

# **Food Science Graduate Seminar Series Fall 2023**

Tuesdays from 3:35– 4:25 PM  
Stocking Hall  
Cornell University

Seminar Chair: Dr. Syed Rizvi  
Seminar Committee: Erin Atkins, Leto Solla, Jessica Uhrin,  
Abdul Fateh Hosseini, Demi Perry, Annika Madler, Claire Noack

### Respect Statement

Diversity in the field of food science – in race, gender, sex, religion, language, ability, veteran status, place of origin, academic specialization, etc. – is an asset to our learning experience. As a result, we hope to provide an inclusive and welcoming space for our speakers to share their expertise. We want to reaffirm our commitment to speaking respectfully and mindfully to members of our Cornell community as well as our guests and note that individuals identifying with historically minoritized groups should not be expected to describe or provide perspective on these groups unless they themselves volunteer to relate their experiences. We value the scholarship of each of our speakers, and we invite our speakers in order to hear their unique contributions to the field.

Date	Speaker	Seminar Title
Aug 22	<b>Dennis Heldman, PhD</b> Dale A. Seiberling Endowed Professor of Food Engineering Department of Food Science & Technology Department of Food, Agricultural and Biological Engineering The Ohio State University	“The Evolution of Food Engineering – Recent History”
Aug 29	<b>Marcia Walker, PhD</b> Vice President, Research and Development & FSQA Schlotterbeck & Foss	“Commercializing New and Innovative Foods”
Sept 5	<b>Prabhu Pingali, PhD</b> Professor Charles H. Dyson School of Applied Economics and Management Cornell University	“Making meat and milk from plants: a review of plant-based food for human and planetary health”
Sept 12	<b>Constance Gewa, PhD, MPH</b> Senior Program Director Foundation for Food & Agriculture Research	“Addressing food and nutrition security in global settings”
Sept 19	<b>Alissa Nolden, PhD</b> Assistant Professor Department of Food Science University of Massachusetts, Amherst	“Consumers demand sustainable food options”
Sept 26	<b>Kimberly Jackson, PhD</b> Professor and Chair Chemistry and Biochemistry Spelman College	“Re-engineering the environment: Centering Black women’s voices through science and placemaking”
Oct 3	<b>Patrick Gibney, PhD</b> Assistant Professor Department of Food Science Cornell University	“Yeast metabolism in wine, beer, and stress resistance”
Oct 10	<b>Fall Break</b>	

Date	Speaker	Seminar Title
Oct 16	<b>Bauman Lecture</b>	[Title Pending]
Oct 24	<p><b>Cydney Jackson</b> PhD Candidate Tako Lab</p> <p><b>Caroline Motzer</b> MS Candidate Wiedmann Lab</p> <p><b>Rory Wang</b> PhD Candidate Worobo Lab</p>	<p>“Empire Apple (<i>Malus domestica</i>) Juice, Pomace, and Pulp Modulate Intestinal Functionality, Morphology, and Bacterial Populations In Vivo (<i>Gallus gallus</i>)”</p> <p>“Method Development for Industry Regarding Isolation and Tracking of Thermotolerant, Non-spore forming, Defect causing Bacteria in Dairy”</p> <p>“Validation of <i>Cryptosporidium parvum</i> inactivation in apple juices: moving away from animal models”</p>
Oct 31	<b>Gretchen Mahler, PhD</b> Professor Biomedical Engineering Department Binghamton University	“Development of a small intestinal model for assessing the impact of food additives”
Nov 7	<b>Olga Padilla-Zakour, PhD</b> Professor Department of Food Science Cornell University	“Food Product Development and Entrepreneurship: Integration of Science, Regulations and Marketing”
Nov 14	<b>Ray Glahn, PhD</b> Research Leader/Physiologist Robert Holley Center for Agriculture and Health	“Advancements in Providing Foods Rich in Bioavailable Iron”
Nov 21	<b>David Putnam, PhD</b> Associate Dean, Innovation & Entrepreneurship Samuel B. Eckert Professor in Engineering Stephen H. Weiss Presidential Fellow Professor, Meinig School of Biomedical Engineering Professor, Smith School of Chemical & Biomolecular Engineering Cornell University	“Translation of Academic Research into the Commercial Sector”
Nov 28	<b>David Barbano, PhD</b> Professor Department of Food Science Cornell University	“The Quest for In-line Real-time Milk Based Metrics for Large Dairy Herd Management”

## Dennis Heldman



Dennis R. Heldman was awarded B.S. (1960) and M.S. (1962) degrees from The Ohio State University, and a PhD (1965) from Michigan State University. His educational background emphasized the application of engineering principles and concepts to the processing of foods.

