University of Illinois at Urbana-Champaign
Division of Nutritional Sciences

2014 NUTRITION SYMPOSIUM

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

APRIL 23, 2014

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 2014 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. David Levitsky deliver the keynote address, "The Weigh to Control Body Weight: the Only Way." Given that obesity is a problem in the United States, Dr. Levitsky will discuss the responsibilities that lie with the individual regarding maintaining a healthy body weight. He will also discuss regular self-weighing as a tool to combat the slow, but persistent gain in body weight over time.

Additionally, NSGSA is proud to highlight the work of world-class faculty members through a mini-symposium. This year's presentations address nutrition, cognition, and exercise and will feature Drs. Rodney Johnson, Jeffrey Woods, Neal Cohen, and Justin Rhodes.

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

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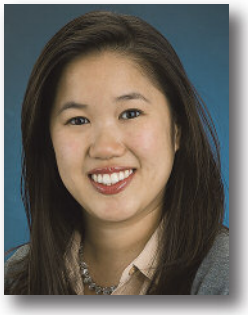

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Schedule of Events

APRIL 23, 2014

***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. – 10:15 a.m. .....Graduate Student Oral Presentations 1**
Monsanto Room, ACES Library

9:15 a.m. Lauren Conlon

9:30 a.m. Trisha Gibbons

9:45 a.m. Katie Paige

10:00 a.m. Joshua Smith

10:15 a.m. – 10:30 a.m. .....Break

***10:30 a.m. – 11:30 a.m. ....Graduate Student Oral Presentations 2**
Monsanto Room, ACES Library

10:30 a.m. Allyson Bower

10:45 a.m. Reeba Jacob

11:00 a.m. Matthew Panasevich

11:15 a.m. Brigitte Townsend

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. – 12:45 p.m......**Break**

***12:45 p.m. – 2:45 p.m.**.....**Faculty Mini-Symposium**
Monsanto Room, ACES Library

"Nutrition, Cognition, and Exercise: Connecting the Themes"

12:45 p.m. Dr. Rodney Johnson:
Developmental origins of changes in stress resilience or vulnerability

1:15 p.m. Dr. Jeffrey Woods:
Exercise and targeted dietary supplementation as a means of improving cognition in the aged

1:45 p.m. Dr. Neal Cohen:
Effects of exercise, fitness, and nutrition on the hippocampus and relational memory

2:15 p.m. Dr. Justin Rhodes:
Modulation of new neurons in the hippocampus from diet and exercise

2:45 p.m. – 4:00 p.m......**Break**

***4:00 p.m. – 5:00 p.m.**.....**Keynote Address by Dr. David Levitsky, Cornell University**
180 Bevier Hall

"The Weigh to Control Body Weight: the Only Way"

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*

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Nutritional Sciences Graduate Student Association

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

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Keynote Speaker: Dr. David Levitsky

Dr. Levitsky first came to Nutrition at Cornell University in 1968 as a NIH postdoctoral fellow after obtaining a Ph.D. from Rutgers University in Experimental Psychology. He is currently a Full Professor in the Division of Nutritional Sciences and the Department of Psychology. The focus of his research has always been energy balance and the control of body weight. He has published more than 200 articles in refereed scientific journals and has won several teaching awards including becoming a Weiss Presidential Fellow (the highest teaching awarded at Cornell), the New York State Chancellor's Award, the Innovative Teaching Award (College of Agriculture and Life Sciences, Cornell University), USDA Excellence in College and University Teaching Awards, and the Excellence in Nutrition Education Award by the American Society for Nutrition (ASN).

"The Weigh to Control Body Weight: the Only Way"

We know that the most powerful determinants of how much we eat emanate not from our bodies but rather from our environment. Who is responsible for protecting us against those environmental stimuli is a long standing debate in public health nutrition. Is it the government, the food industry, or the individual? I shall argue that neither the food companies nor the government should be held responsible. Food companies will do nothing effective because it is against their self-interest to do so and government can't because of the powerful influence the food companies have on our government. Thus, the onus to resist weight gain must lie with the individual. But the individual cannot do it alone, but requires tools to help them combat all the environmental stimuli that seduce them to eat slightly more energy than they require. That tool is the bathroom scale. I will argue that regular self-weighing is the only mechanism proven to be effective in shielding us from the environmental stimuli that cause that slow, but persistent, gain in body weight.

Dr. Levitsky's Keynote Address
4:00 – 5:00 p.m.
180 Bevier Hall

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Graduate Student Oral Presentations Session 1

9:15 a.m. - 10:15 a.m.
Monsanto Room, ACES Library

Graduate Student Oral Presentations Session 2

10:30 a.m. – 11:30 a.m.
Monsanto Room, ACES Library

Faculty Mini-Symposium: Nutrition, Cognition, and Exercise: Connecting the Themes

12:45 p.m. – 2:45 p.m.
Monsanto Room, ACES Library

Graduate Student Poster Session

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

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Abstracts

Graduate Student Oral Presentations Session 1

Soy germ for the prevention of prostate carcinogenesis in TRAMP mice

Lauren E. Conlon[1], 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*

Prostate cancer (PCa) is the most commonly diagnosed cancer and second leading cause of cancer deaths in United States men. Soy germ has higher levels of daidzein and glycitein, and lower amounts of genistein compared to typical soy products. Genistein has been well studied, but less is known about daidzein and its microbially-produced metabolite, (-) equol, in PCa development. The objective of this research is to investigate the effect of feeding 2% soy germ, daidzein, or (-) equol on the progression of PCa in the transgenic adenocarcinoma of the mouse prostate (TRAMP) model. 3-week old male C57BL/6 X FVB TRAMP mice were weaned from our breeding colony and immediately acclimated to a custom AIN-93G control diet for one week. At 4 weeks of age, mice (n=30 per diet group) were randomized to one of four study diets, AIN-93G control, AIN-93G + 2% soy germ, AIN-93G + 92 ppm daidzein, or AIN-93G + 88 ppm (-) equol until 18 weeks of age. Levels of daidzein and (-) equol were matched to daidzein equivalents found in a 2% soy germ diet. Preliminary data shows no differences in food intake or body weight between the groups. Further analyses to be completed include prostate pathology scores, serum inflammatory markers, and epigenetic changes in prostate tissue. At the conclusion of this study, we will determine if a previously observed protective effect of soy germ is associated with the daidzein component or the daidzein metabolite, (-) equol. *[Support: NIH P50 AT006268]*

Diet, exercise, neurogenesis and cognition

Trisha E. Gibbons, B.D. Pence, T.K. Bhattacharya, H.C. Mach, J.M. Ossyra, R.H. McCusker, K.W. Kelley, J.S. Rhodes, R.W. Johnson and J.A. Woods.
University of Illinois at Urbana-Champaign, Urbana, IL

Aging is associated with a decline in cognition in humans and rodents. Recently, these changes have been linked with decreased hippocampal neurogenesis. Physical exercise increases neurogenesis and reverses some of the cognitive deficits in elderly subjects, but the extent to which dietary supplementation may interact with physical exercise is unknown. Green tea contains high levels of epigallocatechin gallate (EGCG) that reduces age-related cognitive decline. Similarly, β-alanine (β-Ala) may be beneficial against cognitive aging. We tested the hypothesis that exercise (voluntary wheel running) and dietary supplementation with EGCG (1.5mg/g) and β-Ala (3.4 mg/g) would interact to improve cognition of aged mice. Balb/c mice (17 mo) served as sedentary controls or were provided access to running wheels for 4 weeks with or without EGCG + β-Ala. The Morris water maze (MWM) and contextual fear conditioning (CFC) were used to assess learning and memory. Hippocampal neurogenesis was assessed by labeling new neurons with BrdU. Exercise improved cognition with increased platform crossings in the MWM and increased time spent frozen during CFC. Exercise also increased BDNF expression and diminished microglial activation in the hippocampus. Dietary supplementation did not affect any measurement. Collectively, these data verify that exercise has positive effects on neurogenesis and cognition of aged mice. [*Support: Abbott Nutrition to JAW]*

