University of Illinois at Urbana-Champaign
Division of Nutritional Sciences

2012

NUTRITION SYMPOSIUM

N • S • G • S • A

Nutritional Sciences Graduate Student Association

Welcome

On behalf of the Nutritional Sciences Graduate Student Association (NSGSA), Division of Nutritional Sciences (DNS) and all participating presenters, we would like to welcome you to the 2012 Nutrition Symposium at the University of Illinois! The Nutrition Symposium is an important event for sharing ideas across disciplines and with the community.

Started in 1994 by NSGSA, the symposium offers students within DNS and related disciplines on campus an opportunity to present their nutrition research prior to the national meetings held annually in the spring. This symposium offers a first glance at exciting research in the areas of metabolic regulation, cancer, gastrointestinal physiology, immunology, physical activity, public health, and bioactive plant compounds. Students will be traveling and presenting at a variety of conferences including Experimental Biology and American Society of Animal Sciences.

This year, NSGSA is honored to have Dr. James O. Hill deliver the keynote address, "What will it Really Take to Reverse the Obesity Epidemic?" Based on years of research, Dr. Hill will discuss the modification of biological, behavioral and social factors that alter energy balance and lead to obesity. He will also explain how a better understanding of obesity's root cause can improve the effectiveness of obesity reduction strategies.

Additionally, NSGSA is proud to highlight the work of world-class faculty members through a mini-symposium. This year's presentations address advances in microbiome research and will feature Drs. Bryan White, Kelly Swanson, Isaac Cann, and Sharon Donovan.

We are grateful to the many people involved with this meeting and program. We would like to first thank our keynote speaker, Dr. James Hill. Thank you to our sponsors – their support is essential to the success and quality of the program. The NSGSA executive board and the symposium program committee have worked long and hard to organize an excellent program. We also thank the many others who contributed to this undertaking, including DNS staff and College of ACES Advancement Office staff. Most of all, we would like to thank our session chairs, judges, presenters and attendees for participating in this year's events and making them a success.

The Nutritional Sciences Graduate Student Association Board

http://www.nutritionalsciences.illinois.edu

Nutritional Sciences Graduate Student Association

The Nutritional Sciences Graduate Student Association (NSGSA) was founded in the spring of 1973 by students in the program. The purpose of the organization is to provide a means of communication among graduate students, faculty, and alumni of the Division of Nutritional Sciences (DNS) which spans multiple colleges and departments.

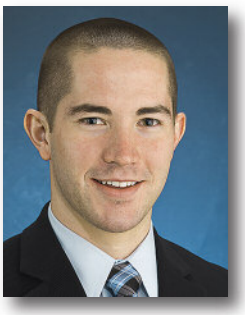
NSGSA serves as a forum for student opinion and input to DNS as well as giving students the opportunity to expand their experiences as graduate students. Our activities reflect our desire to enrich our experiences as graduate students and to promote the importance of the nutritional sciences discipline both within the University and among the surrounding communities of Champaign and Urbana.

NSGSA Board

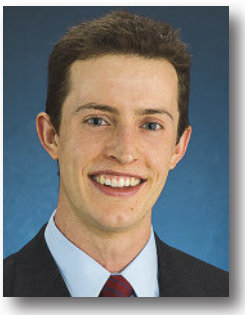
Nathan Pratt
Chair

Jane Naberhuis
Co-Chair

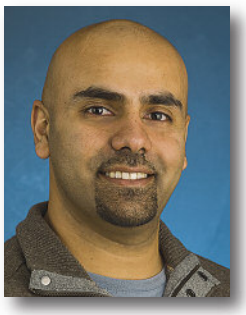
Amy Elsen
Treasurer



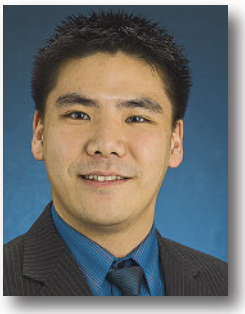
Josh Smith
Co-Treasurer



Brendon Smith
Representative to the Faculty



Naiman Khan
Grievance Representative



Gabriel Chiu
Networking Chair

Elizabeth Reznikov
Media Chair

Amy MacInnes
Secretary

2012 Nutrition Symposium Committee

Nathan Pratt, *Nutrition Symposium Chair*

Planning Committee

Jennifer Barnes
Gabriel Chiu
Amy Elsen
Naiman Khan
Amy MacInnes
Jon Mun
Henna Muzaffar
Jane Naberhuis
Elizabeth Reznikov
Brendon Smith
Josh Smith
Krystle Zuniga

2012 Nutrition Symposium Session Chairs and Judges

Dr. Juan Andrade
Dr. Lee Beverly
Dr. Elvira de Mejia
Dr. Ryan Dilger
Dr. Sharon Donovan
Dr. John Erdman
Dr. Peter Garlick
Dr. Elizabeth Jeffery
Dr. Juan Loor
Dr. Nancy Moran
Dr. Angela Myracle
Dr. Manabu Nakamura
Dr. Rita Strakovsky
Dr. Margarita Teran-Garcia
Dr. Barbara Yudell

Table of Contents

Schedule of Events

APRIL 18, 2012

8:00 a.m. – 9:00 a.m. .....**Breakfast**
Sims Executive Conference Room, ACES Library
Sponsors, DNS students, faculty, and staff are invited

***9:00 a.m. – 11:00 a.m.**.....**Faculty Mini-Symposium**
Monsanto Room, ACES Library
"Can Microbiomes Predict Nutrient Utilization, Health, and Disease?"

11:00 a.m. – 11:15 a.m. ..... **Break**

11:15 a.m. – 12:15 p.m. .....**Lunch**
Heritage Room, ACES Library
DNS students and sponsors are invited, RSVP required

12:15 p.m. – 12:30 p.m. .....**Break**

***12:30 p.m. – 1:50 p.m.** .....**Graduate Student Oral Presentations 1**
Monsanto Room, ACES Library

1:50 p.m. – 2:00 p.m. .....**Break**

***2:00 p.m. – 3:30 p.m.** .....**Graduate Student Oral Presentations 2**
Monsanto Room, ACES Library

3:30 p.m. – 4:00 p.m. .....**Break**

***4:00 p.m. – 5:00 p.m.** .....**Keynote Address by Dr. James O. Hill**
134 Temple Hoyne Buell Hall
"What Will It Really Take To Reverse the Obesity Epidemic?"

5:00 p.m. – 5:15 p.m. .....**Break**

***5:15 p.m. – 6:40 p.m.** .....**Graduate Student Poster Session**
Heritage Room, ACES Library
Evening Reception
Award Announcements
Sponsors, DNS students, faculty, and staff are invited

**Open to the gereral public*

Contact Information

2012 Symposium Contact

Nathan Pratt
468 Bevier Hall
University of Illinois
Urbana, IL 61801
(217) 333-7371
nspratt2@illinois.edu

2013 Symposium Contact

Jane Naberhuis
420 Bevier Hall
University of Illinois
Urbana, IL 61801
(217) 265-0776
naberhu2@illinois.edu

Division of Nutritional Sciences

Jessica Hartke, Ph.D.
Assistant Director
445 Bevier Hall
University of Illinois
Urbana, IL 61801
(217) 333-4177
nutrsci@illinois.edu

Nutritional Sciences Graduate Student Association

http://www.nutritionalsciences.illinois.edu

The University of Illinois Division of Nutritional Sciences and the Nutritional Sciences Graduate Student Association (NSGSA) would like to acknowledge the generosity of the sponsors and friends of our 2012 Nutrition Symposium.

