

WELCOME TO

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# **CYCLONE SCHOLARS SUMMER RESEARCH EXPERIENCE**

SYMPOSIUM

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JULY 28TH, 2017 AT 1:00 PM

CENTER FOR CROPS UTILIZATION RESEARCH

TECHNOLOGY TRANSFER THEATRE

FOOD SCIENCE BUILDING



# Schedule of Events

TIME	TOPIC	PRESENTER/MENTOR
<b>1:00 PM</b>	Opening Remarks	Dr. MacDonald, PhD, RD
<b>1:15 PM</b>	<b>My Health, My Way – Preliminary Results from a Clinical Intervention for Childhood Overweight and Obesity</b>	<b>Ben Dralle</b> <i>Dr. Lorraine Lanningham-Foster</i>
<b>1:30 PM</b>	Evaluation of Food Safety Technical Assistance for Healthy Food Access Project	Heather Pamperin <i>Dr. Shannon Coleman</i>
<b>1:45 PM</b>	<b>Theory-based Nutrition Education: A Review of Fresh Conversations</b>	<b>Morgan Schonert</b> <i>Dr. Sarah Francis</i>
<b>2:00 PM</b>	Impact of Ulcerative Colitis on Glycine N-methyltransferase Expression in the Liver	Celia Andreo <i>Dr. Kevin Schalinske</i>
<b>2:15 PM</b>	<b>Shelf-life Extension of Salad kits using Innovative Light Filtering and Display Case Technology</b>	<b>Kayla Johnson</b> <i>Dr. Keith Vorst</i>
<b>2:30 PM</b>	Nutrition Environment in the River Bend Community	Lydia Stephney <i>Dr. Ruth Litchfeild</i>
<b>2:45 PM</b>	<b>The Effects of Exercise on Striatal Adenosine Receptor Density</b>	<b>Raquelle Weight</b> <i>Dr. Peter Clark</i>
<b>3:00 PM</b>	Shiga Toxin-Producing <i>Escherichia coli</i> (STEC) Adherence to Cattle Colonic Explants and Immune Response of Mice Infected with STEC	Cat Spivak <i>Dr. Melha Mellata</i>
<b>3:15 PM</b>	<b>Analysis of Amaranth Flour Blends in Wheat and White Breads</b>	<b>Robin Cameron</b> <i>Dr. Kurt Rosentrater</i>
<b>3:30 PM</b>	Producing Selenium-Rich Microalgae as a Food and Fee-Supplement	Elizabeth Eisnor <i>Dr. Zhiyou Wen</i>
<b>3:45 PM</b>	<b>Closing Remarks</b>	
<b>4:00 PM</b>	Reception	



## **My Health, My Way – Preliminary Results from a Clinical Intervention for Childhood Overweight and Obesity**

Benjamin Dralle<sup>1</sup>, Maren Wolff, MS, RDN, LD<sup>1,2</sup>, Julia Richards-Krapfl, MS<sup>3</sup>, Dr. Jennifer Groos, MD<sup>4</sup>, Dr. Lorraine Lanningham-Foster, PhD<sup>1,2</sup>

<sup>1</sup>Cyclone Scholars Summer Research Program and the Department of Food Science and Human Nutrition, Iowa State University, Ames, <sup>2</sup>Interdepartmental Graduate Program in Nutritional Sciences, Iowa State University, Ames, IA <sup>3</sup>Blank Children's Hospital Center for Advocacy and Outreach, Des Moines, Iowa <sup>4</sup>Blank Children's Hospital Pediatric Clinic, Des Moines, Iowa

Rates of childhood overweight and obesity in the U.S. are at historically high levels, with comorbidities placing an increasing burden on families and healthcare systems. Previous research suggests that the primary care setting may be an appropriate site for health interventions related to a child's lifestyle and weight. The My Health, My Way (MHMW) Study is intended to evaluate the effects of an intervention for childhood overweight and obesity based out of a pediatric primary care office. Twenty-four participants have been enrolled in the study; participants in the control group receive weight-conscious pediatric primary care, while the intervention group receives weight-conscious pediatric primary care and supplementary health coaching. The primary outcome of obesogenic behavior change is measured via the Family Nutrition and Physical Activity (FNPA) questionnaire. Secondary outcomes, including BMI and BMI-related measures, parental self-efficacy, health literacy, and parent/program satisfaction, are tracked as well. Preliminary analyses show a nearly equal distribution of ages, genders, and BMI percentiles between study groups. Initial FNPA outcomes indicate excessive screen time and lack of physical activity participation as common obesogenic behaviors MHMW families identify as problematic. Health literacy assessments at enrollment reveal varying levels of health literacy among participants, with 24% demonstrating possibly limited healthy literacy and 76% demonstrating adequate health literacy. Any additional outcomes lack sufficient data for analysis at this point in the study. As a whole, these results reveal the many facets of the MHMW study and provide a robust starting point for further analysis as the study continues.

