

CALIFORNIA Dairy Dispatch

RESEARCH, EDUCATION AND SERVICE TO SUPPORT THE DAIRY INDUSTRY

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Fermenting a revolution: How research fueled the probiotic phenomenon

By Joseph O'Donnell

Another year and once again probiotics are topping everyone's list as what's hot in food development. Those trendy little bugs are suddenly the darlings of food developers and consumers looking to fine-tune their digestive system – a thought that would have been taboo to voice a decade ago. Fermented dairy foods like yogurt, kefir and cheeses packed with probiotic strains touting immunity and digestive health benefits are crowding the dairy aisle in every flavor and style possible. However, the science behind probiotics has taken centuries to develop.

Well before recorded history, humans caught on to the enormous nourishing advantages of milk. In the early days, the only downside to this food source was rapid spoilage. Fermentation brought a solution. The discovery of fermentation led to the development of an entirely new source of food as the process was refined and new products were developed, diets expanded and potential starvation turned to survival.

Fast-forwarding to modern times,

(see **Probiotics** on page 2)



Cal Poly creates dual master's degree programs with China university

Cal Poly's College of Agriculture, Food and Environmental Sciences recently announced a new dual master's degree program in cooperation with Shanghai Jiao Tong University, one of the oldest universities in China. The program will allow two Jiao Tong students to study dairy science in San Luis Obispo.

Phillip Tong, director of Cal Poly's Dairy Products Technology Center, said the program is extraordinary in that participants will graduate with two degrees – a master's in food science from Jiao Tong, a science and technology-focused campus often thought of as China's MIT, and a master's in agriculture with specialization in dairy products technology from Cal Poly.

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dairy scientists in the 1970s, including Drs. Khem Shahani, Bill Sandine and Larry McKay, kept the field of study perking along with significant discoveries. More importantly, they set the stage enabling the next generation of researchers to make tremendous breakthroughs in scientific technology, especially through studies of bacterial DNA.

The 1980s put a spotlight firmly on the concept of probiotics and the role dairy products played in delivering these beneficial cultures. At the

time, science was well aware of the fact that bacteria “owned” our large intestines (colon). While science moved forward with understanding how to make better cheese or yogurt, researchers were laying the groundwork for understanding the physiological benefit these dairy-associated bacteria might have for consumers.

Support for probiotic research was steady in the 1980s, with most of the microbiological attention focused on starter cultures. The National Dairy Council funded clinical studies by Gorbach and Goldin that supported the physiological benefits of dairy probiotics. Their findings attracted attention from other researchers and companies, yet the cultures were too unstable and the market for fermented dairy products in the United States was slow to develop, compared with what was happening in Europe and Asia.

A major breakthrough came with the ability to genetically sequence the DNA of milk-associated bacteria. A group of lactic acid microbiologists worked with the Joint Genome Institute to sequence 11 fermentative bacteria, opening the door to truly understanding what these bugs can do.

In the late 1980s and early '90s, microbiologist Todd Klaenhammer became a leader in the field. Klaenhammer, who took his Ph.D. under Larry McKay, trained a number of leading dairy microbiologists and is the only dairy food scientist to become a member of the National Academy of Sciences.

At the turn of the 21st century, clinical studies using dairy lactics became more feasible in universities, and big companies were investing in their own independent research. Dannon took the first step and introduced first Actimel and then Activia to the United States. Activia became one of the most successful new product launches ever. Other companies

followed suit and the U.S. market finally materialized.

With financial support from CDRE, in 2000 leading scientists in the probiotics field formed the International Scientific Association of Probiotics and Prebiotics (ISAPP) to establish a scientific basis for the benefits of probiotics. Today, marketers are positioning their products according to ISAPP's Guidelines for Consumers.

And what of the role that milk plays in the support of probiotics? The association has always been there but what about the scientific support? Again, breakthrough technology produced the analytical capability of measuring the carbohydrates in milk. What scientists found was great diversity of oligosaccharides in milk. A team from UC Davis that included Bruce German, David Mills and Carlito Lebrilla started looking very seriously at how oligosaccharides from human milk affected the growth of probiotics. These results have been published and represent the bedrock science connecting milk to probiotic activity. This work attracted other scientists extending into immunology, appetite control and other areas. It also moved from human oligosaccharides to the large-scale availability of bovine milk.