SPONSORS

Abbott Nutritionals

DAIRY RESEARCH INSTITUTE
NUTRITION • PRODUCTS • SUSTAINABILITY

Kellogg's

kraft foods
make today delicious

Mead Johnson Nutrition

PEPSICO
pepsi. Frito-Lay Tropicana Quaker Gatorade

WRIGLEY
A Subsidiary of Mars, Incorporated

FRIENDS

University of Illinois
Department of Food Science
and Human Nutrition

University of Illinois
Department of Animal Sciences

Bell Institute of
Health and Nutrition
GENERAL MILLS

University of Illinois
Department of Kinesiology
and Community Health

SORF (Student
Organization Resource Fee)

The Coca-Cola Company

Keynote Speaker
Dr. James O. Hill

Dr. James O. Hill is the Founding Executive Director of the Colorado Center for Health and Wellness at the University of Colorado Anschutz Medical Campus. He also holds the Anschutz Endowed Chair in Health and Wellness. He is Professor of Pediatrics and Medicine and Director of Healthy Kids for the Children's Health Advocacy Institute of Children's Hospital Colorado. Dr. Hill holds a B.S. degree from the University of Tennessee and M.S. and Ph.D. degrees from the University of New Hampshire in Physiological Psychology. He served as Chair of the first World Health Organization Consultation on Obesity in 1997. He is a Past President of the American Society for Nutrition (ASN) and The Obesity Society (TOS). He was a member of the Expert Panel on Obesity of the National Institutes of Health that developed first U.S guidelines for the treatment and prevention of obesity.

Dr. Hill has published more than 400 scientific articles and book chapters in the area of obesity and nutrition. Many of these focus on the importance of healthy eating and physical activity in weight management. He is the recipient of the 2007 TOPS award from The Obesity Society. He has received the Centrum Center, McCollum and Kritchevsky awards from the American Society for Nutrition. Dr. Hill is a co-founder of the National Weight Control Registry, a registry of individuals who have been successful in maintenance of a reduced body weight. He is co-founder of America on the Move, a national weight gain prevention initiative that aims to inspire Americans to make small changes in how much they eat and how much they move to prevent weight gain. Dr. Hill is the author of the *Step Diet Book*, published in June 2004. He lectures widely throughout the world on obesity, health and wellness.

"What will it Really Take to Reverse the Obesity Epidemic?"

James O. Hill, Ph.D.
Anschutz Professor of Pediatrics & Medicine
University of Colorado

Obesity rates are extremely high in U.S. adults and children, and obesity has even been called an epidemic. It is difficult to approach obesity from any single discipline and to date, efforts to reduce obesity have not shown great efficacy. Obesity may be best understood from an energy balance point of view and a better understanding of energy balance may help us develop more effective strategies to prevent and treat obesity. This will require examining how biological, behavioral and social factors impact energy balance and how these factors may be modified. Efforts to reduce obesity rates involve strategies directed toward individuals, families, communities and societies. This presentation will examine the effectiveness of these current obesity reduction strategies and consider how our strategies could be improved by a better understanding of the complexity of obesity.

Dr. James O. Hill's Keynote Address:
4:00 p.m. – 5:00 p.m.
134 Temple Hoyne Buell Hall

Mini-Symposium: Can Microbiomes Predict Nutrient Utilization, Health, and Disease?

9:00 a.m. – 11:00 a.m.
Monsanto Room, ACES Library

Graduate Student Oral Presentations Session 1

12:30 p.m. – 1:50 p.m.
Monsanto Room, ACES Library

Graduate Student Oral Presentations Session 2

2:00 p.m. – 3:30 p.m.
Monsanto Room, ACES Library

Graduate Student Poster Session

5:15 p.m. – 6:40 p.m.
Heritage Room, ACES Library

See poster session floor plan map on page 26

Abstracts & Biographies

Mini-Symposium: Can Microbiomes Predict Nutrient Utilization, Health, and Disease?

Progress in understanding the human microbiome

Bryan White, Ph.D.
Division of Nutritional Sciences, Department of Animal Sciences and Division of Biomedical Sciences

ABSTRACT: The human body is host to a multitude of microbial species and communities that are estimated to outnumber the body's somatic cells. Advances in sequencing have been paralleled by new analysis tools and have allowed us to perform more detailed metagenomic characterizations of these species, many of which have been implicated in various health conditions and diseases. The omics realm for interrogating microbial communities goes far beyond sequencing and includes proteomics and metabolomics. In addition, characterizing the human microbiome has gone from studies focused on one or two individuals to large-scale worldwide initiatives focused on major disorders and involving hundreds of participants. Questions focus on whether there is a core human microbiome, the correlations between microbial population dynamics and disease, and the technological and bioinformatics needs for supporting the advances in data generation. For example, the Human Microbiome Project, which is funded by the National Institutes of Health, involves the sequencing of at least 3,000 bacterial reference genomes, as well as significant meta-genomic sequencing to characterize the microbial communities from 15 to 18 body sites in 300 consenting individuals. It is clear that the omics field holds significant promise for increasing our understanding of many microbial diseases of humans, including those yet to be characterized.

BIOGRAPHY: Bryan White is currently a Professor of Animal Sciences in the Institute for Genomic Biology, and Director of Microbiome Projects in the Division of Biomedical Sciences at the University of Illinois. He received his Bachelor of Science at Virginia Wesleyan College and his Ph.D. in Microbiology from the Medical College of Virginia, and was a NIH Postdoctoral Fellow in the Department of Oral Biology at the University of Michigan. His major research interests are in using microbial genomics, metagenomics, and microbial ecology to understand host-microbe interactions. He uses human and non-human primate models of disease to link microbiomes to important clinical outcomes in colorectal cancer, breast cancer and women's reproductive tract cancers (ovarian, cervical and endometrial).

Current state of knowledge: Canine and feline gastrointestinal microbiome

Kelly S. Swanson, Ph.D.
Division of Nutritional Sciences and Department of Animal Sciences

ABSTRACT: Dogs and cats have evolved as members of Carnivora and have traditionally relied on high-protein, high-fat diets containing relatively low fiber concentrations. Despite having a simple gastrointestinal tract designed to digest such diets, a rich microbial community that has relevance to health and disease exists. Molecular techniques, including high-throughput sequencing, have dramatically changed the research landscape in regards to gastrointestinal microbiology. Although the field is still in its infancy stages, these techniques have recently been used to characterize the phylogeny and functional capacity of the canine and feline gastrointestinal microbiota and identify the effects of diet, age, and disease on these communities. Several hundred bacterial phylotypes, predominated by members of Firmicutes, Fusobacteria, Proteobacteria, Bacteroidetes, and Actinobacteria, are now known to inhabit the dog and cat gastrointestinal tract. Recent studies have also revealed that the functional capacity of the gastrointestinal microbiota in dogs and cats is quite broad and similar to that of humans and rodents. Although these populations are quite stable over time, macronutrient profile (e.g., dietary protein: carbohydrate ratio), dietary fiber amount and type, and the form of food

consumed (e.g., raw vs. extruded) may affect the number and/or metabolism of the colonic microbiota. Continued use of molecular techniques to characterize the microbiome of healthy and diseased dogs and cats, along with other technologies to analyze microbial RNA (gene expression), protein, and metabolite profiles, will enhance our ability to understand gastrointestinal health and disease on a molecular level, leading to improved disease diagnosis and treatment in coming years. The current state of knowledge and future needs in this field will be reviewed.

BIOGRAPHY: Kelly Swanson received a Ph.D. in Nutritional Sciences at the University of Illinois (UIUC). After receiving post-doctoral training in functional genomics, he became Assistant Professor in the Department of Animal Sciences at UIUC in 2004. He was promoted to Associate Professor with indefinite tenure in 2009. He is also a member of the Division of Nutritional Sciences and the Department of Veterinary Clinical Medicine. Dr. Swanson has established himself as a leader in companion animal nutrition and nutrigenomics, primarily in the areas of gut health and obesity. His lab uses DNA-based techniques to assess dog and cat intestinal microbiota and exploits other genomic assays to characterize tissue transcriptome changes due to dietary manipulation, weight gain/obesity, and aging in dogs and cats. His research program has gained international recognition, highlighted by over 60 invited lectures at scientific meetings in 7 countries, many international research collaborations, invited review articles, awards, and service on 4 editorial boards. He has published nearly 70 peer-reviewed manuscripts and invited reviews, 5 book chapters, and 45 conference proceedings.

