

Department of Food Science & Technology

Institute of Agriculture
and Natural Resources

Fall 2006

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A Message from the Department Head and Center Director...



Dr. Rolando A. Flores
Department Head and Center Director

Greetings from Lincoln! As the new Head of the Department of Food Science and Technology and Director of the Food Processing Center, it is a pleasure for me to send you this *Alumni News*. I would like to take this opportunity to introduce myself and give you an update on the Department and the Food Processing Center.

Before doing this, however, I would like to thank and commend Dr. David Jackson for the great job he did as Interim Department Head prior to my arrival. Everyone in the Department appreciates Dr. Jackson's professionalism and great service to the University.

Please allow me to outline my background, which spans over thirty years of industrial, academic, and research experience in food processing and engineering. I was born in Costa Rica, where I received a B.S. in Mechanical Engineering from the Universidad de Costa Rica. I came to the States for my M.S. and Ph.D. I received an M.S. in Agricultural Engineering from Iowa State University (ISU) and a Ph.D. in Grain Science from Kansas State University (KSU). Prior to coming to the University of Nebraska-Lincoln this past March, I conducted food engineering research on food safety and ethanol by-products at the Eastern Regional Research Center of the USDA Agricultural Research Service in Wyndmoor, Pennsylvania. Before that, I worked for over 16 years in teaching, research, and extension at ISU and KSU. Much of my work at these universities dealt with dry and wet milling, food processing, process modeling, and grain processing byproducts. Also, before joining academia, I worked at the National Production Bureau in San Jose, Costa Rica, including three years as the Director of the Administration Division, which oversaw that nation's \$27 million a year wheat and corn purchase program.

I am very proud to join the Department of Food Science and Technology and to have the opportunity to work with faculty, students, and alumni in order to benefit the State of Nebraska. It is an honor to be part of a department such as ours—a department that has a strong tradition of academic excellence and faculty who are dedicated to the main functions of the University: teaching, research and extension.

I am also proud to say that we had several students graduate in Spring 2006 and join the ranks of our alumni. The following students graduated from our B.S. program: Sara Morrissey, Rachel Reuss, Emily Richmond, Andrew Wassinger, Jessica Williams, and Aubrey Vifquain. In addition, R. M. Wajira Ratnayake received his PhD; he is currently doing a postdoc with Dr. David Jackson.

New and exiting things are happening in Filley Hall. We are ready for a new academic year and the enrollment in our undergraduate program continues to grow. The opportunities for graduate students keep increasing due to the hard work of the Food Science and Technology faculty in attracting funding for their research and extension programs. We have a new addition to the faculty in September. I am very pleased to welcome Dr. Jens Walter, who will be teaching food microbiology and conducting research in gastrointestinal track microbiology. A native of Germany, Dr. Walter has spent several years at the University of Otago, New Zealand, conducting research on microbial ecology in the characterization and dynamics of intestinal *Lactobacillus* populations using molecular methods.

The Food Processing Center (FPC) is looking forward to having new programs that will assist the food industry and contribute to the economic development of Nebraska. The FPC has hired a new process engineer, Dr. Shaowei Liu, who will provide much needed engineering assistance to food processors and entrepreneurs through our outreach programs. Dr. Liu did his PhD studies at Pennsylvania State University in Agricultural and Biological Engineering. The FPC welcomes Dr. Liu, who will also start work in September.

Two remodeling projects are underway. An old storage facility in Room 36 of Filley Hall is being converted into a new lab dedicated to microbial modeling and spectral imaging to predict food quality. Also, the construction of the Food Safety and Security Pilot Plant will start in early 2007. The Food Safety and Security Pilot Plant will be a state-of-the-art facility capable of evaluating the effectiveness of antimicrobial intervention systems designed for food processing systems. These two projects clearly demonstrate the commitment of the Department and the University to training, outreach, and research in food safety and food microbiology.

In other news of interest, we are happy to announce that a new line of ice cream products, available in 10 oz single servings, is going to hit the market this fall, just in time for the football games. New cheese products will be available in our redesigned gift boxes that can be purchased through the Dairy Store website (<http://www.dairystore.unl.edu>). Also, the new East Campus Visitor Center, located in the Dairy Store area across from the customer counters, will open its doors this fall.

A lot of great and exciting things are happening in Filley Hall. Please stop by and visit us when you are in town. Also, please feel free to drop me an e-mail (rflores2@unl.edu) with your comments, concerns, and suggestions as to how we can do a better job.

Thank you for your support!

Rolando A. Flores, PhD
Professor, Head & Director

Dr. Susan L. Hefle

Professor, scientist, friend, colleague, world traveler, bike racer, and so much more.