## **Evaluation of Food Safety Technical Assistance for Healthy Food Access Project**

Heather Pamperin<sup>1,6</sup>, Laura Irish<sup>2</sup>, Carrie Chennault<sup>3</sup>, Dr. Cynthia L. Haynes<sup>2</sup>, Dr. Denny Schrock<sup>3,5</sup>, Christine Hradek<sup>4</sup>, Susan DeBilieck<sup>5</sup>, Dr. Shannon M. Coleman<sup>6</sup>

<sup>1</sup>Department of Nutritional Sciences University of Wisconsin-Madison, Madison, WI <sup>2</sup>Department of Horticulture Iowa State University, Ames, IA <sup>3</sup> Department of Sustainable Agriculture Iowa State University, Ames, IA <sup>4</sup> Supplemental Nutrition Assistance Program (SNAP-Ed), Iowa State University Extension and Outreach, Ames, IA <sup>5</sup> Master Gardener Program, Iowa State University Extension and Outreach, <sup>6</sup>Cyclone Scholars Summer Research Experience and Iowa State University Department of Food Science and Human Nutrition

For many years, master gardeners have served their communities as volunteers through gardening projects. The SNAP-Ed program improves participants' healthy food and lifestyle choices. In 2015 the two programs created the Growing Together Project to provide fresh produce to local food pantries. Multi-disciplinary team members developed continuing education resources for the master gardeners. A two-hour long training was delivered to master gardeners that covered food safety, harvesting, data collection, and donation for the six participating ISU Research and Demonstration Farms' Home Demonstration pantry gardens. The objectives of this study were to determine the effectiveness of the face-to-face food safety training provided to master gardeners at demonstration garden sites and to decide on how it could be improved. A six-question, post-training survey approved by the ISU Institutional Review Board, assessed training satisfaction and knowledge gained by the training participants. Seventeen participants completed the survey. All of the participants indicated that food safety in donation gardens is extremely important. About half of the participants indicated that they were very unsatisfied with the training, however, 67% of them responded that nothing should be changed in the training. Overall, the participants of the trainings were engaged, as assessed by on/off task observations, and gained some new knowledge about food safety in a donation garden. In addition to the technical assistance training an infographic and toolkit were developed to relay the message of food safety to the master gardeners statewide.

## **Theory-based Nutrition Education: A Review of Fresh Conversations**

Morgan Schonert<sup>1</sup> and Dr. Sarah Francis<sup>1</sup>

<sup>1</sup>Cyclone Scholar Summer Research Experience and Department of Food Science and Human Nutrition, Iowa State University, Ames, IA

Nutrition education programs have an important role in preventing and/or reducing nutritional risk for older adults with limited incomes. The purpose of this research was to assess to what extent the Iowa Supplemental Nutrition Assistance Program Education (SNAP-Ed), Fresh Conversations (FC), is based on the Health Belief Model (HBM), an evidence-based behavior change theory. FC is a newsletter-based monthly program administered by trained facilitators in congregate meal sites throughout Iowa for adults age 60+. FC covers topics related to nutrition, physical activity, food security, food safety, and general health. Two research assistants were trained in how to evaluate newsletters according to the FC HBM Writing Guide. Seven newsletters and facilitators' guides for the months of January to July 2017 were evaluated for evidence of adhering to the six HBM constructs. The facilitators' guides were also reviewed for active or passive group activities. HBM gaps were identified in the areas of perceived susceptibility and severity. Food safety and food security topics are of important concern to older adults but were not addressed often (4 times and once respectively). Per the guides, the FC meetings were facilitated in a mostly passive manner and included little activity or interaction between participants other than group question and answer discussions. Future FC programs should address food safety and food security topics, include content that emphasizes susceptibility and severity, and make meetings more interactive.