In 1966, Dr. Heldman joined the faculty at Michigan State University, and began teaching and research in the area of food process engineering. In 1975, the first edition of Food Process Engineering (by Heldman), a textbook for undergraduate engineering students, was published. He served as Chair of the Agricultural Engineering Department at Michigan State University from 1975 to 1979. In 1981, the second edition of Food Process Engineering (with R. Paul Singh) was published, and in the 1984, the first edition of Introduction to Food Engineering (with R. Paul Singh) was published.

Dr. Heldman joined the Campbell Soup Company in 1984, as the Vice President of Process Research and Development. In 1986, he moved to the National Food Processors Association, as Executive Vice President of Scientific Affairs, and CEO for The National Food Laboratory, and President of The Food Processors Institute. In 1991, Dr. Heldman joined the Weinberg Consulting Group Inc and was involved in consulting on food regulatory issues. In 1992, the first edition of the Handbook of Food Engineering (Heldman and Daryl B. Lund as Co-Editors) was published.

In 1992, Dr. Heldman was appointed Professor of Food Process Engineering at the University of Missouri and Leader for the Foods, Feeds and Products cluster in the Foods for the 21st Century program; including teaching and research in food engineering. Beginning in 1994, he served as Unit Leader for the Food Science and Engineering Unit, and in 1997, as Director for the Office of Value-Added Agriculture Outreach. In 1993, the second edition of Introduction to Food Engineering (with R. Paul Singh) was published, and in 1997, Principles of Food Processing (with Richard W. Hartel) was published.

From 1998 to 2004, Dr. Heldman was Professor of Food Process Engineering at Rutgers, the State University of New Jersey, and Director of the Cooperative Research & Development Program in the Center for Advanced Food Technology (CAFT). The third edition of Introduction to Food Engineering (with R. Paul Singh) was published in 2001. In 2003, the print edition of the Encyclopedia of Agricultural, Food and Biological Engineering (Heldman as Editor) was published; the print edition has been followed by quarterly on-line up-dates.

From 2004 to 2012, Dr. Heldman was a consultant involved in applications of engineering concepts to food processing for educational institutions, industry and government. These activities include publication of the second edition of the Handbook of Food Engineering (with Daryl B Lund) in 2007. In 2008, the fourth edition of Introduction of Food Engineering (with R. Paul Singh) was published. More recently, the Encyclopedia of Biotechnology in Agriculture and Food (Heldman as Editor) was published in 2010, followed by the second edition of the Encyclopedia of Agricultural, Food and Biological

Engineering (with Carmen I. Moraru as Co-Editor). In 2011, a new text/reference book entitled Food Preservation Process Design (authored by Heldman) was published.

Heldman served as President of IFT, the Society for Food Science and Technology, from 2006–07. He was elected Fellow in the International Academy of Food Science & Technology in 2006. He served as President of Phi Tau Sigma, the Honorary Society for Food Science and Technology from 2010–11. Heldman was recognized with the Life Achievement Award from the International Association for Engineering and Food in Athens, Greece in May, 2011. He presented the 2011 Bernard E. Proctor Food Engineering Division Lecture at the Annual IFT Meeting in New Orleans. In August, 2011, Heldman was recipient of the Frozen Food Foundation Freezing Research Award and was recipient of the Carl R. Fellers Award from the IFT and Phi Tau Sigma in 2013. Heldman received the Harold Macy Food Science and Technology Award from the Minnesota Section of IFT in March, 2017, and the 2018 Nicholas Appert Award from IFT, The Society for Food Science and Technology. In 2019, he was inducted into the Food Science and Technology Hall of Distinction at The Ohio State University.

In August, 2012, Heldman joined the faculty at The Ohio State University as Dale A. Seiberling Endowed Professor of Food Engineering. His focus in teaching and research is on food engineering, with a specific emphasis on sustainability of the food system, and improvements in process efficiencies while enhancing product quality. He became Director of the Center for Advanced Processing and Packaging Studies (CAPPS) in 2017

### **The Evolution of Food Engineering – Recent History**

Food engineering has many interpretations, from the very general applications of engineering concepts to food, to an evolving independent discipline. The most frequent reference in the U. S. is to that portion of the curriculum in Food Science dedicated to unit operations for food manufacturing. Much of the evolution in research and education in the U.S. has occurred in the past 75–100 years. The overall objective of this seminar will be to review the recent progress of education, research and outreach programs, and speculate on the future of these programs.

