Foods

April 16-18, 2012 – Lincoln, NE

Better Process Control School

October 30 to November 1, 2012 – Lincoln, NE

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