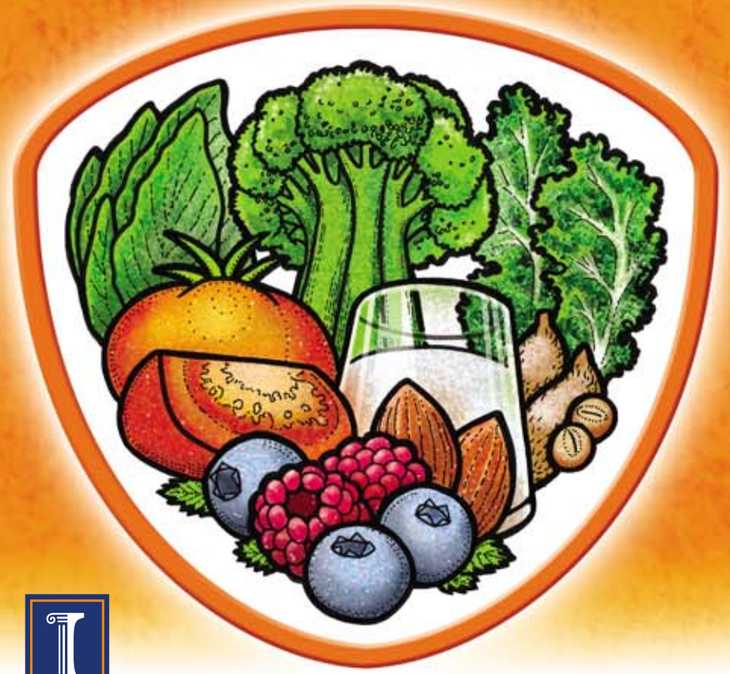
University of Illinois at Urbana-Champaign
Division of Nutritional Sciences

2013 NUTRITION SYMPOSIUM

N • S • G • S • A
Nutritional Sciences Graduate Student Association



APRIL 17, 2013

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 2013 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 Fleet deliver the keynote address, "Forward and Reverse Genetic Approaches Reveal Critical Gene x Diet Interactions Affecting Calcium Absorption and Bone Metabolism." Given that many U.S. women have low dietary calcium intake, Dr. Fleet will discuss the current understanding of and remaining gaps in knowledge in the mechanism of basal and vitamin D regulated intestinal calcium absorption. He will also discuss gene-mapping strategies aimed at gaining greater insight into the genes controlling the genetic diversity in intestinal calcium absorption efficiency, with the goal of understanding the feasibility of personalized nutritional requirements.

Additionally, NSGSA is proud to highlight the work of world-class DNS faculty members through a mini-symposium. This year's presentations address bioactives and cancer prevention and will feature Drs. Elizabeth Jeffery, John Erdman, Hong Chen, and Alan Diamond.

We are grateful to the many people involved with this meeting and program. We would like to first thank our keynote speaker, Dr. James Fleet. 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

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

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Dr. Lindsey Alexander
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Dr. Nancy Engelmann Moran
Dr. Duncan Ferguson
Dr. James Fleet
Dr. Gregory Freund
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Dr. Margarethe Hoenig
Dr. Hannah Holscher
Dr. Elizabeth Jeffery
Dr. Rodney Johnson
Dr. Naiman Khan
Dr. Schuyler Korban
Dr. William O'Brien
Dr. Emily Radlowski
Dr. Rita Strakovsky
Dr. Margarita Teran-Garcia
Dr. Kenneth Wilund

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Schedule of Events

APRIL 17, 2013

8:15 a.m. – 9:15 a.m. .....**Breakfast**
Sims Executive Conference Room, ACES Library
Sponsors, DNS students, faculty, and staff are invited

***9:15 a.m. – 11:15 a.m.**.....**Faculty Mini-Symposium**
Monsanto Room, ACES Library
"Bioactives and Cancer Prevention"

11:15 a.m. – 11:30 a.m. .....**Break**

11:30 a.m. – 12:30 p.m. .....**Lunch**
Heritage Room, ACES Library
DNS students and sponsors are invited, RSVP required

12:30 p.m. – 12:40 p.m. .....**Break**

***12:40 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. – 3:10 p.m.** .....**Graduate Student Oral Presentations 2**
Monsanto Room, ACES Library

3:10 p.m. – 4:00 p.m. .....**Break**

***4:00 p.m. – 5:00 p.m.** .....**Keynote Address by Dr. James Fleet**
134 Temple Hoyne Buell Hall
"Forward and Reverse Genetic Approaches Reveal Critical Gene x Diet Interactions Affecting Calcium Absorption and Bone Metabolism"

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 general public*

Contact Information

2013 Symposium Contact

Jane Naberhuis
420 Bevier Hall
University of Illinois
Urbana, IL 61801
(217) 300-2139
naberhu2@illinois.edu

2014 Symposium Contact

Lauren Conlon
448 Bevier Hall
University of Illinois
Urbana, IL 61801
(217) 300-6560
lconlon2@illinois.edu

Division of Nutritional Sciences

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

Nutritional Sciences Graduate Student Association

http://nutrsci.illinois.edu/current_students/nutritional_sciences_graduate_student_association

The University of Illinois Division of Nutritional Sciences and the Nutritional Sciences Graduate Student Association would like to acknowledge the generosity of the sponsors and friends of our 2013 Nutrition Symposium.

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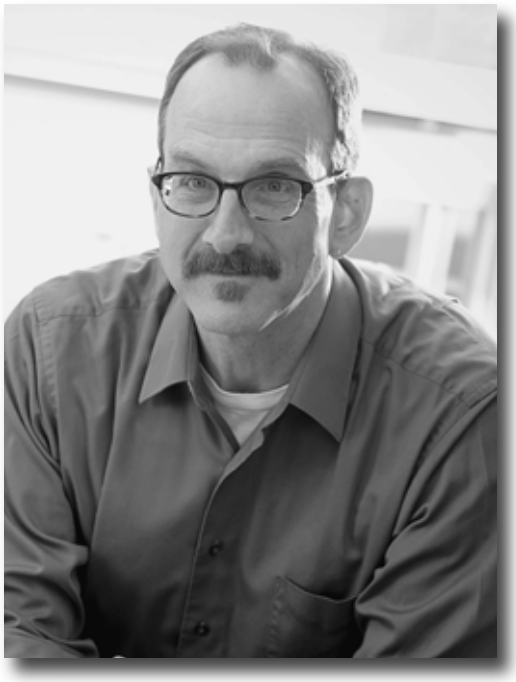
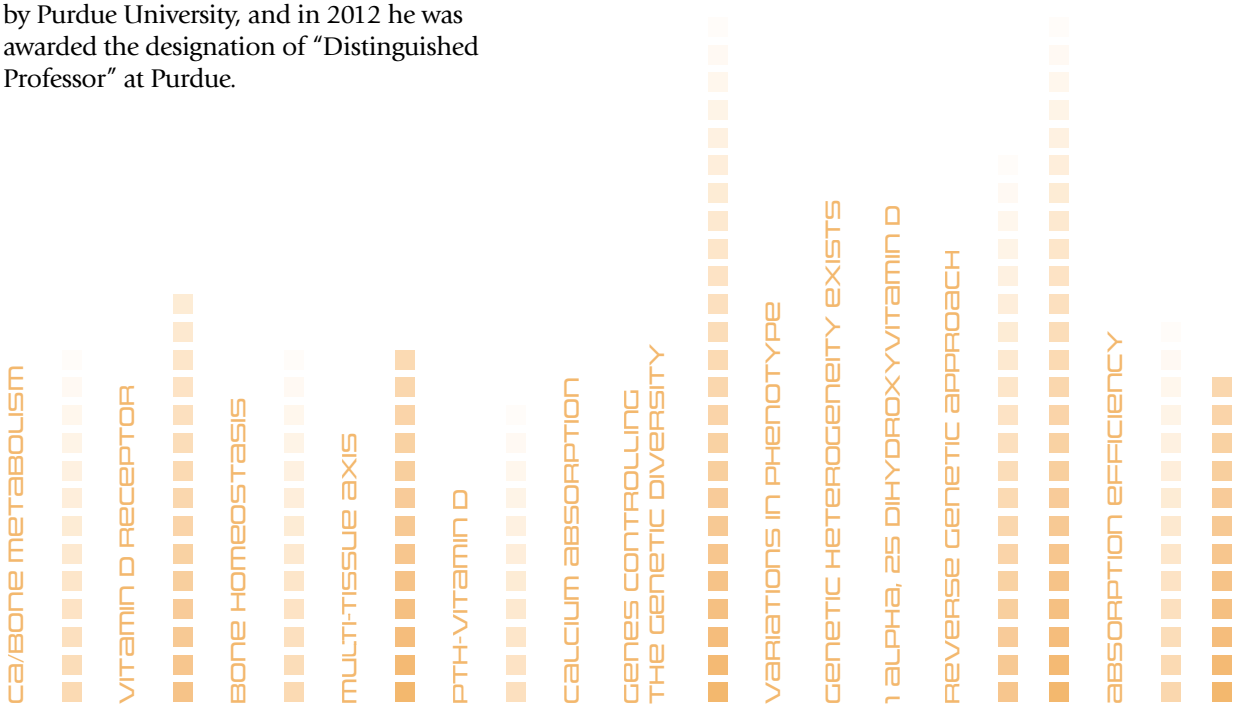
Keynote Speaker
Dr. James Fleet



Dr. James Fleet is a Distinguished Professor in the Department of Nutrition Science as well as the Director of the Interdepartmental Nutrition Program for graduate training in nutrition at Purdue University. He holds a B.S. and Ph.D. from Cornell University and has previously held faculty appointments at Tufts University and the University of North Carolina at Greensboro. Dr. Fleet's research is focused on the molecular and physiological functions of vitamin D as they pertain to the control of calcium metabolism and the prevention of cancer. He uses the tools of molecular biology, genomics, and genetics to address questions relevant to human health and disease. He has served as a contributing editor to *Nutrition Reviews*, on the editorial board of *The Journal of Nutrition*, and on the INMP and CDP study sections at NIH. He has been an organizer of FASEB Summer Conferences, on the Program Committees for International Workshops on Vitamin D, and he has been invited to speak on his work across the globe. In 2001, he was the recipient of the Mead Johnson Award from the American Society for Nutrition, in 2004 he was honored as a "University Faculty Scholar" by Purdue University, and in 2012 he was awarded the designation of "Distinguished Professor" at Purdue.