Food engineering is generally viewed as the application of physical concepts to processes and operations occurring during transformation of raw food materials and ingredients into consumer food products. The seminar will review the evolution of food engineering in the U.S. and internationally, using references to programs, publications, organizations and conferences. The impacts of educational programs and research outcomes on the current and future food supply chains will be discussed. Finally, a projection of the future of food engineering in education and commercial applications will be attempted.

## Marcia Walker



Marcia has extensive food safety and product development/innovation experience spanning over 20 years and a well-known speaker and expert in product innovation and new technology commercialization. With experience working for Tofurky, PepsiCo supporting the Naked Emerging Brands innovation team and Starbucks/Evolution Fresh she has been a pioneer in advancing new to the market products, food safety and emerging technologies. Walker helped to pioneer HPP at Fresherized Foods. She oversaw the development and commercialization of avocado, guacamole, fruit, juice and meat items as well as being instrumental in the branding of Wholly Guacamole. Prior, Dr. Walker was at Oregon State University and worked on HPP product development, microbiological validation and sensory analysis. The work was part of a Dept. of Defense grant that included improving combat rations using novel technologies and was critical in the adoption of HPP as a now widely used processing technology.

She also was involved in pioneering an effort to establish the Nonthermal Processing Division of IFT, as well as serving in several leadership roles for them. Marcia assisted in creating the Nonthermal Processing Workshop and Short course and served on the NPD- EFFoST Nonthermal Processing Workshop committee for the past 6 years. Additionally, she has served in many other roles within IFT including regional leadership. Most recently, she was part of the IFT Leadership Development Committee and served as Chair and past chair. Walker received her B.S. in Biology from Gonzaga University, M.S in Food Science and Nutrition from Washington State University and a Ph.D. in Food Science from Oregon State University.

### Commercializing New and Innovative Foods

The consumer demand for innovative, healthy and convenient foods has been a theme in my food career. Food innovation can involve the development of new food processes, products and packages to bring new and exciting products to market. Food industry Innovation involves all aspects of the food supply chain. Food and beverage companies continuously find more ways to produce healthier and newer options for consumers. Food innovations are often seen in products with healthier or premium ingredients or offer a consumer a convenient option for healthier RTE or prepared foods.

Consumer requests for food that is produced in a sustainable way, minimally processed, natural, free from additives and provides a maximum level of safety, convenience, taste, and nutrients are currently challenging food manufacturers to keep up with this demand. Processing technologies play a major role in food innovation, I will highlight the technical aspects of commercializing new technologies through product, process and packaging.

I will also highlight my experience with developing and marketing plant-based food products. With the diversity of the consumer eating plant-based foods shifting, so has an increased expectation for these products to deliver on flavor, quality and innovation. Traditional vegan or vegetarian products are no longer the acceptable norm. HPP offers an innovative path to creating better quality products as well as improving the ingredient statements.

The presentation will give an overview on innovation and meeting the consumer need and explore the opportunity that HPP and new technologies can offer in developing innovative food and beverage products.

## Prabhu Pingali



Prabhu Pingali is a Professor in the Charles H. Dyson School of Applied Economics and Management at Cornell University, with a joint appointment to the Department of Global Development. He is the Founding Director of the Tata-Cornell Institute for Agriculture and Nutrition (TCI). Prior to joining Cornell, he was the Deputy Director of the Agricultural Development Division of the Bill & Melinda Gates Foundation from 2008 to May 2013. He was director of the UN Food and Agriculture Organization's Agriculture and Development Economics Division from 2002-2007. In addition, he worked with the CGIAR for 15 years from 1987 to 2002, first with IRRI in the Philippines and then with CIMMYT in Mexico. He is currently the Chair of the Governing Board of ICRISAT, a Fellow of the American Association for the Advancement of Science, a member of the U.S. National Academy of Sciences, and a Fellow of the American Agricultural Economics Association (AAEA). He has over four decades of experience as an academic researcher and development practitioner focused on addressing the problems of global hunger, poverty and environmental sustainability. Dr. Pingali has written 14 books and over 200 refereed journal articles and book chapters on agriculture and food policy. His latest book, "Transforming food systems for a rising India", has been downloaded 150 thousand times and has been very influential in India's food and agriculture community.