This recent work, to me, will stand as the first scientifically proven evidence of the role that milk plays in the support of probiotic activity. Exactly what that probiotic activity means is under intense investigation by researchers around the world. Clearly, probiotics will find a role in basic health throughout the stages of life, as well as an eventual role in the treatment of various maladies. No doubt, other components of milk will be proven to support probiotics, giving dairy a continuing role in bringing the benefits of probiotics to consumers.

CDD



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ORGANIZATION SPOTLIGHT: American Dairy Products Institute

The American Dairy Products Institute (ADPI) is an organization with almost as many layers as the dairy industry itself. Formed as a national trade association representing the processed dairy products industry, ADPI is actually a hybrid that developed when multiple separate organizations merged together.

The ADPI name was officially adopted in April 1986 when the then 61-year-old American Dry Milk Institute (ADMI) merged with the 15-year-old Whey Products Institute (WPI). The Evaporated Milk Association, which was formed in 1923, joined the fold in 1997, the same year a separate cheese division was established. Today ADPI is the leading association for manufactured dairy products.

ADPI's main purpose is to promote the acceptance and use of processed dairy products, both nationally and internationally, by communicating the many positive health and nutritional attributes of milk-derived products. Additionally, ADPI serves its membership by

- representing the industry's interest in government and regulatory affairs,
- establishing key product standards, some of which have been adopted as federal standards of identity,
- providing technical assistance and marketing support,
- collecting and disseminating key production and utilization statistics,
- providing input on industry standards for certain dairy processing equipment,
- monitoring and delivering current dairy industry information and developments,
- collaborating with other dairy associations on issues of common interest
- promoting the dairy products processing industry and its products through relations with affiliated industry organizations and applicable government bodies, and
- providing a strong, effective voice for the processed dairy products industry and promoting the awareness and consumption of nutritional processed dairy products.

ADPI serves its membership by representing the industry's interest in government and regulatory affairs, establishing key product standards, providing technical assistance and marketing support...

Services

One of the primary services provided to ADPI members is research and coordination of statistical information, including:

- * Total production and commercial sales of nonfat dry milk (NDM)
- * Production of whey and modified whey products
- * Monthly cheese production
- * Statistical analysis
- * U.S. cheese imports
- * Government purchases of NDM
- * Government purchases of cheese
- * Dairy Export Incentive Program

ADPI

AMERICAN DAIRY PRODUCTS INSTITUTE 

ADPI is the only industry organization to produce an annual census of end-use markets for dry milk and whey – an important tool for marketing of these products domestically and abroad.

The organization heavily recruits industry leaders to lend their knowledge, expertise and guidance to standing committees on topics such as dairy products marketing, evaporated milks, lactose and sanitary standards.

Currently, ADPI's membership includes manufacturers of evaporated and condensed milk, dry milk, cheese and whey products; firms that provide supplies and services to processors; and many companies that either use or trade these manufactured dairy products or are otherwise involved in the dairy industry. While the majority of ADPI members are located in the U.S., the organization also represents many international members.

Each year, ADPI partners with the American Butter Institute for a joint annual conference for more than 700 manufacturers, marketers and suppliers of manufactured dairy products. The 2009 conference will be held April 26-28 in Chicago. Additional information about the conference and ADPI are available at www.adpi.org.

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The program is launching as China's dairy industry experiences rapid growth, in part because of government's efforts to bolster residents' nutrition by increasing dairy consumption. The recent growth in dairy consumption has challenged China's dairy technology infrastructure and, as a result, its ability to develop a strong safety system.

"The food industry in China is quite advanced overall, and consumers are seeking more value-added foods. So the potential is there for dairy," Tong said. "Cal Poly has a chance to play a role in helping China ensure a safe and healthy food supply."

This will be the only dual-degree program in the College of Agriculture, Food and Environmental Sciences, said Associate Dean Mark Shelton. However, it is a pilot program, and more could follow in the college.

The program is also the next step in the college's continuing connection with China. Tong first visited China 15 years ago as part of a U.S. Department of Agriculture team, and began traveling there regularly to conduct educational seminars on dairy science through the U.S. Dairy Export Council. The Dairy Products Technology Center began hosting visiting scholars from China about a decade ago.

Other Cal Poly news...

Jimenez-Flores Leads Spanish Cheesemaking Course for California Artisan Cheese Guild

Cal Poly Professor Rafael Jimenez-Flores and Mariano Gonzalez, head cheesemaker for Fiscalini Cheese, recently led a Spanish-language cheesemaking seminar for the California Artisan Cheese Guild. The course led 25 participants through basic cheesemaking topics, such as the effect of temperature on culture, the microscopic characteristics of bacteria, measurement of pH, and the science behind traditional cheese recipes. The seminar is part of the guild's ongoing educational series for members. In-

formation about the guild and its programs is available at www.cacheeseguild.org.