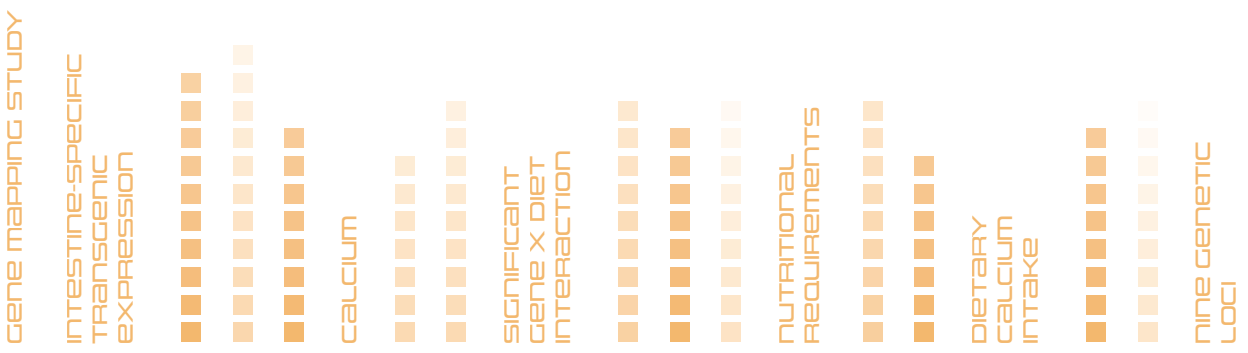


"Forward and Reverse Genetic Approaches Reveal Critical Gene x Diet Interactions Affecting Calcium Absorption and Bone Metabolism"

James C. Fleet, Ph.D.
Distinguished Professor, Department of Nutrition Science and Director, Interdepartmental Nutrition Program for graduate training in nutrition, Purdue University

Calcium (Ca) absorption is a critical component of the multi-tissue axis controlling Ca and bone homeostasis. This is revealed during periods of low dietary Ca intake - a common problem in US women. Here the PTH-vitamin D axis is activated leading to increased renal production of 1 alpha, 25 dihydroxyvitamin D (1,25 D), a hormone that works through the vitamin D receptor (VDR) to upregulate Ca absorption efficiency. VDR deletion severely disrupts whole body Ca/bone metabolism and reduces Ca absorption efficiency but intestine-specific transgenic expression of VDR normalizes Ca absorption and restores whole body Ca metabolism. These reverse genetic approaches show that the most important function of vitamin D during growth is to control Ca absorption. However, significant gaps remain in our understanding of the mechanism of basal and vitamin D regulated intestinal Ca absorption. To overcome this knowledge gap, we have initiated a forward genetics approach that uses inter-individual variations in phenotype (e.g. intestinal Ca absorption efficiency) within genetically well-defined populations to identify genomic loci that control the phenotype. Using a genetically diverse panel of 11 inbred mouse lines we have found significant heterogeneity in Ca absorption efficiency and in bone parameters. This variability weakens well-established relationships between Ca absorption and serum 1,25 D or bone mass and reveals genetic sub-populations with divergent adaptive responses to inadequate dietary Ca intake. To gain greater insight into the genes controlling the genetic diversity in intestinal Ca absorption efficiency we conducted a gene mapping study using 51 lines from the BXD recombinant inbred mouse panel fed Ca adequate (0.5%) or low Ca (0.25%) diets. This analysis revealed 9 genetic loci controlling Ca absorption - two of which reflect a significant gene x diet interaction. None of these regions contain genes previously proposed to regulate Ca absorption. The major finding in this research is that significant genetic heterogeneity exists in Ca/bone metabolism as well as their adaptive response to low Ca intake. We believe that can be used as a foundation for understanding the feasibility of personalized nutritional requirements.

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



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Faculty Mini-Symposium: Bioactives and Cancer Prevention

9:15 a.m. – 11:15 a.m.
Monsanto Room, ACES Library

Graduate Student Oral Presentations Session 1

12:40 p.m. – 1:50 p.m.
Monsanto Room, ACES Library

Graduate Student Oral Presentations Session 2

2:00 p.m. – 3:10 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 30.

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Abstracts and Biographies

Faculty Mini-Symposium: Bioactives and Cancer Prevention

Bioactives and Cancer: An introduction with a focus on crucifers

Elizabeth Jeffery, Ph.D.
Division of Nutritional Sciences, Department of Food Science and Human Nutrition, College of ACES ,College of Medicine, University of Illinois at Urbana-Champaign, Urbana, IL

ABSTRACT: Plant foods provide a surprisingly large array of plant secondary compounds, often termed dietary bioactives, that positively affect human health in a variety of ways, including cancer prevention. Many of these individual compounds have been isolated and studied in purified form, in cell culture and animal models. Many, as pure compounds or extracts, have been formulated into popular dietary supplements. Yet few are accepted by the FDA as worthy of a health claim. One such example is the broccoli bioactive sulforaphane. Unstable in purified form, sulforaphane can be found in supplements as the parent glycoside, glucoraphanin in a semi-purified or whole plant extract. The research using cultured cells and sulforaphane direct from the freezer to evaluate mechanism appears persuasive to a scientist. But supplements carry no health claim sanctioned by the FDA, and no assurances of efficacy at the doses recommended on the package. Sulforaphane is traditionally consumed as part of whole broccoli, where the content varies many fold with genotype, growing conditions and post-harvest handling. A recent genotype introduction is advertised as a richer source of sulforaphane, but with no advice on preparations that might maintain the content. Even animal studies, where many of these factors are controlled, are not all positive. Furthermore, although there are clinical bioavailability studies, there are no clinical cancer prevention trials. Epidemiological studies support the idea that broccoli prevents cancer – but epidemiological data can only be used to generate hypotheses, not to prove health benefits. It is not enough for scientists to focus solely on mechanisms in cell culture – to generate information that can move the field forward, we need to find ways to show efficacy to the government and to the individual interested in supplements or whole foods.

BIOGRAPHY: Elizabeth Jeffery, Ph.D. joined the University of Illinois in 1983 and is Professor Emerita of Nutrition in the Department of Food Science and Human Nutrition, in the College of Agricultural, Consumer and Environmental Sciences. She is also Professor Emerita in the College of Medicine and the Interdisciplinary Division of Nutritional Sciences. Dr. Jeffery performs research in the area of diet and disease prevention, and has served as program director for a multi-state research program on bioactive food components. She has over a hundred peer-reviewed publications, including a chapter on bioactive food components in the major textbook on nutrition for graduate schools, "Biochemical, Physiological, Molecular Aspects of Human Nutrition". She has served on committees for the National Academy of Science, focused on safety and efficacy of dietary supplements and on numerous USDA, NIH, Army and DOD study sections, in the areas of Pharmacology, Toxicology, Nutrition and Disease Prevention. Dr. Jeffery has a Ph.D. in Biochemistry from the University of London, England.

Diet and prostate cancer risk; whole foods or their bioactive components?