1959 - 2006

On Wednesday, August 30, 2006, Dr. Sue Hefle passed away after a brave battle against cancer. The legacy of Dr. Hefle is one of courage and dedication. Her professional accomplishments and impacts on food science and the food industry are known around the world. She brought recognition and prestige to the University of Nebraska-Lincoln and especially to the Department of Food Science and Technology through her dedication to the Food Allergy Research and Resource Program. We are all honored by knowing her. The lessons she taught us are many and will be with us forever.

Dr. Hefle will be truly missed.

A tribute to the life of Sue Hefle was held on Thursday, September 14, 2006. A memorial fund has been established with the University of Nebraska Foundation. Donations to the Susan L. Hefle Memorial Fund should be sent to Dr. Steve Taylor, FARRP, 143 H.C. Filley Hall, University of Nebraska-Lincoln, Lincoln, NE 68583-0919.

Condolences or personal reflections may be submitted online at <http://www.go4milkshakes.com>. Sue's brother and her two young nephews would truly appreciate receiving such sentiments from anyone who is so motivated.

Graduate Information

Graduates of the Ph.D. Program

Yixiang Xu (May 2005) - Thesis: *Preparations and properties of biodegradable polymers from starch acetate and starch-maleate mixed esters* - Dr. Hanna, Advisor

Yong Jun Goh (December 2005) - Thesis: *Genetic basis for fructooligosaccharide metabolism by Lactobacillus paracasei 1195* - Dr. Hutkins, Advisor

S. Samudra K. Wijeratne (December 2005) - Thesis: *Impact of Natural Antioxidants on Oxidative Stress in CACO-2 Human Colon Cells* - Dr. Cuppett, Advisor

R.M. Wajira Ratnayake (May 2006) - Thesis: *A new insight into the phase transition processes of food starches* - Dr. Jackson, Advisor

Graduates of the M.S. Program

Carolina Estrada (May 2005) - Thesis: *Development of an enzyme-linked immunosorbent assay (ELISA) for the detection of shrimp residues in processed foods* - Dr. Hefle, Advisor

Yousef Hassan (August 2005) - Thesis: *Antifungal and Anti-Mycotoxin Activity of Lactic Acid Bacteria Isolated From Sourdough Bread Cultures* - Dr. Bullerman, Advisor

Weston Johnson (August 2005) - Thesis: *The influence of corn and sorghum characteristics on wet milling and nixtamalization performance* - Dr. Jackson, Advisor

Pat Littrell (August 2006) - Thesis: *Quality Fermented Apple Beverages Produced from Standard Apple Cultivars Grown in the Midwest* - Dr. Smith, Advisor

Andres Vargas (August 2005) - Thesis: *Control of Listeria monocytogenes on Ready-to-Eat meat products using salts of organic acids and saturated steam* - Dr. Thippareddi, Advisor

Michelle Ziemann (December 2005) - Non-thesis - Dr. Cuppett, Advisor

Graduates of the B.S. Program

Poi-Wah Lee (May 2004)

Melissa Patterson (May 2004)

David Schroeder (May 2004)

Jennifer Huebner (August 2004)

Shawn Peters (December 2004)

Toluwalope Olanrewaju Makinde (December 2004)

Ellie Watts (December 2004)

Kristin Ahrens (May 2005)

Jose Baez (May 2005)

Effie Epke (May 2005)

Stephanie Frankowiak (May 2005)

Vivian Omondi (May 2005)

Shawna Veasey (May 2005)

Richard Zbasnik (May 2005)

Sara Morrissey (May 2006)

Rachel Reuss (May 2006)

Emily Richmond (May 2006)

Aubrey Vifquain (May 2006)

Andrew Wassinger (May 2006)

Jessica Williams (May 2006)

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Student Awards

FELLOWSHIPS

Buckey Memorial Graduate

Joseph Baumert '06

Chancellor's Doctoral

Roxana Yglesias '05

Twila Herman Claybaugh

Jennifer L. Huebner '05
S. Samudra K. Wijeratne '05

William J. Curtis

Kelly Kurtzer '06

Hazel V. Emley

Joseph L. Baumert '05

Maude Hammond Fling

R.M. Wajira S. Ratnayake '05

Larson Graduate Research

Roxana Yglesias '06

Victor W. Henningsen Sr.

David R. Monsalve '05, '06

Milton E. Mohr

S. Samudra K. Wijeratne '05
Joseph Baumert '06

John & Louise Skala

David R. Monsalve '05
Carolina Leguizamon '06

Frank & Marie Wheeler

Kari D. Shoaf '05

Widaman Trust Distinguished Graduate Assistant

Jennifer L. Huebner '05

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SCHOLARSHIPS

Daniel Bestor

Paul D. Callahan '05

Allen & Barbara Sawyer Boettcher

Nicole A. Schuett '05
Jamie Jo Olson '06
Angel Aquilar-Salazar '06

Edward J. Cornish

Jamie L. Eggerss '05
Grant M. Wallace '05
Amanda J. Walls '05
Kristen Cochran '06

