Impacting gut health with whole grains

Much of the research on manipulating the gut microbiota through diet has been with prebiotics, which are non-digestible carbohydrate polymers that are readily fermented by gut bacteria and cause stimulation of beneficial bacteria.

“However, our diets are not typically very high in prebiotics,” said Devin Rose, assistant professor in the Department of Food Science and Technology.

“In fact, the majority of non-digestible carbohydrates in whole grains are cross-linked and insoluble and not readily fermented by the gut microbiota. A large proportion of these dietary fibers pass through the gastrointestinal tract without modification.

However, the gut microbiota from individuals who consume diets high in dietary fiber in general, not just prebiotics, are better able to ferment the complex carbohydrates in whole grains and produce byproducts that are beneficial to human health (Figure 1, page 4). Rose and graduate assistants Junyi Yang and Alejandra Arcila are currently investigating the types of bacteria that are most responsible for this.
We are in the midst of one of the most exciting — and challenging — times in the history of the Department of Food Science and Technology as we prepare to move our entire department to the Nebraska Innovation Campus in summer 2015.

UNL’s Innovation Campus is a 250-acre, public-private research and technology park that is envisioned to include more than 2 million square feet of research, meeting and office space. As many as 7,000 public and private employees are expected to work there. Innovation Campus is on the former Nebraska State Fairgrounds. Our department will be in the historic Industrial Arts Building, which is being completely renovated, and in the new Life Sciences building.

Our Food Processing Center is recognized worldwide as one of the leaders in the food science industry. The center focuses on the development of applied research, new products, entrepreneurs and technology assistance to the food and agriculture industries, which is one of the many reasons our department is a perfect fit for Innovation Campus. Learn more about Innovation Campus.

ConAgra, the first official Innovation Campus tenant, wants to partner with our department to help foster a food production-related culture of innovation. We already conduct research and provide training to ConAgra employees in a variety of areas. ConAgra plans to conduct research in the pilot plants, which will be located in the Industrial Arts Building. The company also plans to lease greenhouse space and conduct research on tomatoes and popcorn.

We are looking forward to strengthening our partnership with ConAgra, and we welcome the opportunity to create and increase partnerships with other companies in the area of food innovation.

In other department news, we extend a special welcome to our newest faculty member Bing Wang, assistant professor in food safety and risk assessment. Read more about her on page 3.

Best wishes,

Rolando A. Flores
Head, Department of Food Science and Technology
Director, The Food Processing Center

LET US KNOW WHAT YOU THINK!

We’d love to hear from you! For any feedback or story contributions you’d like to see in future issues, email us at FOODSCI@UNL.EDU.
Bing Wang joined the Department of Food Science and Technology in January 2014.

Wang is an assistant professor in food safety and risk assessment. Her appointment is 60 percent research, 30 percent extension and 10 percent teaching.

She expects to use a quantitative risk assessment approach to evaluate the risk of human health due to consuming contaminated foods, which is an increasingly popular approach in the ongoing effort to manage food safety.

Wang’s research has focused on risk assessment since she received her bachelor’s degree in veterinary medicine. Wang also holds a master’s degree in veterinary pharmacology and toxicology from China Agricultural University. Her doctorate is in veterinary microbiology with an emphasis on veterinary preventive medicine, and a minor in statistics from Iowa State University.

After graduation, she was a postdoctoral research associate at the University of Maryland and a postdoctoral research scientist at George Washington University.

Wang has applied the principles of these disciplines to a diverse set of fields, including characterizing the risks of sparsely tested chemicals, developing probabilistic evidence-synthesis methods for dose-response assessment, risk-benefit analysis of nutrient fortification in grain food, and exposure assessment of foodborne pathogens along the animal protein production chain, to improve the use of scientific information in regulatory decisions and understand how risk perception influences decisions about health and safety.

Wang said when she first came to the United States, she was working on her doctorate in Ames, Iowa. “So, going back to the Midwest is like going back home.”

---

Partnering with the state Department of Agriculture

The Food Processing Center’s success is built on partnerships, and one of its most important is with the Nebraska Department of Agriculture.

A key liaison in that partnership is Stan Garbacz, agricultural trade representative with the agriculture department. Garbacz sits on the Center’s advisory board.

It’s time well spent, Garbacz said.

“What Dr. Flores does is have a broad spectrum of industry people involved with food processing,” he said. “It’s very helpful to us to hear updates on what’s going on in The Food Processing Center.”

One of the more interesting recent activities was the opportunity to review the Center’s plans to move to the Nebraska Innovation Campus. “They will be one of the first UNL departments to go to Innovation Campus,” Garbacz said. “We’re not telling them how to design anything; we just give a lot of general comments. This interaction is really important.”