John W. Erdman Jr., Ph.D., Professor Emeritus
Division of Nutritional Sciences, Department of Food Science and Human Nutrition, College of ACES, University of Illinois at Urbana-Champaign, Urbana, IL

ABSTRACT: Prostate cancer (PCa) is the second leading cause of cancer-related deaths in U.S. men. Since PCa is a slow-growing cancer, identifying dietary interventions to reduce the risk or progression of this cancer could greatly impact survival. A growing body of evidence has identified several foods that may reduce risk of PCa. Mechanistic studies have investigated individual bioactives from foods to identify their anti-carcinogenic properties. My laboratory has investigated whether tomato or broccoli powders or soy germ reduces prostate carcinogenesis in various animal models of PCa. We are especially interested in the comparison of whole tomato powder with lycopene, the primary red pigment in tomatoes. We have proposed that metabolites of lycopene and other carotenoids impact PCa. We have utilized a number of novel transgenic mice models and have found evidence that carotenoid metabolites reduce androgen status which may lead to reduced tumor growth. Additionally, we have determined that broccoli powder reduces growth of existing prostate tumors in rats and the combination of tomato and broccoli powders was especially effective. Whole soy protein has been demonstrated by others to reduce PCa. Recently we evaluated soy germ (soy hypocotyl which is high in isoflavones but low in genistein) in the TRAMP mouse model of spontaneous prostate cancer and found inhibition of progression of PCa. Once the most important bioactives are identified in whole foods, their content can be enhanced through breeding or food processing with the goal of providing the consumer with optimized foods for health. (Supported by PHS-1-RO1CA125384 and PHS-R21AT005166)

BIOGRAPHY: Dr. Erdman is Emeritus Professor of Food Science and Human Nutrition, Professor of Internal Medicine and Professor of Nutrition in the Division of Nutritional Sciences at the University of Illinois at Urbana. Dr. Erdman's training and expertise encompass the nutritional and physiological biochemistry of man and animals. He has authored over 175 original research articles on these subjects and has over 300 total publications including other articles and chapters. He is a member of a variety of professional organizations including the American Society for Nutrition (ASN), the Institute of Food Technologists (IFT), and the American Heart Association (AHA). He is past President of the American Society for Nutritional Sciences (now ASN), has been elected Fellow for ASN, AHA and IFT. He has been extensively involved with the Food and Nutrition Board (FNB) of the Institute of Medicine, National Academy of Sciences (NAS), where he served on the FNB for 9 years, 6 as Vice Chair. Among other committees of the FNB, he served as Chair of the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (DRIs) and Chair of the Committee on Military Nutrition Research. Recently this committee published the report "Nutrition and Traumatic Brain Injury". For his extensive contributions to the NAS, he was named as Lifetime National Associate of the NAS in 2001 and was elected as a Member of the Institute of Medicine, NAS in 2003. Other honors include: receipt of the Samuel Cate Prescott Award for Research and the William Cruess Award for Teaching from IFT: the Borden Award from ASN; being named as an Original Member in Agricultural Science by ISI as an Highly Cited Researcher (top 0.05%); and several University of Illinois Excellent and Outstanding Teaching awards. He is a member of the Board of Trustees of ILSI- NA. Dr. Erdman is past Executive Director of the Mars Science Advisory Council. Dr Erdman received his B.S., M.S., M.Ph., and Ph.D. in Food Science from Rutgers University.

Dietary Genistein Modifies Colon Cancer Development: Mechanistic Aspects

Hong Chen, Ph.D.
Division of Nutritional Sciences, Department of Food Science and Human Nutrition, College of ACES, University of Illinois at Urbana-Champaign, Urbana, IL

ABSTRACT: Colorectal cancer is among the most common cancers in men and women worldwide. Epidemiological studies suggested lower incidence of colorectal cancer in Asian countries and this is associated with higher dietary intake of soy products. Time, length, and dose of exposure play important roles in determining the effects of protection by soy. Moreover, isoflavones in soy protein isolates have been shown to have complex interactions in cancer prevention. My research focuses on testing the central hypothesis that early exposure of soy/genistein reduces colon cancer development later in life through epigenetic modifications of WNT signaling pathway. Using a rat model for chemical-induced colon neoplasia, results showed that lifelong feeding of genistein or soy protein greatly reduced the development of colon neoplasia (Aberrant crypt foci). This study also provides strong evidence that genistein is a novel suppressor of carcinogen-induced WNT signaling. Importantly, dietary genistein exerts the control of WNT gene expression during carcinogen induction through an epigenetic mechanism involving DNA methylation and histone modifications at the regulatory region of gene.

BIOGRAPHY: Dr. Hong Chen received her B.S. degree in cell biology from Lanzhou University in China. She then studied animal nutrition at Virginia Tech and received both her M.S. and Ph.D. degrees in molecular nutrition. She continued her training as a postdoctoral fellow in the Department of Biochemistry and Molecular Biology at University of Florida College of Medicine. She has been an assistant professor in the Department of Food Science and Human Nutrition since 2006. Dr. Chen's research focuses on the roles of epigenetic regulations during colon cancer development and metastasis. By using innovative tools, her laboratory is investigating how epigenetic modifications are regulated by dietary components in colon tumor cells as well as in preclinical animal models and how these modifications contribute to tumorigenesis and cancer progression. The long-term goal is to better understand the epigenetic mechanisms that regulate critical pathways during colon cancer development and to determine the interactions of diets and signaling pathways in cancer development and metastasis. Dr. Chen has been recognized for her efforts in nutrition-related research including being the recipient of the 2010 Mary Schwartz Rose Young Investigator Award from American Society for Nutrition.

Selenium and Cancer Prevention: What have we learned?

Alan Diamond, Ph.D.
Division of Nutritional Sciences, Department of Human Nutrition, Department of Pathology, University of Illinois at Chicago and at Urbana-Champaign, Urbana, IL

ABSTRACT: Selenium is an essential micronutrient that has received significant attention regarding its potential to prevent cancer. Well over 100 animal studies have supported its efficacy in cancer prevention at low, non-toxic doses, it being shown to be beneficial against a broad range of carcinogenic insults in most organ types examined. Human epidemiological studies have also supported the development of selenium as a dietary chemopreventive by revealing an inverse association between the levels of selenium ingested and cancer incidence. Also supported by the results of a selenium supplementation study published in 1996, the NIH embarked on the largest prostate cancer prevention trial in history, SELECT, (Selenium, and Vitamin E Prevention Trial) being conducted in North America and involving 34,000 men and 400 centers in the United States and Canada. Also examined in this trial were the benefits of Vitamin E, provided both alone and in combination with selenium. SELECT was terminated early and the results were disappointing, there being no benefit observed for selenium and concerns raised about a possible increased risk of diabetes, as well as an increased risk of prostate cancer among those in the Vitamin E arm of the trial. The conclusion drawn, that there was no benefit to providing men over the age of 50 additional selenium in order to reduce the risk of prostate cancer was clear, although positive results for sub-populations may still emerge when data on stratification by baseline selenium status and certain genetic polymorphisms are released. The apparent contradiction between the pre-clinical data on selenium and the results obtained from SELECT indicate the needs for more research to understand the biological effects of this trace mineral.

BIOGRAPHY: Dr. Alan Diamond obtained his Ph.D. in Biochemistry from the State University of New York at Stony Brook and post-doctoral training in cancer molecular biology at Harvard Medical School. His first faculty position was at the University of Chicago where he began the work on selenium and selenium-containing proteins that continues today. In 1998, he joined the Department of Human Nutrition at the University of Illinois at Chicago where he served as the Department Head prior moving to his current position as a Professor in the Department of Pathology in the College of Medicine. Dr. Diamond's interests in selenium began with his early research on the mechanism of synthesis of selenium-containing proteins, focusing on the structure and function of selenocysteine-inserting tRNA. These efforts led to an interest into the mechanisms by which nutritional levels of selenium prevents cancer, focusing on the selenium-containing anti-oxidant protein glutathione peroxidase and the naturally occurring genetic variants of the gene for this protein that have been associated with human disease. His efforts are currently supported by funding from the NIH and he has served continuously on NIH study sections for over a decade. He is also a past recipient of the ELR Stokstad Award from the American Society for Nutritional Sciences.

Abstracts

Oral Session 1

Socio-demographic and geographic variation of overweight and obesity in Uganda

Mary J. Christoph[1], K.N. Turi[1], D.S. Grigsby-Toussaint[1,2]
[1]Department of Community Health, [2]Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Overweight, obesity, and related chronic diseases are understudied in sub-Saharan Africa, and even fewer studies have observed geographic correlates, necessitating an investigation of geospatial population patterns. We used ArcGIS 10.1 to investigate clustering of overweight and obesity in rural and urban areas of Uganda for 2,420 adult females and children, based on aggregated latitude and longitude data from the 2011 Uganda Demographic and Health Survey (DHS). We further examined socioeconomic factors in STATA 12.0 to show spatial heterogeneity of overweight and obesity. Overweight and obesity clustered in larger cities, and were significantly correlated with high education level and wealth index; further, 52.9% of overweight women lived in urban areas, compared to just 26.8% of normal-weight females. Overweight or obese women were also more likely to have overweight children (21.8%) than their normal or under-weight counterparts (16.6%). Our results suggest that there is a significant burden of chronic disease in Uganda, particularly in the capital and in wealthier regions of the country. This study underscores the necessity of using geostatistical tools to elucidate the etiology of overweight, obesity, and the increasing rates of chronic disease in Sub-Saharan Africa.
(Support: UIUC Illinois Transdisciplinary Obesity Prevention Program)

Establishing and maintaining the complex adhesions of the testes: A role for the omega-3 DHA

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

An insufficiency in omega-3 fatty acids has been linked to a wide variety of health concerns including Alzheimer's disease, CHD, sub-optimal fetal development and male infertility. Although the long chain omega-3 docosahexaenoic acid (DHA) is preferentially enriched in the brain, retina and testes, specific functions for DHA in these tissues have not yet been defined. Here, we use a novel mouse model of selective DHA deficiency to investigate the role of DHA in the testis. Normal spermatid development depends on the establishment and maintenance of cell adhesion complexes which anchor spermatids to the epithelial tissue and allow for extensive morphological restructuring. Under DHA-deficient conditions, we show a failure of this cell adhesion process. Specifically, critical adhesion proteins expressed in spermatids, and their binding partners expressed in the supporting epithelial cells (Sertoli cells), fail to organize at, specifically, the sites of spermatid-Sertoli contact, and this protein mislocalization is associated with premature spermatid release from the testis. Interestingly, cytoskeletal structures known to support these adhesion complexes do initially localize properly but become delocalized as development proceeds. We conclude that DHA is critical for the assembly of certain adhesion complexes in the testes and may prove to have similar roles in other tissues where DHA is abundant.