### **Making meat and milk from plants: a review of plant-based food for human and planetary health**

Interest in alternative protein sources to substitute for animal source protein-rich foods has emerged alongside calls for sustainable food systems to meet protein demands as the global population grows towards a projected 9.8 billion people by 2050. Food companies are capitalizing on sustainable diet recommendations that encourage consumption of plant-based foods and have heavily invested in new plant-based foods that mimic animal source foods, effectively expanding the "plant-based foods" category. At the same time, globally there are two opposing protein transitions taking place as lower-income populations shift from plant to animal protein sources and higher-income populations that overconsume animal protein sources are recommended to shift towards plant-based foods. Using a global food systems lens, this review article builds on existing literature to assess the extent to which plant-based meat and milk analogs can become part of sustainable diets across two competing protein transitions and to identify unresolved knowledge gaps. This article first examines global meat and dairy consumption trends as well as the emergence of plant-based analogs and consumer perceptions. We then draw on the literature to compare the environmental footprints and nutrition compositions of plant-based meats and milks against their respective conventional equivalents. We find that, while there are promising environmental benefits

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to substituting meats and milk with certain plant-based analogs, the uptake of these products is likely stifled based on the small number of products they mimic (i.e., ground meat, meat emulsions, meat crumbles, and fluid milk). Further, plant-based analogs do not completely mimic the nutrient composition of animal source foods. Plant-based analogs may have improved compositions, such as improved fat profiles. However, analogs may lack comparable protein and micronutrients that are highly bioavailable in animal source foods. Care should be considered for plant-based analogs that inherently fall under the “plant-based food” category as they are vastly different from whole and minimally processed plant foods and the intended benefits of plant-based food consumption may not be generalizable. Future assessments of meat and milk analogs should consider under which contexts direct substitution of animal source foods are viable from a consumer standpoint and examine both environment and nutrition impacts that are important to the given population.

## Constance Gewa



Dr. Gewa is the Scientific Program Director at the Foundation of Food and Agriculture Research (FFAR) where she leads the Agriculture-Health Nexus Challenge Area. Prior to that, Dr. Gewa was an Associate Professor in the Department of Nutrition and Food Studies at George Mason University.

Her background is in human nutrition and public health research with expertise in conducting research among mothers and children in low-income communities. She has co-authored multiple publications on dietary practices and nutritional status of mothers and children, validity of dietary assessment methodologies, the role of nutrition in improving health and development outcomes among children, nutrition transition and non-communicable diseases in low-income countries, and household food security.

### **Addressing food and nutrition security in global settings**

Childhood stunting rates remain high while rising overweight and obesity are on the rise in sub-Saharan Africa. While efforts to achieve food and nutrition security have been derailed by climate change and high inflation rates among other factors. The upcoming presentation will reference a food and nutrition project in Kenya to discuss the opportunities and challenges in identifying sustainable solutions to food and nutrition security in low-income nations. Furthermore, it will showcase the Foundation of Food and Agriculture's (FFAR's) approach to addressing food and nutrition security and improved health in communities around the world. By the end of the presentation, students will have increased understanding of the factors influencing food and nutrition security in low-income nations and the role that FFAR plays in supporting food and nutrition security among different populations in the US and around the world.

**Alissa Nolden**

Alissa Nolden is an Assistant Professor at The University of Massachusetts, Amherst in the Department of Food Science who works with her colleagues and students to enhance the field of food science and human health. Alissa believes understanding factors influencing sensory perception and taste preferences is important in increasing consumption and creating delicious, healthful, and sustainable foods. She has conducted consumer surveys and supported collaborative projects regarding plant-based foods to understand consumers' motivation to adopt a diet that includes plant-based products, focusing on sensory attributes and personality factors associated with liking and intake.

**Consumers demand sustainable food options**

Many reports claim that consumers demand sustainable food options, yet there is limited evidence that this is the case. In 2023, US adult consumers report sustainability following behind taste, price, and health when it comes to drivers of food choice. With a long-term goal of improving the sustainability of the agricultural food supply, the food industry is making great strides to offer various sustainable options. There must be an increase in our understanding of consumers' motivation and uncertainty regarding sustainable foods. Our research focuses on examining both intrinsic (product-related) and extrinsic (person-related) factors that drive and deter consumers from consuming plant-based foods. Considering the product itself and consumers' perspective will help to improve the development of new products and identify opportunities to motivate and educate consumers on the importance of adopting a sustainable diet.