Functional analyses to understand fiber utilization in the gut bacteroidetes

Isaac Cann, Ph.D.
Department of Animal Sciences and Department of Microbiology

ABSTRACT: The human distal gut is densely populated by a microbial community that is thought to influence health and nutritional status of an individual. The microbial community is predominated by two bacterial phyla, namely the Bacteroidetes and the Firmicutes. Research in our lab focuses on the fiber degrading *Bacteroides* and *Prevotella*, both members of the Bacteroidetes. Analyses of several members of glycoside hydrolases (GH), especially GH family 3, from this group of gut microbes demonstrated differences in catalytic activities compared to their functions assigned through bioinformatics. In order to gain a better understanding of how the Bacteroidetes inhabiting mammalian guts capture energy from plant fiber, we have been applying transcriptomics, biochemistry, and structural biology to study two reference organisms from humans and another two from ruminants. Thus, we have obtained transcriptional profiles of *Bacteroides intestinalis* and *Bacteroides ovatus* (human gut associated) and also of *Prevotella bryantii* and *Prevotella ruminicola* (cow ruminal associated). In general, several genes containing GH modules, carbohydrate binding modules and carbohydrate esterases were up-regulated when each of these organisms was grown on the complex polysaccharide wheat arabinoxylan compared to its component simple sugars. Fascinatingly, in both the human and ruminant gut bacteria, an endoxylanase of similar polypeptide architecture was the most highly up-regulated xylan degrading enzyme. In addition, gene clusters containing the xylan utilization (Xus) system, recently described in our lab, were also highly up-regulated. I will present data on how the Xus system functions and how xylan degrading enzymes function synergistically to breakdown the complex polysaccharide to monosaccharides for subsequent fermentation to short chain fatty acids.

BIOGRAPHY: Isaac Cann is a Professor of Animal Sciences, Microbiology, and the Institute for Genomic Biology at the University of Illinois at Urbana-Champaign. He received his PhD at Mie University, Japan, and was a postdoctoral fellow and research scientist at the Department of Animal Sciences (UIUC) and Biomolecular Engineering Research Institute (Japan), respectively. After a short stint at New England Biolabs, MA, he joined UIUC in 2001. In addition to his interest in plant cell wall hydrolysis by gut microbes, his lab studies DNA replication and repair in mesophilic and hyperthermophilic archaea.

Host-microbe interactions in the infant: Role of early nutrition

Sharon M. Donovan, Ph.D., R.D.
Division of Nutritional Sciences and Department of Food Science and Human Nutrition

ABSTRACT: Infants are born with a sterile gut and a naïve immune system, making them susceptible to infection. Breastfeeding protects against disease and promotes mucosal immune development and colonization with beneficial microbiota. Human milk contains a bioactive proteins, carbohydrates and lipids that are not present in infant formulas and likely contribute to the health benefits of breastfeeding, thus providing potential targets for additions to infant formula. Our long-term goal is to use non-invasive approaches to define how early nutrition influences intestinal development and shapes host-microbe interactions in the intestine of breast (BF)- and formula (FF)-fed infants. We have developed a novel molecular methodology that utilizes stool samples containing intact sloughed epithelial cells to quantify intestinal gene expression profiles in the developing human neonate (*AJP* 2010;298:G582-9). Recently, this database was extended to include human milk oligosaccharide (HMO) composition determined by GC/MS, infant stool short chain fatty acids (SCFA) by GC and infant microbiota composition and gene expression (in a subset of samples, n=6/group) by Roche 454 metagenomic pyrosequencing. My presentation will present results of our systems biology approach that integrates information from the breastmilk, host gene expression and the microbiome to identify important mechanistic pathways affecting intestinal development in the first few months of life.

BIOGRAPHY: Sharon Donovan is currently a Professor and holder of the Melissa M. Noel Endowed Chair in Nutrition and Health in the Department of Food Science and Human Nutrition at the University of Illinois. She received her B.S. and Ph.D. in Nutrition from the University of California, Davis. After completing a post-doctoral fellowship in Pediatric Endocrinology at Stanford University School of Medicine, she accepted a faculty position at the University of Illinois, Urbana in 1991. She served as Director of the Division of Nutritional Sciences Interdisciplinary Graduate Program from 1999-2009. She currently serves as the President of the American Society for Nutrition (2011-2012). Her research focuses on pediatric nutrition, with an emphasis on optimization of neonatal intestinal development. She compares the biological effects of human milk and infant formulas on intestinal development in healthy infants and piglets and in various piglet models of intestinal disease. Her current research thrust involves defining factors influencing establishment of the microbiota of infants and delineating host-microbe interactions.

Abstracts

Oral Session 1

Human milk oligosaccharides inhibit acute rotavirus infection in neonatal piglets

Shelly N. Hester[1], S.S. Comstock[2], M.H. Monaco[2], T.B. Kuhlenschmidt[3], M.S. Kuhlenschmidt[1,3], S.M. Donovan[1,2]
[1]Division of Nutritional Sciences, [2]Food Science and Human Nutrition, [3]Pathobiology, University of Illinois at Urbana-Champaign, Urbana, IL

Human milk oligosaccharides (HMO) are being investigated as potential additives to infant formula. Herein, acute HMO treatment within the ileal lumen of both healthy and acutely rotavirus (RV)-infected piglets was studied. Piglets (n=9 group) were fed formula from 48h to d21 of age. At d21, a midline laparotomy was performed and six 10cm loops of ileum were isolated in situ. The following treatments were injected into the loops: media, a single HMO, an HMO mixture (mHMO), or each treatment + OSU strain RV (1 x 107 FFU). After treatment, samples were collected. Loops treated with the single HMO + RV or with the HMO mixture + RV had lower RV replication, as assessed by NSP4 mRNA expression, than other RV-treated loops (p=0.0026). Ileal loops not treated with RV showed no NSP4 expression. There was no difference in cytokine mRNA expression in ileal mucosa as analyzed by loop or dietary treatment. In conclusion, a single HMO or unique HMO mixture decreased NSP4 expression during acute RV infection. *(Support: Abbott Nutrition)*

Bioactive compounds of dealcoholized fermented berry fruit beverages inhibit inflammation *in vitro* and are a good source of antioxidants

Michelle H. Johnson[1], E.G. de Mejia[1], M.A. Lila[2], G.G. Yousef[2].
[1]Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, [2]College of Agriculture and Life Sciences, NC Research Campus, Plants for Human Health Institute, Kannapolis, NC

Berries are one of the best dietary sources of polyphenolic compounds and are associated with decreased markers of chronic inflammation linked with metabolic diseases. The objective was to evaluate bioactive compounds from dealcoholized blueberry-blackberry fermented beverages in order to optimize blends based on *in vitro* inhibition of markers of inflammation and antioxidant capacity. Polyphenolic-enriched fractions obtained from fermented beverages were analyzed. Main anthocyanins (ANCY) in blueberry and blackberry blended beverages, as identified by HPLC, were malvidin-3-glucoside and delphinidin-3-arabinoside. Total anthocyanins in enriched fractions ranged from 642 to 1550 mg/ml, cyanidin-3-glucoside (C3G) equivalents. Antioxidant capacity ranged from 5.2 ± 0.3 to 16.4 ± 1.8 and 6.2 ± 0.8 to 8.1 ± 1.0 mmol trolox equivalents (TE)/L for the ANCY- and proanthocyanidin (PAC)-enriched fractions, respectively. None of the fractions were cytotoxic to macrophages at concentrations up to 100 μM C3G equivalents, the concentration used to measure markers of inflammation iNOS, COX-2, PGE-2, IL-6, TNF-α, and NF-κB. The *in vitro* anti-inflammatory activities were correlated with total anthocyanins and antioxidant capacity. These results suggest that bioactive compounds in highbush blueberry and blackberry fermented beverages are beneficial sources of antioxidants and inhibitors of inflammation. *(Support: Office of Research, Dixon Springs Research Center)*

The effect of tomato powder, soy germ, or a combination on prostate carcinogenesis in TRAMP mice

Krystle E. Zuniga[1], S.K. Clinton[2], J.M. Thomas-Ahner[2], J.W. Erdman, Jr[1].
[1]Division of Nutritional Sciences and Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL, [2]Division of Medical Oncology, The Ohio State University, Columbus, OH