Potato pulp as a dietary fiber source in high quality dog foods

Matthew R. Panasevich[1], R.N. Dilger[1,2], K.S. Swanson[1,2], L. Guérin-Deremaux[3], G.L. Lynch[4], G.C. Fahey, Jr.[1,2]
[1]Department of Animal Sciences, [2]Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, USA, [3]Roquette Fréres, Biology and Nutrition Department, Lestrem, France, [4]Roquette America, Inc., Geneva, IL, USA

Potato Pulp (PP) (Roquette Frères, France) was evaluated for chemical composition and *in vivo* responses. Ten female dogs with hound bloodlines (5.4 ± 0.0 yr; 22 ± 2.1 kg) were each provided 5 diets with graded levels (0, 1.5, 3, 4.5, or 6%; added in place of cellulose) of PP in a replicated 5 x 5 Latin square design. Fresh fecal samples were collected to measure fecal pH and fermentation end-products. Chemical composition results revealed that raw and cooked PP contained 55% total dietary fiber (TDF), with 32% insoluble fiber and 23% soluble fiber, as well as 4% crude protein (CP) and 2% acid-hydrolyzed fat (AHF). No differences were observed in total tract dry matter (DM), organic matter (OM), CP, AHF, or energy digestibilities of diets containing graded levels of PP. Total dietary fiber digestibility was greater ($P < 0.01$) for dogs fed the 3, 4.5, and 6% PP diets compared to dogs fed the 0% PP diet. Fecal pH was lower ($P < 0.01$) when dogs were fed the 4.5 and 6% PP diets compared to the 0% PP diet. Fecal acetate, propionate, and total SCFA were higher when dogs were fed the 3, 4.5, and 6% PP diets, and fecal butyrate was higher when dogs were fed 4.5 and 6% diets compared to the 0% PP diet ($P < 0.05$). Overall, linear increases ($P < 0.01$) were observed for all SCFA, with a concomitant linear decrease ($P < 0.01$) in fecal pH. Overall, this collectively shows that PP could be a high quality ingredient in dog foods.

Key markers associated with intestinal adaptation in pediatric short bowel syndrome

Jane K. Naberhuis, K.A. Tappenden
Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana IL

Administration of partial enteral nutrition (PEN) and trophic peptides, such as glucagon-like peptide-2 (GLP-2), are emerging strategies for stimulating structural and functional aspects of intestinal adaptation in individuals with intestinal failure. To investigate the temporal sequence of events associated with PEN and/or GLP-2-mediated intestinal adaptation following massive small bowel resection, neonatal piglets underwent an 80% jejunoileal resection (n=72) and were randomized to 1 of 4 treatment groups using a 2x2 factorial model with total parenteral nutrition (TPN) or TPN+PEN and placebo or GLP-2. Piglets were euthanized 4h, 48h or 7d after surgery and 93 variables of adaptation were analyzed by principal component analysis (PCA). Maximal variation was accounted for by small intestinal proliferation, apoptosis and crypt depth when all time points were pooled. The main factors accounting for variance shifted from crypt depth at 4h, to small intestinal nutrient transport and cellular proliferation at 48h. By d7, mucosal architecture, epithelial proliferation and nutrient transport accounted for maximal variation. These results indicate that structural markers of adaptations precede those of functional adaptation; however, crypt depth remains a strong indicator, regardless of time.

Abstracts

Oral Session 2

Testosterone alterations in tomato carotenoid-fed CMO1$^{-/-}$ mice may be due to impaired steroidogenesis but not reductions in testicular cholesterol availability

Joshua 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 Comprehensive Cancer Center, The Ohio State University, Columbus, OH*

Higher serum levels of lycopene (LYC) are inversely associated with prostate cancer incidence. We have previously demonstrated that, in mice lacking carotene-15,15′-monooxygenase (CMO1), dietary tomato powder (TP) and LYC reduce testicular and serum testosterone (T) levels. We hypothesized that these diets may reduce T output through modulation of testicular steroidogenesis or cholesterol homeostasis. Nine- to twelve-week-old male wild-type (WT), CMO1$^{-/-}$, and carotene-9′,10′-monooxygenase knockout (CMO2$^{-/-}$) mice were fed AIN-93G-based diets containing 10% TP, LYC beadlets, or controls for four days. We examined testicular mRNA and protein expression of canonical steroidogenic enzymes and found that regardless of diet, CMO1$^{-/-}$ mice had significantly lower mRNA levels of 17β-HSD3 ($p<0.01$), which converts androstenedione to T. We found no changes at other steps in steroidogenesis. Additionally, we found no significant changes in either SR-B1 mRNA expression or testicular cholesterol levels. Paradoxically, while mRNA levels were unchanged, HMG-CoA reductase protein was suppressed in LYC-fed WT animals, but induced in LYC-fed CMO1$^{-/-}$ animals (G*D $p=0.043$). It seems unlikely that alterations in testicular cholesterol homeostasis cause changes in T levels. Further work to explain these observations is under way, as well as work on prostatic mRNA expression of PPARγ- and androgen receptor targets.
(Support: NIH grant PHS-1-RO1 CA125384)

Biochemical and metabolomic effects of perinatal choline deficiency in the piglet

Caitlyn M. Getty[1,2,3], R.N. Dilger[1,2]
[1]*Department of Animal Sciences,* [2]*Division of Nutritional Sciences,* [3]*College of Veterinary Medicine, University of Illinois at Urbana-Champaign, Urbana, IL*

Choline plays an essential role in tissue development during gestation and early postnatal life, and the piglet (*Sus scrofa*) may serve as a translational animal model to study perinatal effects of choline deficiency. Our objective was to determine developmental changes in piglets exposed to differing levels of choline both prenatally and postnatally. A factorial arrangement of choline sufficient (CS; 50% above requirement) and choline deficient (CD; 50% below requirement) diets were provided during the prenatal (last 65 d of gestation) and postnatal (48 h after birth through 28 d of age) periods. An interactive effect of choline level and perinatal period was observed for body weight gain ($P < 0.001$), and prenatal CD piglets had smaller ($P = 0.014$) brains than prenatal CS piglets. Blood chemistry panels revealed generalized impairments in liver function in postnatal CD piglets. Overall, metabolomic analysis identified 276 biochemicals and revealed that choline deficiency in the pre- and postnatal periods altered plasma levels of metabolites related to choline biosynthesis, glycolysis, and lipid metabolism. Additionally, interactive effects were noted for glycolytic intermediates, carnitine-related metabolites, and many choline-containing lysolipids. We conclude that the piglet is a sensitive animal model for

studying developmental aspects of perinatal choline deficiency. *(Support: U.S. Department of Agriculture Hatch Project ILLU-538-319)*

Clostridium cluster IV abundance is inversely related to BMI in young Caucasian children

Anthony A. Wang, M. Wang, S.M. Donovan, M.D. Teran-Garcia
Division of Nutritional Sciences, University of Illinois, Urbana, IL

In 2010, 31.8% of children in the United States were considered overweight. Differences in the gut microbiota have been associated with obesity in mice and adult humans, but less is known about child obesity. The human distal gut is inhabited by two predominant phyla: *Bacteroidetes* and *Firmicutes.* Bacterial species within *Clostridium cluster IV* are members of the *Firmicutes* phyla and have been shown to play an important role in gut health as butyrate producers. The association between abundance of several bacterial types and obesity was studied in Caucasian children (4-7 yrs) recruited from the STRONG Kids Program. Quantitative RT-PCR was conducted on DNA extracted from fecal samples for *Clostridium cluster XIVa, Clostridium cluster IV, Lactobacillus, Bifidobacterium,* and *Bacteriodes-Prevotella*. Height and weight were measured to calculate BMI. When comparing overweight and obese (ow/ob, n=6) to lean (n=12) children, *Clostridium cluster IV* levels were found to be lower in ow/ob than lean individuals (9.9 ± 0.6 vs. 10.6 ± 0.3 log10 copies/g content, p=0.03). This relationship was also observed by stepwise regression where BMI was negatively associated with *Clostridium cluster IV* with sex as the only other variable included in the model (R^2=0.39, p=0.03). While these findings suggest a role for *Clostridium cluster IV* and BMI, the mechanism of this interaction and butyrate production remains to be elucidated.

