

BIOGRAPHICAL SKETCH

NAME: Shearrer, Grace

eRA COMMONS USER NAME: gshearrer1

POSITION TITLE: Research Assistant Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date	FIELD OF STUDY
University of Wyoming, Laramie, WY	BS	05/2012	Nutritional Science and Physiology
University of Texas, Austin, TX	PHD	12/2016	Nutritional Science
University of North Carolina, Chapel Hill, NC	Postdoctoral Fellow	3/31/2019	Biobehavioral drivers of ingestive behavior
University of North Carolina, Chapel Hill, NC	Research Assistant Professor	Present	Neural signature of pediatric insulin resistance

A. Personal Statement

I am a research assistant professor in the Department of Nutrition at the University of North Carolina, Chapel Hill. My work focuses on the interplay between endocrine and neural systems in under studied, insulin resistant populations (postpartum women, children, adolescents). My graduate work looked at the effect of sugar sweetened beverage intake on hunger and satiety, as well as on metabolic factors (visceral adipose accumulation, cortisol response, and endocrine function), showing that sugar sweetened beverage intake is associated with an unfavorable metabolic profile in adolescents. This research has been published and presented through posters and oral presentations at various national meetings. Extending this line of research into my post doc, I have found adolescents with overweight and obese parents were at greater risk of weight gain, and showed altered neural response to a high sugar beverage. In sum, showing adolescence is a critical time period for weight gain and altered metabolic factors. To more acutely explore the interplay of the brain and endocrine signals, Dr. Burger and I collaborated on the *A multimodel examination of bromocriptine on homeostatic and hedonic mechanisms of food intake in individuals at high risk for type 2 diabetes* grant. In preparation for this proposal, I have further investigated the role of puberty and insulin resistance in adults. However, to date, few studies have examined the impact of insulin resistance and neural response in youth. Under the mentorship of Drs. Burger and D'Alessio, and the support of an advisory team comprised of Drs. Small, Lindquist, Shaw, and Jain, I am applying for this K01 to receive further training in: 1) insulin resistance, 2) high level functional magnetic resonance imaging modeling, and 3) pubertal assessment. Strong mentoring has been and continues to be key to my success as I transition from student to researcher. Drs. Burger and D'Alessio represent two of the top researchers in their respective fields (ingestive behavior and insulin resistance), as well as provide complimentary perspectives on early career development and navigation of the tenure track process. As the principal investigator (PI) of this research project, I will gain necessary training in lab management, grant writing, and application of data to future grant submissions. The cornerstone of this project is learning techniques that will not only allow me to complete this project, but also facilitate future experiments and grants. Finally, and most importantly, the mentoring will be a model for myself as I step into the role of mentor for future scientists. Thus fulfilling my long term goal of being the PI of my own R1 lab training scientists and researching the cognitive-physiological underpinnings of pediatric insulin resistance.

Relevant work

- Shearrer GE**, Stice E, Burger KS. Adolescents at high-risk for obesity show greater striatal response to increased sugar content in milkshakes. *American Journal of Clinical Nutrition*. 2018 June; 107(6):859-866. PubMed PMID: 29771283
- Shearrer GE**. Comparison of neural topology between pubertal and weight status. [Preregistration]. OSF created 2019 March; DOI 10.17605/OSF.IO/9Y73T
- Shearrer, GE**. K Means Puberty Analysis with ABCD Data (aka the Alphabet). [preregistration] OSF created 2018 June. doi:10.17605/OSF.IO/KCNZ2

B. Positions and Honors

Positions and Employment

2010 - 2012 Teaching Assistant, University of Wyoming, Department of Chemistry, Laramie, WY
2010 - 2012 Research Assistant, University of Wyoming, Department of Zoology and Physiology, Laramie, WY
2012 - 2015 Teaching Assistant, University of Texas, Department of Nutritional Science, Austin, TX
2014 - 2016 Imaging Technician, Imaging Research Center at the University of Texas, Austin, TX
2015 - 2016 Graduate Research Assistant, University of Texas, Department of Nutritional Science, Austin, TX
2016 - 2019 Postdoctoral Research Fellow, University of North Carolina, Center for Women's Health Research, Chapel Hill, NC
2019- Research Assistant Professor, University of North Carolina, Department of Nutritional Science, Chapel Hill, NC

