# Food Science Graduate Seminar Series Spring 2021

Tuesdays from 3:45– 4:35 PM
*7-week course, session 2*
Stocking Hall
Cornell University

Seminar Chair: Dr. Anna Katharine Mansfield

Cornell CALS

College of Agriculture and Life Sciences

Food Science

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## 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 |
|---|---|---|
| Mar 30 | **Sam Reichler**<br>PhD Candidate, Cornell University | "Dr. Strangemilk or: How I Learned to Stop Worrying and Love the *Pseudomonas*." |
| Apr 6 | **Rachel Allison**<br>PhD Candidate, Cornell University | "Development of hydrogen sulfide in wine during storage." |
| | **Jessie Rafson**<br>PhD Candidate, Cornell University | "Novel, High-Throughput Methods for Trace-Level Analyses of Grape and Wine Volatiles using DART-MS." |
| Apr 13 | **Jennifer McEntire**, PhD<br>Senior Vice President of Food Safety and Technology, United Fresh Produce Association | "Produce Safety: Endless Opportunities to Make an Impact." |
| Apr 20 | **Allie Hall**<br>PhD Candidate, Cornell University | "Comparative Effects of High Pressure Processing and Thermal Treatment on Pulse Protein Structure, Function, and Digestibility." |
| Apr 27 | **Jessica Fanzo**, PhD<br>Bloomberg Distinguished Professor of Global Food Policy and Ethics, Johns Hopkins University | "Food Systems Transformation: Possible but not without challenges." |
| May 4 | **Omry Koren**, PhD<br>Professor, Azrieli Faculty of Medicine | "Several stories on the pregnancy and infancy microbiomes." |
| May 11 | **Danielle Reed**, PhD<br>Associate Director, Monell Chemical Senses Center | "Sensory fingerprint: the genetics of taste perception." |

**For questions contact: Erin Atkins | ea56@cornell.edu | 607-255-2539 (office)**

## Samuel Reichler

Samuel Reichler was born in Albany, New York, and raised in the Town of Bethlehem just south of the city. Sam received his New York State High School Equivalency Diploma in 2008. He earned an Associate of Occupational Studies in Culinary Arts from Schenectady County Community College in 2010. While at SCCC, he won a gold medal for competing in the American Culinary Federation Baron H. Galand Culinary Knowledge Bowl. Sam attended the University at Albany and Hudson Valley Community College, winning the CRC Press Freshman Achievement Award for general chemistry at UAlbany, before transferring to Cornell University in August 2012 as a Food Science major. In February 2013, Sam began working in the Milk Quality Improvement Program Laboratory as a dishwasher. After earning a Bachelor of Science degree from Cornell in May 2015, Sam began a PhD in the Milk Quality Improvement Program under the direction of Dr. Martin Wiedmann. Sam was awarded a two-year USDA NIFA Predoctoral Fellowship in 2018, extending his program time to 6 years to complete this research on the spoilage of fluid milk by sporeforming bacteria. Sam is an aquarist and grows orchids. Following graduation, he will remain with the Milk Quality Improvement Program.

### Dr. Strangemilk or: How I Learned to Stop Worrying and Love the *Pseudomonas*

Human consumption of domesticated ruminant milk began over 10,000 years ago during the Neolithic Revolution. The extremely perishable nature of fresh milk has remained a persistent challenge from these prehistoric times to the present day. Bacteria present in and on the udder, in the farm environment, and on the hands and implements of milkers contaminate the milk and rapidly proliferate in its nutrient-rich conditions. For this reason, untreated fresh milk spoils within hours at ambient temperatures. This changed with the dual advents of mechanical refrigeration and pasteurization in the 19th century. Although the primary purpose of pasteurization is to reduce the foodborne pathogen population of milk to an acceptable risk level, pasteurization also drastically reduces the population of nonpathogenic vegetative bacterial cells responsible for spoilage. For this reason, refrigerated contemporary high-temperature, short-time pasteurized milk has an optimum shelf life of approximately 21 days. The largest obstacle to achieving this optimum is recontamination of milk with heat-labile bacteria during processing following pasteurization, a phenomenon called postpasteurization contamination (PPC).