Bailey Harris '06

Steven Kaiser '06
Tessa Porter '06

L.K. Crowe Kiwanis

Jessica R. Peterson '05
Melanie Downs '06

NMA DeBenedetti Memorial

Sara E. Morrissey '05

Luther Drake

Daniela M. Bautista '05
Rachelle R. Struebing '05

Mervin Eighmy

Emily J. Richmond '05

Will Forbes

Carolina Leguizamon '06
Roxana Yglesias '06
Bhimalingeswarappa Geera '06

Food Science Club

Rachel M. Reuss '05
Gregory A. Knudsen '05

Ella Husted Frisbie

Jessica R. Peterson '05

Holling Memorial

Morgan J. McGowan '05
Melanie L. Downs '05

Institute of Food Technologists (IFT)

Amanda J. Walls '05
Aubrey A. Vifquain '05
Bailey Harris '06
Emily C. Ogden '05
Grant M. Wallace '05
Gregory Knudsen '06
Jamie L. Eggerss '05, '06
Jennifer L. Huebner '05, '06
Jessica R. Peterson '05, '06
Kari D. Shoaf '05
Lauren M. Gemar '05, '06
Melanie L. Downs '05, '06
Morgan J. McGowan '05, '06
Robert Lacy '06
Sara E. Morrissey '05
Stefanie Graff '06
Tessa Porter '06

Kellogg's

Aubrey A. Vifquain '05

Raymond & Annette Kubie

Jessica R. Peterson '05

Lancaster County Farm Bureau

William P. Davis '05

David H. & Annie E. Larrick

Yong Jun Goh '05
Kari D. Shoaf '05
Andreia Bianchini '06
Carolina Leguizamon '06

James & Anna Lemley

Rachelle R. Struebing '05

Dr. Morrison & Genevieve Lowenstein

David Splonskowski '06

George McGinnis

Lauren M. Gemar '05

Samuel & Martha McKelvie

Aubrey A. Vifquain '05

Frank E. & Inez L. Mussehl

Timothy W. Anderson '05
David R. Monsalve '05
Sara E. Morrissey '05
Emily C. Ogden '05
Ryan J. Talley '05

Erwin & Dorothy Schulz

Jamie L. Eggerss '05
Robert J. Lacy '05
Amanda J. Walls '05

Corporal Herbert Ulrich

Grant M. Wallace '05

Oak B. Smith/Wenger Manufacturing

Sara E. Morrissey '05
Rachel M. Reuss '05
Andrew B. Wassinger '05
Steven L. Beckman '05, '06
Pei-Ven Kam '05
Gregory A. Knudsen '05, '06
Jessica R. Peterson '05, '06
Ryan J. Talley '05, '06
Melanie L. Downs '05, '06
Lauren M. Gemar '05, '06
Emily C. Ogden '05
Daniela M. Bautista '05, '06
Paul D. Callahan '05
William P. Davis '05
Stefanie A. Graff '05, '06
Olivia M. Kunzman '05, '06
Rachelle R. Struebing '05
Timothy Anderson '06

Student Awards cont.

Oak B. Smith/Wenger Manufacturing (cont.)

Kenzi Clark '06
Ashley Hejny '06
Robert Lacy '06
Thanh Tuyen Thi Le '06
Morgan McGowan '06
Emily Sitorius '06
Amanda Walls '06
Grant Wallace '06
Erin Golden '06
Nicole Johnson '06
Jeffrey Schroeder '06
Michael Smith '06
Cassidy Robinson '06
David Splonskowski '06

Yunkers Farm Aid

Olivia M. Kunzman '05

UCARE

Undergraduate Creative Activities & Research Experiences

(Funded by the Pepsi Endowment as a 1- or 2-year program, offering undergraduates the opportunity to work alongside faculty members on a research project.)

2005-2006 Participants: **Pei-Ven Kam, Hooi Ling Lee, Rachel M. Reuss, Aubrey A. Vifquain**

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OTHER AWARDS

Steven Beckman: 2006 National Dairy Promotion & Research Board Scholarship

Chiew Hui Kaw: 2006 Institute of Food Technologists Annual Meeting 2nd place in Toxicology & Safety Evaluation Division Graduate Paper Competition

Poi-Wah Lee: 2006 Institute of Food Technologists Annual Meeting Honorable mention in Toxicology & Safety Evaluation Division Graduate Paper Competition

Sara E. Morrissey: 2005 Star in Agriscience for the National FFA Organization

R.M. Wajira S. Ratnayake: 2005 AACC International Graduate Fellowship in Cereal Chemistry & Technology funded by the Charles Becker Endowment

R.M. Wajira S. Ratnayake: 2005 AACC Annual Meeting Best Presentation for Cereal Chemistry given by the Corn Refiners Association