Annual Dairy Ingredients Symposium Returns March 10-11

Dairy ingredients will be the focus of the 11th annual Cal Poly Dairy Ingredients Symposium, which will be held March 10-11 in San Francisco. Each year, the event attracts more than 200 food and beverage formulators, marketers and dairy ingredient manufacturers to examine current and evolving dairy ingredient science, hot issues affecting the current food marketplace (such as food safety) and practical implications of recent industry advances for the business practices of food manufacturers – from sales and marketing strategies to manufacturing technology and more.

This year, the event will again host the annual presentation of the William C. Haines Dairy Science Award, which was created by the California Dairy Research Foundation to recognize individual scientific contributions to the dairy industry. Event information is available at www.dairyingredients2009.com.

CDD



The International Milk Genomics Consortium (IMGC) convened its Fifth International Symposium on Milk Genomics, Oct. 14-16, in Sydney, Australia. CDRF Executive Director Joseph O'Donnell is shown here with Isabel MacNeill, who leads Dairy Australia's Value Chain Innovation business group. The 6th IMGC symposium is scheduled for Sept. 28-30, in Paris, France. See article on page 5.

Genome sequence reveals evolutionary alliance

As every parent discovers, human babies are bubbling, burping processing plants that take in milk, extract compounds useful for rapid growth and development, and unceremoniously excrete the byproducts. Those babies' guts are full of helpful bacteria, and a new study shows how humans and bacteria evolved together.

Scientists have known for some time that a certain subspecies of bacteria quickly colonize the gastrointestinal tracts of breast-fed infants, playing an important role not only in the digestive process but also in keeping out harmful microorganisms. Interestingly, these beneficial bacteria, known as *Bifidobacterium longum* subsp. *infantis*, feed on specific sugars in human milk that are nutritionally of no use to the baby.

In hopes of better understanding the molecular mechanisms and networks that make possible this functional alliance between the baby, the bacteria and the mother's milk, a team of researchers, led by scientists at the University of California, Davis, recently published a sequencing of the genome — an analysis all of the genes and related DNA — of *B. longum* subsp. *infantis*.

Through sequencing the genome, the researchers identified gene clusters that appear to equip these bacteria to make use of the sugars in human breast milk.

They also identified another cluster of genes that control production of enzymes that enable the bacteria to

capture milk-borne urea — an important source of nitrogen — from the baby's bowel. This recycling of the urea to salvage nitrogen is significant because the protein concentration in human breast milk is often too low to supply all of the nitrogen needed for the rapid growth of a newborn baby.



“In short, the genome sequencing revealed that the relationship between *B. longum infantis*, its infant host and human breast milk is a fascinating example of co-evolution,” said David Mills, a UC Davis microbiologist and lead author on the study, which was published in the Dec. 2 issue of the *Proceedings of the National Academy of Sciences*.

“It is obvious that human milk has been evolutionarily refined through the millennia to retain highly beneficial properties,” he said. “The result is a fluid that is so valuable to the infant that it more than justifies the energy costs to the mother to produce it.”

Collaborating with Mills were researchers from UC Davis; the U.S. Department of Energy's Joint Genome Institute in Walnut Creek, Calif.; and the U.S. Department of Agriculture's National Center for Agricultural Utilization Research in Peoria, Ill.

The genome sequencing study was funded by the National Institutes of Health, the University of California, the California Dairy Research Foundation and the U.S. Department of Agriculture.

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International genomics meeting set for September in Paris

The Sixth International Symposium on Milk Genomics & Human Health will be held Sept. 28-30, in Paris, France. International experts in nutrition, genomics, bioinformatics and milk research will discuss the biological processes underlying mammalian milk genomics, the biological products that result from milk and lactation genes, and the health traits that these biological processes and products confer to both the mother and the infant.

A call for papers, posters and Student Travel Award applications has been issued with a submission deadline of March 16. Information can be obtained through the International Milk Genomics Consortium (IMGC) Web Portal at <http://lactoknow.ucdavis.edu/awards/2009-abstract-submission-form>. Applicants must create a free login in order to access the forms.