The 4 studies I will present advance our knowledge of PPC in several relevant areas: (1) The prevalence and identity of postpasteurization contaminant Gram negative bacteria in large Northeastern United States fluid milk processing plants; (2) an assessment of plant sanitation and employee training interventions for the reduction of PPC rates in fluid milk; (3) a single gene sequencing-based subtyping technique for Pseudomonas spp., currently the most common postpasteurization contaminant; and (4) genotypic and phenotypic characterization of 2 Pseudomonas spp. responsible for blue and gray color defects in dairy products. The results of these studies emphasized several high-level conclusions regarding the present state of PPC and our knowledge thereof.

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## Rachel Allison

Rachel Allison is a PhD candidate in Gavin Sacks' lab, with a focus in wine flavor chemistry. Her research looks at the development of reductive off-aromas in wine during storage, particularly those aromas related to the stability of copper fining treatments and interactions between wine and aluminum can packaging. She received her undergraduate degrees in Chemical Engineering and Economics from Queen's University in Canada.

**Development of hydrogen sulfide in wine during storage**

Sulfur-like off-aromas (SLOs) are reportedly responsible for upwards of one quarter of the faults identified in premium wines in competition. Of the many volatile sulfur compounds (VSC) reported in wine, hydrogen sulfide ($H_2S$, "rotten egg aroma") is most frequently reported to be in excess of its sensory threshold (~ 1 µg/L) in wines with SLOs. $H_2S$ can be produced during fermentation through several pathways but is sufficiently volatile such that the majority formed during fermentation will be lost to CO2 entrainment. After fermentation, winemakers may attempt to remove $H_2S$ by inert gas sparging, or by aeration to oxidize H2S or other VSCs or by addition of cupric (Cu[II]) salts to form non-volatile complexes.

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## Jessie Rafson

Jessie is a PhD candidate in Gavin Sacks' lab. She earned her Bachelor's in Chemistry from the University of Southern California. Before coming to Cornell, Jessie worked as an analytical chemistry fellow at the CDC. At Cornell, her dissertation research has focused on developing rapid, high-throughput methods for trace-level volatile compounds. After graduating later this year, Jessie will be joining the FDA in Denver to work as a research chemist.

### Novel, High-Throughput Methods for Trace-Level Analyses of Grape and Wine Volatiles using DART-MS

There is a need for affordable, rapid, trace-level (sub-ppm) chemical technology to characterize large numbers of samples to proactively ensure high-quality and safe agricultural and food products. This is especially true for wine and grapes where large numbers of samples require analyses to assess smoke taint exposure, characterize breeding programs, etc. Solid-phase microextraction (SPME) is widely used in conjunction with gas chromatography-mass spectrometry (GC-MS) for volatile analyses in foodstuffs and other complex matrices. However, standard GC-MS quantitation methods generally require ~30-60 min per sample, making it suboptimal for high throughput analyses. Recent work from our lab has developed a method for the selective extraction and pre-concentration of volatiles which uses a planar sorbent sheet (SPMESH) headspace extraction prior to rapid analysis by Direct Analysis in Real Time (DART)-MS. Using this combined SPMESH-DART-MS approach, 24 samples could be extracted and analyzed in 45 min with detection limits of common odorants in the ng/L to µg/L range. While the original work using SPMESH-DART-MS was a substantial improvement over SPME-GC-MS, it still has its limitations. First, instead of being limited by a lengthy GC cycle, throughput is now limited by: (1) the equilibration time needed for a headspace extraction, (2) crosstalk within the system limiting the number of useable wells, and (3) the dimensions of the well plate itself. Additionally, the current range of compounds compatible with SPMESH-DART-MS is rather narrow. While SPMESH-DART-MS has previously worked well for non-polar, highly volatile compounds, it has poor performance with semi-polar volatiles and is incompatible with non-volatile compounds in headspace mode. This seminar presentation will discuss how we have overcome these challenges.