## Kimberly Jackson



Dr. Kimberly M. Jackson is a professor of biochemistry, chair of chemistry and biochemistry, and director of the food studies program at Spelman College. She is also the director of a living and learning community for STEM scholars, an initiative whose goal is to improve access to STEM careers through professional and social networks and social justice empowerment. A Fulbright Scholar, Dr. Jackson maintains a robust and active research program focused on novel therapeutic agents (plant-based) for castration-resistant prostate cancer and advancing equity for Black women scientists. In March 2022, she was honored with the national American Chemical Society Award for *Encouraging Disadvantaged Students into Careers in the Chemical Sciences*, sponsored by the Dreyfus Foundation.

Click the links to learn more about [Dr. Jackson](#) and [her research](#).

### **Re-engineering the environment: Centering Black women's voices through science and placemaking**

Advocating for and cultivating diverse talent in the chemical and biochemical sciences rooted in a STEM identity and agency framework allows me to *dismantle, decenter, and deconstruct* the prevailing narrative dominated by systemic racism and marginalization. My work in advancing equity in STEM begins with my development as a principal investigator and creating space in my research laboratory to promote inclusiveness. With an eye towards intentionality and re-engineering the STEM learning ecosystem, I examine and evaluate the effectiveness of cohorts, social environments, or networks (peer-peer or near-peer) as interventions and structures that acknowledge and foster positive interactions to increase entry in, persistence, and launch successful scientific careers of Black women scientists. This talk will outline how my work in this area has allowed me to create impactful spaces (*networks and community building for students*), innovative courses (*experiential and interdisciplinary*), a robust research program (*cancer therapeutics*), and mentoring training programs (*The LINCS Scholars and Food Scholars*) to close the science gap and produce women who are equipped with the intellectual engagement, a social justice framework, and personal experience required of 21st-century change agents.

**Patrick Gibney**

Patrick Gibney is an Assistant Professor in the Department of Food Science at Cornell University. He teaches courses related to wine microbiology and his lab focuses on studying the yeast *Saccharomyces cerevisiae* to solve problems in the wine and beer industries, in addition to understanding fundamental biological processes in eukaryotic cells.

**Yeast metabolism in wine, beer, and stress resistance**

The yeast *Saccharomyces cerevisiae* has been interconnected with human civilization for thousands of years. Humans have domesticated this yeast to produce a variety of foods and beverages, engineered it to produce industrially valuable compounds, and studied it to understand general principles of eukaryotic cell biology. In this talk, the role of yeast metabolism in a variety of processes will be explored, including the role of trehalose metabolism in stress resistance, the role of the electron transport chain in starvation survival, the role of hexose metabolism in stuck and sluggish wine fermentations, and the role of starch metabolism in beer spoilage.

**Cydney Jackson**

Cydney Jackson completed her bachelor's degree in Food Science at Alabama Agricultural & Mechanical University where she studied the antioxidant capacity of portobella mushrooms. She is currently a Ph.D. student in Dr. Elad Tako's laboratory utilizing the broiler chicken model to investigate the interrelation between dietary zinc physiological status, vitamin A and the gut microbiome. Cydney has also led research projects investigating the effects of Empire apples and soy flour-enriched traditional bread on intestinal health and the gut microbiome.

**Empire Apple (*Malus domestica*) Juice, Pomace, and Pulp Modulate Intestinal Functionality, Morphology, and Bacterial Populations In Vivo (*Gallus gallus*)**

With an estimated 5 million tons produced yearly in the U.S. within the last decade, apple consumption is considered ubiquitous. Apples are comprised of bioactive constituents such as phytochemicals and prebiotics that may potentiate intestinal health and the gut microbiome. This study aimed to evaluate the effects of Empire apple juice, pomace, and pulp soluble extracts on intestinal functionality, morphology, and the microbiome in vivo (*Gallus gallus*). There were five treatment groups: noninjected (NI); 18 MΩ H<sub>2</sub>O (H<sub>2</sub>O); 6% apple juice (AJ); 6% apple pomace (APo); 6% apple pulp (APu). The eggs were treated by intra-amniotic administration of the samples on day 17 of incubation. After hatching, the blood, tissue, and cecum samples were collected for further analyses—including duodenal histomorphology, hepatic and duodenal mRNA expression, and cecal bacterial populations. Crypt depth was significantly ( $p < 0.5$ ) shortest in AJ when compared to APo and APu. APo and APu soluble extracts significantly improved villi surface area compared to NI and H<sub>2</sub>O control groups. The highest count of Paneth cells per crypt was observed in APo as compared to all groups. In addition, the expression of brush border membrane micronutrient metabolism and functional proteins varied between treatments. Lastly, *Lactobacillus* cecal microbial populations increased significantly in the AJ group, while AJ, APu, and APu increased the abundance of *Clostridium* ( $p < 0.5$ ). Ultimately, these results indicate the potential of Empire apple pomace to improve host intestinal health and the gut microbiome.