Symposium registration is \$450 through Aug. 23, and \$500 thereafter, and includes all program materials and daytime meals as well as a Monday evening reception. Sponsoring members of the IMGC can register at the rate of \$400 through Aug. 23, and \$450 thereafter. Student rates are also available. For registration information, visit www.milkgenomics.org or contact Jennifer Giambroni at info@imgconsortium.org. Online registration is available at www.acteva.com/go/cdrf.

Event sponsors include IMGC sponsoring members CDRE, CNIEL, Dairy Australia, Dairy Farmers of Canada, Dutch Dairy Association, National Dairy Council and Teagasc (The Agriculture and Food Development Authority in Ireland).

ODD

NEWS AND NOTES

Milk Board lets consumers pick next happy cow

The California Milk Advisory Board is for the first time letting consumers pick its next Happy Cow.

The board, in partnership with agency Deutsch LA, trotted out its latest herd of “wannabe” spokes-cows in four new TV spots that began airing in October. Another six ads will run this year. The 30-second spots will act as auditions for the bovines, and viewers can vote for their favorites through Sept. 30.

The Happy Cow with the most votes will be revealed to viewers online in October.

The promotion is part of the latest phase of the eight-year-old Happy Cows ad campaign and supports the tag line: “Great Milk Comes from Happy Cows, and Happy Cows Come from California.”

People will have quite a cast of bovine characters from which to choose.



There is the super-spunky teenager named Alicia, who is out to prove to her friends and her taunting brother that she can make it as a California babe. And then there's Cajun Jenn, who hails from the heart of the Bayou and is eager to break out from under her dramatic stage mom's overpowering presence.

Across the pond, there's Shelby Fogbottom, the English bovine who boasts a royal bloodline, is well versed in proper tea-time etiquette, and wants the opportunity to leave the fog behind for sunny California pastures.

“It just seemed like the next logical step in a totally illogical world. If the cows are happier in California, then it just seemed to make sense that cows from everywhere else would be clamoring to come here,” said Eric Hirshberg,

president and chief creative officer at Deutsch. “The reality show audition tape format is something everyone can relate to. From *American Idol* to online dating services, people are used to seeing other people pitch themselves like this. Why would our fictitious bovine friends be any different?”

This article, by Patricia O'dell, appeared in the Oct. 14 issue of promomagazine.com.

Probiotic bacteria's immune-enhancing mechanism reported

Dutch scientists have reported that the potential immune system-enhancing effects of probiotics may be due to an activation of specific genes in the walls of our intestines. Led by Professor Michiel Kleerebezem of NIZO Food Research, scientists identified patterns of gene expressions in the cells of the intestinal wall that may trigger mechanism for immune tolerance.

The study is claimed to offer the first scientific evidence of how probiotics influence the immune system in humans. The findings are published online in the Proceedings of the National Academy of Sciences (PNAS Online Early Edition).

A potential immune-enhancing effect from probiotic bacteria has been reported by many scientific groups, but the mechanism by how these effects may be occurring has not been elucidated, according to the Dutch researchers behind the new study. Scientists from Top Institute Food and Nutrition, NIZO food research, Maastricht University, Wageningen UR, and Radboud University Nijmegen performed an in-vivo human study in order to investigate the response of certain genes to *Lactobacillus plantarum*.

The randomized, double blind, placebo-controlled, crossover study involved the ingestion of live *L. plantarum*, heat-killed *L. plantarum*, or placebo. Biopsies were taken from the duodenum of the subjects and their gene expression pattern was analyzed.

Using gene expression analysis, Kleerebezem and his co-workers observed differences between the expression profiles of people who consumed the live *L. plantarum*, compared to the heat-killed *L. plantarum* or placebo.

“Our in-vivo study identified mucosal gene expression patterns and cellular pathways that correlated with the establishment of immune tolerance in healthy adults,” they concluded.

This article, by Stephen Daniells, was excerpted from the Feb. 5, 2009, issue of Foodnavigator.com.

More pizza!

By Dairy Herd news source, Dec. 22, 2008

America's dairy producers, through their investment in the dairy checkoff, are working to help reinvigorate the pizza category and increase sales for pizza products containing more cheese. Dairy Management Inc. (DMI), which manages the national dairy checkoff program, is facilitating an industry task force to develop action plans on how the dairy and pizza industries can reinforce pizza as the favorite choice among American consumers for quality and value. Industry experts concur that increasing cheese on pizza is key to increasing overall pizza sales. DMI is identifying short- and long-term solutions toward this objective.

"Pizza sales are important, because they directly affect overall cheese sales," says Paul Rovey, Arizona dairy producer and chair of DMI. About 25 percent of total cheese is used on pizza, representing more than 25 billion pounds of annual milk production, he adds.