A role for BCMO1 beyond carotenoid metabolism: regulation of androgen status and signaling

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

In human studies, higher serum lycopene (Lyc) levels are inversely associated with risk of prostate cancer (PCa), which is driven by androgens. Genomic alterations in carotene-15,15′-monooxygenase (*BCMO1*), which cleaves provitamin A carotenoids to yield retinal, have been shown to alter Lyc accumulation. We hypothesized that Lyc and tomato powder (TP) feeding may impact the prostate by altering testosterone (T) action and that BCMO1 may modulate this process. Nine- to fourteen-week-old male WT and *Bcmo1*$^{-/-}$ mice were fed AIN-93G-based control or diets containing TP or Lyc for four days. Surprisingly, we found that independent of Lyc or TP feeding, loss of *Bcmo1* decreased testicular esterified cholesterol ($p<0.05$) and testicular mRNA expression of 17 β-hydroxysteroid dehydrogenase 3 ($p<0.001$), which converts androstenedione to T. In parallel, *Bcmo1*$^{-/-}$ mice show reduced serum T and reduced androgen receptor-mediated gene expression in the prostate. Regardless of diet, the weight of the prostate and the seminal vesicles was correlated ($R^2=0.12$, $p=0.0015$, and $R^2=0.33$, $p<0.0001$, respectively) with logarithmic concentrations of serum T, in agreement with published androgen-driven growth kinetics. In summary, BCMO1 seems to play a significant role in androgen and prostate physiology independent of its function in carotenoid metabolism, highlighting a potential role in PCa. *[Support: NIH grant PHS-1-RO1 CA125384]*

Accuracy of food guide and nutrition label use by caretakers in the STRONG Kids cohort

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

Childhood obesity rates have risen dramatically in recent decades, compelling researchers to analyze the changing environment surrounding this weight gain. Our goal was to assess parents' knowledge of food guides and nutrition labels. Parents (n=407) of preschoolers (age 3-5) reported that moms and grandparents were primarily responsible for selecting meals. Overweight parents had 1.86-times higher odds of having overweight children (95% CI 1.15-2.99, $p=0.01$). Parents of children who were overweight (>85th BMI percentile) had a higher average BMI than parents of children who were normal weight (29.6 vs. 26.6 kg/m^2; $p=0.0001$). Parents' ability to choose healthy foods may be limited by the way nutrition information is presented. On a nutrition fact label, 35% of parents were unable to correctly complete calculations necessary to interpret nutrition facts. Although 56% of parents attained a Bachelor's degree or higher, only 32.2% could identify the current USDA food guide. Older and less-educated parents were more likely to choose an incorrect or outdated food guide ($p\leq0.05$). The release of multiple food guides in recent decades may have led to consumer confusion. Parent inability to identify current guidelines and interpret nutrition labels suggests poor dissemination of these tools. Clinical settings and grocery stores may serve as opportunities for continued education. *[Support: USDA (Hatch 793-328), I-CAR, and NIFA (2011-67001-30101)]*

Abstracts

Graduate Student Oral Presentations Session 2

Compounds from rosemary and Mexican oregano are natural inhibitors of dipeptidyl peptidase-IV, a target of type-2 diabetes therapy

Allyson M. Bower[1], L.M.R. Hernandez[2], M.A. Berhow[3], E.G. de Mejia[1]
[1]*Division of Nutritional Sciences,*
[2]*Department of Food Science and Human Nutrition, University of Illinois at Urbana-Champaign, Urbana, IL*
[3]*United States Department of Agriculture - Agricultural Research Service*

Herbs are a rich source of polyphenols and research shows polyphenols inhibit the diabetic target dipeptidyl peptidase-IV (DPPiv). The aim of this study was to identify compounds in herbs that may be used in the management of type-2 diabetes (T2DM). Total polyphenol (TP) concentrations and DPPiv inhibition were measured in oregano (OV, Origanum vulgare), marjoram (MO, Origanum majorana), rosemary (RO, Rosmarinus officinalis) and Mexican oregano (LG, Lippia graveolens). Bioassay guided fractionation was used to identify compounds within them that inhibit DPPiv. OV had the highest concentration of TP (430±17 µg gallic acid equiv/mg dry weight, DW). Herbs with the lowest IC_{50} ($P<0.05$) for DPPiv were RO (16±5 µM) and LG (31±3 µM). Fractions from RO (range 0.37-20.27 µM) and LG (range 1.1-17.4 µM) also had the lowest IC_{50}. LC/MS identified many flavonoids in fractions from LG and RO. Of these, computational modeling indicated hispidulin (-9.4), eriodictyol (-8.9) and naringenin (-8.6) as having the lowest binding affinities (kcal/mol). These compounds had $IC_{50's}$ of 0.51, 11.16 and 2.84 µM, respectively. The amino acid interactions to DPP-IV were similar for all flavonoids, suggesting they may be important sites for DPPiv inhibition. Overall, these data suggest that hispidulin, naringenin and herbs containing these flavonoids are potent inhibitors of DPPiv and should be investigated further in the management of T2DM.

Comparison of brain development in sow-reared and artificially-reared piglets

Reeba M. Jacob[1, 2], A.T. Mudd[2, 3], M.S. Conrad[2, 3], C.S. Lai[4] , R.N. Dilger [1, 2, 3]
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[2]*Department of Animal Sciences,*
[3]*Neuroscience Program, University of Illinois at Urbana-Champaign, Urbana, IL*
[4]*Abbott Nutrition, Abbott Labs, Columbus, OH*

Provision of nutrients immediately following birth is critical for proper growth and development of the neonate, but the impact of nutritional composition of breast milk on neural maturation has yet to be determined. Using the piglet as a model for the human infant, our objective was to compare maternal sow's milk with artificial formula on postnatal neurodevelopmental patterns. Over a 25-day study, piglets (n=9-10 per treatment, 1.5 ± 0.2 kg initial BW) were either sow-reared (SR; control) with ad libitum intake, or artificially-reared (AR) receiving 285-325 ml/kg BW of milk replacer to mimic the nutritional profile and intake pattern of sow's milk. At study conclusion, piglets were subjected to a standardized set of magnetic resonance imaging (MRI) procedures to quantify structure and composition of the brain. Overall, SR piglets exhibited higher ($P<0.05$) body weight gain and heavier ($P<0.05$) extracted whole brain weights compared with AR piglets. Diffusion tensor imaging, an MRI sequence that characterizes brain microstructure, revealed that SR piglets had greater ($P<0.05$) average whole-brain fractional anisotropy (FA) values compared with AR piglets, suggesting differences in white matter organization. Tract-based spatial statistics revealed SR piglets had distinct areas of higher FA values along specific white matter tracts compared with AR piglets. Voxel-based morphometric analysis, a measure of brain region volumes, revealed differences ($P<0.05$) in bilateral development of grey matter clusters in the cortical brain regions of

the AR piglets compared with SR piglets. Quantification of brain metabolites using magnetic resonance spectroscopy revealed SR piglets had higher (P<0.05) concentrations of myo-inositol, N-acetylasparate + N-acetylaspartylglutamate, glycerophospho choline + phosphocholine, and creatine + phosphocreatine compared with AR piglets. Overall, increases in these metabolite concentrations, coupled with greater FA values in white matter tracts and volume differences in grey matter of specific brain regions, suggest greater myelin development and cell proliferation in SR piglets. *[Support: Abbott Nutrition]*

