2017 ISGA Convention Speakers

Dr. Cara Haney is an Assistant Professor in the department of Microbiology and Immunology and Michael Smith Labs at the University of British Columbia. Dr. Haney's research focuses on interactions between beneficial plant-associated microbes (the "microbiome") and plant growth and disease resistance. She received her B.S. in Plant Science from Cornell University and her Ph.D. in Cell and Molecular Biology from Stanford. She worked at Harvard as a postdoc developing a model system to study plant-microbiome interactions prior to joining the UBC faculty in 2016. Dr. Haney holds the Canada Research Chair in plant-microbiome interactions.

The plant microbiome in plant health and disease

Plants depend on their associated microbial communities ("the microbiome") to access nutrients and protect themselves from disease, and yet modern agricultural practice heavily relies on inorganic crop treatments (i.e. fertilizers and pesticides) to do the same thing. Given that most inorganic crop treatments have appreciable environmental and economic costs, it is desirable to replace them with treatments that consist of beneficial plant-associated microbes. Doing so has the potential to improve agricultural sustainability. However, most attempts to use microbes in agriculture have been unsuccessful, often because microbes that show promise in greenhouse trials fail in the field.

Our research is focused on understanding the mechanisms that underlie microbial effects on plant health and disease. We use simplified soil-free bacterial communities to untangle how different plant cultivars interact with distinct microbial strains without the confounding variables of soil and environment. Because of this reductionist approach, we think many of our findings may be directly applicable to protecting sprouts from introduced human and plant pathogens. This talk will review the current paradigms of plant-microbiome associations and the latest findings of our lab and of the field.

Greg McLaren is a marketing and business management professional with over 30 years of experience in marketing, business development, sales operations and the teaching of these processes. He and his team are Farm Food Drink branding and marketing specialists, conducting research, planning and marketing for small farm and food businesses only within this sector.

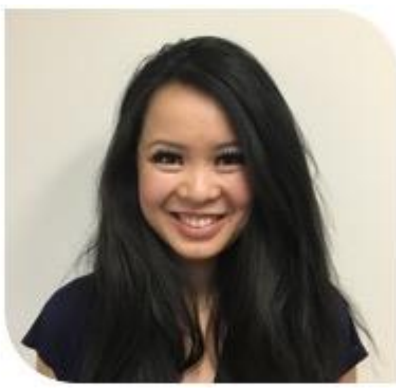
Pairing two distinct teams, one that specializes in business research and development, the other in marketing and branding, Greg and his team grow local and regional farm and food businesses and organizations throughout British Columbia. Left Field Marketing's branding and campaign successes include double digit sales increases with Natural Pastures Cheese Company, Eatmore Sprouts & Greens Ltd., and 40 Knots Vineyard

& Estate Winery. Under the Business Advisory Team, Greg has guided strategic plans with organizations like the Small Scale Food Processors Association, Certified Organic Association of B.C. and the B.C. Association of Farmers Markets.

A passionate supporter of local food systems, Greg dedicates energy to organizations throughout the province who support the values of the local food movement.

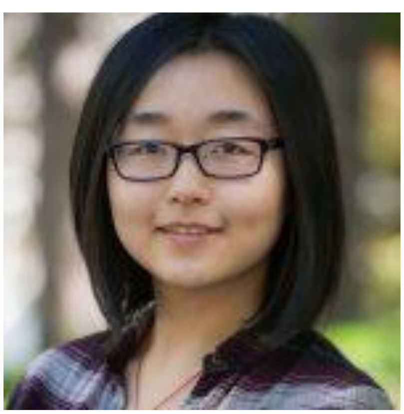
Siyun Wang, Assistant Professor of Food Safety Engineering at UBC

Dr. Wang is an Assistant Professor of Food Safety Engineering at UBC. Her career in food safety started at the Institute for Food Safety and Health at Illinois Institute of Technology in Chicago, where she was a PhD student. Prior to joining UBC in 2013, she was a postdoctoral associate at the Department of Food Science in Cornell University. Over the past several years, Dr. Wang has published more than 20 papers and book chapters on microbial food safety.



Karen Fong, PhD candidate at UBC

Karen obtained her BSc in Microbiology at UBC Okanagan in 2012. She completed her MSc degree in Food Science in 2015 where she studied the survival of *Salmonella* in low water activity food products. She has since published these findings in the Journal of Food Protection and Food Microbiology. Currently, Karen is a second year PhD candidate in Dr. Siyun Wang's lab at UBC, where her project is focused on characterizing virulent bacteriophages for effective control of *Salmonella* in food products.



Yue (Cindy) Dai, MSc student at UBC

Cindy obtained her BSc in Food Science with Honours from UBC in 2016. She completed her undergraduate thesis project in 2016 studying the extraction and quantification of bioactive Maillard reaction products from bread. Her current area of research is on developing mitigation strategies for reducing *Salmonella* contamination on alfalfa sprouts.

Ensuring alfalfa sprouts safety – Silver bullet or finding Waldo?

Authors: Yue Dai, Karen Fong, Pascal Delaquis, Carmen Wakeling and Siyun Wang

Abstract: See Below

Introduction: Alfalfa sprouts contaminated with *Salmonella* have been the source of many foodborne disease outbreaks in North America. Although seed disinfection treatments recommended by the Canadian Food Inspection Agency (CFIA) are meant to achieve a minimum 3 log cfu/g reduction immediately after sanitation, previous research has shown that persistent *Salmonella* cells that survive the treatment can multiply during germination.
Purpose: The purpose of this study was to (i) investigate the ability of different *Salmonella* strains to grow on alfalfa sprouts after CFIA-recommended seed treatments and a treatment compliant with organic production principles; (ii) evaluate the performance of a bacteriophage (SI1) for reducing *Salmonella* contamination on alfalfa sprouts.

