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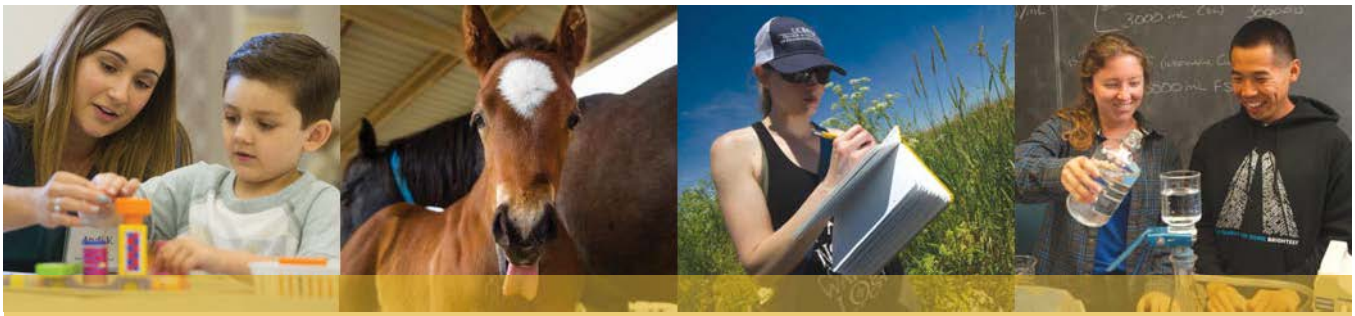
2017–2018 Endowed Fund Report



Peter J. Shields Endowed Chair in Dairy Food Science

David Mills
Professor

Department of Food Science and Technology
foodscience.ucdavis.edu
damills@ucdavis.edu

ENDOWMENT PURPOSE

The Peter J. Shields Chair in Dairy Food Science was established in 1983 by the California Milk Advisory Board and the California Manufacturing Milk Advisory Board to attract and sustain outstanding dairy food science scholars in the Department of Food Science and Technology. The Chair was named to recognize the historic relationship of the "founder of the Davis campus" to the dairy food industry, and should provide the occupant with opportunities to conduct exemplary research and teaching, as well as to offer continuous interaction with the dairy food industry.

RESEARCH

With support from the Peter J Shields Endowed Chair I have advanced a research agenda focused on understanding the beneficial impact of milk components on the gastrointestinal tract. In order to gain medical community acceptance of the unique benefits of the bioactive components within milk, it is critical to perform detailed mechanistic studies demonstrating how specific milk components improve health as well as beneficially modulate the gut microbiota. To accomplish this, Peter J. Shields Chair funds have paid, in part, for senior scientific staff, postdoctoral scholars, graduate students and undergraduates doing research in my laboratory. In the last year, my lab published work defining how milk oligosaccharides and cognate oligosaccharide-consuming bifidobacteria combine to beneficially improve health in a model of fatty liver disease. We also demonstrated how milk-oriented bifidobacteria can rapidly colonize and improve the health of infants by dramatically lowering their exposure to endotoxins. We also published how such colonization of infants by milk oligosaccharide-consuming bifidobacteria correlates with the lowering of antibiotic resistance genes in those infant's gastrointestinal tract—thereby preventing further spread of such resistance genes. These advances will continue to drive research, translation and commercial interest in bioactive molecules from milk.

TEACHING

I continued to teach two courses I recently developed, one undergraduate course "The Microbiology of Fermented Foods" and a second graduate level course "Interactions of Food and the Gut Microbiota". The Fermented Foods class covers the background technology and microbiology of most dairy fermentations (yogurt, sour cream, cheese, fermented milks etc.) in the context of other types of food fermentations. In the last year this course was opened up to Biotechnology students thus exposing more UC Davis students to dairy microbiology and technology topics. At present, I am working to cross-list this course with the Viticulture and Enology curriculum so as to reach even more students. The graduate course prepares students with the tools necessary to design, interpret and evaluate feeding trial studies employing foods that beneficially modulate the gut microbiota—a common target for all functional foods today. Major components of this class are milk, prebiotics and probiotics. At the end of this class we have the students design and defend a food "pitch" detailing how they would prove the impact of their functional food on the gut microbiome and host health. I am truly impressed with the ideas these bright students come up with and am confident their pitches will some day turn into startup companies.

STUDENTS

Shields Chair funds have advanced numerous student activities. In 2017-18, the endowment paid, in part, for a Staff Research Associate (Dr. Karen Kalanetra), Project Scientist (Dr. Ishita Shah) and a Junior Specialist (Alice Yu). Together, Drs. Kalanetra, Shah and Ms. Yu coordinate the microbiological and metagenomic work in my lab in support of all the ongoing milk-related research carried out by my graduate students and postdoctoral researchers (who, in turn, are funded by NIH, USDA, Bill and Melinda Gates Foundation and several company-funded projects). In addition, the Shields Chair Endowment funds help cover training of graduate students and postdocs for a number of workshops related to metagenomics (Data Carpentry Genomics workshop, Microbial Community Analysis workshop, Differential Gene Expression Analysis mini-workshop, Analyzing High Throughput Sequencing Data workshop, Metagenomic, and the Metatrascriptomic, and Multi'Omic Microbiome Analyses workshop, among others).