Nutriose®FM as a dietary fiber source in dog diets

Matthew R. Panasevich[1], M. Rossoni Serao[1], M.R.C. de Godoy[1], K.S. Swanson[1], L. Guérin-Deremaux[2], G.L. Lynch[3], G.C. Fahey[1] and R.N. Dilger[1]
[1] *University of Illinois at Urbana-Champaign, Urbana, IL*
[2] *Roquette Fréres, Lestrem, France*
[3] *Roquette America Inc., Genera, IL*

Dietary fermentable fiber is known to benefit intestinal health of companion animals. Nutriose®FM (NU), a soluble corn fiber dextran, was evaluated for in vitro fermentablity, in vivo nutrient digestibility, and fecal fermentation end-products. Nutriose®FM was subjected to in vitro fermentation using dog fecal inoculum, with fermentative outcomes measured at 0, 3, 6, 9, and 12 h. In the in vivo experiment, ten female dogs (6.36 ± 0.17 yr; 22 ± 2.1 kg) received 5 diets with graded concentrations of NU [0, 0.5, 0.75, 1.0, or 1.25% (as-is basis)] replacing cellulose in a replicated 5 x 5 Latin square design. Fresh fecal samples were collected to measure pH and fermentation end-products. In the in vitro fermentation experiment, NU elicited increased (P < 0.05) concentrations of short-chain fatty acids through 12 h, with acetate, propionate, and butyrate reaching peak concentrations of 1,803, 926, and 112 µmol/g DM, respectively. In comparison to cellulose and pectin, fermentability of NU was higher (P < 0.05) than cellulose, but lower (P < 0.05) than pectin. Few changes in nutrient digestibility, or fecal fermentation end-products and consistency were observed in the in vivo experiment, suggesting no appreciable alteration of the colonic microbiota. Overall, NU appears to be fermentable in vitro; however, more research is needed to better understand in vivo fermentability of this substrate.

Neuroinflammation and sickness induced by lipopolysaccharide in adult and aged mice are not mitigated by dietary broccoli

Brigitte E. Townsend[1], Y. Chen[2], E.H. Jeffery[1,2], and R.W. Johnson[1, 2, 3]
[1] *Division of Nutritional Sciences,*
[2] *Department of Food Science and Human Nutrition,* [3] *Integrative Immunology and Behavior Program,* [4] *Department of Animal Sciences, University of Illinois, Urbana, IL*

Aging is associated with chronic neuroinflammation and a heightened neuroinflammatory response during infection resulting in prolonged sickness. Dietary interventions to reduce neuroinflammation are therefore desirable. Broccoli contains glucoraphanin, which is converted to sulforaphane (SFN) during digestion. SFN activates antioxidants including heme oxygenase 1 (HMOX1) and NAD(P)H quinone oxidoreductase (NQO1) and inhibits production of interleukin-1 (IL-1β) by lipopolysaccharide (LPS)-stimulated microglia. Therefore, we hypothesized that dietary broccoli would support an antioxidant response in the brain and inhibit LPS-induced neuroinflammation and sickness. Adult and aged mice were fed control diet or control diet with 10% broccoli for 4 wk, and then injected i.p. with saline or LPS. After injection social behavior was assessed at 2, 4, 8, and 24 h; and HMOX1, NQO1, and IL-1β mRNA were quantified in brain at 24 h. LPS reduced social behavior and increased HMOX1, NQO1, and IL-1 in adult and aged mice (P<0.04); as expected, in aged mice IL-1β was higher before LPS (P<0.004), tended to be higher after LPS (P=0.11), and restoration of normal behavior took longer (P<0.03). No significant effects of broccoli consumption were evident. Collectively, the results suggest that dietary broccoli does not affect neuroinflammation or sickness in adult or aged mice.

Abstracts and Biographies

Faculty Mini-Symposium: Nutrition, Cognition, and Exercise: Connecting the Themes

Developmental origins of changes in stress resilience or vulnerability

Rodney W. Johnson, Ph.D.
Department of Animal Sciences, Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

ABSTRACT: Mounting evidence indicates that early life insults in the prenatal or early postnatal period affect brain development, reducing the ability to adapt successfully to acute stress or adversity later in life. Less resilient subjects experience exaggerated or prolonged physiological and psychological responses to mild or innocuous stressors. Thus, the exaggerated stress response in less resilient subjects adds to the allostatic load, creating wear-and-tear to the body and brain, and ill health. This presentation will highlight two common events that potentially influence brain and cognitive development and resilience. First, the influence of iron deficiency in the early postnatal period will be considered. Iron deficiency is the primary cause of anemia, which affects one-quarter of the world's population. Iron deficiency in the postnatal period of rapid brain growth inhibits neurocognitive development, including learning and memory. Unfortunately, the neurocognitive complications of iron deficiency during critical pre-and postnatal periods of brain development are difficult to remedy, persisting into adulthood. Second, the influence of respiratory infection in the early postnatal period will be considered. Infectious disease remains the most common cause of illness in children, with acute respiratory infection constituting the most prevalent reason for medical intervention in children under one year of age. Given the well characterized immune-to-brain signaling pathways that lead to neuroinflammation, serious peripheral infection in the neonatal period when the brain is undergoing rapid growth and development is a concern. A framework for investigating the effects of these and other environmental insults on brain development in a neonatal piglet model will be discussed.

BIOGRAPHY: Dr. Rodney Johnson is a professor of Integrative Immunology and Behavior in the University of Illinois Department of Animal Sciences and is Director of the Division of Nutritional Sciences. His research investigates neuroinflammation and its effects on brain and cognitive development and aging. A special focus is on how diet influences the communication between the immune system and brain. Johnson earned a B.S. from Truman State University and a M.S. and Ph.D. from the University of Illinois. After postdoctorate training at Iowa State University, he joined the U. of I. faculty in 1993. Johnson has published over 115 peer reviewed papers and is a University Scholar.

Exercise and targeted dietary supplementation as a means of improving cognition in the aged

Jeffrey A. Woods, Ph.D.
Department of Kinesiology and Community Health, Division of Nutritional Sciences, University of Illinois at Urbana-Champaign, Urbana, IL

ABSTRACT: My laboratory is focused on the effects of exercise and nutrition on exaggerated and chronic inflammation associated with aging and inflammatory disease. For the purpose of this presentation, I will highlight work examining the extent to which targeted dietary supplementation and exercise independently, additively or synergistically act to improve learning and memory, hippocampal neurogenesis and growth factor expression in normal aged mice and in aged mice that undergo an inflammatory stimulus. This pre-clinical research could potentially lead to strategies that benefit the general aged population or a subset of this population that exhibits elevated inflammatory status.

