



## Christopher T. Smith

**Graduate Student**  
Curriculum in Neurobiology  
University of North Carolina at Chapel Hill  
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### Education:

**Ph.D. Neurobiology, University of North Carolina, Chapel Hill (UNC-CH) May 2014  
(expected)**

Dissertation: Frontal Dopamine Modulates Now Bias Behavior According to an Inverted-U Function:  
Implications for Groups at Risk for Alcohol Use Disorders (Advanced to candidacy 2010)

Advisor: Charlotte A. Boettiger, PhD

**B.S. Neuroscience (magna cum laude), Furman University 2008**

### Academic Honors and Awards:

Graduate Mentor Award from UNC Office of Undergraduate Research	2013, 2012, 2010
HHMI Future Scientists and Clinicians Summer Program Co-Mentor	2013
Graduate Student Award, Cognitive Neuroscience Society 2012 Annual Meeting (\$500)	2012
Funded trainee for 2011 <i>Training Course in fMRI</i> program at the University of Michigan	2011
Research Society on Alcoholism Student Merit Travel Award (\$150)	2010
S.C. NIH-IDeA Networks of Biomedical Research Excellence Summer Research Fellow	2007

### Research Experience:

**Graduate Research Assistant May 2009-Present**

Curriculum in Neurobiology, UNC-CH

Advisor: Charlotte A. Boettiger, PhD

Investigating the neurobiology of immediate reward bias, an intermediate behavioral phenotype associated with substance use disorders in humans.

#### Findings and conclusions:

- Prefrontal cortex dopamine levels as indexed by a polymorphism in the COMT enzyme interacts with age group (18-21 vs. 22-40) to affect degree of discounting behavior observed in a delay discounting task (Smith & Boettiger, 2012).
- Discounting of delayed rewards decreases as function of age in low/moderate alcohol drinkers but not heavy, possible problem drinkers.

- Estradiol increases are associated with decreases in discounting of delayed rewards in individuals with putatively lower frontal DA (COMT Val carriers).

Investigating the neurobiology of working memory processes using behavioral genetics.

Findings and conclusions:

- Target detection in an n-back working memory task is associated with genes implicated in frontal dopamine signaling according to an inverted-U function (Smith, Swift-Scanlan, and Boettiger, 2014).

**Graduate Research Assistant, Rotating Student**

**June 2008 - May 2009**

Biological and Biomedical Sciences Program, UNC-CH

Labs of Mark Wightman, Clyde Hodge, Charlotte Boettiger, and Patricia Maness

**Undergraduate Research Assistant**

**2007-2008**

Department of Psychology, Furman University

Advisor: Judith E. Grisel, PhD

Phenotypic and neurobiological differences in beta-endorphin transgenic mice to alcohol:

- Behavioral measures of rewarding, anxiolytic, and antidepressant effects of alcohol
- *in vivo* microdialysis measures of striatal dopamine and glutamate release to acute alcohol

**Publications:**

**Smith CT**, Sierra Y, Oppler SH, Boettiger CA (2014). Ovarian Cycle Effects on Immediate Reward Bias in humans: a role for estradiol. *Journal of Neuroscience*, under review.

Swift-Scanlan T, **Smith CT**, Bardowell SA, Boettiger CA (2014). Comprehensive interrogation of CpG islands in the gene encoding COMT, a key estrogen and catecholamine regulator. *BMC Medical Genomics*, in press.

**Smith CT**, Swift-Scanlan T, Boettiger CA (2014). Genetic polymorphisms regulating dopamine signaling in the frontal cortex interact to affect target detection under high working memory load. *Journal of Cognitive Neuroscience*, 26 (2), 395-407. PMID: PMC3877727

**Smith CT**, Boettiger CA (2012). Age modulates the effect of COMT genotype on delay discounting behavior. *Psychopharmacology*, 222 (4), 609-617. PMID: PMC3401276

**In revision:**

**Smith CT**, Steel EA, Parrish MH, Kelm MK, Boettiger CA (2013). Intertemporal Choice Behavior in Late Adolescents and Adults: Effects of Age Interact with Alcohol Use and Family History Status. *Psychopharmacology*.