## Caroline Motzer



Caroline Motzer is an MS Student in the Wiedmann Lab studying new methods for industry to isolate defect causing thermophilic bacteria in dairy products. Additionally, she is researching the economics of *Listeria* environmental monitoring programs in dairy facilities and possible food safety uses for AI in controlled environment agriculture. Previously, Caroline served as Quality Assurance Food Scientist and SQF Practitioner for plant-based meat tech company, Rebellyous Foods. Prior to that, she worked as an assistant grower for hydroponic, urban agriculture start up, Farmbox Greens. She received two B.S degrees from Cornell University in 2019 in Agriculture Sciences and International

Development and Rural Agriculture.

### **Method Development for Industry Regarding Isolation and Tracking of Thermophilic, Non-spore forming, Defect causing Bacteria in Dairy**

Bacterial contaminants enter the dairy product supply chain through a variety of avenues from farm to processing. These bacterial contaminants represent diverse groups, many of which can cause deterioration in dairy product quality, including in cheese, yogurt, fluid milk and others. Of particular importance to cultured dairy products such as cheese and yogurt are thermophilic bacteria and Nonstarter Lactic Acid Bacteria (NSLAB), which can survive moderate to severe heat treatments such as pasteurization. In the cheddar cheese industry, of which nearly 1.3 billion lb of NY raw milk went toward the manufacture of in 2020, slits and cracks caused by thermophilic bacteria and NSLAB is one of the most common quality defects. To that end, the 3 objectives of this study are Objective 1. Development of testing methods for detection of key thermophilic and NSLAB populations known to cause dairy product defects, Objective 2. Compare isolates obtained to “finished product issues” caused by select thermophilic and non-starter lactic acid bacteria and Objective 3. Knowledge and method transfer to allow large cheese manufacturers and other stakeholders to reduce spoilage issues due to thermophilic or non-starter lactic acid bacteria. The current state of the project is focused Objective 1, specifically surrounding thermophilic bacteria. 9 Genera were selected based on their survival in lab pasteurized milk and their ability to cause defects. From there, using the inhouse Food Safety Laboratory library of strains, 40 strains from these 9 genera were selected based on genetic differences to use for method development for isolation from milk broth. Methods being tested are a combination of 4 time and temperature treatments, 2 media and 3 incubation times. Due to the ongoing nature of this study, results are currently not finalized. Once a method for isolation has been established, industry can use said method(s) to test raw milk at different points in the dairy continuum to identify avenues of contamination and identify what bacterial contaminant is causing defects.

**Rory Wang**

Rory Wang is a third-year PhD student in Randy Worobo's research group. He attended Iowa State University for his B.S. in food science and attended Washington State University for his M.S. in food microbiology. His current research focuses on advancing microbial aspects of high-pressure processing applications in juices. He also enjoys working on extension and outreach projects, and he serves as the current DEI liaison for the Community Outreach Committee in the department.

**Validation of *Cryptosporidium parvum* inactivation in apple juices: moving away from animal models**

*Cryptosporidium parvum* is a pertinent pathogen in apple juices and the FDA requires validation against *C. parvum* in apple juices or products that contain apple juice blend. Gold standard validation of parasite inactivation in juices relies on animal models, which can be costly and difficult to perform. This study explores the validity and practicality of several animal-free methods including human cell line-qPCR model, human cell line-live/dead qPCR model and simple sucrose centrifugation-qPCR model.

## Gretchen Mahler



Gretchen Mahler is a Professor in the Biomedical Engineering Department in the Watson College of Engineering at Binghamton University, part of the State University of New York (SUNY) system. She also serves as the Interim Vice Provost and Dean of the Graduate School. Gretchen earned her BS in Chemical Engineering from the University of Massachusetts Amherst in 2002. She completed her honors thesis with Dr. Susan Roberts. Dr. Mahler completed her PhD in Chemical and Biomolecular Engineering with Dr. Michael Shuler at Cornell University in 2008. In 2011, Gretchen completed a postdoctoral fellowship at Cornell University in the Biomedical Engineering Department with Dr. Jonathan Butcher. Dr. Mahler joined the Biomedical Engineering Department at Binghamton University in 2011. Her research interests include the development, characterization and validation of cell culture organ and tissue microfluidic models. Her current research includes the development of barrier tissue organs on a chip, including the GI tract, liver, kidney, and vascular and valvular endothelium, for mechanobiological and toxicity testing.