BIOGRAPHY: Jeff Woods received his undergraduate degree in Exercise Science from the University of Massachusetts at Amherst, a master's degree in Exercise Physiology/Cardiac Rehabilitation from Springfield College (Springfield, MA), and his doctorate in Exercise Science from the University of South Carolina at Columbia. He did a post-doctoral fellowship at the Minneapolis Medical Research Foundation in the area of neuroimmunology. He has received several awards including the *American College of Sports Medicine's* (ACSM) New Investigator Award (1998), the *Psychoneuroimmunology Research Society's* Young Investigator Award (1999) and the King James McCristal Distinguished Scholar Award (2009). He is currently a Professor of Kinesiology and Community Health with additional appointments in the Division of Nutritional Science and the Department of Pathology in the College of Medicine at the University of Illinois at Urbana/ Champaign. His research focuses on; (1) describing the effects of different doses of exercise on inflammatory and immune responses, (2) determining the mechanisms (central nervous, endocrine, cellular, intracellular) responsible for exercise-induced changes in immunity, (3) defining the physiological significance of exercise-induced changes in immunity in relation to disease susceptibility (influenza infection, cancer, wound healing) and changes in behavior (fatigue, reduced locomotion, reduced food intake), and (4) exploring the use of appropriate forms of exercise as therapy for those with dysregulated immune systems (elderly, obese, cancer patients). His research lab has been continuously funded since 1994. He has authored over 95 peer-reviewed journal articles and has an H-index of 28. His doctoral students are successfully employed at universities and colleges and he has been recognized as an outstanding mentor having been awarded the *UIUC Campus Award for Excellence in Guiding Undergraduate Research* in 2008. He is a Fellow of the ACSM and the National Academy of Kinesiology and is past-President of the *International Society for Exercise and Immunology*. He has served on numerous NIH review groups, is Chair of the ACSM Research Review Committee, and acts as an Associate Editor for several journals in his field. He is currently the Acting Director of UIUC's Center of Health, Aging and Disability.

Effects of exercise, fitness, and nutrition on the hippocampus and relational memory

Neal Cohen, Ph.D.
Department of Psychology, Beckman Institute, University of Illinois at Urbana-Champaign, Urbana, IL

ABSTRACT: The hippocampus, long associated with aspects of learning and memory, shows unique plastic properties that may make it especially sensitive to the effects of various lifestyle factors and conditions, including exercise and nutrition. The hippocampus is critical for memory for facts and events, and, more particularly, for supporting relational memory of the constituent elements of experience. This talk will illustrate relational memory, identify several particularly sensitive tests of relational memory and hippocampal function, and provide some examples of the success of such targeted assessments in documenting the effects of exercise or nutrition on brain and cognitive health.

BIOGRAPHY: Dr. Neal J. Cohen is Professor of Psychology, Neuroscience, and the Beckman Institute, and serves as the Director of the Neuroscience Program and of the Center for Nutrition, Learning, and Memory (CNLM), at the University of Illinois. He received his Ph.D. from the University of California San Diego and did his postdoctoral training at MIT. His research on the cognitive neuroscience of memory has been instrumental in the discovery and characterization of multiple memory systems of the brain, and has advanced the development of novel methods and paradigms for assessing memory in various populations and in interventions aimed at improving memory and brain function. Dr. Cohen's current research program is funded by the National Institute of Mental Health, National Institute on Aging, National Institute on Child Health and Human Development, Institute of Educational Sciences, Intelligence Advanced Research Projects Activity, and Abbott Laboratories. Dr. Cohen is an elected Fellow of the *American Association for the Advancement of Science*, and of the *Association of Psychological Science*.

Modulation of new neurons in the hippocampus from diet and exercise

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ABSTRACT: The recent discovery that new neurons are continuously born in two regions of the adult human brain has generated great interest and enthusiasm. Understanding how to regenerate nerves in the brain has broad reaching implications for neurodegenerative diseases, stroke, brain trauma, and normal aging. Perhaps most intriguing is that one of the two brain regions that displays continuous neurogenesis throughout life is the hippocampus, a brain region critical for learning and memory. This has led to the common belief that hippocampal neurogenesis represents a cellular mechanism or substrate for learning and memory. However, direct evidence is scarce and the functional significance of hippocampal neurogenesis remains controversial. A variety of environmental factors have been identified that regulate levels of hippocampal neurogenesis including diet and exercise. Effects of exercise on hippocampal neurogenesis are particularly potent, resulting in increases in neurogenesis up to 5 fold depending on the mouse strain and level of exercise. Although the question of functional significance remains a hotly debated topic, I will review some evidence suggesting that exercise-induced neurogenesis contributes to improved spatial learning performance in mice. Finally I will present some new data from my lab suggesting that even though a high fructose diet results in greater accumulation of body fat and slightly reduced physical activity, it does not affect hippocampal neurogenesis or behavioral performance in mice. I will conclude with the suggestion that in order to have a profound influence on neurogenesis, the environmental intervention (e.g., diet or exercise) must heavily influence the activation of the hippocampus, a phenomenon that clearly occurs with exercise but has not yet clearly been demonstrated to occur with dietary interventions.

BIOGRAPHY: Justin S. Rhodes is an Associate Professor of Psychology and Neuroscience at the University of Illinois. He holds appointments at the Beckman Institute, Institute for Genomic Biology, Division of Nutritional Sciences, and Program for Ecology, Evolution and Conservation Biology. He received his Ph.D. in Zoology at the University of Wisconsin-Madison in 2002. His research focuses on how lifestyle factors such as diet, exercise and drugs of abuse affect the brain and behavior. He recently initiated a new line of research on the neuroendocrinology of socially influenced sex change in clownfish. Professor Rhodes' research has been featured in a long list of print and electronic media including the *New York Times, Scientific American, Parade Magazine, Discovery Fit and Health, SmartPlanet, Nature News,* and *Science Magazine.*

Abstracts

Graduate Student Poster Session

Adhesions of the testes are selectively disrupted by a docosahexaenoic acid and arachidonic acid deficiency

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The healthy maturation of germ cells within the testes is dependent on two classes of intercellular adhesions that form at opposite ends of the epithelial, "Mother" cells of the testes (Sertoli cells). A Sertoli-Sertoli junctional complex that serves to segregate post-meiotic autoantigens from the general circulation forms at the basolateral regions of adjacent Sertoli cells, whereas spermatid-Sertoli junctional complexes, which support the morphological maturation of developing spermatids, form within crypts at the apical regions of Sertoli cells. Here, we identify the highly unsaturated fatty acids (HUFAs) docosahexaenoic acid (DHA) and arachidonic acid (ARA) as critical regulators of spermatid-Sertoli adhesions, but not Sertoli-Sertoli adhesions. Under HUFA deficiency, cell adhesion molecules (CAMs) are appropriately expressed in their respective cell types, but localization is lost at, selectively, the apical spermatid-Sertoli adhesions. By contrast, functional, histological and molecular evaluations show Sertoli-Sertoli adhesions to be intact by all accounts, with the Sertoli cell CAM nectin-2 localizing properly at basolateral adhesions despite a complete loss of distribution to apical adhesions. These results identify the fatty acids DHA and ARA as critical to the healthy production of sperm and maintenance of male fertility by supporting the assembly of spermatid-Sertoli adhesions.

Examining the relationship between fried food intake and depressive symptoms in older Latinas

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Inadequate nutritional patterns, particularly high intake of fried foods are common in the traditional Latino diet. These patterns can have an adverse impact on health status and lead to increased vulnerability for a number of diseases including depression. We explored the correlation between changes in frequency of fried food intake and depressive symptoms over a 6-month physical activity, nutrition and stress management intervention. Latinas age 50+ residing in a Latino Chicago community were invited to participate in a community-based intervention called *Abuelas en Acción* (AEA). *AEA* consisted of face-to-face meetings, monthly educational workshops, and follow-up calls. Activities were led by trained community volunteers. Participants (n=16) completed standardized food frequency questionnaires, 24 hr. food recall, and the CESD-SF before and after the intervention. All participants were depressed at baseline (CESD-SF score >10). Changes in fried food intake were correlated with changes in depression scores, r=-.55, p=.027. Reduction of fried food intake was associated with reduced depressive symptoms. The intervention successfully decreased depressive symptoms, z =-2.44, p =.015 and reduced fried food intake t (18) = -2.136, p<.05. Considering future interventions with this population, fried food intake is an important lifestyle component which affords protection against depression.