Other Experience and Professional Memberships

2010 - 2012 Student Member, The Endocrine Society
2012 - Member, The Obesity Society
2012 - Member, Society for the Scientific Study of Ingestive Behavior
2016- Member, American Diabetes Association
2017 Co-Director UNC fMRI Analysis Workshop
2019- Member, Organization of Human Brain Mapping

Honors

2011 EPSCOR undergraduate research fellowship, University of Wyoming
2012 INBRE undergraduate research fellowship, University of Wyoming
2015 Karen and Charles Matthews Endowed Presidential Fellowship in Nutrition, University of Texas
2016 National Institute of Health BRAIN initiative summer course on interdisciplinary computational neuroscience, National Institute of Health
2017 Neurohack Week Travel Scholarship
2017 The Obesity Society Ethan Sims Young Investigator Award Finalist
2018 Society for the Study Ingestive Behavior New Investigator Travel Award Winner

Seminars, lectures, oral presentations (selected)

2011 **GnRH agonists alter body composition after long-term exposure**, Undergraduate research symposium, University of Wyoming
2014 **Nutrition and Cognition**, KIN 395: Cognition and exercise across the lifespan, University of Texas at Austin
2015 **The association between body fat deposition, cortisol response, and sugar sweetened beverage (SSB) intake in a minority youth population**, The Obesity Society
2015 **Nutrition and Cognition**, KIN 395: Cognition and exercise across the lifespan, University of Texas at Austin
2015 **Sugar Sweetened Beverages: refreshing and distressing**, University of Wyoming Neuro-physiology departmental lecture
2015 **The Gut Brain Axis**, Obesity and Metabolic Health, NTR365 University of Texas at Austin
2017 **Obesity risk moderates healthy weight adolescents' BOLD response to sugar and fat**, The Obesity Society Ethan Sims Young Investigators Award Finalist Session
2017 **UNC fMRI Workshop**, University of North Carolina Co-Director and lecturer
2018 **The impact of body mass on neural responses during negative prediction error**, The Society for the Study of Ingestive Behavior New Investigator Travel Award Session
2018 **Later puberty predicts visual/self-control functional brain connectivity and low BMI in adulthood**, Annual meeting of The Obesity Society