Epidemiological and laboratory studies support the hypothesis that diets rich in soy or tomato food products may reduce the risk of prostate cancer (PCa). The objective of this study was to investigate the *in vivo* effect of diets containing tomato powder, soy germ, both, or neither, on

the progression of PCa in the transgenic adenocarcinoma of mouse prostate (TRAMP) model. Four-week old male TRAMP mice (n=118) were randomized to consume experimental diets: AIN-93G control, 10% tomato powder (TP), 2% soy germ (SG), or 10% tomato powder + 2% soy germ (TP+SG) until 18 weeks of age. Body weight and food intake were similar. The prostate-seminal vesicle (P-SV) complex weight among each of the three dietary intervention groups was non-significantly reduced compared to the control group. Prostate pathology shows a range of PIN to invasive carcinoma, with grading and staging underway. Our results with P-SV weights suggest that dietary interventions with tomato or soy may reduce TRAMP cancer burden. *(Support: NIH under Ruth L. Kirschstein National Research Service Award, 1 F31 CA153804-01A1)*

Role of caffeine in adenosine-mediated neuroinflammation

Gabriel Chiu[1, 3], D. Chatterjee[3], P. Darmody[3], J. Walsh[3], R.W. Johnson[1, 2], G.G. Freund[1, 2, 3]
[1]*Division of Nutritional Science,* [2]*Department of Animal Sciences,* [3]*College of Medicine, Department of Pathology, Program of Integrative Immunology and Behavior (IIB), University of Illinois at Urbana-Champaign, Urbana, IL*

Caffeine is arguably the number one drug of choice in America. Recent studies are showing many beneficial effects in both the periphery and the brain. There are two possible mechanisms in which caffeine can be protective: by acting as an antioxidant, or as a non-selective adenosine receptor antagonist. In this project, we set out to examine the neuroprotective effects of caffeine during a non-infectious stimulation of the neuroimmune system by using a hypoxia/reoxygenation model. Mice were subjected to 6% oxygen for 2 hours and allowed to rest for an hour after hypoxia. The production of mature interleukin (IL)-1β was measured by the activity of its converting enzyme, caspase 1. Mice subjected to hypoxia showed a two-fold increase in caspase 1 activity, while caffeine supplemented mice were protected against this upregulation. However, pretreatment with the antioxidant, N-acetyl cysteine, yielded similar results as hypoxic saline control. Interestingly, mice pretreated with selective adenosine A1/A2A receptor antagonists were also protected against caspase 1 activation. Furthermore, to confirm the results, brains perfused with adenosine mixed in phosphate-buffered saline showed a similar effect when compared to hypoxia-treated mice. Taken together, these findings suggest an important role of adenosine in neuroinflammation and importance of caffeine in this pathway.

Human milk oligosaccharides (HMO) influence intestinal maturation *in vitro*

Hannah D. Holscher[1], S.R. Davis[2], K.A. Tappenden[1]
[1]*Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana IL,* [2]*Abbott Nutrition, Columbus, OH*

Human milk oligosaccharides (HMO) are abundant in human milk (> 15 g/L) and associated with enhanced intestinal maturation *in vitro*. We aimed to assess the induction of epithelial differentiation by three individual HMO, 2′-fucosyllactose (2′FL), lacto-N-neotetraose (LNnT), and 6′-sialyllactose (6′SL), using an *in vitro* model of the crypt-villus axis (pre-confluent HT-29, pre-confluent Caco-2Bbe, and post-confluent Caco-2Bbe cells). HMO effects on cellular kinetics and function were assessed in the following treatments: a) LNnT at 0, 20, 200 or 2000 mg/L or substrate control; b) 2′FL at 0, 20, 200 or 2000 mg/L or substrate control; c) 6′SL at 0, 40, 400, 4000 mg/L or substrate control. HT-29 cell proliferation was reduced ($p<0.05$) with 200 and 2000 LNnT, 2000 2′FL and 400 and 4000 6′SL. Differentiation was increased 31% ($p=0.030$) in HT-29 cells and sucrase activity increased 54% ($p=0.036$) in post-confluent CaCo-2 cells with 2000 2′FL. Transepithelial resistance increased 21% ($p=0.002$) in post-confluent Caco-2 cells with 200 LNnT. In summary, inhibition of proliferation was associated with enhanced epithelial differentiation. Well differentiated cells had greater digestive and barrier function when treated with 2′FL and LNnT, respectively. Although further study is needed, the addition of HMO to infant formula may promote small intestinal maturation and benefit preterm infants. *(Support: Abbott Nutrition)*

Abstracts

Oral Session 2

Television viewing and intake of added sugars related to increased central adiposity in prepubertal children

Naiman A. Khan[1], L.B. Raine[2], E. Drollette[2], M. Scudder[2], M. Pontifex[2], D.M. Castelli[3], C.H. Hillman[1,2], S.M. Donovan[1], E.M. Evans[4].
[1]Division of Nutritional Sciences, [2]Kinesiology and Community Health, University of Illinois at Urbana-Champaign, Urbana, IL, [3]Kinesiology and Health Education, University of Texas at Austin, Austin, TX, [4]Kinesiology, University of Georgia, Athens, GA

Central adiposity is related to insulin resistance and may be the most clinically relevant body fat in children as is the case in adults. This study aimed to determine relationships between child's television viewing (TV), aerobic fitness, diet and central adiposity in 172 prepubertal children (8-9 years). Parents reported child's weekday and weekend TV viewing. Maximal oxygen consumption (VO_{2max}) and one 24-hour recall assessed fitness and diet, respectively. Dual energy X-ray absorptiometry was used to measure percent fat mass (%Fat) and central adiposity (FM-abd). Waist circumference to height ratio (WHtR) was also measured. Aerobic fitness was not related to TV, however, it was negatively related to %FM ($r=-0.49$, $p < 0.01$) and FM-abd ($r=-0.41$, $p < 0.01$). Weekday and weekend TV was positively related to FM-abd ($r=0.18$, $p=0.02$ and $r=0.20$, $p=0.01$). After adjusting for VO_{2max} and total diet energy density (kcals/g), added sugars (g) positively related to FM-abd ($r=0.18$, $p=0.03$). To further assess central adiposity, children were classified as normal (n=129) or obese (n=43) based on the 0.5 cutoff for WHtR. Obese children had significantly higher weekday TV ($p=0.03$) and consumed higher amounts of added sugars ($p=0.02$). Our findings suggest that central adiposity is related to increased intake of added sugars independent of aerobic fitness and energy density in prepubertal children. *(Support: NIH HD055352)*

Docosahexaenoic acid (DHA) deficiency impairs fusion protein organization and ultrastructural morphology in mouse spermatids

Timothy L. Abbott[1], M. Roqueta-Rivera[2], M. Sivaguru[3], R.A. Hess[4], M.T. Nakamura[1,2].
[1]Division of Nutritional Sciences, [2]Department of Food Science and Human Nutrition, [3]Institute for Genomic Biology, [4]Department of Comparative Bioscience, University of Illinois at Urbana-Champaign, Urbana, IL

Spermiogenesis is the process whereby post-meiotic round spermatids are transformed into elongated spermatids. Among the most critical developments in this process is the biogenesis of an organelle unique to sperm, the acrosome, whose construction is dependent on stage-specific vesicular trafficking and membrane fusion events. Deficiency in docosahexaenoic acid (DHA) was recently shown to result in a failure of acrosome biogenesis; however a role for DHA in membrane fusion has yet to be defined. Here, we use Fads2-/- mice to investigate the effect of a DHA deficiency on intracellular trafficking and membrane fusion in spermiogenesis, in vivo. We show that proacrosomal vesicles are successfully released from the Golgi apparatus but fail to coalesce to form larger proacrosomal granules. Similarly, we show that the localization of acrosin (a cargo protein of proacrosomal vesicles) is normally distributed in early spermiogenesis, but in subsequent phases is dispersed throughout the cytosol in an abnormal punctate pattern. Further, membrane fusion proteins syntaxin2 and VAMP4 displayed aberrant accumulation throughout spermiogenesis. In conclusion, acrosome biogenesis under DHA deficiency is halted after the release of proacrosomal vesicles; the mislocalization of syntaxin2, VAMP4 and acrosin suggests a role for DHA in certain specialized systems of intracellular trafficking and membrane fusion.