Gastrointestinal morphology and tight junction gene expression of the Ossabaw obese pig model

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Obesity is characterized by chronic low-grade inflammation, with reduced gastrointestinal (GI) barrier function hypothesized to be a contributing factor. Animal models are invaluable for understanding disease pathophysiology, with porcine models offering several advantages over rodents, including anatomical similarities to humans. A pilot study was undertaken to characterize GI differences in obese Ossabaw pigs vs. lean controls. Ossabaw gilts (n=8) were fed a high-fat, high-sugar diet ad libitum until 12 months of age and compared to lean Ossabaw controls (n=9). Plasma inflammatory markers (TNF-α, IL-6, and LPS-binding protein), intestinal morphology, and tight junction protein gene expression were assessed. Preliminary results indicate that LPS-binding protein concentrations tended to be greater (P=0.08) in obese vs. lean pigs (6233 vs.3802 µg/L). Blood TNF- concentrations were numerically, but not significantly increased in obese vs. lean pigs (39 vs. 29 ng/L; P=0.24). Obese pigs had greater (P=0.03) cecal crypt depth (494 vs. 430 µm) and tended to have greater (P=0.09) ileal villus height (477 vs. 400 µm) compared to lean controls. Our findings suggest a correlation between GI architecture, systemic inflammation, and obesity in high-fat, high-sugar fed Ossabaw pigs, supporting its use as a model of human obesity and metabolic syndrome.

Foods consumed away from the home are associated with higher augmentation index in maintenance hemodialysis patients

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Foods consumed away from the home (FAFH) tend to be higher in phosphate, sodium and saturated fat. Our objective was to determine dietary intake at beginning (BM) and end of the month (EM) and to classify it by purchase location. Finally, to see if there is a relationship between purchase location and vascular function measured by pulse wave velocity (PWV), augmentation index (Aix) and augmentation pressure (AP). Thirty-two maintenance hemodialysis (MHD) patients underwent applanation tonometry to measure cardiovascular disease risk. A 24-hour diet recall was collected on a dialysis (DD) and non-dialysis day (NDD) during the first 7 days (BM) and last 7 days of the month (EM). Food items were analyzed for dietary composition and purchase location. Foods not purchased at grocery stores were considered FAFH. We found a significantly higher energy (NDD 21.86±1.70 vs. DD 19.10±1.62 kcal/kg, p= 0.009) and protein intake (NDD 0.89±0.07 vs. DD 0.79±0.07 g/kg, p= 0.028) on NDD. However, there was no difference in consumption of any nutrient between BM and EM (p>0.05 for all). Percentage of energy intake from FAFH was higher on NDD (NDD 35.67±5.36% vs. DD 23.67±4.82%, p= 0.006). The percentage of FAFH was positively associated with Aix (r=0.476, p =0.006) and there was a positive trend with AP (p=0.051), but not PWV (p=0.212). These results suggest that consumption of FAFH is associated with greater augmented central pressure in MHD.

Broccoli bioactives inhibit human prostate cancer cell invasions *in vitro*

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Previous studies have found that various bioactives in broccoli may have anti-cancer activities, including anti-invasion ability. We hypothesized that regular consumption of broccoli may inhibit prostate cancer via inhibition of invasion. Thus, the invasive human prostate cancer cell line, DU145, was treated with two broccoli bioactives—sulforaphane and indole-3-carbinol. Cells were seeded in matrigel inserts in 24-well plates containing complete medium as the chemoattractant. Treatments were renewed at the 24th hour. After a total of 48 hours treatment, the matrigel layer was removed, and cells on the bottom membrane were stained and counted. The invasive ability of DU145 was significantly suppressed in a dose-dependent manner by treatment with sulforaphane at concentrations as low as 3μM. Indole-3-carbinol also significantly reduced invasion, but at concentration as low as 0.2μM. In summary, two major bioactives in broccoli show anti-invasion activity *in vitro*, at physiologically-achievable concentrations.

The assessment of diet and physical activity related to obesity risk among Ugandan school children

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In Uganda, 10.4% and 3.2% of adolescent girls and boys are considered overweight, even in the midst of malnutrition. However, few studies have explored risk factors associated with obesity among adolescents. We conducted a cross-sectional survey of 151 randomly selected children aged 11- 16 years in two central Ugandan rural and urban schools in November 2013. Sociodemographic characteristics, diet, and physical activity were surveyed; height, weight, and waist circumference were measured (kg/m^2, cm). Mean age of participants was 12.1 years (±1), with a mean BMI percentile of 43% (49% male). Sixty-two percent of the children owned TVs, primarily driven by the urban sample, 73% of whom owned TVs. Soda consumption (64% having consumed within the past week) did not differ by school. Underweight was more common than overweight, with 10% of children being below the 10th percentile, and only 5.3% above the 80th percentile. Meat and fruit (but not vegetable) consumption and physical activity differed by rural-urban residence ($P<0.01$), with rural children reporting lower physical activity and meat consumption, but higher fruit intake. This study is one of the first to assess the impact of diet and activity among rural and urban school children in Uganda. It provides a basis for understanding the risk factors associated with overweight and obesity in adolescents in Sub-Saharan Africa.

Performance of young and aged C57BL/6J mice on cognitive task depends on the task

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Aging has been associated with weakening of cognitive function, and nutritional supplementation has been suggested to enhance cognitive function. Prior research has demonstrated limited effects of dietary supplementation on rodent performance on cognitive tasks. The objective of this study is to identify behavior tasks that provide the greatest degree of sensitivity in aging-associated cognitive decline for use in future studies. Young (2 months old) and aged (18 months old) female and male C57BL/6J mice were evaluated for performance on the Morris

water maze, elevated plus maze, novel object recognition, passive avoidance, and active avoidance. Animals were euthanized at the end of the study to quantify proliferation of new neurons using doublecortin immunohistochemistry. The largest statistical differences in performance between age groups were seen in novel object recognition and active avoidance. This research model will lay the foundation for understanding the underlying mechanisms by which nutrition interventions may be implemented to slow the cognitive decline associated with aging.

Variable impact of a high-fat diet (HFD) on cognition within the hippocampus and amygdala

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Obesity has been an ever increasing epidemic as the consumption of dietary fat intake increases. High-fat diet (HFD) feeding has been associated with cognitive and behavioral impairments but there is still vague understanding of the effects that a HFD has on various brain-based regions with regards to learning and memory, especially within the amygdala and hippocampus. To comprehend the effects of a HFD feeding on learning and memory within brain regions, we utilized two behavioral tests including novel object recognition (NOR) test to examine amygdala-based memory and novel location (NL) to test for hippocampal-based memory with animals being placed on a HFD (60% kcal from fat) and LFD (10% kcal from fat). Within the NOR test, HFD animals were impaired at 1 and 3 weeks but recovered at the 6 week time point and this effect was independent of age at the start of diet. While in the NL test, memory was not impaired at 1 week but showed HFD impairment that persisted in both juvenile and aged animals. Based on the results, HFD feeding impacts short-term memory in the amygdala but has long-lasting effects on hippocampal based memory regardless of age at start of the diet. This is strong evidence that the amygdala can overcome HFD induced deficits but the hippocampus shows long-term susceptibility to the intake of a HFD.