C. Contributions to Science

1. A major theme of my work is the effect of **sugar intake on metabolic, endocrine, and neural pathways in adolescents**. Increased autonomy, rapid growth, and high availability of sugary foods highlight the adolescent period. With a combination of secondary data analysis from across the US, I have found that increased sugar intake is associated with increased visceral adiposity, higher cortisol awakening response, increased feelings of hunger, and decreased gut hormones ghrelin and PYY. In adolescents at high risk for weight gain by virtue of parental overweight or obese status, we found increased BOLD response in reward and gustatory regions compared to those at low risk to a high sugar beverage. Furthermore, those adolescents who were at high risk gained more weight at a 3 y follow up compared to the normal weight (see citation a above). In a slightly older group of college students, a high sugar meal (compared to fasted) was associated with increased connectivity between the oral somatosensory cortex and dorsolateral prefrontal cortex (dlPFC, drive/attention/motivation). Suggesting the brain increases communication between sensory regions and stimuli control regions with sugar intake. This may result in increased motivation to consume more sugar. Overall, intake of sugar appears to promote further sugar intake and is related to unfavorable hormonal and metabolic profiles. Familial risk for obesity is associated with increased neural response to high sugar beverages associated and with increased weight gain, possibly putting the children of parents with high BMI at risk for overconsumption of sugar foods.
 - a. **Shearrer GE**, Daniels MJ, Toledo-Corral CM, Weigensberg MJ, Spruijt-Metz D, Davis JN. Associations among sugar sweetened beverage intake, visceral fat, and cortisol awakening response in minority youth. *Physiol Behav.* 2016 Sep 19;167:188-193. PubMed PMID: 27660033.
 - b. **Shearrer GE**, O'Reilly GA, Belcher BR, Daniels MJ, Goran MI, Spruijt-Metz D, Davis JN. The impact of sugar sweetened beverage intake on hunger and satiety in minority adolescents. *Appetite.* 2016 Feb 1;97: 43-8. PubMed PMID: 26606887.
 - c. **Shearrer GE**, Sadler JR, Burger KS. Dynamic Resting State Connectivity after a High-Sugar Meal—A Neural Signature of Feeding. *Diabetes* Jul 2018, 67 (Supplement 1) 2428
PUB; DOI: 10.2337/db18-2428-PUB
2. **Pregnancy, and the postpartum period are critical stages of insulin resistance for the mother and development for the child.** My work has shown that diet and gestational diabetes (GDM) effect both mother and child. Children who were breastfed, even if the mother had GDM, were less likely to be obese at age 4 compared to children who were not breastfed. This is particularly impactful as children of mothers with GDM are more likely to be overweight or obese, however breastfeeding appears to be protective. In the mothers, intake of sugar (in particular sugar sweetened beverages) appears to increase risk of weight retention in the postpartum period. Finally, in the first study of its kind, I found that postpartum weight does not present the same BOLD response to milkshake flavor as traditional weight gain from overeating. This suggests that postpartum weight may operate differently from traditional weight gain, and may require novel interventions.
 - a. **Shearrer GE**, Nansel T, Lipsky L, Sadler JR, Burger KS. Impact of body mass on brain responses during appetitive prediction error in postpartum women. *Physiology and Behavior.* 2019 April; In Press. PubMed PMID: 30986423.
 - b. **Shearrer GE**, Whaley SE, Miller SJ, House BT, Held T, Davis JN. Association of gestational diabetes and breastfeeding on obesity prevalence in predominately Hispanic low-income youth. *Pediatr Obes.* 2015 Jun;10(3):165-71. PubMed PMID: 25044818.
 - c. Davis JN, Koleilat M, **Shearrer GE**, Whaley SE. Association of infant feeding and dietary intake on obesity prevalence in low-income toddlers. *Obesity (Silver Spring).* 2014 Apr;22(4):1103-11. PubMed PMID: 24123802.
 - d. Davis JN, **Shearrer GE**, Tao W, Hurston SR, Gunderson EP. Dietary variables associated with substantial postpartum weight retention at 1-year among woman with GDM pregnancy. *BMC Obesity.* 2017 Aug;4(1): eCollection. PubMed PMID: 28794888

3. I have begun to explore the **relationship between puberty, insulin resistance, and the brain**. Using pilot data from previous a previous task-based milkshake study, the Human Connectome Project (HCP), and the Adolescent Brain Cognition and Development (ABCD) study, I have found that the OFC, dlPFC, and precuneus are sensitive to both changes in glycemic control and pubertal status. These are brain regions associated with insulin resistance, the primary taste cortex, and decision making. A topological analysis of BMI status in adults roots these findings in a graphical state, showing elevated BMI is associated with increased integration of the somatosensory network (including the precuneus) and segregation of task control networks (including the OFC and dlPFC). Using the ABCD dataset (citation b in personal statement), I similarly found decreased connectivity between sensorimotor and task control networks (specifically the cingulo-opercular network) in adolescents with obesity compared to their normal weight peers. In the same cohort, mid-pubertal adolescents (pubertal development score (PDS) ≥ 3 , no menarche) showed increased whole brain connectivity compared to early pubertal (PDS < 3 and no menarche) and late pubertal groups (PDS ≤ 7 and menarche). In an additional non-imaging dataset (citation c under personal statement), using data driven methods, testosterone levels, weight, and waist circumference explained most of the variation in self-reported pubertal status (pubertal development scale), whereas in boys self-reported voice change explained the most variation. Thus, testosterone, waist circumference, weight status, and voice change should be measured to validate self-reported pubertal status. Overall, these studies serve as both a contribution to science in general and provide pilot data for the present K01 application. Specifically, the precuneus, OFC, dlPFC appear to be sensitive to both glycemia and development, while network analyses show alterations in sensorimotor areas and task control brain regions with BMI status.
 - a. **Shearrer GE**, Sadler JR, Burger KS. Alterations in ventral attention network connectivity in individuals with prediabetes. Nutritional Neuroscience. 2019 April; In Press. PubMed PMID: 31030631.
 - b. **Shearrer, GE**, KS Burger. A Comparison of Neural Connectivity between Obese, Overweight, and Normal Weight Adults. [Preregistration] OSF. 2017 February. doi:10.17605/OSF.IO/6U2J8.
 - c. **Shearrer GE**, Sadler JR, Burger KS. T-OR-2038 | Later Puberty Predicts Visual/Self-control Functional Brain Connectivity and Low BMI in Adulthood. The Obesity Society Meeting. Nashville, TN. 2018 November. <https://2018.obesityweek.com/abstract/later-puberty-predicts-visual-self-control-functional-brain-connectivity-and-low-bmi-in-adulthood/>
 - d. Sadler JR, **Shearrer GE**, Burger KS. Body mass variability is represented by distinct functional connectivity patterns. Neuroimage. 2018 Nov. 181p. 55-63. PubMed PMID: 29966718.