Interactions between dietary flavonoids apigenin and luteolin and chemotherapeutic drugs in pancreatic cancer treatment

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

Resistance to chemotherapy is believed to be a major cause of treatment failure in pancreatic cancer. The objective was to assess the potential of apigenin and luteolin to increase the anticancer activity of chemotherapeutic drugs in BxPC-3 cells. Cells were pretreated for 24 h with apigenin or luteolin (15 µM) followed by the addition of a chemotherapeutic drug cisplatin (CIS, 10 µM), 5-fluorouracil (5-FU, 50 µM), gemcitabine (GEM, 10 µM) or oxaliplatin (OXA, 0.1 µM) for 36 h. In addition, the effects of adding either flavonoid (13, 25 or 50 µM) as pretreatment or at the same time as 5-FU or GEM was tested at a total treatment time of 60 h. Pretreatment of cells with apigenin (15 µM) significantly increased the anticancer activity of 5-FU, GEM and OXA with combination treatments causing 56, 64 and 63% inhibition, respectively. Luteolin (15µM) pretreatment caused 54, 65 and 54% inhibition when combined with 5-FU, GEM or OXA, respectively. Neither flavonoid at 15 µM led to a significant increase in cisplatin activity. High flavonoid pretreatment concentrations (25 and 50 µM) as well as simultaneous treatment of flavonoids with chemotherapeutic drugs caused a less-than-additive effect in the anticancer activity of 5-FU or GEM. These results suggest that pretreatment of pancreatic cancer cells with low concentrations of flavonoids effectively aid in the anticancer activity of the chemotherapeutic drugs 5-FU, GEM and OXA.

Abstracts

Graduate Student Poster Session

Impact of computer-mediated nutrition education interventions in adolescents: A systematic review

Whitney N. Ajie, K. Chapman-Novakofski
Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Objectives were to assess web/computer-based interventions' effectiveness for adolescents (11-18y); identify which intervention element(s) made the most impact on nutrition-related variables; and ascertain recommendations for research/practice. Online databases/journal archives were systematically searched using key words; related articles' bibliographies manually searched. One author examined abstracts for review inclusion; both authors conducted quality assessments using USDA's National Evidence Library's guidelines for Research Design/Implementation. Initial article retrieval (n=37488) was reduced to 14 using inclusion/exclusion criteria. Randomized controlled trials (RCTs) for preventing weight gain (*n*=2), weight loss (*n*=2) had NS results; RCTs (*n*=6), non-RCTs (*n*=4) for healthy eating (HE) included significant and NS results for HE components. Optimal intervention duration could not be concluded. Studies lacking behavior theory (*n*=6) had NS (*n*=3) and significant (*n*=3) results; those with behavior theory (*n*=8) had mostly significant results (*n*=7), some gender-specific (*n*=3). Neither setting nor parental involvement influenced outcomes. Research needs include studies with stronger design (randomization, power analyses, treatment fidelity, mediating variable measurements, long-term evaluation) in order to develop computer-based nutrition education best practices.

Prebiotic short chain fructooligosaccharides increase butyrate and are acutely associated with expression of short chain fatty acid transporters and receptors

Jennifer L. Barnes, G.C. Fahey, K.A. Tappenden
Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Butyrate, short chain fatty acid (SCFA) increases intestinal adaptation but the association with SCFA receptors and transporters in intestinal failure (IF) is unknown. We hypothesized that prebiotic supplementation would increase butyrate, FFAR2, FFAR3, MCT1 and SMCT1 mRNA in an IF piglet model. Neonatal piglets (n=87) underwent an 80% jejunoileal resection and placement of a jugular catheter. Piglets received 80% parenteral and 20% enteral nutrition (EN) for 1, 3 or 7 days (d). Control (con) received unsupplemented EN, prebiotic (pre) 10 g/L EN short chain fructooligosaccharides (scFOS), probiotic (pro) $1x10^9$ CFU LGG, and synbiotic (syn) received scFOS + LGG. SCFA, ileum and colon mRNA were analyzed as a randomized block design and considered significant at $p \leq 0.05$. Pre increased butyrate concentration vs. con independent of time (p=0.05), while other SCFA did not differ. Ileal FFAR2 and FFAR3 mRNA were greatest in the pre and pro group vs. con on d1 (p=0.01 and 0.01) while MCT1 and SMCT1 mRNA increased in all groups vs. con on d1 (p=0.01 and 0.01). By d7, pro was greater than pre and syn but similar to con for FFAR2 and FFAR3 in the ileum (p=0.03 and <0.01). Colon mRNA levels were not significantly impacted by treatment. This study shows that scFOS increases butyrate in a pediatric IF model and that SCFA receptors and transporters may be an acute signaling mechanism for intestinal adaptations.

Endocytic mechanisms of dietary RGD peptide lunasin in human macrophages

Anthony Cam,[1] E.G. de Mejia[1], M. Sivaguru[2]
[1]*Department of Food Science and Human Nutrition,* [2]*Institute for Genomic Biology, University of Illinois at Urbana-Champaign, Urbana, IL*

Diet influences risk factors associated with atherosclerosis, a major inflammatory vascular disease. Lunasin, a dietary peptide, contains a unique Arg-Gly-Asp cell adhesion motif and reduces inflammation. The objective was to determine the effect of lunasin on endocytic proteins and elucidate pathways involved in its internalization in human macrophages. Lunasin internalized within intracellular vesicles and localized within aggregations of clathrin coated structures but did not modulate the expression of clathrin at the cell membrane ($p < 0.05$). Lunasin increased recruitment of membrane adaptor caveolin-1 to the cell surface by up to 205% ($p < 0.05$). Brefeldin A, an inhibitor of protein trafficking, inhibited lunasin internalization by up to 99.8% ($p < 0.05$). Amantadine and amiloride, inhibitors of clathrin-mediated endocytosis and macropinocytosis, abolished lunasin cell entry ($p < 0.05$). Lunasin elicited a transient reduction in intracellular Ca^{2+}, a cation involved in integrin regulation. Therefore, lunasin endocytosis appears to be primarily mediated by mechanisms involving integrins, calcium signaling and clathrin-dependent endocytosis.

Ultrasound imaging to monitor prostate tumor progression and metastases in TRAMP mice

Lauren E. Conlon[1], K.E. Zuniga[1], E. Hartman[2], W.D. O'Brien Jr.[1,3], J.W. Erdman Jr.[1,4]
[1]*Division of Nutritional Sciences,* [2]*Beckman Biomedical Imaging Center,* [3]*Department of Electrical and Computer Engineering,* [4]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*

The Transgenic Adenocarcinoma of the Mouse Prostate (TRAMP) model develops and progresses through all stages of carcinogenesis including metastases. The development of high-resolution small animal ultrasound (US) technology allows us to obtain longitudinal 3-D volume calculations from 2-D images of the mouse prostate. The objective of this research is to utilize longitudinal US imaging to monitor prostate carcinogenesis and development of metastases in the TRAMP model. Beginning at 10 weeks of age, male C57BL/6 X FVB TRAMP mice (n=15) underwent US imaging every two weeks until 20 weeks of age. Prostate tumors were detected as early as 10 weeks of age. Average prostate tumor volume at 20 weeks of age was in excess of 2000 mm^3. In mice without tumors, average prostate volume at 10 weeks of age was 50 mm^3 and increased to 90 mm^3 at 20 weeks. US imaging allowed for the detection and growth of metastases to the regional pelvic lymph nodes. Small animal US technology has not yet been utilized to investigate the efficacy of anti-cancer therapies, including dietary interventions. At 8 weeks of age, TRAMP mice were randomly assigned to consume AIN-93G control (n=15) or 10% tomato powder diet until 20 weeks of age, and mice were imaged every two weeks. Through the use of non-invasive 3D US imaging of prostate growth and development of metastases, we are able to monitor and quantify treatment responses *in vivo* over time. (*Support: USDA Hatch grant #ILLU-971-348 and the UIUC Margin of Excellence Research Award*)

Predictors of Head Start and childcare providers' mealtime controlling feeding practices: An ecological approach

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

The childhood obesity epidemic is fuelled in part by controlling feeding practices that are also associated with unhealthy eating styles, diet and weight in children. A goal of this study was to identify predictors of child-care providers' controlling feeding practices using an ecological approach. In this cross-sectional study, 118 providers in licensed center-based child-care programs in Central Illinois completed self-administered surveys regarding their characteristics and feeding practices for 2-5 year old children. Multi-level multivariate linear regression was used to determine predictors. Provider controlling feeding practices (pressure to eat, restriction) were predicted by provider ethnicity, nutrition training, provider attitudes (e.g., perceived responsibility, concern about child weight, perceived dietary quality), and feeding style. Provider supportive feeding practices (modeling, and teaching children about nutrition) were predicted by provider feeding style and child-care contexts (Head Start [HS], Child and Adult Care Food Program [CACFP] and non-CACFP). Training should be developed to educate providers regarding negative aspects of controlling feeding practices. Possible reasons for HS policy-based contexts to predict supportive feeding practices may be attributed to HS Nutrition Performance Standards and increased nutrition training opportunities for HS staff.