High fat diet induces aberrant COX-2 gene expression through demethylation of a transcriptional enhancer at a 5′ upstream region of the gene

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Cyclooxygenase-2 (COX-2) produces prostaglandins that participate in multiple physiological and pathological processes, including the activation of inflammatory responses. Induction of COX-2 gene expression has been reported to be correlated with DNA hypomethylation. This study characterized a novel enhancer located at an upstream region on the COX-2 gene and associated alterations of the DNA methylation patterns by high fat diet. Male Sprague-Dawley rats received a high fat diet at different life stages, including maternal (HF/C), post-weaning (C/HF), and lifelong (HF/HF). Liver was collected for analysis at 12 wks of age. Results showed that the high fat diet induced the expression of COX-2 mRNA in all three high fat groups when compared to the control group (C/C). Genome-wide methylated DNA immunoprecipitation (MeDIP) showed that DNA hypomethylation occurred at an upstream region of distal promoter of COX-2 gene in all three high fat groups. Site-specific hypomethylation of CpG in this region was further analyzed by bisulfite sequencing. Luciferase reporter assay demonstrated an enhancer activity of this particular region. Thus, it is likely that exposure to a high fat diet at various stages of life induces COX-2 expression through the reduction of DNA methylation at an upstream enhancer region of the gene.

Berry bioactive phenolics reduce DPP-IV expression and increase insulin secretion from pancreatic beta cells *in vitro*

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Berries are a rich source of bioactive phenolic compounds that are able to bind and inhibit the enzyme DPP-IV, a current target for type-2 diabetes therapy. The objective was to screen berry phenolic bioactive compounds to decrease DPP-IV activity in vitro and determine the potential mechanism of action to increase insulin secretion. Blueberry extract reduced DPP-IV activity in Caco-2 cells by 31% after 8 h. Western blot analysis revealed a decrease in DPP-IV protein expression of 78% ± 0.1 ($p < 0.05$) by this blueberry extract and of 44% ± 2.8 ($p < 0.05$) by anthocyanin (ANC) extracts from fermented blueberry-blackberry beverages. ANC at 50 µM cyanidin-3-glucoside equivalents were also able to increase glucose-stimulated insulin secretion from pancreatic iNS-1E cells by 233 and 100 µIU insulin/mL directly and after epithelial transport, respectively. ANCs up-regulated gene expression of incretin hormone GLP-1 (fold-change 2.4 ± 0.3), and genes in the insulin secretory pathway including iGF1R (1.6 ± 0.4), iGFBP1 (1.5 ± 0.2), iRS2 (1.4 ± 0.3) and iNS2 (1.3 ± 0.4). Also, PTP1B gene expression was down-regulated (-1.8 ± 0.1), a potential therapeutic target of type-2 diabetes. In conclusion, bioactive compounds from berries have potential to reduce onset and progression of type-2 diabetes through increased insulin secretion due to reduced DPP-IV expression and up-regulated insulin-receptor associated proteins.

Butyryl-CoA transferase DNA abundance is not correlated with butyrate production of the intestinal microbial community in piglets with short-bowel syndrome (SBS)

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The objective of this study was to examine the relationship between microbial composition, gene abundance, and corresponding short-chain fatty acid (SCFA) concentration in piglets with short-bowel syndrome (SBS) fed pre- and/or probiotics. We hypothesized that prebiotic consumption would increase the abundance of butyrogenic bactria, butyryl-CoA transferase DNA (BCoAT), and butyrate concentration while attenuating acetogens, acetyl-CoA synthase DNA (ACS), and acetate concentration. Neonatal piglets (n=70) underwent 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 piglets (CON) received unsupplemented EN, prebiotic (PRE) 10 g short-chain fructooligo-saccharides/L EN (scFOS), probiotic (PRO) $1x10^9$ CFU LGG, and synbiotic (SYN) scFOS + LGG. BCoAT was increased by PRE on ileal mucosa at 7d and by PRO in ileal lumen at 3d and 7d ($p=0.05$). PRE increased butyrate concentration vs CON independent of time ($p=0.05$). However, BCoAT abundance was not correlated with butyrate concentration. ACS and acetate concentration were neither impacted by treatments nor correlated with each other. This demonstrates that SCFA production may not be regulated simply by gene abundance in the microbial community, thus regulation at the level of mRNA or metabolic activity needs study.

Impact of parent perception of child pickiness on utilized mealtime strategies

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Picky eaters (PE) are typically characterized as consuming a narrow range of food, as well as rejecting several food items. While data on parents' concerns about the implications picky eating has on their children's health

exist, little is known about the strategies used when parents perceive that their child is a PE. Herein, differences in mealtime strategies used by parents based on their perceptions of their child's pickiness were explored. Parents (n=54) were asked via survey to rate if their child was Never/Rarely, Sometimes, or Often/Always a PE and how often they use 22 mealtime strategies. Using chi-square analysis, 4 strategies were found to be significantly different ($P<0.05$) across the parental perceptions of pickiness: 'Make a different food for your child before the meal if they don't like what is being served', 'Spoon-feed your child to get them to eat', 'Model to your child that Mom/Dad are eating the food so they should eat the food too', and 'No strategies are needed to get my child to eat at mealtime.' Results suggest that parent perception of child pickiness may be a factor in how often these 4 strategies are used, possibly affecting child mealtime behavior. Researchers who work in the field of child feeding behaviors should consider the potential parental bias associated with perceived child pickiness, which may influence child feeding behavior through the consistent use of specific mealtime strategies.

Variants in the β, β-carotene monooxygenase-1 (BCMO1) gene are associated with elevated plasma high density lipoprotein cholesterol (HDL-C) levels in young Mexican adults

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Retinoic acid and retinol are important mediators of a multitude of metabolic processes in the human body, including lipid metabolism. Major dietary precursors of retinoids include the pro-vitamin A carotenoids. Beta-carotene, which is cleaved by the enzyme BCMO1, can be a principle source of retinoic acid in the diet. Within the BCMO1 gene, single nucleotide polymorphisms (SNPs) (rs6564851 and rs10048138) have been found to affect activity of this enzyme. Previously, associations between these SNPs and plasma lipid levels have been observed in U.S. cohorts but have not been replicated in the Mexican population. Our objective was to examine the association between differences in genotype of BCMO1-rs6564851 and rs10048138 and plasma lipid levels in a cohort of young Mexican adults (n=374). DNA was obtained from whole blood and was genotyped using the Taqman system. General linear models were used to systematically analyze associations. Both SNPs were in Hardy-Weinberg Equilibrium with minor allele frequencies of 0.53 and 0.29, respectively. We found a genetic association between a haplotype constructed with these two SNPs and plasma HDL-C levels. Regardless of BMI category and smoking status, minor allele carriers were associated with elevated plasma HDL-C ($p<0.02$). These results suggest that the SNPs in the BCMO1 gene could confer changes in enzyme activity that could affect risk for dyslipidemia.