S. Samudra K. Wijeratne: 2005 American Oil Chemists' Society Annual Meeting Student Poster Award

S. Samudra K. Wijeratne: 2006 American Oil Chemists Society (AOCS) Annual Meeting for Health & Nutrition Division Best Poster Award

Roxana Yglesias: 2006-2007 AACC International Bill Doty Memorial Graduate Fellowship

2nd Place Team, 2006 IFTSA College Bowl, Columbia, MO: Tim Anderson, Jennifer Huebner, Rachel Reuss, Ryan Talley, Richard Zbasnik

CASNR Week Winners & Finalists

Food Science Club: Outstanding Student Organization Winner

Gregory Knudsen: Outstanding Student Organization Officer Finalists

Thanh Tuyen Thi Le: Outstanding Student Organization Member Finalists

Rachel Reuss: Student Leadership Award Finalist

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Khem Shahani Professorship in Food Science and Technology

Through a generous gift from Leona Shahani (wife of the late Dr. Khem Shahani, former UNL Dairy Science Professor) and the American Dairy Association of Nebraska to the University of Nebraska Foundation, the Department of Food Science and Technology is proud to name Dr. Robert W. Hutkins as the first "**Khem Shahani Professor in Food Science and Technology.**" Dr. Hutkins began his initial five-year Professorship on July 1, 2005. A reception was held in October to thank the generous donors and honor Dr. Hutkins.

Pictured: Michael Shahani, Leona Shahani, Robert Hutkins and David Jackson



Robert W. Hutkins, Ph.D.

Dr. Hutkins obtained his Ph.D. in Food Microbiology from the University of Minnesota in 1984. He was a postdoctoral fellow at Boston University School of Medicine and a Research Scientist at Sanofi Bio Ingredients prior to joining the Department of Food Science and Technology at the University of Nebraska–Lincoln in 1987. Dr. Hutkins' research has focused on two groups of bacteria important in foods, those that cause foodborne disease and those responsible for food fermentations. He has been especially interested in bacteria that promote gastrointestinal health in animals and humans and in identifying the molecular mechanisms for these effects.

Hutkins' Lab

Graduate Students - Jennifer Huebner,
Jake Knickerbocker, Kelly Dawson, Kari Shoaf

Undergraduate Students - Kenzi Clark, Lauren Gemar,
Morgan McGowan, Jami Olson,
Daniella Bautista

Department of Food Science and Technology honors alumnus at UNL's 2005 Master's Week



S. Suzanne Nielsen, Ph.D., '76

Dr. S. Suzanne Nielsen is widely recognized as both an outstanding teacher and research scientist in the field of Food Science. She graduated from UNL with a B.S. degree in 1976 and is now a professor and head of the Department of Food Science at Purdue University. Dr. Nielsen is the editor of *Food Analysis*, a popular textbook used by a vast majority of food science departments in the U.S. and received the William V. Cruess Award by the Institute of Food Technologists in 2002. Dr. Nielsen earned an M.S. and Ph.D. from the University of Minnesota in 1979 and 1982, respectively.

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Research News



Research on Probiotics and Prebiotics at the University of Nebraska: A Century of Progress

Robert W. Hutkins, Ph.D.

Khem Shahani Professor in Food Science and Technology, Department of Food Science and Technology, UNL

Ever since the famous Russian immunologist and Nobel Laureate, Elie Metchnikoff, extolled the virtues of fermented milk products in his 1908 book, *Prolongation of Life*, scientists from around the world have been studying the bacteria thought to be responsible for promoting human health. Now referred to as “probiotics”, these bacteria are defined as “live microorganisms which when administered in adequate amount confer a health benefit on the host” (Fuller, 1989). The probiotic bacteria that initially attracted the most interest, and that are still studied even today, belong to the genera, *Lactobacillus* and *Bifidobacterium*. More details on these bacteria will be discussed later in this article.

When one considers the universities where scientists first began to study fermented dairy products and probiotic bacteria, it might seem unlikely that the University of Nebraska would be high on the list. After all, a century ago, weren't Wisconsin, Minnesota, and New York the “dairy” states where most dairy research occurred? Indeed, universities in those states were well known for their research on milk and dairy products, but the University of Nebraska-Lincoln was also quite involved in dairy-related research, especially research focused on the probiotic bacterium, *Lactobacillus acidophilus*. Although researchers at Yale, Harvard, and Cornell had begun to identify and characterize probiotic bacteria in the early 1920s, studies using *Lactobacillus acidophilus* had also begun at UNL in the laboratory of Professor H.P. Davis, who was then the Head of the Department of Dairy Husbandry. A UNL extension bulletin (based on an M.S. thesis), with the intriguing title, “The commercial application of *Lactobacillus acidophilus* milk”, was even published in 1928 by Reichart and Davis.