Meal consisting of egg white protein yields higher satiety than an isocaloric wheat gluten protein meal

Kristy Du[1], S. Adams[2], J.L. Beverly[1,2]
[1]Division of Nutritional Sciences, [2]Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

Satiety is a primary factor influencing total food intake and high protein diets may produce greater satiation. We tested the composition of "breakfast" (BF), the first meal following an overnight fast, on the timing and size of a subsequent meal. Male Sprague-Dawley rats (n=24) were entrained to a meal-feeding schedule which included an overnight fast before being provided BF. For BF, rats were allowed 30 minutes to consume 20% of average daily intake of one of three isocaloric diets. The basal diet was 60:20:20 (carbohydrate:protein:fat, as % calories) with protein provided equally by egg white protein (EW) and wheat gluten protein (WG). The two remaining diets were 45:35:20 with protein from either EW or WG. In the first study, rats had access to basal diet 15 min after BF. Rats fed WG consumed more ($p<0.01$) than rats fed either basal or EW (6.8 ± 1.0 vs 4.8 ± 0.6 and 2.9 ± 0.4, respectively). In study two, rats were randomly assigned to freely choose between two of the three diets for 90 min following BF. The study was repeated until all rats experienced all 3 diet pairings. Across all choices, rats fed WG consumed more ($p<0.01$) than basal-fed rats (6.3 ± 0.6 vs 4.7 ± 0.3) while EW-fed rats consumed less ($p<0.05$; 3.2 ± 0.3). Animals consumed less ($p<0.01$) of the EW diet regardless of protein source. These results suggest that satiation from high protein diets is dependent upon the protein source with egg white protein being more satiating. (*Support: NIH and various donors*)

Physiological changes in a natural male bodybuilder during contest preparation: a case study

Peter J. Fitschen[1], B.M. Kistler[2], S. Ranadive[2], B. Fernhall[3], K.R. Wilund[1,2]
[1]Division of Nutritional Sciences, [2]Departemnt of Kinesiology and Community Health, University of Illinois at Urbana-Champaign, Urbana, IL, [3]College of Applied Health Sciences, University of Illinois at Chicago, Chicago, IL

The purpose of this study was to document the physiological changes that occur in a natural bodybuilder during a 28 week contest preparation. Food intake and exercise were quantified daily and the athlete was weighed twice a week following an overnight fast. Blood pressure, heart rate, pulse wave analysis and velocity, heart rate and blood pressure variability, and arterial and cardiac ultrasound were measured every 2 weeks. Body composition was measured monthly. VO2 max was measured at 0, 13, and 26 weeks. Linear regression was performed for all variables over time. Body weight was reduced from 195.0 to 158.8lbs, lean mass from 75.2 to 68.6 kg, and fat mass from 15.9 to 5.4 kg resulting in a reduction in body fat percentage from 17.4 to 7.4% ($p<0.0001$ for all). Mean arterial pressure was reduced from 83.3 to 73.7 mm Hg ($p=0.0048$).Peripheral pulse wave velocity ($p=0.0027$) and augmentation index ($p=0.0022$) were significantly reduced. Resting heart rate was reduced from 71 bpm to 44 bpm ($p=0.0046$). Assessment of heart rate variability found a significant shift towards parasympathetic dominance ($p=0.0014$). Relative VO2 was increased from 41.9 to 47.8 mL/kg. No significant changes were observed in any other variable measured. In general, bodybuilding contest preparation led to positive changes in both cardiovascular health and body composition. Prolonged contest preparation appears to be safe in natural male bodybuilders.

Metabolomic profiling of the small for gestational age piglet

Caitlyn M. Getty[1,2,3], A.A. Baratta[1], R.N. Dilger[1,2]
[1]Department of Animal Sciences, [2]Division of Nutritional Sciences, [3]College of Veterinary Medicine, University of Illinois at Urbana-Champaign, Urbana, IL

Human infants born small for their gestational age (SGA), as associated with intrauterine growth restriction, are at increased risk of morbidity and mortality during early life and beyond. As an animal model, the domestic piglet (*Sus scrofa*) provides many benefits for studying developmental aspects of the SGA condition. Our objective was to assess global metabolomic profiles of SGA (≤ 0.9kg body weight) and average for gestational age (AGA, 1.3-1.5kg body weight) piglets. Piglets were selected in littermate pairs, weighed daily to assess growth rate, and blood was collected at 15-17 days of age; piglets remained with their mother throughout the study. Following stringent quality assurance procedures on multiple analytical platforms, a total of 323 named biochemicals were identified in plasma samples, with significant effects noted in metabolic pathways involving energy (i.e., TCA cycle), amino acids, nucleotides, and fatty acids. Most notably, de novo synthesis of nicotinamide derivatives was higher ($P < 0.05$) in SGA piglets, suggesting a deficiency in cofactors important for energy metabolism and biosynthetic reactions. Moreover, changes in glucose metabolism suggested the ability to extract energy from dietary sources may have been compromised in the SGA piglet. We conclude that a significant reduction in the growth potential of SGA piglets is associated with perturbations in multiple metabolic pathways. (*Support: ACES James Scholar Honors Program, College of ACES, University of Illinois at Urbana-Champaign)*

Citrus and berry flavonoids inhibit dipeptidyl peptidase-IV enzymatic activity by binding to the catalytic site

J. Fan[1], **Michelle Johnson**[2], E.G. de Mejia[2]
[1]Food Science, Beijing Forestry University, Haidian, Beijing, China, People's Republic of, [2]Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

We investigated 25 citrus and berry flavonoids on inhibition of DPP-IV, contributing to decrease glucose absorption. Hesperetin, nobiletin, tangeretin, cyanidin, petunidin, genistein and EGCG could bind to DPP-IV active sites. Binding energies (kcal/mol), hesperetin (-5.8), nobiletin (-5.7), petunidin (-5.1) and tangeretin (-4.9) were lower than diprotin A (-4.8), indicating more potency in inhibiting DPP-IV. This was attributed to H bonds between hydroxyl groups on flavone aromatic rings and amino acid residues in the enzyme, and ð-interactions of flavonoids aromatic ring B and DPP-IV arg125, phe357 and arg669. Aglycone flavonoids (luteolin, apigenin, quercetin, kaempferol, flavone, naringenin, catechin, gallocatechin, epicatechin) and glycosylated flavonoids (cyanidin-3-glucoside, delphinidin-3-glucoside, dephinidin-3-arabinoside, malvinidin-3-galactoside, malvinidin-3-arabinoside) could bind their aromatic B-ring to DPP-IV active sites, inhibiting its activity. Flavonoinds with disaccharides (naringin, rutin and narirutin) could not bind DPP-IV due to unfavorable sugars steric obstacle. Biochemical kinetics showed blueberry and blackberry anthocyanins effectively reduced DPP-IV activity (IC50 4.0 M C3G), comparable to the known inhibitor (IC50 4.3 mg/mL). Citrus and berry flavonoids can bind DPP-IV active pockets with potential as antidiabetes therapy. (*Support: USDA)*

Individual genetic variations (IGV) of β,β-carotene monooxygenase-1 (BCMO1) are associated with changes in total cholesterol in young Mexican adults

Courtney Marques[1], M.D. Teran-Garcia[2], J.W. Erdman, Jr.[1,2], J.M. Vargas Morales[3], C. Aradillas-Garcia[4], UPAMIGOS Group[2]
[1]Division of Nutritional Sciences, [2]Food Science and Human Nutrition, 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

Retinoids are key in facilitating many physiological functions, including lipid metabolism, and are typically formed from the cleavage of β,β-carotene by BCMO1. Recently, an IGV in the BCMO1 gene (SNP, rs10048138) was associated with cholesterol levels in a U. S. cohort; however, there are no replicates in the Mexican population. Our objective was to examine the association of this BCMO1 marker with cholesterol levels, a risk factor for metabolic disease, in college-age individuals from the UPAMIGOS cohort. UP-AMIGOS is a multidisciplinary project on genetics, obesity, and social environment between the Universities of San Luis Potosi (San Luis Potosi, Mexico) and Illinois. For this cross-sectional study genotype, health and nutrition data from 72 participants (aged 18-21 years) was analyzed. Homozygotes for the minor allele of BCMO1-rs10048138 had lower cholesterol (137.4±9.8 mg/dL) compared to the other genotypes (158.1±2.7 and 157.6±4.0 mg/dL) adjusted for sex and age ($p<0.04$). Our analyses show that genetic variability in BCMO1 was associated with cholesterol levels and may prove to influence risk for metabolic disease; this association was strengthened ($p<0.02$) when considering smoking.

Head Start and child care teachers' perceived facilitators and barriers to meeting the Academy of Nutrition and Dietetics (The Academy): Benchmarks for nutrition in child-care (2011)

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

The Academy recommends feeding practices for child-care providers to establish nutrition habits in early childhood to prevent obesity. With over 12 million US children in child-care, little is known about child-care providers' feeding practices. The objective of this study was to determine child-care providers' facilitators and barriers regarding the Academy's benchmarks, and to explore possible variations in providers' perceptions across child-care contexts (Head Start [HS], Child and Adult Care Food Program [CACFP] and non-CACFP) using mixed methods. We collected cross-sectional data from 118 child-care providers who completed self-administered surveys regarding their feeding practices for 2-5-year-old children. We found that HS providers significantly met the Academy's benchmarks compared to CACFP and non-CACFP providers. E.g. HS providers served meals family style ($P<0.0001$), modeled healthy eating ($P<0.001$), and taught children about nutrition ($P<0.001$) compared to CACFP and non-CACFP providers. We then interviewed 18 child-care providers across contexts using maximum variation sampling and found that HS providers reported more enablers and CACFP and non-CACFP providers reported more barriers to meeting benchmarks. Possible reasons may be attributed to HS Performance Standards for child nutrition and increased nutrition training and education opportunities for HS staff and children.