In his role as NDA’s agricultural trade representative, Garbacz said, he often works with the Center. “We’ve been able to utilize them in some of the projects we’ve been involved in that need their expertise. ... It allows me to have a little closer connection to see the whole picture and use it in the work that I do.”

That includes efforts to find international markets for Nebraska’s dry bean crop and involvement with the Paulson Institute, which promotes sustainable economic growth with China, especially in areas of value-added exports.
Impacting gut health with whole grains

“We believe that this will help us understand the mechanism behind the positive effect of whole grains on human health and could lead to strategies to improve the impact of whole grains on health,” Yang said.

In another approach, Rose and his team are investigating processing treatments that may improve the gut health-promoting effect of whole grains. One of these approaches has been to subject whole grain flour to repeated cooking and freezing cycles.

“This causes a small portion of the starch to convert to resistant starch (Figure 2), which means that it resists digestion by our own digestive enzymes and becomes food for our gut bacteria,” Arcila said.

“Resistant starch has been shown to have tremendously positive effects on gut health. Though the content of resistant starch produced by our cooking-freezing approach is relatively modest (though statistically significant), we see significant improvements in beneficial fermentation metabolites using this approach (Figure 3),” Rose said.

Rose, Yang and Arcila are currently investigating how other processing treatments positively influence fermentation properties of whole grains.

Figure 1. Butyrate produced during in vitro fecal fermentation of the dietary fibers from whole wheat as a function of the dietary fiber intake of the individual from which the fecal bacteria were collected. Butyrate is a beneficial metabolite resulting from the metabolism of carbohydrates by gut bacteria.

Figure 2. Resistant starch in whole wheat flour after subject to the indicated number of cooking-freezing cycles.

Figure 3. Butyrate produced over 24 hours of in vitro fecal fermentation of the dietary fibers from whole wheat flour that had been subjected to cooking-freezing cycles.
It is possible to lose everything and still get an education.

UNL alumnus Ramesh Chandan knows that is so from personal experience.

Chandan, who was born in India, had a happy childhood until India was partitioned and Pakistan was created in 1947. He and his family were forced to flee their home to save their lives, and Chandan remembers walking all night to escape Islamic fundamentalists.

After the partition violence, refugee family members rebuilt their lives and Chandan earned his B.Sc. (Honors) and M.Sc. (Honors) degrees in chemistry from Panjab University in India. In 1959, he came to UNL with the help and encouragement of the late Khem Shahani, a UNL food science and technology faculty member considered a research pioneer in probiotics (a dietary supplement containing live bacteria taken orally to restore beneficial bacteria to the body) and acidophilus (a beneficial bacteria occurring naturally in the human gut). Chandan was a research assistant and earned his Ph.D. in dairy manufacturing and chemistry in 1963. He was the first graduate student to earn a Ph.D. in Dairy/Food Science at UNL. After earning his doctorate, he stayed in touch with some of the UNL faculty members he had worked with, particularly Shahani.

“I feel very proud to be associated with the University of Nebraska,” Chandan said.

“I feel very proud to be associated with the University of Nebraska.”

After receiving his Ph.D., Chandan worked as a scientist at Unilever Ltd. in England. In 1968, he returned to the United States and worked in the food industry for eight years. In 1976, he was appointed associate professor of Food Science and Human Nutrition at Michigan State University in East Lansing. Later, he also worked in research and development for several major food manufacturing companies.

In 1994, Chandan formed Global Technologies, a consulting company focused on food science and technology, which he continues to operate. He has served as a consultant for many companies, including Land O’ Lakes for cheese products; General Mills for Yoplait® yogurt, breakfast cereals, cakes, cheese pasta, potato side dishes and microwave popcorn; Organic Valley for organic yogurt production; Edwards Fine Foods for the production of condensed milk-based products such as key lime pie; and Cargill for liquid egg processing and yogurt ingredient applications. He also has served as an expert witness in several court cases.

Chandan, 79, has been an invited speaker for many national and international organizations and has received numerous awards. The author/editor of nine books, he is working on his 10th.

Although Chandan never lived in Lincoln again after earning his doctorate, he has visited the Department of Food Science and Technology from time to time.

“When we have made pilgrimages to Lincoln, we always stopped for ice cream cones at the Dairy Store,” he said, smiling.
Most people know that the human gut is full of bacteria that aid in digestion, but what you may not know is that your gut also has fungi in it.

Second year master’s student Mallory Suhr of Seward, Neb., has been studying the role of fungi in the human gut in the Department of Food Science and Technology.

“Everyone has fungi in their gut,” Suhr said. “Not much is known about what the fungi are doing.”

Within Suhr’s first year of her master’s program, she identified and characterized the fungal species in the gut of humans with vegetarian diets.

The most abundant fungi found in the gut are candida yeasts. Other fungi found in the gut can be from airborne fungi or food-associated fungi such as mushrooms.