The University of Nebraska became one of the real pioneers in probiotic research in the late 1950s, shortly after Professor Khem Shahani joined the faculty of the Department of Dairy Science. Professor Shahani was interested in isolating intestinal bacteria that satisfied the physiological and biochemical properties that would be expected for a probiotic organism. Specifically, candidate probiotics should be able to survive the digestive process, colonize the gastrointestinal tract, and have, at least, in vitro, the ability to impart beneficial health effects on the host. Of the organisms isolated and screened, one particular strain of *Lactobacillus acidophilus* appeared to satisfy these requirements. This strain was named DDS-1 (in honor of the Department of Dairy Science). For the next 30 years, this organism was the subject of numerous studies and published reports. Professor Shahani eventually developed techniques and formulations for high cell density production and preservation of probiotic bacteria. A company, Nebraska Cultures, was formed in 1981 that has continued to produce and distribute *Lactobacillus acidophilus* DDS-1 and other probiotic strains.

One of the questions that has emerged from the research on probiotic bacteria deals with the means by which these organisms colonize the intestinal tract. Even if the probiotic bacteria are consumed in large doses and possess adherence and other colonization factors, they are still at a decided disadvantage. This is because the intestinal tract is a highly competitive environment, containing perhaps a trillion organisms per gram (more than a million times that of the probiotic). The existing microflora is so densely populated and so well-established that newcomers will have a very difficult time gaining a foot-hold. That is, unless some means of providing the new-

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comer with a selective advantage is introduced. One way to provide probiotic bacteria with such an advantage and to enhance, specifically, their growth in a mixed population, would be to add nutrients into the growth environment (e.g., the gastrointestinal tract) that only the target bacteria (i.e., the probiotics) could metabolize and use as a carbon or energy source. Thus, growth of bacteria that can metabolize these substances is stimulated, presumably at the expense of those bacteria that cannot. In addition, these substances may also promote persistence in the colon, i.e., colonization. Nutrients that have this property are called prebiotics (Gibson and Roberfroid, 1995). The main requirement of a prebiotic, however (in addition to their selective metabolism), is that they must escape digestion and adsorption in the stomach and small intestine so that they can reach the colon intact. Most prebiotics are in the form of oligosaccharides (chains of sugar molecules containing from 3 to 20 monosaccharides). The best-studied of these are fructooligosaccharides (FOS) and galactooligosaccharides (GOS), although inulin (a polymer of fructose) also has prebiotic activity. These oligosaccharides exist naturally in foods or can be enzymatically synthesized; both types are available commercially. In the U.S., there are only a few foods, mainly yogurt and other cultured dairy products that contain prebiotics. However, in Europe and the Far East, there are hundreds of prebiotic-containing food products, including breads, cereals, and beverages.

Although this “new” idea of using oligosaccharides to influence the microflora in the gastrointestinal tract has very important implications for human health, it is worth noting that the “prebiotic hypothesis” actually has roots in the older literature. It is well-known that nursed infants contain a much higher proportion of bifidobacteria in their intestinal tract compared to formula-fed infants and that these nursed infants generally have a lower incidence of diarrheal diseases. What was in human milk that stimulated bifidobacteria? Scientists called this unknown substance “bifidus” factor. Now we know that human milk contains appreciable amounts of galactooligosaccharides (as much as 2%), and that bifidus factor and galactooligosaccharides are one and the same.

As noted above, the ability to metabolize oligosaccharides must be specific to only selected organisms; if they were widely fermented, they would stimulate all organisms within the gastrointestinal tract. Therefore, one of the main goals of the Hutkins’ microbiology lab at UNL has been to establish the molecular basis by which these oligosaccharides are metabolized. Our approach was to use DNA microarray technology to identify the genes (in *Lactobacillus paracasei*) that were induced when cells were grown in medium containing FOS, but that were not induced when grown on glucose. We also could identify FOS-induced genes whose expression was turned off when glucose was suddenly added. The DNA microarrays (also called DNA chips) were manufactured in the University’s state-of-the-art Microarray Core Facility (housed right in the Food Industry Complex). Results from the array experiments, conducted by Dr. Jun Goh (formerly in the Hutkins’ lab), combined with computational analyses, revealed the presence of a group of genes (called the FOS operon) that encoded for a putative cell wall-anchored, FOS hydrolyzing enzyme and several proteins involved in transporting the fructose monomers released during hydrolysis. Of course, our analysis only allows one to predict the function of the genes identified, and actual assignment of a function requires that appropriate biochemical experiments (including the use of isogenic mutants) be performed. These experiments subsequently confirmed that our predicted functions were correct. In fact, we were also able to move the FOS genes into a non-FOS fermenting strain (*Lactobacillus* GG), such that the new strain could metabolize FOS. Interestingly, in an earlier collaborative study with Dr. Todd Klaenhammer’s lab at North Carolina State University, we reported that a different *Lactobacillus*, *Lactobacillus acidophilus*, metabolized FOS by transporting the intact molecules and hydrolyzing the internalized FOS within the cytoplasm (Barrangou et al., 2003, Kaplan and Hutkins, 2003). Thus, there appears to be at least two different mechanisms by which FOS is metabolized.