# **Impact of Ulcerative Colitis on Glycine N-methyltransferase Expression in the Liver**

Cecelia L. Andreo<sup>1,2</sup>, Samantha K. Jones<sup>2</sup> and Dr. Kevin L. Schalinske<sup>2</sup>

<sup>1</sup>Department of Food Science, Nutrition, and Health Promotion, Mississippi State University, Starkville, MS <sup>2</sup> Cyclone Scholar Summer Research Experience and Department of Food Science and Human Nutrition, Iowa State University, Ames, IA

Ulcerative colitis is characterized by chronic inflammation and ulceration in the epithelial lining of the colon. While the etiology of this disease is unclear, examining proteins that may elicit a protective effect on colitis has been of growing importance. Glycine N-methyltransferase (GNMT) is a highly abundant hepatic protein that plays a key role in regulating methyl group metabolism. GNMT is also expressed in the intestine where it is upregulated in response to colitis. Moreover, a lack of intestinal GNMT expression exacerbates the severity of the disease, suggesting possible anti-inflammatory effects. However, hepatic GNMT expression as a function of ulcerative colitis has not been examined. Increasing the supply of methyl groups is known to upregulate GNMT expression; therefore, whole egg-based diets were included in this study, because they contain a rich quantity of choline, a source of methyl groups. Sprague Dawley rats were fed casein- or whole egg-based diets prior to induction of colitis by the inclusion of dextran sodium sulfate (DSS) in the drinking water. After 7 days, rats were sacrificed and hepatic levels of GNMT were measured by an ELISA kit. Previous findings suggest that whole eggs may be a dietary modification capable of upregulating hepatic GNMT. In this study, neither diet nor disease had an effect on GNMT expression in the liver. This lack of response by the liver with respect to GNMT expression suggests, unlike the colon, it is resistant to the inflammation mediated ulcerative colitis. Maintaining appropriate hepatic expression of GNMT and its regulation of methyl group metabolism could be favorable, considering there are numerous adverse health effects associated with aberrant methylation.



## **Shelf-life Extension of Salad kits using Innovative Light Filtering and Display Case Technology**

Kayla Johnson<sup>1</sup>, Ana-Lorena Monge-Brenes<sup>2</sup>, Dr. Greg Curtzwiler<sup>2</sup> and Dr. Keith Vorst<sup>1,2</sup>

<sup>1</sup>Cyclone Scholar Summer Research Experience and Department of Food Science and Human Nutrition, Iowa State University, Ames, IA <sup>2</sup>Polymer and Food Protection Consortium, Iowa State University, Ames, IA

Product appearance contributes to consumer perception which can influence their purchasing decisions. Food products that contain fats and various nutrients are affected by light, causing lipid oxidation and degradation of the product and packaging substrate. This changes the quality of the product and can induce off flavors and odors. This study identified the effects of light on product degradation by using display cases common to grocery and convenience stores that exhibit various distribution of wavelength intensities (contributing to degradation of the product). The light intensity as a function of wavelengths was measured using a light and colorimeter in three different self-service display cases. Wavelengths and intensity measurements were gathered in six different locations per shelf throughout each self-service display case. A colorimeter was used to gather information on the CIE L\*, a\*, and b\* color space for three different salad kits (L\* - black to white, A\* - green to red, and B\* - blue to yellow) twice a day for five to six days. During the study, degradation of the products was visually detected. Wilted lettuce, odor after breaking the seal of the packaging, discoloration, browning, and excess moisture which softened the toppings were characteristics observed throughout the study. These characteristics showed degradation of the salad kits was occurring before the intended use by date but data must be analyzed to understand the mechanism of the degradation.

## **Nutrition Environment in The River Bend Community**

Lydia M. Stephney<sup>1,2</sup>, Dr. Ruth Litchfield<sup>2</sup> and Dr. Lorraine Lanningham-Foster<sup>2</sup>

<sup>1</sup>Department of Nutrition, Georgia State University, Atlanta, GA <sup>2</sup>Cyclone Scholar Summer Research Experience and Department of Food Science and Human Nutrition, Iowa State University, Ames, IA