A multidimensional assessment of pre-adolescent lifestyle: A mixed methods study

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Collaborative research into the different aspects of a child's lifestyle to address concerns of obesity and sedentary behavior is not conclusive. It is imperative to address major influences for lifestyle behaviors such as physical activity (PA), nutrition intake (NI), weight status, and knowledge and attitudes towards leading a healthier lifestyle in order to create successful interventions. This study assessed the above factors in a mixed-methods approach using a 3-day time

frame to assess PA, NI, weight status, and qualitative interview to assess knowledge and attitudes of these factors. A sample (n=30) of fifth grade children were given accelerometers, PA and food diaries to self report their lifestyle habits, alongside having weight, height and waist circumference taken for weight status. Data were analyzed using Pearson product moment correlations and linear regression to assess relationships and potential causality. Results showed mixed findings to reflect the divergent evidence base between those who have high daily PA and those who meet recommendations for diet. Correlations between PA and nutrition variables revealed insignificant findings; however BMI, energy intake (EI) and waist to height ratio (WHTR) were significantly related. Findings stress the need for interventions impacting children at different levels, yet more research is warranted.

Increased capacity for glycogen turnover in the rat ventromedial hypothalamus (VMH) following hypoglycemia

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Recurrent hypoglycemia impairs the ability of the VMH to initiate a counterregulatory response and contributes to hypoglycemia-associated autonomic failure (HAAF). We hypothesize that mobilization of VMH glycogen during and following hypoglycemia interferes with local glucose sensing and that genes associated with increased glycogen turnover will be upregulated after single and recurrent episodes of hypoglycemia. VMH were dissected from rats (N=23) 6 h after a single episode of insulin-induced hypoglycemia (IIH) (acute), 24 h after the third of 3 recurrent episodes of IIH (recurrent), and saline-treated euglycemia (control). RNA was extracted for RNA sequencing and real time-PCR (RT-PCR) analysis for glucose metabolism genes. One-way ANOVA identified genes with statistically significant expression changes between treatments, principal component (PC) analysis of significantly different genes separated data points by treatment group, and genes significantly correlated with the PCs were identified. Glycogen synthase, phosphorylase kinase, glycogen phosphorylase, and UDP-glucose pyrophosphorylase were significantly increased after acute hypoglycemia compared to control in the RT-PCR analysis. Glycogen phosphorylase was upregulated in the acute treatment groups from both RNAseq and RT-PCR compared to control and showed sustained elevation in the recurrent treatment from RT-PCR analysis. These data provide evidence supporting the hypothesis that glycogen metabolism contributes to impaired glucose counterregulation and identify genes that are associated with novel hypotheses for future exploration. *[Support: DK082609]*

Teduglutide for safe reduction of parenteral nutrition requirements in adults: A systematic review

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Teduglutide (TG), a recombinant analogue of human glucagon-like peptide-2, is the first long-term medical therapy approved by the Food and Drug Administration (FDA) for treatment of adults dependent on parenteral nutrition (PN). The aim of this systematic review was to assess the safety and efficacy of TG in reducing PN or fluid requirements in PN-dependent adults. Studies were identified using predefined search criteria and multiple databases, including Medline and Embase. The search was completed to December 31, 2013 in the absence of date or study design restrictions. Hits were assessed for inclusion criteria and methodological quality by 2 independent reviewers. The outcomes of interest were changes in PN or fluid requirements and adverse events (AE). From 1,273 unique records, 10 reports met the inclusion criteria, including data from 2 phase III, placebo-controlled clinical trials and their respective extension studies. Significantly more subjects achieved ≥ 20% volume, and/or ≥ 1 day/week, reduction in PN requirements with the FDA-approved TG dose than with a higher dose or placebo. AE

were distributed similarly between active treatment and placebo groups. TG appears to be a well-tolerated means to reduce PN dependence in adults, but additional long-term trials are required to directly compare the safety and efficacy of TG to that of other approved therapies such as glutamine or recombinant growth hormone.

Healthy Eating Index, cognitive function and gender differences in older adults

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Differences have been reported in healthy eating behaviors by gender; however, the gender difference in adherence to the 2010-Dietary Guidelines for Americans in older adults has not been explored. Studies have also suggested interactions between nutrition, cognition and aging. NCI-Diet History Questionnaire was administered among a random sample of 46 cognitively intact older adults aged 65 to 75 years. The Healthy Eating Index-2010 (HEI), a measure of diet quality relative to the 2010-Dietary Guidelines, was derived. Cognitive abilities were measured using the Wechsler Memory Scale (WMS), Wechsler Abbreviated Scale of Intelligence (WASI) and Delis-Kaplan Trail Making Test (DKEFS). Independent sample t-tests showed that women had superior scores for total HEI (p=0.018), HEI total vegetable (p=0.036), HEI green and bean (p=0.036), HEI fatty acid (p=0.008) and HEI empty calories (p=0.038). Women had better scores on cognitive tests for WASI verbal comprehension (p=0.018), WASI full scale IQ (p=0.049), WMS auditory memory (p=0.034), WMS delayed memory (p=0.028) and DKEFS-Trails 4-5 executive function (p=0.018). Results indicate that dietary patterns among women differ from those observed among men and thus highlight the importance of evaluating gender interactions between nutrition and cognition. This factor may also contribute to understanding the beneficial effects of nutrition on cognitive aging.

Lactoferrin supplementation and *Bifidobacteria infantis* administration in a piglet model of systemic *Staphylococcus aureus* infection

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Infections in infants caused by antibiotic resistant *S. aureus* have limited treatment options. In a clinical trial, premature infants fed formula with bovine lactoferrin (bLf) had decreased blood-borne staphylococcal infections, but the mechanism was not known. Additionally, Lf promotes the growth of *B. infantis*, a predominant species in the breast-fed infant intestine. Herein, the effect of bLf alone or in combination with *B. infantis* on the course of *S. aureus* infection was assessed. Colostrum-deprived pigs had umbilical catheters placed at birth and were fed formula with 4g/L bLf (LF) or whey protein (CON); half of the piglets in each group were further randomized to receive *B. infantis* (10^9 CFU/day, ATCC 15697). On d7, piglets were infected intravenously with *S. aureus* (10^5 CFU/kg BW, S54F9) and euthanized on d12. Piglets had elevated ($p<0.05$) rectal temperature beginning at 36 h post-infection. LF piglets also had elevated rectal temperatures and improved weight gain on d10, 72 h post-infection. Importantly, LF piglets had decreased ($p<0.05$) staphylococcal load at the kidney and lung compared to CON, with no effect of *B. infantis*. Thus, bLf decreases translocation of *S. aureus* to tissues, which could potentially reduce organ dysfunction. On-going investigations are defining the potential mechanism by which bLf and *B. infantis* regulate the immune response to *S. aureus* infection.