Another unique property of prebiotics is now being investigated in the Hutkins lab. We (and others) have observed that the galactooligosaccharides are structurally similar to the oligosaccharides that cover the surface of

the epithelial cells that line the human gastrointestinal tract. These oligosaccharide residues are recognized as attachment sites by various pathogenic bacteria, including enteropathogenic *E. coli*. In fact, this attachment to the host epithelial cells, mediated via binding to cell surface oligosaccharides, is the very first step in the infection process. If, however, exogenous galactooligosaccharides are present (in the form of prebiotic GOS), then *E. coli* will bind to those molecules, rather than the cell surface galactooligosaccharides. Thus, the GOS would serve as a decoy, and host cells binding by *E. coli* will decrease. This hypothesis has been tested by Kari Shoaf, a doctoral student in the Hutkins' lab. She conducted a series of adherence assays, using a tissue culture model, and showed that adherence of enteropathogenic *E. coli* to two tissue cell types is indeed inhibited in the presence of GOS. Other oligosaccharides, however, were less inhibitory, presumably because of their structural dissimilarity.

As noted above, when prebiotics are incorporated into yogurt, kefir, and other cultured milk products, they are often combined with probiotics, in the form of "synbiotics". However, not all probiotics can ferment prebiotic sugars. Several years ago, we developed a plating method to distinguish between prebiotic-fermenting and non-fermenting strains (Kaplan and Hutkins, 2000). Still, this method was strictly qualitative and could not assign an "activity" to a given prebiotic. In other words, there would be value in knowing how active or stimulatory a specific prebiotic would be to a specific probiotic organism, so that the best combination could be selected. In addition, one might also be interested in knowing whether food processing (e.g., high temperature pasteurization or low pH) had affected the activity of a prebiotic. Thus, Jennifer Huebner, an M.S. student, developed a method, a bio-assay of sorts that would give a prebiotic activity "score", analogous to vitamin activity bioassays. Using ten probiotic strains and five prebiotics, she was able to identify the best combinations. She is now determining how well these prebiotics stand up to food processing treatments.

Finally, the genomes of several lactic acid bacteria, including several that are used as probiotics, have recently been sequenced. Many of the genes that encode for essential metabolic pathways or that are thought to be necessary for survival and colonization in the gastrointestinal tract have been identified. The Hutkins lab, along with ten other groups, has been a part of the Lactic Acid Bacteria Genome Consortium. We sequenced the genome of *Streptococcus thermophilus*, an industrially important bacterium used in the manufacture of yogurt, as well as Mozzarella, Parmesan, and Swiss cheeses. Our results have revealed that although this organism has limited metabolic diversity (i.e., few catabolic genes), it is well equipped to grow rapidly in milk. We are now in the process of identifying functional roles for many of the genes of interest.

In conclusion, research (as well as commercial interest) in the beneficial role of probiotic bacteria on human health is now at an all time high. The ability of prebiotic and other dietary components to influence the growth and persistence of selected probiotic bacteria has been touted as one of the most remarkable developments in microbiology in a century (Macfarlane and Cummings, 1999). Research on probiotic bacteria at the University of Nebraska-Lincoln has attracted industrial, academic, and consumer interest for nearly a hundred years. The recent establishment of the Khem Shahani Professorship of Food Science and Technology will ensure that research in this important area will continue for many years to come.

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Food Processing Center



2005 marked the arrival of several pieces of new processing equipment at the Food Processing Center (FPC). In the spring, a vacuum belt dryer was installed in our Pilot Plant Facility. This dryer is the only one of its kind in the United States. It enables the FPC to offer the food industry an opportunity to explore food drying options for their products. The advantages of vacuum drying include a homogenous, high-quality product; no product oxidation or contamination; aroma retention; a hygienic closed system; and minimal product loss.

The FPC Dairy Pilot Plant just purchased a new separator to help clients better control the nutritional aspects of milk solids as well as enhance the Plant's manufacturing capacity. The new separator will help clients conduct projects on all types of dairy products, and is sized for small, continuous product runs and batch systems. This is advantageous for small dairy processors who want to develop new products without having to stop production lines or purchase new equipment. Also, a new ice cream filler is scheduled to arrive in September 2006.

This year was especially busy for the Dairy Store at the Food Processing Center. In addition to selling the usual delicious selections of ice cream and cheese, new gourmet salads and sandwiches were added to the lunch menu. The expanded lunch menu has increased business during the noon hour as the Dairy Store has become a popular place for UNL staff, students and visitors to take a break. The Dairy Store is once again selling holiday cheese boxes this year. The boxes include cheese made by staff and students in the UNL Dairy Plant.

