FOODS FOR HEALTH
Postdoctoral Researcher Awards

Recipients of Foods for Health Postdoctoral Researcher Awards are funded for 50% support for one year to work on a transdisciplinary, collaborative project that uses metabolomics to address a relevant problem in the food-nutrition-health axis, with mentoring by Foods for Health faculty affiliates from two or more different departments.

2017 Awards

Probiotic Escherichia Coli Nissle 1917: Impacts on ‘Omics’ (metabolomics, metagenomics) and Human Rotavirus Infection

Awardee: Husheem Michael, PhD, OARDC Food Animal Health
Faculty Mentors: Linda J. Saif, OARDC Food Animal Health; Vicki Wysocki, Chemistry and Biochemistry

Human rotavirus (HRV) is a leading cause of diarrhea in children. It causes significant morbidity and mortality, especially in developing countries where the efficacy of RV vaccines is low. Probiotics are increasingly used to enhance oral vaccine responses and to treat enteric infections and ulcerative colitis in children. The probiotic Escherichia coli Nissle 1917 (EcN) lacks virulence factors and possesses unique health-promoting properties and has been widely used in the treatment of ulcerative colitis in humans. Neonatal gnotobiotic (Gn) pigs resemble infants in their physiology, anatomy, mucosal immune system and outbred status providing a unique model to study the impact of probiotics on host metabolism, neonatal immune system, enteric viral infections or oral vaccines. There is no information on EcN induced metabolic activity or as related to protection against HRV. We hypothesize the recognition and uptake of HRV associated EcN by intestinal antigen presenting cells followed by interactions of the HRV-EcN complex with diverse TLRs may result in more potent stimulation of the immune system, alleviating intestinal inflammation and restoring the gut homeostasis after HRV challenge. We further hypothesize that EcN will enhance neonatal immune responses by altering the metabolome and metagenome in the gut of human infant fecal microbiota (HIFM) colonized pigs, thus moderating HRV infection. We aim to evaluate a) EcN as an immune stimulator to treat HRV diarrhea in the HIFM transplanted Gn pig model and b) EcN effects on metabolic and metagenomic profiles of the HIFM, immunity, and RV diarrhea.

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Integration, Via Linear Modeling, of Metabolomics and Microbiome Data from a Mouse Model of Lifetime Obesity and Colon Cancer

**Awardee:** Jalal Siddiqui, PhD, Department of Biomedical Informatics  
**Faculty Mentors:** Ewy Mathé, Biomedical Informatics, Rachel Kopec, Human Sciences; Emmanuel Hatzakis, Food Science & Technology; Susan Olivo-Marston, Public Health

Metabolomics is playing an increasingly large role in clinical and translational research, and has assisted in identifying novel biomarkers for cancers [Of note, analyzing metabolomics data poses unique challenges]. One of the challenges is understanding how metabolites affect and are affected by genes and the proteins they produce (following from the molecular biology dogma). In studying the metabolome, it becomes necessary to understand how the associations between gene expression and metabolites are linked with a particular phenotype. Our research group has developed a novel approach IntLIM that can integrate gene expression and metabolomic data and query what gene-metabolite pairs are dependent upon phenotype. However, we wish to extend this approach toward integrating metabolomics data with other omics data sets, specially with microbiome data. Indeed, studies have shown that commensal microbes do influence metabolite profiles and human health/disease. We are now developing approaches to integrate microbe and metabolite abundance data to query what microbe-metabolite pairs are phenotype-dependent, and are applying this approach to murine models of obesity.

Role of Omega-3 Fatty Acids on Bioaccessibility, Cell Uptake, and Metabolism of Carotenoids

**Awardee:** Bo Zhang, Dept. of Chemistry and Biochemistry  
**Faculty Mentors:** Rafael Bruschweiler, Chemistry and Biochemistry; Rachel Kopec, Human Sciences

Carotenoids, synthesized by plants, bacteria, and some kinds of algae, provide the yellow, orange and red colors of foods. Carotenoids demonstrate characteristic health benefits in decreasing the risk of disease, particularly certain cancers, eye and cardiovascular disease. Omega-3 fatty acids (FAs) are a class of lipids found in plant foods, nuts, and cold-water fish, and play a crucial role in brain function, as well as normal growth and development. Omega-3 FAs also demonstrate benefits by reducing the risk of chronic diseases such as heart disease, cancer, and arthritis. Due to the commensal benefits of omega-3 and carotenoids, it is sensible to supplement them together in the diet to promote human health. Interesting enough, limited data have indicated that omega-3 consumption could influence the bioavailability of carotenoids by reducing carotenoid absorption. The central hypothesis of this study is whether the bioaccessibility, cell uptake, and metabolism of carotenoids can be mediated by omega-3 fatty acids. We will determine the bioaccessibility and bioavailability of common carotenoids when digested in the presence of omega-3 FA, using a targeted HPLC-MS/MS approach. We will also evaluate the metabolic regulation of omega-3 FA on carotenoid uptake by Caco-2 cells using a non-targeted, integrated HPLC-MS/NMR approach.

Learn how FFH is integrating food, nutrition, and metabolomics for health at discovery.osu.edu/ffh