Effects of prebiotic inclusion and chain length on intestinal barrier, histomorphology, and mRNA abundance in obese C57BL/6J mice

Kimberly D. Cephas[1], H.F. Mangian[1], K.A. Tappenden[1,2], K.S. Swanson[1,3]
[1]Division of Nutritional Sciences, [2]Department of Food Science and Human Nutrition, [3]Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Obesity is linked with increased intestinal permeability, which may contribute to low grade inflammation. The objective of this study was to test the effects of prebiotics on intestinal permeability, morphology and gene expression in an obese mouse model. Obese 18-week old, C57BL/6J mice (n=6) were randomized to high-fat diets containing 5% cellulose and 10% cellulose, scFOS or inulin and fed for 28 d. Ileum, cecum and colon samples were collected for Ussing chamber, histomorphology, and RT-qPCR analyses. Cecal epithelial resistance was greater ($p<0.05$) in mice fed inulin vs. mice fed cellulose or scFOS. Distal colon epithelial resistance tended to increase ($p=0.08$) in mice fed scFOS vs. mice fed cellulose or inulin. Ileal and cecal crypt depth was greater ($p<0.05$) in mice fed scFOS or inulin vs. mice fed cellulose. Ileal MUC2 expression was greater ($p<0.05$) in mice fed 10% cellulose vs. mice fed 5% cellulose, inulin or scFOS. Distal colon AMPK and ZO-1 expression was greater ($p<0.05$) in mice fed scFOS vs. mice fed cellulose or inulin. Ileal and cecal occludin expression was lower ($p<0.05$) in mice fed inulin or scFOS vs. mice fed 5% cellulose. Colon occludin expression was lower ($p<0.05$) in mice fed inulin or scFOS vs. mice fed 10% cellulose. These data suggest prebiotics improve intestinal permeability in the obese and involve tight junction proteins.

Mineral composition of commercially available whole prey items: Comparison to dog and cat requirements.

Katherine R. Kerr[1], K.S. Swanson[1,2]
[1]Division of Nutritional Sciences, [2]Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

The popularity of feeding whole prey diets to pets has increased. However, compositional data for these diet types are lacking. The objective of this study was to evaluate the mineral composition of common whole prey items of different ages: mice (1 to 2 d, 10 to 13 d, 21 to 25 d, 30 to 40 d, and 150 to 180 d); rats (1 to 4 d, 10 to 13 d, 21 to 25 d, 33 to 42 d, and > 60 d); rabbits (still born, 30 to 45 d, > 65 d with skin, and >65 d with skin removed); chicken (1 d); and quail (1 d, 21 d, and 35 to 56 d). Additionally, a ground chicken sample and ground duck sample were analyzed. Mineral composition data (percent DM) were compared to AAFCO recommendations for dogs and cats (2012). Phosphorus concentrations exceeded the safe upper limit (SUL) of dogs (1.6%) in 21 to 25 d mice; 1 to 4 d, 21 to 25 d and 30 to 40 d rats; 30 to 45 d rabbit with skin removed; and 21 d quail. Calcium concentrations exceeded the SUL for dogs (2.5%) in 21 to 25 d rats, > 65 day rabbits with skin removed, and the ground chicken sample. The Ca:P ratio was less than 1:1 for 1 to 2 d mice and 1 to 4 d rats. Deficiencies were noted for Mg, Na, K, Cl, Cu, Zn and Mn in several whole prey items. These data indicate that whole prey items should not be considered nutritionally complete foods and should only be included as part of a properly balanced diet. Research on the bioavailability of these minerals and impact on animal physiology (e.g., growth, urine pH, etc.), is warranted and may impact feeding recommendations.

Sow milk, formula and combined feeding differentially regulate gene expression in piglet colon.

Emily C. Radlowski[1], M. Wang[1], M.H. Monaco[2], J. Drnevich[3], S.M. Donovan[1,2]
[1]Division of Nutritional Sciences, [2]Food Science and Human Nutrition, [3]Keck Center for Functional Genomics, University of Illinois at Urbana-Champaign, Urbana, IL

Breastfeeding is recommended for the first year of life. However, breastfeeding rates in the U.S. decline from 77% at birth to 43% by 6 months and only 13% of these infants are exclusively breastfed, while the remainder are supplemented with formula (combined feeding; CF). Herein, we developed a novel piglet model to

investigate the effect of CF on the colonic transcriptome. Newborn piglets were randomized into 3 groups: sow-reared (SR), formula fed (FF) and CF (n=6 per group). SR remained with the sow 24h/day and FF were fed a sow milk replacer. CF piglets were sow-reared for 5d and were then rotated between the sow and formula feeding every 12h. On d21, ascending colon was collected and mRNA was extracted. Gene expression was assessed using a porcine microarray (Agilent). Among 25,273 probes, 449 were differentially expressed (FDR p<0.2). Bioinformatic analyses using MetaCore, revealed that the most significant GeneGo pathway maps were oxidative phosphorylation, apoptosis, immune response, lipid metabolism and cholesterol biosynthesis. On-going analyses are investigating relationships between host gene expression and composition of the colonic microbiota. *(Support: Bristol-Myers Squibb Freedom to Discover Award)*

Poster Session

Coconut oil facilitates tomato carotenoid tissue accumulation in the Mongolian gerbil (*Meriones unguiculatus*)

Lauren E. Conlon, R.D. King, N.E. Moran, J.W. Erdman Jr.
Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Tomato carotenoids have demonstrated anticancer bioactivity, and co-consumption of carotenoids with a polyunsaturated fat source has been shown to enhance bioavailability. To investigate the effect of fatty acid chain length and saturation on tomato carotenoid tissue accumulation, Mongolian gerbils (*Meriones unguiculatus*) were fed a 20% fat diet. Gerbils (n = 40) were fed control diets with safflower or coconut oil, or experimental diets containing 10% tomato powder and coconut oil or 10% tomato powder and safflower oil for 28 days. Coconut oil feeding increased carotenoids among many compartments including total carotenoids in the serum (p = 0.0001), adrenal glandular phytoene (p = 0.047), hepatic phytofluene (p = 0.0001), testicular *all-trans* lycopene (p = 0.01), and *cis*-lycopene (p = 0.006) in the prostate-seminal vesicle complex compared to safflower oil. Safflower oil-fed gerbils had greater splenic lycopene (p = 0.006) compared to coconut oil fed gerbils. Coconut oil also increased serum cholesterol (p = 0.0001), and decreased hepatic cholesterol (p = 0.0003) compared to safflower oil suggesting a shift in cholesterol flux that may have facilitated extrahepatic carotenoid tissue deposition. In summary, coconut oil containing a large proportion of medium chain fatty acids enhances tissue uptake of tomato carotenoids altering health implications.