Hypoglycemia increases glycolytic metabolism in the rat ventromedial hypothalamus (VMH)

Jonathan G. Mun[1], A. Cooper[2], J. Cavaretta[2], J.L. Beverly[1,2]
[1]*Nutritional Sciences,* [2]*Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL*

The VMH is a critical brain-area involved in energy sensing and responsible for initiating the counter regulatory response (CRR) during hypoglycemia. We hypothesize local metabolic changes following hypoglycemia contribute to hypoglycemia-associated autonomic failure (HAAF), an impairment of the CRR. VMH and CA1 hippocampus (HPC) were collected from rats (n=30) 6 hours following a single episode of insulin-induced hypoglycemia (IIH) (acute hypoglycemia; AH), 24 h following the third of 3 recurrent episodes of IIH (recurrent hypoglycemia; RH), or saline-treated euglycemia (control; SC). Tissue samples were randomly pooled before methanol extraction and analysis by GC/MS and LC/MS/MS. 180 metabolites were identified and quantified. In the VMH lactate, tricarboxylic acid (TCA) cycle intermediates (citrate, cis-aconitate, and malate), and phospholipid metabolism products (glycerol and glycerol-3-phosphate) were increased ($p\leq0.05$) 6 h following AH, but were not significantly different 24 h after RH. These changes were not observed in HPC following IIH. RNA sequencing analysis showed a 0.9, 0.2, and 0.1 fold-increase in glycerol-3-phosphate dehydrogenase, GLUT1, and 2-oxoglutarate dehydrogenase gene expression, respectively ($p\leq0.01$), in the VMH 24 h after RH. It is unclear at this time whether the hypoglycemia-induced changes in carbohydrate and lipid metabolism in the VMH contribute to HAAF. *(Support: DK082609)*

Prevalence of food allergies (FA) and asthma and associated risk factors in the STRONG Kids Program (SKP)

Katie N. Paige, M.D. Teran-Garcia, S.M. Donovan
Division of Nutritional Sciences and the STRONG Kids Research Program, University of Illinois at Urbana-Champaign, IL

FA are most prevalent in children under age five and are linked to family history, ethnicity, early-life feeding practices, absence of breastfeeding and presence of other atopic diseases, including asthma. χ^2 tests were used to compare risk factors in children (ages 3-5) with and without FA enrolled in SKP, a longitudinal study of childhood obesity and health within an ecological framework. In the SKP cohort (n=423), 12% of kids had FA or sensitivity and 8.5% were diagnosed with asthma. Gender, weight status and ethnicity were not associated with risk of allergy. Children with FA were three-times more likely to have asthma (95% CI 1.48-7.29, p=0.003) and other chronic diseases (95% CI 1.95-6.81, p<0.0001). Peanut, fruit, cow's milk, and other nut allergies were the most common food allergies reported in the SKP cohort (4.3%, 3.0%, 3.0%, and 2.1% respectively). Family history of FA was associated with allergy occurrence in children (p<0.0001). Family history, asthma and other chronic conditions were risk factors for FA in SKP participants. *(Support: USDA 2011-67001-30101)*

The effects of signposting nutrition information using a graphical interpretation of nutrients on consumer purchasing behavior in an a la carte cafeteria setting

Nathan S. Pratt[1], B. Ellison[2], M.T. Nakamura[1]
[1]*Division of Nutritional Sciences,* [2]*Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, IL*

It is challenging to effectively deliver nutrient information to consumers in a way that promotes healthy choices. The 4 Nutrient Profiling System (4NPS) interprets fiber, protein, saturated fat, and sodium content of foods per calorie relative to dietary recommendations to promote formation of meals and diets that reduce the risk of overeating and chronic disease. The aim of this study was to determine if visually summarizing nutrition information was more effective than the traditional presentation of nutrition information using nutrition facts panels (NFP) in shifting consumer purchases toward healthier items. The study was divided into four three-week blocks: baseline, nutrition signposting using NFP, washout, and nutrition signposting using the 4NPS. Signposting was present immediately prior to the point of sale to all patrons passing through the cafeteria line. During the third week of each condition, sales receipts were collected from patrons and attached to surveys measuring demographics, health consciousness, and purchase characteristics (n=696). Signposting information using the 4NPS showed a decrease in calories sold and an increase in protein per calorie sold per receipt relative to the NFP and no label conditions. Visual summaries of nutrition information may be more effective at changing consumer behavior than a numerical presentation in time constrained settings.

Development of a piglet model of neonatal systemic *Staphylococcus aureus* infection.

Elizabeth A. Reznikov[1], J.L. Hoeflinger[2], M.H. Monaco[2], M.J. Miller[1,2], S.M. Donovan[1,2]
[1]*Division of Nutritional Sciences,* [2]*Department of Food Science & Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*

Staphylococcus aureus (*S. aureus*) is a primary cause of death due to sepsis in neonatal intensive care units. Fatal sepsis is characterized by systemic inflammatory response syndrome (SIRS), leading to systemic inflammation and organ dysfunction. Herein, a clinically-relevant piglet model of SIRS secondary to *S. aureus* infection was developed. Colostrum-deprived pigs had umbilical catheters placed within 12h of birth and were fed sow's milk replacer formula. On d7, piglets were either non-infected (n=2) or injected IV with 1ml/kg BW S. *aureus* (strain S54F9) at 10^3(low; n=3) or 10^5(high; n=3) CFU/ml. Blood was repeatedly sampled from the catheter to follow the course of cytokine response and piglets were euthanized 10-14d post-infection. Most infected animals developed a transient fever (>103.5°F) post-infection. Infected animals had elevated WBC count and percentage of neutrophils, characteristic of SIRS. *S. aureus* was detected in the spleen (n=5), kidney (n=3), lung (n=3) and heart (n=2) of infected animals and high-dose pigs developed rear limb septic arthritis confirmed by culture. Serum cytokine responses were variable; however, IL-10 was highest in the first 24 h post-infection, whereas IL-6 peaked between 72-96 h post-infection. In conclusion, we have established a piglet model of systemic *S. aureus* infection that can be used to investigate therapeutic nutritional interventions.

Contrast ultrasound imaging of the aorta does not affect progression of atherosclerosis in ApoE$^{-/-}$ mice

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

Ultrasound Contrast Agents (UCAs) are used clinically to enhance ultrasound imaging of the cardiovascular system. Adverse biological effects have been noted after administration of UCAs, and more research is needed for an understanding of the biological effects of UCAs. Male ApoE$^{-/-}$ mice (8 weeks old, n=38) were intravenously infused with the Definity® UCA ($2x10^{10}$ UCA/hr) and either exposed to 2.8-MHz 10-Hz PRF 1.4-μs PD 2-min ED 1.4-MPa PRPA ultrasound or sham exposed, and then consumed either a chow or Western diet for either 4 or 8 weeks after ultrasound exposure (n=4-5 per group). Plasma total cholesterol was greater in the Western diet group than the chow group for all timepoints after baseline ($p<0.0001$). Plasma von Willebrand Factor (vWF), a biomarker of endothelial function, was elevated in Western diet animals compared to chow animals ($p<0.05$). Atheroma thickness was greater in animals consuming the Western diet than in chow-fed animals ($p<0.001$), and in animals euthanized after 8 weeks than after 4 weeks ($p<0.005$). Ultrasound did not affect plasma total cholesterol levels, plasma vWF or atheroma thickness. (Support: NIH R37EB002641)

Development of a point-of-use, iron fortification technology of nixtamalized corn masa for rural communities in Central America

Pablo C. Torres-Aguilar[1], C. Chen[2], B. Jacobson[2], Y. Lee[2], J. Andrade[1,2]
[1]*Division of Nutritional Sciences,* [2]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*

Iron deficiency anemia (IDA) is major health concern. Fortification of nixtamalized corn (NC) for tortillas at the point of wet grinding could be an effective strategy against IDA in rural Central America. Process of making iron containing extruded pellets (IEP) and their addition to NC is presented. IEPs will be added to NC previous to grinding at local milling facilities. Welly Puffing extruder set at a feed rate of 60 g/min was used to create brown rice:corn grits (1:1, w/w) pellets. Two chelated Fe sources were evaluated, ferric NaEDTA (FeNaEDTA) and ferrous bisglycinate (FeBG). Fe solutions were pumped (2 mL/min) to target levels, 0.4 mg/g or 1 mg/g pellet, respectively. Process stability was evaluated from 0.5 to 19 min from Fe addition. IEPs were added to NC at different amounts,12.5, 25, 50 g pellet/ kg NC, resulting in target levels of 8.2, 16.3 and 32.6 (FeBG) and 3.9, 7.8 15.65 (FeNaEDTA) mg Fe/kg of masa. Fe recoveries in IEPs upon processing were 78.3±5% and 65.3±3.8 % for FeNaEDTA and FeBG, respectively; with homogenous distribution for both iron sources after 14 min of processing (Brown and Forsythe P>0.1). IEPs dimensions (l×ø) from both sources were similar, 16.7±1.1 × 11.4±0.9 mm. Fe source changed color in pellets, but it did not affect masa color. Iron distributed well in NC masa fortified with both EIPs. Our technology shows the feasibility of Fe fortification at the point of NC grinding using extruded materials.