The National Institutes of Health defines health disparities as “differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific populations in the United States.” Populations may be based on race, ethnicity, gender, immigrant status, disability, sexual orientation, geography, or income. In Iowa, African-American and Latino children experience a higher rate of health care disparities than white and Asian children. The River Bend community in Des Moines is an ethnically diverse group where 44% are Caucasian, 24% African American, 10% Asian, and 22% other, 12 different languages are spoken in the community. A focus group and survey was conducted with parents of children attending King or Moulton elementary schools in the River Bend community to explore their perceptions of the health status of their family and the community. The goal of this project is to summarize parental perceptions of their family and community’s health status. Survey results suggest Hispanic or Latino parents are more fearful than African American parents to let their child play outside with a friend ( $p < 0.05$ ). Hispanic and Latino parents were also more fearful than African American parents to let their child play outside or walk alone/walk with friends outside ( $p < 0.05$ ). Common themes from the focus groups included parents describing the health status of their community as poor due to violence and poor food quality at local grocery stores. In conclusion, this sample of parents living in the River Bend community perceived health disparities as an issue.

## **The Effects of Exercise on Striatal Adenosine Receptor Density**

Raquelle Weight<sup>1,2</sup>, Ella Bauer<sup>2</sup> and Dr. Peter Clark<sup>2</sup>

<sup>1</sup>Department of Nutrition, Dietetics and Food Science, Brigham Young University, Provo, UT <sup>2</sup>Cyclone Scholar Summer Research Experience and Department of Food Science and Human Nutrition, Iowa State University, Department of Food Science and Human Nutrition, Ames, IA

Adenosine is an important inhibitory neurotransmitter in the dopamine reward pathway. More adenosine is released during exercise due to increased metabolic demand. Evidence indicates that adenosine receptor density in exercising mice may be decreased compared to sedentary mice in a brain structure important for reward and motivation, the striatum. Therefore, we examined the density of adenosine receptors in sub-regions of the striatum. Adult male mice were housed in cages either with or without access to running wheels (running vs. sedentary groups). Sedentary and running mice were sampled at 3 or 8 weeks. Brains were extracted and thinly sectioned. Immunohistochemistry was performed on striatal sections to stain for adenosine A1 and A2a receptors. Relative optical density of A1 and A2a receptors were examined via microscope and compared across groups. Data collection for this study is ongoing. However, preliminary results indicate that running downregulates A1 and A2a receptor density across all sub-regions of the striatum after 8, but not 3, weeks of running. Consistent engagement in physical activity over a long period of time may be necessary to down-regulate adenosine receptors in the striatum. Decreased adenosine receptor density may increase perception of reward under conditions of elevated energy expenditure. This result may be related to decreased reports of fatigue in those who engage in regular exercise. Further research is needed to understand the mechanisms behind this relationship.

## **Shiga Toxin-Producing *Escherichia coli* (STEC) Adherence to Cattle Colonic Explants and Immune Response of Mice Infected with STEC**

Catherine A. Spivak<sup>1,2</sup>, Zachary R. Stromberg<sup>2</sup>, Dr. Melha Mellata<sup>2</sup>

<sup>1</sup>Department of Nutritional Sciences, Cornell University, Ithaca, NY <sup>2</sup>Cyclone Scholar Summer Research Experience and Department of Food Science and Human Nutrition, Iowa State University, Ames, IA,

Shiga toxin-producing *Escherichia coli* (STEC) strains are foodborne pathogens that infect the gastrointestinal tract and cause mild to bloody diarrhea in humans. While wide-ranging research has been conducted previously on the pathogenesis of O157 STEC, little is understood about its counterpart, non-O157 STEC. This work, which was part of Dr. Stromberg's project on STEC virulence and persistence, aimed to evaluate immune responses to O157:H7 STEC inoculation of mice as a model for STEC human disease, and cattle intestinal adherence of O157 and non-O157 STEC. To assess immune responses, enzyme-linked immunosorbent assays (ELISAs) were performed on samples of blood serum taken from mice infected with the O157:H7 STEC strain, 278:F2. Plates were coated overnight, blocked, and serum was added. Goat anti-mouse IgG antibodies were added and plates were analyzed via spectrophotometry. To assess intestinal adherence, colonic explants were obtained from cattle and inoculated with 10<sup>7</sup> colony-forming units (CFU) of non-O157 STEC strains DEC10E (O26:H11), DEC8B (O111:H8), 4865/96 (O145:H28), O157 STEC EDL933, or non-pathogenic *E. coli* strain MG1655 for 2 hours. After the 2-hour incubation, explants were weighed and homogenized in PBS. A 10-fold serial dilution was performed in PBS and samples were plated on MacConkey agar to quantify CFUs adherent to explants. Results from the ELISAs indicated immune responses to surface antigens of *E. coli*. For explants, it was determined that both non-O157 and O157 STEC strains were able to adhere to cattle colonic epithelial cells. Non-inoculated explants and those inoculated with non-pathogenic strains showed lower levels of adherent bacteria. Like O157 STEC, non-O157 STEC have the ability to cause damaging health consequences in humans. The results of this study indicate that further research is necessary to discern the specific mechanisms of non-O157 STEC adherence, so that patients suffering from infection may receive appropriate treatment.