Genotypic differences impact serum and hepatic lipids in mice lacking carotenoid cleavage enzymes

Amy C. Elsen[1], N.A. Ford[2], J.W. Erdman Jr[1,3]
[1]*Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL,* [2]*Department of Nutritional Sciences, University of Texas at Austin, Austin TX 78723,* [3]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*

Adult mice lacking the β-carotene central cleavage enzyme, carotene-15,15′-monoxygenase (CMO-I), have been reported by Hessel and colleges to have altered lipid metabolism, but little is known about the lipid content in carotene-9′10′-monooxygenase II knock-out (CMO-II KO) mice or whether tomato powder or lycopene alters lipid deposition in either genotype. Serum and hepatic lipid content was measured in female CMO-I KO, CMO-II KO and wild type (C57BL/6Jx129x1/SvJ) mice fed AIN-93G based diets: 10% tomato powder diet, 100 mg lycopene /kg beadlet diet or placebo beadlet diet for 4 days. Hepatic lipid content was significantly greater in CMO-I KO mice and CMO-II KO mice relative to wild-type mice, independent of dietary intervention ($p < 0.005$). H&E staining revealed that 25% of CMO-I KO adult mice have minimal hepatic lipidosis. The diets in this study negligibly impacted lipid content. Specifically, hepatic cholesterol levels were elevated in CMO-II KO mice when fed lycopene beadlet diet compared to placebo beadlet diet ($p < 0.05$) and decreased in mice when fed tomato powder compared to AIN-93 G diet ($p<0.05$). This data suggests that a lack of CMO-I or CMO-II alters serum and hepatic lipids but short term feeding of carotenoid diets has minimal impact on lipid deposition in these mice.
(Support: NIH grant PHS-1-RO1 CA125384)

Contrast ultrasound imaging does not affect Hsp70 expression in cholesterol-fed rabbit aorta

Brendon W. Smith[1,2], D.G. Simpson[3], R.J. Miller[2], M.B. Lee[4], W.D. O'Brien, Jr.[1,2], J.W. Erdman, Jr.[1,5]
[1]*Division of Nutritional Sciences,* [2]*Department of Electrical and Computer Engineering,* [3]*Department of Statistics,* [4]*School of Integrative Biology,* [5]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*

Diagnostic ultrasound imaging (US) is enhanced by the use of circulating microbubble contrast agents (UCAs), but the interactions between US, UCAs, and vascular tissue are not well understood. We hypothesized that US with UCA would represent a stress to the vascular tissue at the site of exposure and increase levels of Hsp70, a cellular stress protein. Male New Zealand White rabbits (n=24) were fed a diet containing 1% cholesterol, 10% fat and 0.11% magnesium. At 21 days, rabbits were either exposed to US (2.1 MPa) using the UCA Definity or sham exposed using a saline control (n=12 per group). Blood plasma was analyzed for cholesterol and von Willebrand Factor (vWF), a marker of endothelial function. Animals were euthanized 24 hours after exposure and a section of the abdominal aorta was quickly isolated and snap-frozen in liquid nitrogen. Aorta lysates from the specific area of US exposure were analyzed for Hsp70 protein expression by Western blot. Plasma total cholesterol levels increased to an average of 705 mg/dL. Hsp70 was expressed in aortas of both groups. No significant differences were observed between the two groups in Hsp70 expression or plasma vWF levels. Elevation of plasma cholesterol is a substantial stress to the vasculature, and the stress protein Hsp70 was expressed in vascular tissue. No additional vascular stress was observed as a result of US imaging. *(Support: NIH R37EB002641)*

NK cell populations and cytotoxic activity are greater in pigs fed mother's milk than formula

Kilia Liu[1], S.S. Comstock[2], J.M. Burdette[1], M.H. Monaco[2] and S.M. Donovan[1,2]
[1]*Division of Nutritional Sciences,* [2]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*

Natural killer cells (NKC) provide an immediate response to fight against infections. Herein, how diet influences NKC numbers and cytotoxic activity was investigated. Using flow cy-

tometry, NKC (CD3-CD4-CD8+) populations were identified in the peripheral blood mononuclear cell (PBMC), mesenteric lymph nodes (MLN) and spleen of 21 day-old sow-reared (SR, n=9) and formula-fed (FF, n=8) pigs. For cytotoxicity assays, NKC were negatively selected from PBMC and incubated (2h) with 20ng/ml IL-2 followed by an incubation (48h) with $DiOC_{18}$ labeled K562 target cells at a 10:1 effector-to-target ratio. Propidium iodide was added to identify killed cells. Cytotoxicity is reported as killed target ($PI+DiOC_{18}+$) cells as a percent of total target ($DiOC_{18}+$) cells using spontaneous target cell death as a normalizer. NKC population were greater in PBMC, MLN, and spleen of SR than FF ($p<0.05$). IL-2 increased the cytotoxicity of NKC from both SR and FF, but NKC from blood of SR exhibited higher cytotoxicity than those from FF ($p<0.001$). In summary, NKC activity was greater in SR than FF piglets, providing a potential mechanism whereby mother's milk improves neonatal innate immune response and defense against microbial infections.

Monocarboxylate transporter-1 genotype and breastfeeding status protect against elevated BMI in preschool aged Caucasian children

Anthony A. Wang[1], S.M. Donovan[1,2], M. Teran-Garcia[1]
[1]*Division of Nutritional Sciences,* [2]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*

The gut microbiota has been implicated in the development of obesity in part through fermenting dietary fibers to short chain fatty acids (SCFAs). The monocarboxylate transporter-1 (MCT-1), coded for by the SLC16A1 gene, facilitates the uptake of SCFAs in the colon. The association between genetic variants of the SLC16A1 gene at rs4839273 and obesity phenotypes in Caucasian 2-5 year-old children (n=128) in the STRONG Kids Program was studied. The marker was in Hardy-Weinberg Equilibrium (^{2}=0.38, p=0.54) and polymorphic information content was 0.34. Genomic DNA was obtained from saliva samples and was genotyped by fluorescence polarization. After adjusting for age, sex, and breastfeeding (BF) status, children with the CC genotype had lower BMI than children with CA or AA alleles (15.3 ± 0.6 vs. 16.6 ± 0.1, p=0.02). Breastfeeding status moderated this effect; individuals with CC genotype that were BF had lower BMI than those with CA or AA alleles who were not BF (15.9 ± 0.4 vs. 16.7 ± 0.2, p=0.05). Thus, genetic variation within the SLC16A1 gene was associated with BMI of the children in our study and this relationship was mediated by BF status.

Early life iron deficiency impairs spatial cognition in neonatal piglets

Jennifer L. Rytych[1,2], M.R.P. Elmore[1,3], M.D. Burton[1,3], R.N. Dilger[2,3], R.W. Johnson[1,2,3]
[1]*Laboratory of Integrated Immunology and Behavior,* [2]*Division of Nutritional Sciences,* [3]*Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL*

Iron deficiency is the most commonly reported nutritional deficiency in the world and has been linked to cognitive impairments in children. Our goal was to assess the impact of iron deficiency on cognition using neonatal piglets as a model for human infants, as swine neurodevelopment closely parallels human brain structure and growth. Piglets were fed one of three diets with varying concentrations of iron (Fe): control (6.3mg Fe/kg body weight [BW]), mild deficient (1.5mg Fe/kg BW), or severely deficient (0.63 mg Fe/kg BW). Piglets were placed on the diet at two days of age for four weeks. Throughout the study, hemoglobin and hematocrit levels decreased in piglets fed deficient diets. Skin pigmentation, as measured by a colorimeter in L*a*b* color space, showed reduced magneta color in the iron deficient piglets, correlating with hematocrit levels. In order to determine the effects of iron deficiency on cognition, piglets were tested in a hippocampal-dependent T-maze with extra-maze visuospatial cues. Severely deficient piglets were unable to acquire the task and those on the mildly deficient diet had significantly lower performance than controls during a reversal phase. This behavioral deficit was mirrored by a decrease in brain iron concentration in the hippocampus but not in the prefrontal cortex. Gene expression of several neurotrophic factors and proinflammatory cytokines was not affected.

Intradialytic protein supplementation reduces markers of inflammation in maintenance hemodialysis patients

Peter J. Fitschen[1], E.J. Tomayko[1], B.M. Kistler[2], P.T. Wu[2], H.R. Chung[2], J.H. Jeong[2], B. Yudell[2], E. Jeanes[3], S.A. Phillips[3], B. Fernhall[4], K.R. Wilund[1,2]
[1]Division of Nutritional Sciences, [2]Department of Kinesiology and Community Health, University of Illinois at Urbana-Champaign, Urbana, IL, [3]Department of Physical Therapy, [4]College of Applied Health Sciences, University of Illinois Chicago, Chicago IL

In maintenance hemodialysis (MHD) patients, elevated inflammation and poor nutrition status often occur in unison resulting in numerous co-morbidities. The purpose of this study was to determine the effects of intradialytic protein supplementation (IP) on markers of inflammation in MHD patients. MHD patients (n=60) were randomly assigned to whey protein, soy protein, or placebo. On 2 days separated by 1 week, blood was drawn both at the start and 3 hours into a dialysis session and analyzed for Interleukin-6 (IL-6). On the first day, subjects received no beverage. One week later, subjects consumed their study beverage immediately before the start of dialysis and blood was collected as described. A subset of subjects (n=29) continued to receive their study beverage during dialysis for 6 months. Blood was drawn prior to a dialysis session at 0 and 6 months. C-reactive protein (CRP) and IL-6 were measured by ELISA kits. IL-6 increased during a single dialysis session in all groups when no beverage was given. The rise in IL-6 was attenuated by IP ($p<0.05$). At six months, there was a significant time by treatment effect for reduced IL-6 with IP compared to the control group ($p<0.05$). A similar trend was observed for CRP ($p=0.089$). These results suggest that IP may be a low-cost intervention to reduce inflammation in MHD patients. Future studies are needed to determine the mechanism by which IP reduces inflammation.