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## Jennifer McEntire

Jennifer McEntire, PhD, is Senior Vice President of Food Safety and Technology at United Fresh Produce Association. A food microbiologist by background, she has spent the past 20 years in the Washington, DC area, bringing the scientific perspective to food safety regulatory issues. She was previously Vice President of Science Operations at the Grocery Manufacturers Association. She has also had roles as VP and Chief Science Officer at The Acheson Group and as the Senior Staff Scientist and Director of Science & Technology Projects at the Institute of Food Technologists. McEntire earned a PhD from Rutgers University as a USDA National Needs Fellow in Food Safety and received a Bachelor of Science with Distinction, magna cum laude, in food science from the University of Delaware. She serves as an advisory board member of the Global Food Traceability Center, on the technical committee of the Center for Produce Safety, and serves on several industry advisory boards for academic research projects. She was recently honored with the NSF International Food Safety Leadership Award.

**Produce Safety: Endless Opportunities to Make an Impact**

Compared to other parts of the food system, research and practices related to produce safety are early in their maturity. At the same time, produce represents the largest segment of the food system consumed without a “kill step”, and it’s role in a healthful diet is well recognized. This creates many opportunities for individuals seeking to make a difference. This discussion will provide historical context for the key issues facing the produce industry, and identify current and future areas for exploration.

## Allie Hall

Allie Hall is a PhD candidate in Food Science and Technology at Cornell University in Dr. Carmen Moraru's research group.

She holds a bachelor's degree in Chemistry from MIT and spent three years prior to graduate school teaching chemistry at Blair Academy in New Jersey. Her research focuses on the effects of high pressure processing on pulse protein structure, function, and digestibility, with the goal that this work will expand the utilization of pulse proteins in our food system.

### Comparative Effects of High Pressure Processing and Thermal Treatment on Pulse Protein Structure, Function, and Digestibility

Increasing the utilization of plant proteins in our food system has the potential to impart far-reaching benefits to global food security, the environment, and human health. In addition, with consumers growing increasingly health and sustainability-conscious, there is a rapidly growing market for high quality plant-based protein products. Despite this, the use of plant proteins in our food system is still relatively limited due to nutritional, functional, logistical, financial, and sensory challenges. For instance, the functionality of plant proteins is not as understood and oftentimes does not compare to that of traditional ingredients. In addition, plant protein quality is generally low due to limited amino acid profiles, poor digestibility, and the presence of antinutritional factors. Structural modification of plant proteins is a viable strategy for overcoming challenges with respect to plant protein functionality and quality. This seminar will focus on high pressure processing (HPP) as a potential tool to elicit changes in pulse (pea, lentil, faba bean) protein functionality and quality via structural modification. Data will be presented on HPP-induced changes in pulse protein structure, function, and digestibility in comparison to thermal treatments in systems with protein concentrations characteristic of protein-fortified beverages and protein gels.

## Jessica Fanzo

Jessica Fanzo, PhD is the Bloomberg Distinguished Professor of Global Food Policy and Ethics at the Johns Hopkins University in the USA. At Hopkins, she holds appointments in the Berman Institute of Bioethics, the Bloomberg School of Public Health, and the Nitze School of Advanced International Studies (SAIS). She also serves as the Director of Hopkins' Global Food Policy and Ethics Program, and as Director of Food & Nutrition Security at Hopkins' Alliance for a Healthier World. She is the Editor-in-Chief for the Global Food Security Journal and leads on the development of the Food Systems Dashboard, in collaboration with GAIN. From 2017 to 2021, Jessica served on the Food Systems Economic Commission, the Expert Panel for the Cornell Atkinson Center's Socio-Technical Innovation Bundles for Agri-Food Systems Transformation report, the Global Panel of Agriculture and Food Systems for Nutrition Foresight 2.0 report, and the EAT-Lancet Commission. She was also the Co-Chair of the Global Nutrition Report and Team Leader for the UN High-Level Panel of Experts on Food Systems and Nutrition. Before coming to Hopkins, she has also held positions at Columbia University, the Earth Institute, Food and Agriculture Organization of the United Nations, the UN World Food Programme, Bioversity International, and the Millennium Development Goal Centre at the World Agroforestry Center in Kenya. Jessica has a PhD in nutrition from the University of Arizona.