Suhr has begun research on the role of candida yeasts in small bowel transplants. Small bowel transplant recipients have a higher-than-average susceptibility to severe fungal bloodstream infections.

Heather Hallen-Adams, assistant professor, is in charge of the research. Suhr says Hallen-Adams is a good role model.

“She is very helpful, she always has her door open and is willing to give ideas and help guide you to be successful.”

When Suhr was an undergraduate at Hastings College, she had an internship at the US Meat Animal Research Center in Clay Center.

“I really like the feel of the department. Everyone is nice and helpful and friendly.”

Suhr said she chose UNL because it has one of the top food science programs in the country.
Job opportunities for alumni

A company in the Greater Seattle (Washington) area is seeking a senior food product development specialist. Applicants should have a degree in food science and a passion for food development. Any pilot plant experience is a big bonus. The type of food/beverage is not important at this time.

Other job opportunities in the Pacific Northwest include:

- Quality assurance manager (Boise, Idaho)
- Quality control/laboratory technician (Seattle, Washington; Boise, Idaho; and Portland, Oregon)
- Senior food scientist-product development (Seattle, Washington)
- Operations manager (Portland, Oregon)
- Packaging manager (Boise, Idaho)
- Food production/plant manager (Washington)
- Analytical chemist (Portland, Oregon)
- Sanitation lead (Bellevue, Washington)
- Process improvement technician (Tri–Cities, Kennewick, Pasco, and Richland, Washington)

If you are interested in any of these job opportunities, send your resume to seattle@labsupport.com. Once your resume is received, a recruiter will contact you.

For more information, contact Wendy Martin, UNL Food Science and Technology Recruitment Coordinator, 402-472-0945 or wmartin3@unl.edu.

Conferences and Workshops

**Better Process Control School**
Sept. 30-Oct. 2, 2014 – Lincoln, NE

**Better Process Control School for Acidified Foods**
April 28-29, 2014 – Lincoln, NE

**Conference of Food Engineering**
April 7-9, 2014 – Omaha, NE

**Extrusion Workshop**
May 13-15, 2014 – Lincoln, NE

**Food Microbiology Workshop**
March 25-26, 2014 – Lincoln, NE

**Recipe to Reality Seminars**
March 22, May 16, Aug. 1, Oct. 25, 2014 – Lincoln, NE

**Recipe to Reality Seminar**
May 30, 2014 – Chicago, IL

For more information, contact Jill Gifford at (402) 472-2819 or jgifford1@unl.edu.
Food Science Links Health Care

How do a food science major and a medical degree fit together? Just ask UNL Food Science and Technology junior Kaelyse Clapper. “I got interested in food science when we toured the department, and I loved it,” Clapper said.

The program met her interest in science that can be applied to real-world problems and fit into her goal of going into the health care field. She is majoring in Food Science and Technology with a pre-health emphasis. After she gets her Bachelor of Science degree, she intends to enter the physician’s assistant program at either the University of Nebraska Medical Center in Kearney or Union College in Lincoln.

“My objective is to open a medical clinic in a rural area because that’s an area that is traditionally medically underserved,” Clapper said. “For example, there’s a huge demand for medical professionals in rural Nebraska.”

During her three years on campus, Clapper has been involved in various campus activities including leadership positions while living in on-campus housing; serving as a student ambassador representing the department to prospective students; holding officer positions in the Food Science Club; and by working in the Food Allergy Research and Resource Program lab.

Last summer she stayed true to her goal of working in rural Nebraska by interning with the Kearney/Franklin County UNL Extension office. “That was a good experience in learning how to do outreach,” she said.

This spring she’ll earn her medication aide certification and her basic life support certification so she can continue on her path to medical school. “The next year will be a mix of finishing my undergraduate degree while applying to medical schools,” Clapper said. “I really enjoy my food science courses as they get into more areas of specialization which is worth it as I head off into the interesting world of medicine.”

ISO accreditation
The Food Allergy Research and Resource Program laboratory was approved for ISO accreditation by the American Association for Laboratory Accreditation. This means that the lab has met certain international standards, and has been checked and approved by a third party. Very few academic laboratories have ISO certification, making it a noteworthy accomplishment.

Awards
Andrew Benson, who leads the Gut Function Initiative, had his appointment as a W.W. Marshall Family University Professor of Food Science & Technology renewed for five more years because of his contributions to food science and UNL.

Curtis Weller was selected as a Fellow by the American Society of Agricultural and Biological Engineers.

A Cup and a Cone
Those polar vortex temps can chill you to the bone, but ice cream is always in season, so pull on that parka and head over to the Dairy Store. If the idea of ice cream in winter leaves you cold, don’t forget about our fresh-brewed coffee. A cup of coffee and a cone are a perfect cold weather combo.