Immunobehavioral complications of the diabesity-associated free-fatty acid, palmitic acid

Morgan L. Moon, G.G. Freund
Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Diabesity is a near ubiquitous disease projected to result in health care costs to the United States exceeding $40 billion during the next 20 yrs. In addition to the complications of coronary heart disease, renal failure and blindness, diabesity causes brain-based maladies that include anxiety, mood disorders, cognitive impairment and frank dementia. How exactly diabesity precipitates these brain-based complications is not clear but linkage to perturbed neuroimmunity is evident. Palmitic acid accounts for 25% of the saturated fat in the HFDs we use to induce mouse diabesity and makes up a large portion of circulating fatty acids. Intraperitoneal administration of palmitic acid triggers rapid (≤ 2 h) sickness behavior in mice, and we have shown that the mechanism of sickness initiation is independent of Toll-like receptor (TLR)4 and MyD88. This intriguing observation is in stark contrast to current dogma, which has tied the immunostimulatory effects of saturated free fatty acids (FFAs) to TLRs, especially TLR4. Further, palmitic acid induces a rapid decrease in body temperature, indicating a neuronal signaling mechanism with involvement of the hypothalamus. Our data indicate a novel pathway for signaling of free fatty acids that needs to be further studied to identify potential targets for treating the complications of diabesity.

Low papaya consumption increases risk for low high-density lipoprotein cholesterol in Mexican college applicants

Michelle A. Mosley[1], F.C.D. Andrade[2], J.M. Vargas Morales[3], C. Aradillas-Garcia[4], M. Teran-Garcia[1]
[1]Food Science and Human Nutrition, [2]Kinesiology & Community Health, University of Illinois at Urbana-Champaign, Urbana, IL, [3]School of Chemistry, [4]School of Medicine, University Autonomous of San Luis Potosi, San Luis Potosi, Mexico

Raising high-density lipoprotein cholesterol (HDL-C) via nutrition intervention is a challenge. Papaya fruit contains Carica papaya lipase, which may influence lipid metabolism. Our objective was to determine whether individuals consuming less papaya were at greater risk for low HDL-C or other dyslipidemias. We focused on a subset of 339 Mexican college applicants (50.7% females) aged 18-25 years with complete data on a Mexican-adapted Willett food frequency questionnaire and blood lipid profiles. Overall prevalence of low HDL-C was 48.4%. Subjects were split into two consumption groups: <3 or >3 weekly papaya servings (mean intake 0.38 vs. 4.3 servings/week, $P<0.0001$). There were no differences in blood lipid profiles between the two groups; however, females who consumed less than 3 servings of papaya per week were at 1.52 times greater risk (95%CI: 0.99-2.32, P=0.05) of having low HDL-C after adjustment for age and family history of cardiovascular disease and diabetes. These findings were not observed in males. We did not observe risk for other at-risk blood lipid measures. Consumption of at least 3 servings of papaya per week may prevent low HDL-C in female Mexican college applicants.

- **RGD-peptide lunasin inhibits PI3-kinase/Akt-mediated NF-κB activation in human and murine macrophages through interaction with αVβ3 integrins**

Anthony Cam, E.G. de Mejia
Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL

Regulation of aberrant macrophage activity under inflammatory conditions is critical in the prevention of cardiovascular disease (CVD). Integrin receptor αVβ3 is highly expressed on macrophages in atherosclerotic lesions and binds Arg-Gly-Asp (RGD) ligands. Lunasin is a food derived peptide that contains an RGD cell adhesion motif. The objective was to determine the effect of lunasin on pro-inflammatory markers from LPS-induced RAW 264.7 murine and THP-1 human macrophages and its role on αVβ3 integrins, important mediators of PI3K/Akt activation of NF- B. Lunasin (50 μM) reduced COX-2, iNOS and NO levels by 57.9, 64.5 and 76.2 %, respectively. Lunasin inhibited the activation of phosphorylated Akt and NF-κB p65 by 59.5 and 74.5%, respectively. Lunasin reduced the production of exogenous PGE_2 and TNF- by 92.5% and 94.9%, respectively. Vitronectin (10 μg/mL), a ligand of αVβ3 integrin, increased expression of pro-inflammatory markers, whereas the presence of lunasin attenuated these effects. Co-immunoprecipitation of lunasin-treated cells confirmed direct interaction with the αVβ3 integrin. The identity of lunasin within the integrin complex was verified through liquid chromatography/mass spectrometry, showing extensive homology to the lunasin sequence. Colocalization of lunasin and αVβ3 integrin was observed with fluorescence confocal microscopy. Lunasin has the potential to prevent CVD through blockade of αVβ3 integrin in macrophages.

- **Effect of glycogen synthase kinase-3β inhibition by apigenin on markers of proliferation, inflammation and apoptosis in pancreatic cancer**

Jodee L. Johnson, E.G. de Mejia
Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Glycogen synthase kinase-3β (GSK-3β) is a therapeutic target of interest in pancreatic cancer because its inhibition suppresses NFκB activity leading to decreased expression of genes that control proliferation, inflammation and apoptosis. The objective was to investigate the effect of apigenin, a dietary flavonoid, on GSK-3β and its downstream markers. Apigenin inhibited BxPC-3 cell proliferation (IC50 = 23 μM, 24 h). An ELISA assay demonstrated that apigenin (25 μM) decreased GSK-3β protein expression from 4.2 ng/mL (control) to 2.3 ng/mL. qPCR results demonstrated that apigenin (IC35 = 14 μM, 24 h) affects a variety of genes related to inflammatory cytokines and receptors (27 upregulated, 13 downregulated). CCL4 was upregulated (2.23-fold) and TOLLIP and CCR4 were downregulated (-2.29- and 2.60-fold, respectively). Flow cytometry analysis demonstrated that apigenin (10, 25, 50 μM) increased the amount of cells undergoing apoptosis in a dose-dependent manner (8, 12 and 23%, respectively). Using a cancer pathway

array, to provide more insight into the potential mechanism(s) of action, demonstrated that apigenin upregulated 30 genes and downregulated 47. For instance, IFN-β, whose activity has been shown to suppress GSK-3β activity, was found to be upregulated 8.9-fold. Apigenin inhibited GSK-3β, and lead to decreased proliferation and inflammation and increased apoptosis in pancreatic cancer cells.

Early life risk factors for obesity in childhood: A cumulative risk model

Dipti Dev[1], B. McBride[2]
[1]*Division of Nutritional Sciences,* [2]*Human and Community Development, University of Illinois at Urbana-Champaign, Urbana, IL*

The objective of this study is to identify multiple levels of influence in predicting weight gain in pre-school children (2-5 years). A cumulative risk approach is taken to predict overweight (85th percentile ≤BMI <95th percentile) and obesity (95th percentile ≤BMI) based on the following predictors (SES, ethnicity, maternal BMI, family size, breast feeding duration, age of introduction of solid foods, parental feeding practices, parental fruit and vegetable intake, family media use, family encouragement of physical activity, child food consumption, sleep patterns and childcare attendance). Baseline data from the Synergistic Theory and Research on Obesity and Nutrition Group (STRONG) kids were used for data analysis. Primary caregiver-child dyads (n= 497) were recruited from childcare centers in Eastern Illinois. Caregivers completed survey and child height and weight was measured. Current sample statistics n= 497 (254 males, 293 females), with 34 Hispanics, 131 Blacks, 278 Whites and 54 Asians. 254 children enrolled in Child and Adult Care Food Program (CACFP), 169 Non- CACFP and 74 in Head Start programs. 25% of children were classified as overweight. Using a cumulative risk model, it was found that the combination of child, family level and childcare risk factors could predict overweight and obesity. The results suggest the need for targeted obesity interventions based on above characteristics.