## **Analysis of Amaranth Flour Blends in Wheat and White Breads**

Robin E. Cameron<sup>1,3</sup>; Kurt A. Rosentrater<sup>2</sup>

<sup>1</sup>Department of Biology, University of Alabama at Birmingham, Birmingham, AL <sup>2</sup>Department of Agricultural and Biosystems Engineering, Iowa State University, Ames, IA <sup>3</sup>Cyclone Scholars Summer Research Experience and Department of Food Science and Human Nutrition, Ames, IA

The remarkable gas holding properties of extensible dough is credited to gluten, which can be found in wheat, rye, spelt, barley, and kamut. The main constituents of gluten are gliadin and glutenin, and these proteins are saturated with prolamins and glutamines. Demand for gluten-free products has been growing for various reasons; however, individuals that choose to, or must refrain from gluten intake in their diets may be at risk for increased levels of exposure to arsenic and mercury. This likelihood occurs mainly when rice is substituted for wheat and other gluten containing cereals; therefore, amaranth flour was substituted in this experimentation to potentially increase nutritional benefits of foods deficient in gluten. The gluten concentrations were manipulated by substituting amaranth flour, in various concentrations, for wheat flour (in wheat bread) and bread flour (in white bread). Six loaves were produced: 100% wheat bread, 50% wheat/ 50% amaranth bread, 100% amaranth “wheat” bread, 100% white bread, 50% white/ 50% amaranth bread, and 100% amaranth “white” bread. Once produced, the loaves with 100% amaranth flour (both white and wheat) did not exemplify ideal characteristics in water activity, color emittance, elasticity, or water retention. The taste and texture were nonstandard in comparison to gluten containing bread loaves, and of slightly less quality than the 50/50 blends of flour. It is likely that a gum substitution in addition to amaranth flour would produce better elasticity qualities in the 100% gluten free breads.

## **Producing Selenium-Rich Microalgae as a Food and Fee-Supplement**

Elizabeth Esinor<sup>1,2</sup> and Dr. Zhiyou Wen<sup>2</sup>

<sup>1</sup>Department of Nutrition and Dietetics/Nutrition Science, Syracuse University, Syracuse, NY <sup>2</sup>Cyclone Scholar Summer Research Experience and Department of Food Science and Human Nutrition, Iowa State University, Ames, IA

The nutrient selenium is required in specified amounts in both the human diet and animal feed. Currently, organic and bioavailable forms of selenium are expensive to produce and purchase. Selenium-containing microalgae is a promising resource for production of a sustainable and economical selenium supplement. The Revolving Algal Biofilm (RAB) system is a novel biofilm-based algal cultivation system established at Iowa State University. Compared to conventional algal cultivation methods, the RAB system can significantly decrease algal cultivation costs due to higher biomass productivity and the use of a low cost medium such as industrial wastewater, as well as lower the cost of harvesting the algae. This project proposes using the RAB system to grow selenium-containing microalgae strand *Chlorella* utilizing selenium rich wastewater from industrial yeast production. The project tests algal ability to uptake selenium from the wastewater, possible inhibition of selenium on algal growth, and the bioavailability of the selenium in the microalgae produced. In a flask culture system, the algae growth monotonically decreased with increased concentration of selenium from 0 to 200mg/L, and was completely inhibited at concentrations >200mg/L. In a bubble column culture system, however, the algae were able to grow without inhibition in selenium concentrations up to 50 mg/L. In future work, optimization of the algal species and selenium source as well as RAB system operation parameters are needed for commercialization of the selenium-algae cultivation system and potential selenium supplement.