Complete List of Published Work in My Bibliography:

https://www.ncbi.nlm.nih.gov/pubmed/?term=ShearrerGE%5BAuthor%5D&cauthor=true&cauthor_uid=29966718

D. Research Support

Ongoing Research Support

NICHD HHSN2752018000021

PI: Burger

6/18-5/23

Development of Eating Behaviors in Young Children

A longitudinal examination of food reward sensitivity, attentional bias and eating habit formation in children from age 2 to age 5.

Role: Co-I (Total: \$3,197,861)

NICHD LRP Program for Clinical Research- Extramural

PI: Burger

7/17-6/19

Neurobehavioral Correlates of Gestational Weight Retention

The motivation of this study is to examine the existing known relationship between food responsivity/impulsivity and sensitivity to negative prediction error and their abilities to predict weight gain in the postpartum period, with the ultimate goal to discover brain-behavior based risk factors for overeating and weight retention.

Role: PDC (Total: \$9,910)

R01 DK112317

PI: Burger

9/17-6/22

Neurobehavioral Plasticity to Regular Sugar-Sweetened Beverage Intake: An fMRI Experiment

This randomized controlled fMRI study examines whether daily sugar sweetened beverage intake alters responsivity of oral somatosensory, gustatory, and reward brain regions, and reduces responsivity of inhibitory regions to anticipated receipt, and receipt of palatable food.

Role: PDC

American Diabetes Association 1-17-JDF-031 PI: Burger 1/17-1/20

A multimodal examination of bromocriptine on homeostatic and hedonic mechanisms of food intake in individuals at high risk for type 2 diabetes.

This cross-over trial examines the effect of the type 2 diabetes drug bromocriptine on reward learning, ad libitum intake of palatable food, and gut endocrinology in overweight and obese adults.

Role: PDC

Completed Research Support

UNC Core Facilities Advocacy Committee Award PI: **Shearrer** 05/18

Biomedical Research Imaging Center Eyetracker

This is a one-time award to purchase a piece of specialty equipment for use by a core. Dr. Shearrer spearheaded the effort.

Role: **PI** (\$40,000)

NICHD HHSN275201300015C PI: Burger, Siega-Riz 10/13-10/18

Diet, Obesity and Weight Change in Pregnancy

This prospective study examines the role of food reward responsivity and food reinforcement value in dietary intake, and weight change during pregnancy through 1 year postpartum. It aims to study the moderating effects of genetic variants, food environment on weight change in mothers and introduction of foods into the infant's diet.

Role: PDC

NIDDK 1R21DK098719-01A1 PI: Davis 04/14-04/16

Sugar Sweetened Beverages: Impact on Reward, Satiety, and Metabolism in Children

This is a cross sectional study of 50 overweight and obese Hispanic children. Looking at the influence of sugar sweetened beverage on satiety hormones and neural reward systems.

Role: GR