Effects of restraint and contrast ultrasound imaging on Hsp70 expression in cholesterol-fed rabbit aorta

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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 increase levels of Hsp70, a cellular stress protein. Male New Zealand White rabbits (n=32) were fed a standard chow diet (n=4) or a 1% cholesterol, 10% fat and 0.11% magnesium diet (n=28). At 21 days, 24 rabbits on cholesterol diet were either exposed to US (3.2 MHz f/3 transducer, 2.1 MPa, Mechanical Index=1.17, 10 Hz pulse repetition frequency, 1.6 μs pulse duration, 2 min exposure duration at 4 sites) using the UCA Definity (1x concentration, 1 mL/min) or sham exposed using a saline control (n=12 per group). Four rabbits on cholesterol diet and four on chow diet were not exposed to ultrasound or restrained for blood sample collection. Animals were euthanized 24 hours after exposure and aortas were snap-frozen in liquid nitrogen. Aorta lysates from the area of US exposure were analyzed for Hsp70 protein level by Western blot. Blood plasma was analyzed for cholesterol and von Willebrand Factor (vWF), a marker of endothelial function. Plasma total cholesterol levels increased to an average of 705 mg/dL. Restraint ($p<0.001$ by ANOVA), but not US with UCA or cholesterol feeding, significantly increased Hsp70. *[Support: NIH R37EB002641 and the Beckman Institute Graduate Fellowship]*

Associations between mothers' psychological well-being factors on food use and accessibility among immigrant Latino families in rural Illinois

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Latinos moving to the U.S. face challenges which negatively impact their mental and physical health. These threats are intensified in rural food and healthcare deserts. We explore psychological factors and its correlations to food security and diet among Latinos. Relations between psychological factors (perceived stress, life satisfaction, or mental health service usage) and food security or diet (protective and risky dietary patterns) were evaluated. Rural immigrant mothers with children provided self-report data (n=105). Principal component analysis was used to create composite variables for each construct and Spearman correlations were conducted to determine associations. Mothers' perceived culture-related stress, health-related stress and life dissatisfaction were associated negatively with household food security. No factors showed a correlation with mothers' dietary patterns. However, mother's life dissatisfaction was negatively associated with children's protective dietary patterns; and mothers' mental health service usage was correlated positively to children risky dietary patterns. Our findings point out obesity factors exacerbating the nutrition transition among Latino immigrants and their offspring. Mothers' negative psychological well-being and limited utilization of mental health services increase household food insecurity and child risky dietary patterns.

Acute calorie restriction as a modulator of anxiety-like behavior

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Cognitive disorders such as depression, cognitive decline, and anxiety are a growing class of epidemic diseases. Recently, several studies have highlighted the role of inflammation in the development of these diseases, specifically the activation of the NLRP3 inflammasome and maturation of Il-1β. Other studies have shown acute calorie restriction, in the form of a 24 hour fast, to have beneficial effects on both mouse behavior and markers of inflammation. The goal of our study was to characterize the effects of fasting on anxiety-like behavior in a mouse model. Additionally, we sought to understand the role of inflammasome activation within this model.

Nutrient intake and cognitive function in older adults: Omega-3 fatty acids and prefrontal executive function

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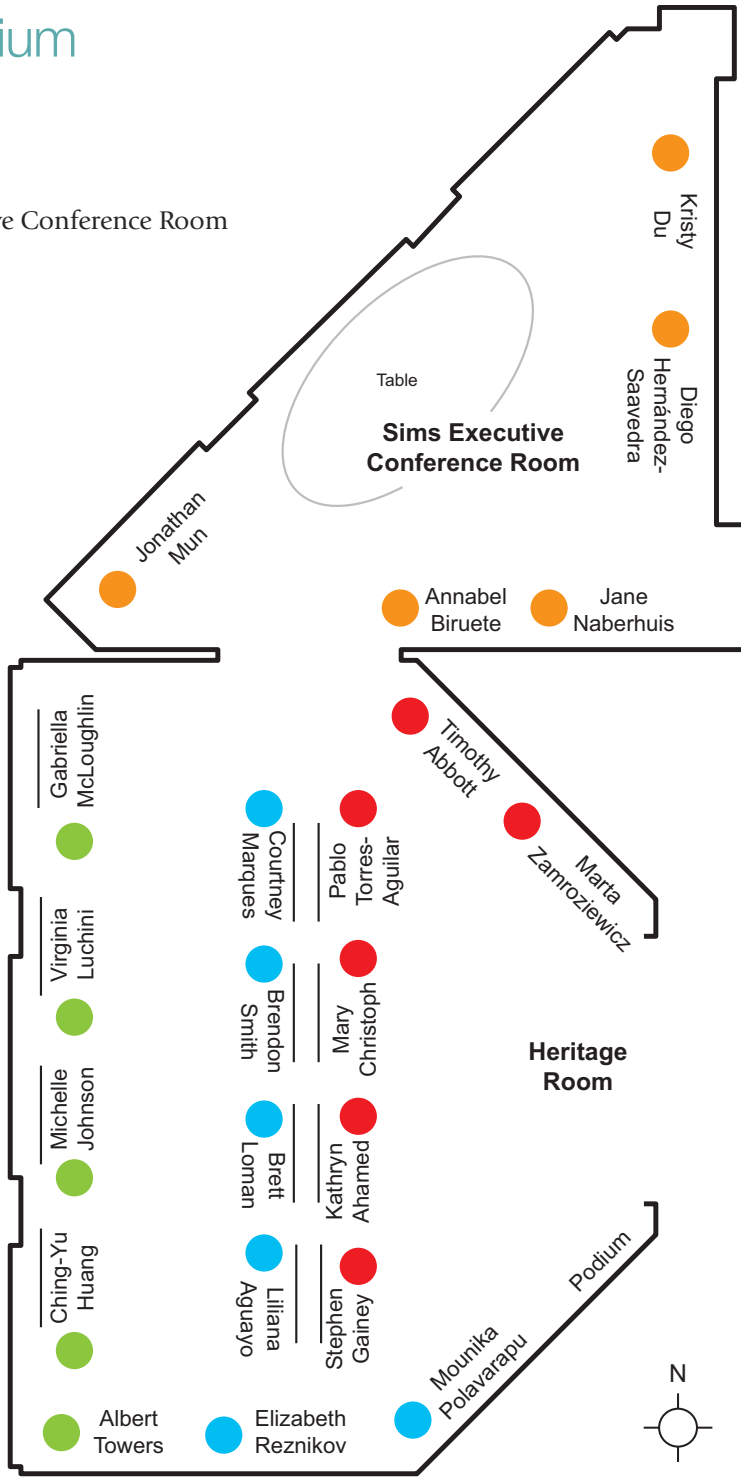
Accumulating evidence indicates that diet has a substantial influence on the aging brain; however, the relationships between specific components of diet and particular aspects of prefrontal executive function remain unclear. The NCI-Diet History Questionnaire was administered in 41 cognitively intact adults between the ages of 65 and 75 (mean = 69.50 , SD = 2.78). To account for total caloric intake, adjusted residual values of the following nutrients were computed: B complex vitamins, vitamin C, vitamin D, vitamin E, eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), lutein, and zeaxanthin. Nutrient values were compared using pearson's correlations with cognitive performance on canonical neuropsychological tests. Executive function was measured by the D-KEFS Trail Making Test, which is designed to assess prefrontal cortex function and cognitive flexibility. Higher EPA and DHA intake is linked to better performance on D-KEFS measures of cognitive flexibility. After adjustment for caloric intake, both EPA and DHA correlated with high levels of performance on the number letter sequencing task while controlling for the processing demands of performing the number and/or letter sequencing tasks individually ($p < 0.05$). The correlation between higher intake of EPA and DHA with superior cognitive flexibility suggests that these nutrients may target specific features of cognition.

Nutrition Symposium Poster Session

ACES Library, 1st Floor
Heritage Room and Sims Executive Conference Room
Wednesday, April 23, 2014
5:15 p.m. – 6:40 p.m.



Poster Judges

Orange Team
Dr. Teran-Garcia (captain)
Dr. Radlowski
Dr. Godoy

Green Team
Dr. Stein (captain)
Dr. Holscher
Dr. Moulton

Blue Team
Dr. Nakamura (captain)
Dr. Khan
Dr. Alexander

Red Team
Dr. Andrade (captain)
Dr. Strakovsky
Dr. Barnes

Presenting Author Index

Winners of the 2013 University of Illinois Nutrition Symposium poster and oral competitions with keynote speaker, Dr. Jim Fleet.

NOTES