In 2017-2018, the Shields Chair Endowment also helped fund the research of 11 undergraduate researchers— Dadne Lopez, Chaitanya Sharma, Jesse Bach, Avni Suri, Julia Wong, Sarah Goldberg, Rigel Rose Laganse, Henderson Lu, Katie Nguyen, Erick Santos, Zi Fang,—all who work closely with my graduate students and postdoctoral researchers to examine various bioactive componants in milks. I am very thankful and proud that the Shields Chair Endowment is having such an important impact on the lives of so many undergraduate students.

OUTREACH

In the last year, we have obtained significant new funding for research on bioactive milk oligosaccharides via a $1M project with BASF (https://on.basf.com/2fwjqh1). We also obtained a grant from the Bill and Melinda Gates Foundation to study the interactions of beneficial microbes and specific milk immunoglobulins with potential applications in children with environmental enteropathy.

In addition, our research was profiled by the Sacramento Bee and the American Society for Microbiology. Links to publications and media coverage are on the Mills Laboratory website (mills.ucdavis.edu).

NOTEWORTHY ACCOMPLISHMENTS

I presented our milk-focused research at various meetings including plenary or keynote lectures at the the Korean Society for Food Science & Technology Annual Meeting, the FASEB Meeting on Nutritional Immunology, the 10th World Congress on the Developmental Origins of Health and Disease, the 4th International Conference on Microbial Diversity and the 1st New Zealand Dairy Industry Workshop. At the Nutrition and Growth Conference in Paris, I presented our research on how milk beneficially modulates infant gut to an audience of over 800 physicians and researchers. I also gave a lecture on dairy facility microbiomes at he Microbiology of the Built Environment Symposium at the National Academy of Science in Washington DC.

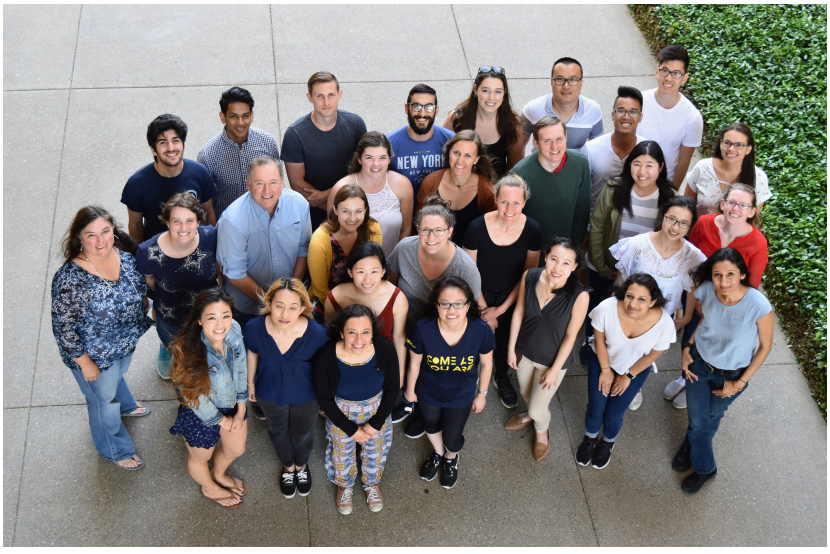
In addition, Shields Chair Endowment funds were used to enable students and postdoctoral researchers to present their work at the 2018 Keystone Symposia on Antimicrobials and Resistance, the UC Davis Research Retreat on Host Microbe Interaction, and the UC Davis Undergraduate Research Conference.

FUTURE USE

We are very excited by the new projects (and funding!) from BASF and Bill and Melinda Gates Foundation to advance our work on bioactive molecules from milk.

THANKS

It is a great honor to be the Peter. J. Shields Endowed Chair in Dairy Food Science. Funding from this endowment is supporting exciting dairy-related studies in the Department of Food Science and Technology. This research is defining the health benefits of milk by identifing novel bioactive molecules and microbes that can be employed to improve intestinal health. We are also using novel techniques to map microbial transfer throughout dairy production facilities, thus providing insight into dairy spoilage and contamination processes. In short, we are training the next generation of dairy scientists focused on using milk processing and milk components. It is an amazing time to study milk—the only food that evolved to make the consumer healthy.



College of Agricultural and Environmental Sciences
Office of the Dean
Development

One Shields Avenue
Davis, CA 95616

(530) 752-1639
caes.ucdavis.edu
supportcaes@ucdavis.edu

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