Sulforaphane activates a protective Nrf2 response and reduces inflammatory markers in microglia cells

Brigitte E. Townsend[1], S. Jang[2], R.W. Johnson[1]
[1]*Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL*
[2]*USDA Beltsville Human Nutrition Research Center, Beltsville, MD*

Cells exposed to oxidative stress require intrinsic mechanisms to abrogate harmful effects of un-neutralized reactive oxygen species. Nrf2 is a primary transcription factor involved in detoxification. Induction of antioxidant response element (ARE) genes heme oxygenase (HO1), glutathione-S-transferase (GSTA), and NAD(P)H quinine oxidoreductase (NQO1) is directly mediated through Nrf2 activation. While Nrf2 has been broadly studied, data characterizing its role in the central nervous system, particularly in microglia, is limited. In this study, BV2 cells were treated with sulforaphane (SFN) to test its effect on activation of Nrf2. SFN treatment increased mRNA expression of HO1, GSTA, and NQO1. In order to determine if the protective effects of Nrf2 activation could reverse inflammatory characteristics of toxin-activated microglia, BV2 cells were treated with LPS. Cells responded to LPS with significantly increased expression of inflammatory genes. Pre-treatment with SFN upregulated ARE genes while down-regulating the increase in inflammatory cytokines IL-6, IL-1β, TNFα, and iNOS caused by LPS. Additionally, SFN negated increased nitric oxide production induced by LPS. Changes in the Nrf2 signaling pathway in microglia may be implicated in cognitive decline associated with an aging inflammatory state. This work paves the way for future studies *in vivo.*

454 pyrosequencing reveals a shift in the fecal microbial community composition of genetically identical co-housed pigs fed different diets

Fang Yang[1,2], N. Chia[2,3], L.B. Schook[1,2,4], B.A. White[1,2,4]
[1]Division of Nutritional Sciences, [2]Institute for Genomic Biology, [4]Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, [3]Department of Surgical Research and Health Sciences Research, Mayo Clinic, Rochester, MN

The impact of diet on the microbial composition in the gastrointestinal tract has been well documented. However, quantifying the role of diet in shaping microbial composition has been difficult due to the presence of factors such as host genetics and environment. We seek to establish a system for isolating diet-induced changes in the microbiome. The fecal microbiomes of two genetically identical co-housed pigs were evaluated when fed diets containing either soybean hulls or wheat bran for 14-days. The fecal microbial community was characterized using high-throughput 16S hypervariable tag sequencing. Shifts in the fecal microbial community composition were assessed with respect to dietary correlations. Similarity analysis revealed that the gut microbiomes from the two different diets clustered separately. Taxa-based approaches detected significantly different bacteria composition in two different diets. Diversity analysis showed that bacterial diversity was higher in the wheat bran group than that in the soybean hull group. To conclude, the impact of diet on gut microbiome composition was isolated from host genetics and environment. Diet-induced changes in gut microbiome composition were observed. Our results show that genetically identical pigs can be used as a model system for assessing the influence of diet and other variables on the composition of the gut microbial community.

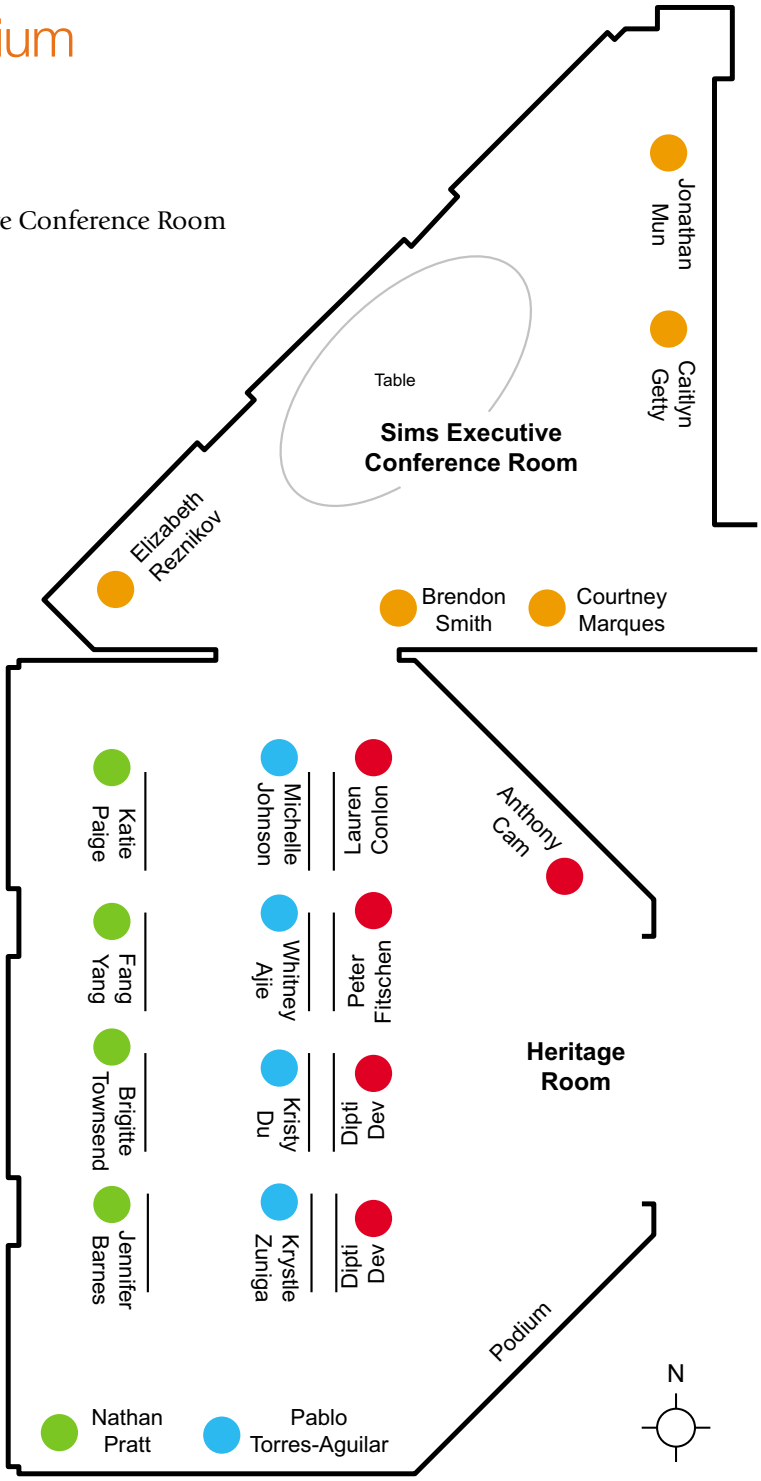
The interaction of tomato powder and soy germ on prostate carcinogenesis in the TRAMP model

Krystle E. Zuniga[1], S.K. Clinton[2], J.W. Erdman, Jr.[1]
[1]Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, [2]Division of Medical Oncology, The Ohio State University, Columbus, OH

The interactions between bioactive rich food components within a complex human diet for the inhibition of prostate carcinogenesis (PCa) are largely unknown and difficult to quantify in humans. The objective of this study was to determine the efficacy of dietary tomato and soy germ, alone and in combination, for the inhibition of prostate carcinogenesis in the transgenic adenocarcinoma of the mouse prostate (TRAMP) model. At 4 weeks of age, male TRAMP mice (n=119) were randomized to consume: AIN-93G control, 10% whole tomato powder (TP), 2% soy germ powder (SG) or 10% tomato powder with 2% soy germ (TP+SG) for 14 weeks. 100% of mice fed the control diet had PCa, while PCa incidence was significantly lower in mice consuming TP (61%, $p<0.001$), SG (66%, $p<0.001$) and TP+SG (45%, $p<0.001$). TP, SG and TP+SG increased apoptotic index (AI) and modestly reduced the proliferative index (PI) in the prostate epithelium of TRAMP mice exhibiting primarily prostatic intraepithelial neoplasia. The dramatic reduction in the PI/AI ratio by the dietary interventions suggests that the control mice experience a stronger stimulus for malignant progression in the prostate microenvironment. Maximally effective and safe strategies for PCa prevention may result from optimizing combinations of nutrients and bioactives through an orchestration of dietary patterns. *(Support: NIH 1 F31 CA153804-01A1 and PHS-1-R01 CA125384)*

Nutrition Symposium Poster Session

ACES Library, 1st Floor
Heritage Room and Sims Executive Conference Room
Wednesday, April 17, 2013
5:15 p.m. – 6:40 p.m.



Poster Judges

Green Team
Dr. Ferguson (captain)
Dr. Engelmann Moran
Dr. Holscher

Blue Team
Dr. Freund (captain)
Dr. Alexander
Dr. Hoenig

Red Team
Dr. Teran-Garcia (captain)
Dr. Khan
Dr. Strakovsky

Orange Team
Dr. Korban (captain)
Dr. Dia
Dr. Radlowski

Presenting Author Index

Winners of the 2012 University of Illinois Nutrition Symposium poster and oral competitions with keynote speaker, Dr. James Hill.