In 2005 the FPC responded to the Food and Drug Administration's (FDA) trans fatty acid regulations on food labeling by promoting the wide variety of services available to food manufacturers who not only are trying to comply with the new labeling regulations but are also launching major product reformulations to remove trans fat. By providing analytical testing, nutritional labeling services and product development services, the FPC has helped many companies comply with the FDA regulations in a timely and confidential manner.

The FPC hosts a wide variety of workshops and conferences. The Food Entrepreneur (FEAP) workshops are always popular with new entrepreneurs, restaurateurs, storeowners and producers who want to start or expand a food-based business. This workshop has been so popular that workshop coordinator, Jill Gifford, has been asked to teach the workshop in other states. In the fall of 2005, Gifford and Joan Scheel traveled to Tanzania with Dr. David Jackson to work with rural entrepreneurs.

Many of the regular FPC workshops are directed towards food processing industry professionals. In Applied Extrusion, participants get practical, hands-on training on the FPC's Wenger TX-57 twin screw extruder. In Better Process Control School, supervisors of thermal food processing and acidified food processing operations receive training and FDA certification on operations of retorts, processing systems, aseptic processing, packaging systems and container closure inspection. Ingredients and Ingredient Functionality provides food industry professionals with a basic understanding of the functionality of major ingredient classes—proteins, lipids, carbohydrates and water.

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The FPC coordinated several new workshops in 2005. In August, a workshop called Transitioning to Certified Organic Production and Processing was held for producers and processors who want to access the rapid market growth and price premiums of selling organic products. In November, we hosted an Artisan Cheese-Making Workshop for producers and entrepreneurs interested in learning how to make artisan cheeses.

Another exciting project for the FPC involved UNL Dining Services, farmers, ranchers and small food processors. The project, called "Good, Fresh, Local - The Nebraska Sustainable Food Project," brought some Nebraska flavor - along with education - to the tables of the Cather-Pound-Neihardt dining hall during the Fall 2005 semester. The "all Nebraska meals" featured food grown by local producers. In addition to enjoying fresh, local food, students had an opportunity to learn about sustainable agriculture and meet with some of the producers who attended the meals.

A study conducted by the FPC examined local food systems and led to the organization of the new Nebraska Food Cooperative. In this new cooperative, Nebraska farmers, ranchers and others who produce local foods are joining to sell their foods locally. The cooperative aims to improve access to reasonably priced, high quality, sustainably produced foods from Nebraska. Additional goals of the cooperative are boosting rural economic development and environmental sustainability.

Some of the FPC staff traveled to Orlando in mid-July to attend the Institute of Food Technologists Annual Meeting and Food Expo where they had the opportunity to connect communicate and collaborate with other food industry professionals from around the world. At this meeting, a dehydration symposium was organized and chaired by Laurie Keeler. Attendance to the symposium was very good and numerous inquiries about the FPC dehydration facilities followed.



A New Look at the Dairy Store! Since 1917 the Dairy Store has provided quality dairy products. Today, we still offer those and more.

This fall, the Dairy Store will unveil a new look. Even though our look is changing, you will still find our same popular ice cream and cheeses. Stop by for a visit or go to our redesigned website at <http://dairystore.unl.edu>.

Coming soon you will be able to enjoy five of our favorite Dairy Store ice cream flavors conveniently packaged in 10 oz single serve cups. These cups will be available in the store and at both Unions as well as home football and volleyball games.

There is a lot happening at the Dairy Store - new look, new products and more. Come and visit us.

Food Processing Center

August 2006

National Program Helps Food Business Entrepreneurs

Have you ever thought of starting a food business? Do you have a favorite family recipe you would like to bring to the marketplace? Are you a producer considering adding value to an agricultural product? Maybe you are a restaurateur or chef exploring the marketing of a house specialty. According to Jill Gifford, Manager of the University of Nebraska Food Processing Center Food Entrepreneur Assistance Program, this is a description of many of the individuals that participate in the program. "Since 1989 the Food Entrepreneur Assistance Program has helped hundreds of entrepreneurs throughout the U.S. investigate and realize their dream of starting a food business," explained Gifford.

John and Beth from Geneva, Illinois utilized this program when they developed their business, Secret Sauces LLC. The Schlitts have been selling their marinades, based on their own kitchen recipes, to specialty markets in Illinois for over a year.

"When we decided to market our products, we were looking for someone that could help us understand the many aspects of taking our recipes from our kitchen to a professionally produced product and how an entrepreneur can get started in this business. The Food Entrepreneur Assistance Program provided us with excellent insight into what it takes to get started, as well as offered the many resources, all in one place, to turn our plan into a real business," explained Beth Schlitt.