T-cell response to *ex vivo* stimulations in neonate piglets is influenced by diet and vaccination

Jill M. Burdette, S.S. Comstock, K. Liu, M.H. Monaco and S.M. Donovan
Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

During the first weeks of life, an infant's immune system is naive and less responsive to infection. Herein, the impact of diet and influenza vaccination on *ex vivo* T-cell responses was assessed. Sow-reared (SR) and formula-fed (FF) piglets were vaccinated with Fluzone on day 7 and 14 postnatal age. *Ex vivo* stimulations with PHA, PMA+A23187, Fluzone and LPS were performed on PBMC isolated on day 21. T-cells were phenotyped by flow cytometry prior to and after 48h stimulation. IFN- secretion by PBMC after 24h was assessed by ELISpot. T-cell populations changed in culture, with an increase in the proportion of CD4+ and a decrease in CD8+ T-cells. After 48h, PBMC from SR piglets, either unstimulated or Fluzone stimulated, contained more ($p<0.05$) CD3+CD4+ T cells than FF. CD3+ CD8+ T cells were greater ($p<0.05$) in PBMC from vaccinated piglets, independent of diet, in unstimulated, Fluzone and PHA treatments. The elevated CD8+ numbers was consistent with greater IFN- secretion ($p<0.05$) by PBMC from vaccinated piglets. Thus, diet and vaccination independently influenced immune cell phenotype and function *ex vivo*.

Effects of dietary carotenoids on steroid hormone status in male mice lacking carotene-15,15′-monooxygenase (CMO-I) or carotene-9′,10′-monooxygenase (CMO-II)

Joshua W. Smith[1], N. A. Ford[3], S. K. Clinton[4], J. W. Erdman, Jr[1,2].
[1]*Division of Nutritional Sciences,* [2]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL,* [3]*Department of Nutritional Sciences, University of Texas at Austin, Austin, TX,* [4]*The James Cancer Hospital and The Ohio State University Comprehensive Cancer Center, The Ohio State University, Columbus, OH*

Higher serum levels of lycopene are inversely associated with prostate cancer incidence, while alterations in the gonadal hormones testosterone (T) and estradiol (E) modulate risk. Nine- to twelve-week-old male WT, CMO-I KO and CMO-II KO mice were fed either a control, lycopene beadlet- (LYC) or tomato powder-supplemented (TP) diet for four days. Previously we reported that diet and genotype significantly interact, resulting in reduced testicular and total serum T in CMO-I KO mice fed either TP or LYC, compared to WT mice. We hypothesized that CMO-I KO genotype, but not CMO-II KO genotype, would interact with LYC and/or TP to result in decreased serum E and alter testicular mRNA expression of 17β-hydroxysteroid dehydrogenases (17β HSD) 2 & 3. Compared to WT, CMO-I KO genotype significantly reduced the testicular mRNA expression of both 17β-HSDs 2 and 3 ($p<0.05$). Serum E was unchanged, although there were trends towards significant genotype-diet interactions in the CMO-I KO/TP (increased; $p=0.06$) and CMO-I KO/LYC (decreased; $p=0.08$) groups, respectively, compared to WT. No changes in serum E were seen in any CMO-II KO mice. Further work is underway to expand upon these findings.

Nutrition Symposium Poster Session

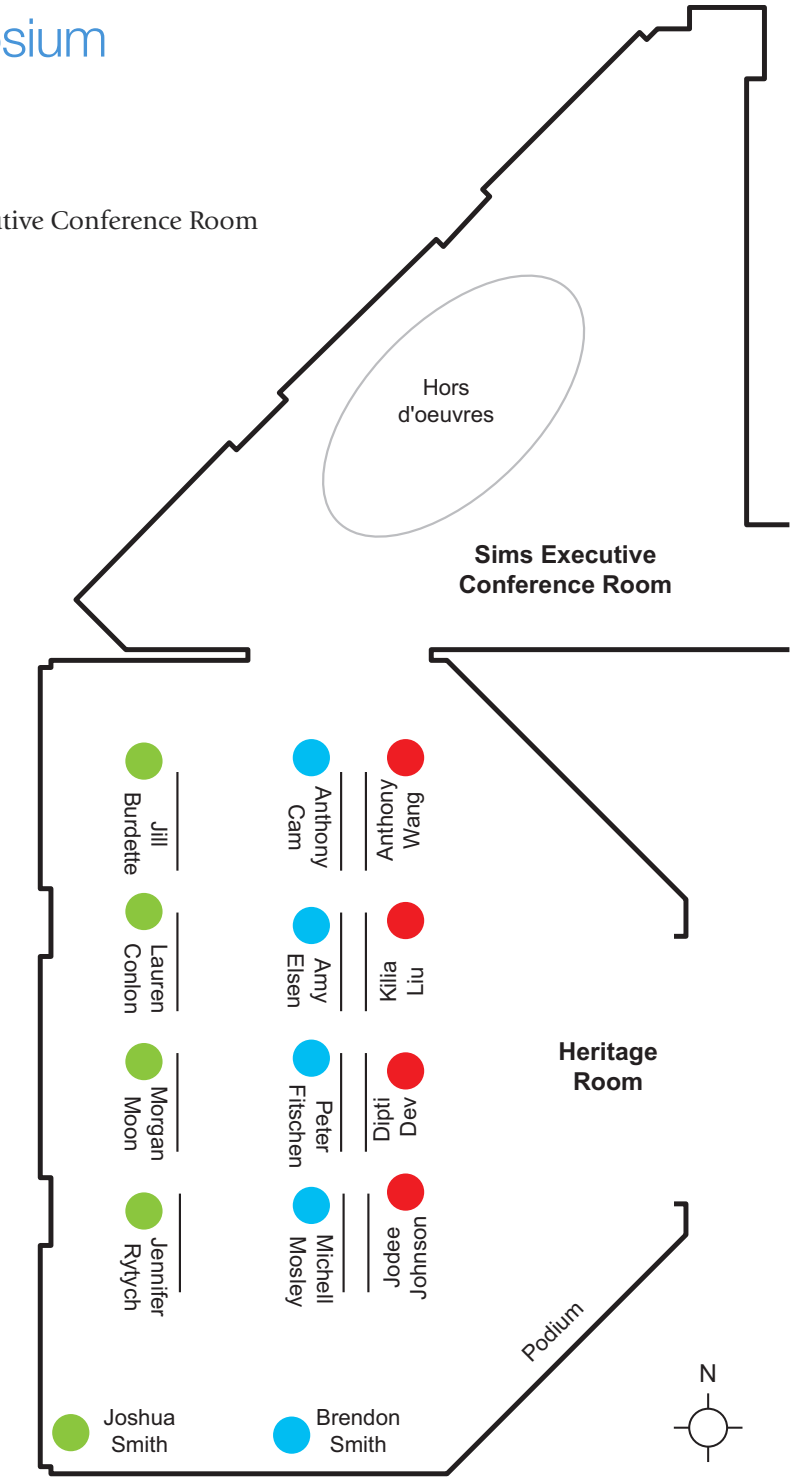
ACES Library, 1st Floor
Heritage Room and Sims Executive Conference Room
Wednesday, April 18, 2012
5:15 p.m. – 6:30 p.m.

Poster Judges

Green Team
Dr. de Mejia (captain)
Dr. Loor
Dr. Yudel

Blue Team
Dr. Donovan (captain)
Dr. Garlick
Dr. Strakovsky

Red Team
Dr. Beverly (captain)
Dr. Moran
Dr. Myracle



Presenting Author Index

Winners of the 2011 University of Illinois Nutrition Symposium poster and oral competitions with keynote speaker, Dr. Brian Wansink.

http://www.nutritionalsciences.illinois.edu