### **Development of a small intestinal model for assessing the impact of food additives**

A Western diet includes engineered nanoparticles (NP) on the order of  $\mu\text{g}$  per day, primarily as metal oxide NP used in processed foods and food packaging. The effects of NP on small intestinal function are not well understood. The goal of our work is to determine if and how ingested metal oxide NP alter gut microbiota populations and intestinal function. The human small intestine is the primary site of macronutrient digestion and absorption, but it is also difficult to access, making sampling and experimentation a challenge. We have developed static and organ on a chip cell culture models of the proximal gastrointestinal (GI) tract that include digestion, a mucus layer, physiologically relevant human cell types including immune cells, and a reproducible, stable, human bacteria-derived synthetic small intestinal microbiome. Data generated with these in vitro models and validated with an in vivo *Gallus gallus* (broiler chicken) model shows that dietary doses of metal oxide NP alter brush border membrane (BBM) enzyme function, decrease mineral, glucose, and lipid absorption, alter bacterial populations and mucus composition, and can induce monocyte differentiation toward macrophages. Decreases in nutrient absorption are due to NP-induced alterations in microvilli structure, mucus content, and bacterial population changes. Beneficial bacterial strains ameliorate negative NP effects, but NP adsorption onto bacteria can result in decreased bacterial viability. These advancements to an in vitro model of the small intestine can provide a novel method for understanding the human response to environmental contaminants and food additives.

**Olga Padilla-Zakour**

Dr. Padilla-Zakour is a Professor of Food Processing in the Department of Food Science at Cornell University, Director of the Cornell Food Venture Center, and Managing Director of the Institute for Food Safety at Cornell University.

Dr. Padilla-Zakour received her Food Engineering degree at the University of Costa Rica. She earned a M.S. in 1988 and then a PhD in Food Science & Technology from Cornell University in 1991. She joined Cornell as Director of the Food Venture Center in 1997, to lead a premiere extension program of the Department of Food Science. She coordinates and develops outreach programs and extension activities to support new and established entrepreneurs, processors and farmers

seeking to introduce new products into the marketplace. She is a recognized Process Authority in acidified and water activity controlled foods. She was selected IFT Fellow in 2014 and has received several academic awards. Her research program focuses on safety and quality of value-added, plant-based foods; thermal and nonthermal technologies for food preservation; upcycling byproducts; and new product development.

**Food Product Development and Entrepreneurship: Integration of Science, Regulations and Marketing**

This seminar highlights the most important stages of food product development from ideation to commercialization, focusing on the knowledge required to successfully market innovative products. The role of the Cornell Food Venture Center and the Center of Excellence for Food and Agriculture in supporting food entrepreneurship will be emphasized with case studies.

## Ray Glahn



Dr. Glahn is a nutritional physiologist for USDA-ARS, with over 30 years of experience in the study of iron nutrition from staple food crops and food products. He holds courtesy professor appointments in the Department of Food Science, and the Division of Nutrition at Cornell University. His research program focuses on defining the bioavailability of iron; thereby studying intestinal physiology, plant breeding approaches, agricultural factors and food processing practices that influence the intestinal absorption of this essential micronutrient. He utilizes a physiological approach, employing in vitro techniques (ie. cell culture) and an animal model (poultry). These models are well-established and validated relative to human nutritional trials. As such, they are employed to guide crop breeding programs, monitor Fe delivery from staple crops, develop food products, and thereby assess the nutritional quality of Fe in food systems.

### **Advancements in Providing Foods Rich in Bioavailable Iron**

Iron (Fe) is an essential micronutrient. Balancing systemic iron levels is critical for human health; thus, knowledge of bioavailable iron is key to understanding the nutritional quality of Fe in staple food crops and food products. The Glahn Lab has over 30 years of experience in studies of Fe nutrition. In that period of research, numerous factors and strategies have been identified that inhibit and promote Fe nutrition from food. This presentation will summarize past accomplishments and recent advancements in knowledge of Fe nutrition from staple food crops and food products, outlining opportunities in agriculture, food science and nutrition to increase the nutritional quality of Fe in foods.