Pizza sales have declined in recent years; some restaurant chains that were once pizza-centric are expanding into non-pizza categories. In response, DMI has begun an overall effort to increase pizza sales in both the short and long term, as part of a comprehensive effort to increase cheese sales, as outlined in the dairy checkoff business plan.

The plan will capitalize on pizza's terrific variety and convenience. Market research indicates that, on average, each American consumes pizza 39 times a year. Pizza offers a great value and a "meal solution" to families.

"Because pizza sales account for more than \$32 billion annually, we know that increasing pizza sales benefits dairy producers and the dairy industry," says Tom Gallagher, DMI's chief executive officer.

As part of the short-term strategy, the dairy checkoff is working with Domino's Pizza to introduce a line of high-quality specialty pizzas that will use up to 40 percent more cheese.

Through the agreement, DMI – together with several state and regional dairy producer organizations – is investing more than \$10 million to support the launch of this line of pizza nationwide. Producer-funded efforts will support Domino's franchisees in advertising, public relations, local market promotions and communications activities. Domino's investment – including menu development, advertising, in-store merchandising and other marketing efforts to support the launch – will total more than four times the investment of dairy producers. The partnership also will work to measure overall increases in

pizza and cheese sales in test markets, and how changes in unit pricing at the consumer level affect total sales.

For more information, go to: www.dairycheckoff.com

Mobile Dairy Classroom moooves across California

Source: KCRA.com, Nov. 21, 2008

The Mobile Dairy Classroom is moooving through elementary schools across California with the goal of teaching kids about agriculture and where milk comes from. Kids get a hands-on experience as the mobile classroom houses a live Holstein cow and calf.

According to the Dairy Council of California, the free Mobile Dairy Classroom began in the 1930s as a joint venture between Venice, Calif., dairyman Clarence Michel of Edgemar Farms and the Dairy Council of California. Michel would travel weekly to Los Angeles-area schools in a truck built to accommodate a live cow, and he would teach children how milk and dairy foods were produced.



Steve Miller, an instructor for the Dairy Council of California Mobile Dairy Classroom, discusses dairy with kids.

Photo courtesy of Dairy Council of California.

After World War II, the Dairy Council teamed with the Los Angeles City School District and hired a professional teacher to increase the program's educational impact. Ultimately, the program expanded into a statewide teaching curriculum.

Today, five Mobile Dairy Classroom units visit schools throughout California, reaching more than 300,000 elementary school students each year. Numerous California dairies support the program by supplying cows for the school visits.

For more information regarding the Mobile Dairy Classroom, visit www.dairycouncilofca.org.

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Calendar of **EVENTS**

March 10–11

11th Cal Poly Dairy Ingredients Symposium. The latest trends and issues in the marketing, science, manufacturing technology and application of dairy ingredients, including whey-derived and milk-derived concentrates and powders. Location: Hotel 480, San Francisco. For more information, contact Laurie Jacobson at ljacobso@calpoly.edu or visit www.calpoly.edu/~dptc for details.

March 24–27

21st Annual Cheese Short Course I. Basic scientific information and practical skills needed to understand and manufacture cheese. Location: Cal Poly Dairy Products Technology Center, San Luis Obispo, CA. For more information, contact Laurie Jacobson at ljacobso@calpoly.edu or visit www.calpoly.edu/~dptc for details.

April 26–28

American Dairy Products Institute (ADPI)/American Butter Institute Annual Meeting, Chicago. Contact ADPI, (630) 530-8700, e-mail: info@adpi.org, Web site: www.adpi.org.

June 6–10

Institute of Food Technologists Annual Meeting & Expo, Anaheim, Calif. Contact IFT, (312) 782-8424, e-mail: info@ift.org, Web site: www.ift.org.

September 8–11

11th Annual Dairy Science and Technology Basics for the Farmstead/Artisan Cheesemaker. Basics of quality cheese manufacture with emphasis on artisan/farmstead cheese manufacture. Location: Cal Poly Dairy Products Technology Center, San Luis Obispo, CA. For more information, contact Laurie Jacobson at ljacobso@calpoly.edu or visit www.calpoly.edu/~dptc for details.

September 28–30

Sixth International Symposium on Milk Genomics & Human health, Paris, France. For registration information, visit www.milkgenomics.org, or contact Jennifer Giambroni at info@imgconsortium.org. (See article on page 5 of this newsletter.)