Methods: Alfalfa seeds inoculated with *Salmonella* were subject to four types of sanitizing treatments: (i) 5,000 ppm chlorine, (ii) 8% hydrogen peroxide, (iii) an organic treatment (50°C hot water, 2% hydrogen peroxide and 0.1% acetic acid) or (iv) a drench inoculation with bacteriophage SI1 for two h to achieve a multiplicity of infection of ~100 PFU/CFU. The sanitized seeds were sprouted and the density of *Salmonella* was enumerated on selective xylose lysine deoxycholate agar during germination.

Results: The density of *Salmonella* increased from <10 CFU/g immediately after treatment to 6-7 log CFU/g after 48 hours of germination and 4-7 log CFU/g after 6 days. *Salmonella* density on seeds with chlorine treatment were significantly higher ($p<0.05$) compared to those treated by H_2O_2 and acetic acid. Bacteriophage SI1 significantly ($p<0.05$) reduced *Salmonella* populations by >3 log CFU/g during the sprouting process on day one.

Significance: These data show that *Salmonella* cells were able to recover and grow on sprouting alfalfa seeds. Future work should investigate the efficacy of SI1 in combination with current sanitation treatments control the growth of *Salmonella* on alfalfa sprouts.

Hippocrates Was Right

Bernhard H.J. Juurlink
Professor emeritus, Department of Anatomy & Cell Biology
College of Medicine, University of Saskatchewan

Mitochondrial dysfunction, oxidative stress and associated inflammation underlie aging and associated chronic diseases. Nrf2 activators set in motion a signaling pathway that that alters gene expression that ultimately decreases oxidative stress and associated inflammation and as well improves mitochondrial function. This pathway was slowly unraveled following the pioneering research by Dr. Lee W. Wattenberg and later Dr. Paul Talalay to understand why certain foods were associated with a decreased risk of developing cancer. It was quickly discovered that what these foods had in common were phytochemicals that caused increased activities of phase 2 enzymes, enzymes involved in the metabolism of drugs and xenobiotics, including carcinogens. Eventually these cancer-preventing phytochemicals were discovered to activate the Nrf2 signaling system that results in the alteration of expression of dozens of genes. Such phytochemicals are now called Nrf2 activators and one of the first of such dietary phytochemicals identified by Dr. Talalay’s group was sulforaphane, an isothiocyanate metabolite of sulforaphane glucosinolate (glucoraphanin). This research group also identified that broccoli sprouts of particular cultivars are a rich source of sulforaphane glucosinolate.

Although the initial focus of research attention was the ability of Nrf2 activators to decrease the probability of cancer formation and progression, I noted that the increased expression of phase 2 enzymes should also decrease oxidative stress and associated inflammation, areas of my research interest. I published an hypothesis paper on this idea in 2001. I, and my colleagues, subsequently obtained funding from the Saskatchewan Agricultural Development Fund to test this idea. My laboratory has shown that intake of Nrf2 activators (including sulforaphane whether via broccoli sprouts consumption or sulforaphane administered by gavage) will decrease oxidative stress and associated inflammation in rodent models of aging. Positive outcomes from these experiments include decreased blood pressure, better brain aging, better locomotory function during old age and better renal function. We also have shown that stroke-prone hypertensive rats on a diet that contained high sulforaphane broccoli sprouts had offspring with better blood pressure and less oxidative stress and inflammation in every tissue examined. That is, a dietary Nrf2 activator had positive effects on fetal determinants of adult health. This latter, at least in part, was associated with normalizing the epigenome of the kidneys.

Subsequently, other laboratories have shown that intake of Nrf2 activators have positive effects on a variety of diseases that have dyslipidemia, oxidative stress and inflammation as underlying disorders in various animal models. Of great significance is that a number of clinical trials have shown that consumption of high sulforaphane broccoli sprouts or extracts thereof have therapeutic effects in humans. These include trials showing positive effects on decreasing helicobacter infections, normalizing lipid metabolism, normalizing glucose control in type 2 diabetes, promoting the ability to detoxify airborne carcinogens, and ameliorating the symptoms of autism and possibly schizophrenia.

Hippocrates stated that food should be our medicine and medicine our food. We are at a stage where Hippocrates dictum can be put into practice. Broccoli is not the only vegetable variety that contains sulforaphane glucosinolate. Black Tuscany kale has even a better glucosinolate profile than the Calabrese broccoli cultivar my laboratory has used. However, a word of caution: although sulforaphane glucosinolate and certain other glucosinolates activate the Nrf2 signalling pathway, a number of glucosinolates are goitrogenic. It becomes very important to know the glucosinolate profile of the sprouts before promoting their consumption. I am not sure if the sprouts of all the broccoli seeds labelled Calabrese have the same glucosinolate profile as the ones we used. A very useful service the International Sprout Growers Association can provide their membership is to determine the glucosinolate profiles of the Brassica sprouts grown from seeds being sold by the membership.

Acknowledgments: I thank my colleagues and the funding agencies that supported my research. I have been very fortunate in having wonderful undergraduate students, graduate students, post-doctoral fellows and other colleagues participating in the research in which I have engaged.