**David Putnam**

David Putnam joined the College of Engineering at Cornell University in 2002, and he currently serves as the Associate Dean for Innovation and Entrepreneurship for the college. He was trained in the laboratory of Professor Jindrich Kopecek at the University of Utah. Prior to joining the engineering faculty at Cornell, he was an NIH postdoctoral fellow in the Department of Chemical Engineering at MIT in the laboratory of Professor Robert Langer. From 2000 until 2002, he held a joint appointment at MIT and as a scientific co-founder of TransForm Pharmaceuticals, Inc., which was acquired by Johnson & Johnson in March, 2005. In 2008-2009 he was an Entrepreneur-in-Residence at PureTech Ventures in Boston, MA where he focused on emerging technologies in the field of drug delivery. He is the founder/co-founder of Versatope Therapeutics, Inc., Articulate Biomedical, LLC and ProVis Medical, Inc. His academic research focuses on the design and synthesis of functional biomaterials with applications in drug delivery, osteoarthritis, and infectious disease. He is a past and current member of several Editorial Advisory Boards including Advanced Drug Delivery Reviews, Pharmaceutical Research, Biomacromolecules, ACS Biomaterial Science & Engineering, and the Journal of Applied Polymer Science. His current/past funding sources include Found Animals Foundation, NIH, NSF, Bausch & Lomb, New York State, Total Inc., and the Department of Defense. He is a Fellow of the National Academy of Inventors, AIMBE and the Coulter Foundation. Beyond academics, he leads two non-profit efforts, one focused on building affordable housing for the rural poor in Upstate New York, and the other focused on building energy-efficient water desalination systems for the developing world. He has completed five Ironman distance triathlons and multiple other long-distance races. He resides in Ithaca, NY with his wife of 33 years, Kathy, and two teenagers, Jane and Andrew.

**Translation of Academic Research into the Commercial Sector**

Academic research focuses on the generation of new knowledge. One outcome of academic research is intellectual property, which incentivizes commercialization through the application of new knowledge to benefit society. The Putnam Lab has worked for two decades at the interface of applied chemistry and microbiology to impact the fields of biomaterials and drug delivery. In this seminar, we will discuss how academic research leads to patents and the creation of new companies. Three case studies will be presented to put the discussion into context.

**David Barbano**

Dave conducts an applied and basic research program on dairy product manufacturing with a focus on cheese manufacturing, chemistry, and filtration technology for milk-based beverages. He also does research on milk analysis for dairy herd management and mid-infrared analysis of products and development of calibration sample sets. Recently, Dave has focused on developing new measures of cow metabolic health, nutrient utilization, and metabolic stress for dairy herd management using mid-infrared milk analysis. Dave has been

very active in the analytical groups of International Dairy Federation and the Association of Official Analytical Chemists International for the past 35 years. He has been a member of the American Dairy Science Association since 1974 and is a past president of ADSA.

**What is the best part of my job?** Working together with students to create new knowledge, technology, and science-based solutions to problems in the dairy industry.

**The Quest for In-line Real-time Milk Based Metrics for Large Dairy Herd Management**

Laboratory based instrumental FTIR-MIR milk analysis using newly developed PLS and PCA models and neural networks for measurement of milk characteristics other than milk fat and protein has provided the proof of concept that data from high frequency MIR milk analysis can be used as the basis for tactical feeding and health management decision making for groups of cows and individual cows, respectively. As the business and physical structure of dairy farms has changed over the past 20 years, the technology needed to ensure the productivity and well-being of each individual dairy cow and has evolved and will continue to evolve. The days of labeling sample containers, physically collecting samples in those containers, keeping them cold, preserving them, transporting them to a laboratory, testing them, handling data, and reporting data back to farms for farm management are numbered. The structure and function of milk testing sector of the dairy industry on one hand has played an important role in enabling the growth and change in milk production technology at the farm. However, in another way milk testing sector of the dairy industry now can be the next road block to change in industry structure for large farm management. The next step will be a transition from an analytical laboratory-based system of information (not data) production to a real-time sensor-based system continuously monitoring the operation providing milk-based performance metrics from within the dairy farm itself. In-line spectral finger printing of milk during the milking from each cow will be the key to moving this forward. From a university and corporate research

perspective, identification and development of solutions to the key individual technological barriers to implementation of an information production and communication system within a large farm with the focus to make each cow, a cow of interest from the perspective of health and well-being is the path forward. Healthy cows are productive cows.