The program was designed specifically to assist food manufacturing entrepreneurs. It begins with a one-day "From Recipe to Reality" seminar that provides entrepreneurs with an understanding of the key factors that need to be considered when starting a food manufacturing business. Topics include market research, product development, packaging, labeling, pricing, product introduction, promotional materials, food safety, and legal and business structure issues. In one day entrepreneurs will gain valuable insight on the basics of starting a food business that could take them months or even years to research on their own.

Following the seminar, participants may choose to enter the "From Product to Profit" phase of the program. During this phase entrepreneurs will receive comprehensive, individualized and confidential assistance from food scientists and business consultants with the development of their own business venture.

The 2007 "From Recipe to Reality" seminar will be offered in Lincoln on January 8, March 8, June 1, August 10 and October 29. In addition, the seminar will be held in Chicago on August 17, St. Paul, Minnesota on April 27 and in Detroit (date to be announced). Early registration is encouraged due to limited space. To receive a Food Entrepreneur Assistance Program information packet and registration form, contact Jill Gifford at the Food Processing Center, University of Nebraska-Lincoln, 143 H.C. Filley Hall, Lincoln, NE 68583-0928, phone 402-472-2819, e-mail: jgifford1@unl.edu, web site: <http://fpc.unl.edu/marketing.ent.htm>.



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New FPC Laboratory & Testing Services

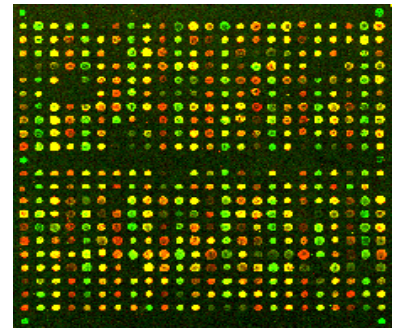
Mycotoxin Detection

Mycotoxins are toxic compounds made by various fungi (molds) as secondary metabolites. They can be produced by fungi growing on grain, feed or food in the field or in storage and are aided by hot and dry conditions. Many mycotoxins are subject to regulations throughout the world and testing for them may be required for your product to enter certain markets. The University of Nebraska-Lincoln Food Processing Center Laboratory Services is pleased to offer mycotoxin analysis to the food and feed industries. Approved testing methods for deoxynivalenol (vomitoxin), aflatoxin, fumonisin, and others will be available upon request. Please go to <http://fpc.unl.edu/Laboratory/> to learn more about our laboratory and testing services.



Printed Microarray Core Facility

The latest cutting edge technologies in molecular biology are now available to the food industry through the University of Nebraska-Lincoln Printed Microarray Core Facility (PMCF). Applications in the food industry include the identification of microorganisms in food, source-tracking of contamination through subtyping methods, as well as the study of functional genomics in various food systems. DNA-based technology has the reputation of providing the most rapid, accurate results to those working with biologically based products or systems. Please go to <http://pmcf.unl.edu/> or <http://fpc.unl.edu/Laboratory/> for more information.



Yes, I want to support the Food Science & Technology Development Fund

Private support is essential to recruiting outstanding undergraduate and graduate students, providing timely and applicable research, and expanding our outreach to small businesses and entrepreneurs across the state. As alumni and friends of the Department of Food Science and Technology, we hope you will consider making a gift to assist us in these efforts. Please complete the contribution form to the right and accept our appreciation for your generosity.

FOOD SCIENCE & TECHNOLOGY DEVELOPMENT FUND #4312

This fund provides general support to the department and is specifically used to enhance undergraduate student recruitment efforts.

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If you have questions regarding other giving opportunities, please contact Dr. Rolando Flores, Department Head of Food Science & Technology, (402) 472-2831, or Ann Bruntz, Director of Development at the University of Nebraska Foundation, (402) 458-1176 or via email abruntz@nufoundation.org

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LFST06

**CONFERENCES & WORKSHOPS
DON'T MISS OUT!**



Food Allergen Methodologies

October 15-18, 2006 - Quebec City, Quebec,
Canada

***Expanding Your Horizons Science and Math
Conference***

(for Middle School girls)
March 13, 2007 - Lincoln, NE

***Food Allergens Issues and Solutions for the
Food Product Manufacturer***

December 5-6, 2006 - Chicago, IL

Better Process Control School

October 3-6, 2006 - Lincoln, NE

Applied Extrusion Workshop

October 17-19, 2006 - Lincoln, NE

Food Entrepreneur Program Workshop

October 30, 2006 - Lincoln, NE
January 8, 2007 - Lincoln, NE
March 8, 2007 - Lincoln, NE
April 27, 2007 - St. Paul, MN
June 1, 2007 - Lincoln, NE
August 10, 2007 - Chicago, IL
August 17, 2007 - Lincoln, NE
October 29, 2007 - Lincoln, NE

***Ingredients and Ingredient Functionality
Workshop***

May 15-17, 2007 - Lincoln, NE

Molds & Mycotoxins in Foods

March 13-15, 2007 - Lincoln, NE



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