### Food Systems Transformation: Possible but not without challenges

In the context of the broad global trends of population growth, climate crisis and unhealthy diets, food available for consumption will need to increase by more than 50 percent to meet the food security and nutritional needs of the world's population in 2050. Additionally, rising incomes will likely increase the demand for climate intensive diets, which tend to have higher negative environmental impacts. These projections indicate that without significant transformation towards more sustainable food production practices, less waste and healthier diets, food systems will continue to exert high pressure on biodiversity loss, land and water use, air and water pollution, and climate change and their currently known boundaries. Transgressing these boundaries could constrain food systems' resilience, the ability to provide safe and sufficient food for everyone and have adverse impacts on human and ecological systems more broadly, particularly in times of disturbances, conflicts and shocks. With the COVID-19 pandemic, there are significant new uncertainties and profound implications for achieving and maintaining this resilience and sustainability across the globe. Food systems are under pressure not only to deliver safe and high-quality food in adequate quantities in a sustainable way, but also to help address poverty by creating jobs and decent livelihoods in an equitable manner. The current COVID-19 pandemic has imposed an additional level of pressure on the governance, functionality, efficiency and resilience of food systems, with potentially long-lasting implications. While the pandemic exposed the significant vulnerabilities of food systems, it could also provide an opportunity for reimagining them, if bold policies are applied that accelerate economic, societal and technological transformations towards a more socially just and sustainable global food system.

## Omry Koren

Omry Koren is a Professor at the Azrieli Faculty of Medicine. His principle field of research is the human microbiome.

Prof. Koren received his MSc and his PhD in Molecular Microbiology and Biotechnology from Tel-Aviv University in Israel. At that time, he was involved with the innovative paper The Coral Probiotic Hypothesis which has now been expanded to The Hologenome Theory of Evolution. Dr Koren subsequently accepted a post- doctoral position at Cornell University where he was part of the NIH Human Microbiome Project and where he led the first study to demonstrate that pregnancy is associated with a profound alteration of the gut microbiota and host metabolism.

Prof. Koren leads his laboratory at Bar-Ilan University and his team's research aims to better understand the interactions between microbiota and the host endocrine system, host behaviour, and host development, in health and in disease states. He has received the prestigious Minerva Award for Research Cooperation and High Excellence in Science, the Alon Fellowship for outstanding young scientists and was also recently awarded an ERC consolidator grant to study the microbiome and social behavior. For the past three years Prof. Koren has also been part of the world's highly cited researchers (top 1%).

**Several stories on the pregnancy and infancy microbiomes**

During pregnancy the female body undergoes hormonal, metabolic, and immunological changes such as an increase in body fat early in pregnancy followed by reduced insulin sensitivity later in gestation. Pregnancy progression is also associated with dramatic alterations in the composition of the gut and vaginal microbiotas. The vaginal microbiota of pregnant women is characterized with a decrease in bacterial diversity which is also seen in the gut microbiota as pregnancy progresses. In the gut, the lower diversity is accompanied by an increase in "between sample" diversity and an increase in the number of Proteobacteria and opportunistic pathogens. Germfree mice inoculated with gut microbiota from pregnant women presented metabolic changes mirroring those of the pregnant women. This microbiota is then transferred to the infants in during birth and there are differences in the microbiota of the newborn depending on the mode of birth vaginal delivery vs. C-section. Whether the infant is breast-fed or formula fed also has a big impact on the infant's microbiota.

We are now at the point of trying to understand whether the microbial changes during pregnancy are a cause or consequence of some of the characteristics of pregnancy. We are also interested in how interventions during pregnancy and infancy such as antibiotic treatment, preterm birth and pregnancy complications influence the mother and newborn.

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## Danielle Reed

Dr. Danielle Reed is the Associate Director of the Monell Chemical Senses Center which is a non-profit research institute whose scientists are devoted to the study of taste, smell, and chemesthesis. She is on the leadership team of the Global Consortium for Chemosensory Research which focuses on understanding the taste and smell loss with COVID-19 and she leads a team studying the global perception of bitter chemicals including foods and medicines.

**Sensory fingerprint: the genetics of taste perception**

In matters of taste, there is no argument. People differ, often dramatically, in their ability to taste and smell many of the constituents in foods and drinks and at least some of these differences are due to inborn genotypes in the taste and olfactory receptors. I will explain ongoing work in my laboratory to investigate the global scale of the human flavor experience and its biological underpinnings.