**Acknowledgements:**

Grisel JE, et al. (2008). Influence of  $\beta$ -endorphin on anxious behavior in mice: interaction with EtOH. *Psychopharmacology*, 200, 105-115.

**Talks:**

Neurobiology Tuesday Mini-Series, UNC-Chapel Hill, Chapel Hill, NC

**Fall 2013**

“Neurobiology of Intertemporal Choice: Implications for Groups at Risk for Alcohol Use Disorders.”

**Smith, CT**

Invited Talk, Addiction Recovery Research Center, Dr. Warren Bickel, Director **July 2013**  
Virginia Tech Carilion Research Institute, Roanoke, VA  
“State and Trait Factors Underlying Now versus Later Decision Making Behavior.”  
**Smith, CT**

Neurobiology Tuesday Mini-Series, UNC-Chapel Hill, Chapel Hill, NC **Spring 2013**  
“Neurobiological investigation of executive processes: Insights from state and trait factors.”  
**Smith, CT**

May Experience Guest Lecture, Furman University, Greenville, SC. **2012**  
“Investigating the role of age and alcohol use on *Now* versus *Later* Decision Making.”  
**Smith CT**

Decision Making across the Disciplines D-CIDES Regional Conference, Duke University **2012**  
“Immediate Reward Bias: Fixed trait or Changeable State? A role for frontal dopamine.”  
Boettiger CA, **Smith CT**, Kelm MK

Cognitive Neuroscience Society 2012 Annual Meeting. Chicago, IL. **2012**  
“Interacting effects of genetic polymorphisms regulating dopamine signaling in the frontal cortex on accurate target detection under high working memory load.” **Smith CT**, Boettiger CA.

Behavioral Neuroscience Seminar Series, UNC – Chapel Hill, Chapel Hill, NC. **2010**  
“Understanding the relationship between immediate reward bias and problem drinking Behavior.” **Smith CT**

First Annual Summer Research Conference Between Furman & Davidson Universities, **2007**  
Furman University, Greenville, SC.  
“Evaluating the neurocircuitry of  $\beta$ -endorphin mediated reinforcement in the nucleus accumbens using transgenic mice” **Smith CT**, Cloonan G, Grisel JE

#### **Poster Abstracts:**

1. **Smith CT**, Chanon VW, Kelm MK, Cerciello ER, Parrish MH, Garbutt JC, Kampov-Polevoy AB, Boettiger CA (2014). Attentional bias to alcohol cues changes in tandem with drinking during treatment: Association with brain activity in a putative visual bias circuit. Research Society on Alcoholism 2014 Annual Meeting. Bellevue, WA.
2. Boettiger CA, **Smith CT**, Kelm MK, Garbutt JC, Chanon VW, Kampov-Polevoy AB (2014). Human studies of impulsive choice: Alcohol use disorders and the frontal cortex. Research Society on Alcoholism 2014 Annual Meeting. Bellevue, WA.
3. **Smith CT**, Chanon VW, Kelm MK, Cerciello ER, Parrish MH, Garbutt JC, Kampov-Polevoy AB, Boettiger CA (2013). A cognitive predictor of alcohol treatment success is associated with reduced activity in circuits implicated in top-down biasing of object recognition. 2013 Biomedical Research Imaging Center (BRIC) Research Day. Chapel Hill, NC.

4. **Smith CT**, Boettiger CA (2012). n-back performance moderates the positive relationship between trait impulsivity and immediate reward bias in adults: Potentiation by heavy alcohol use. Society for Neuroscience 2012 Annual Meeting. New Orleans, LA.
5. **Smith CT**, Boettiger CA (2012). Interacting effects of genetic polymorphisms regulating dopamine signaling in the frontal cortex on accurate target detection under high working memory load. North Carolina Conference on Cognition 2012. Chapel Hill, NC.
6. **Smith CT**, Boettiger CA (2011). Age Modulates the Effect of COMT Genotype on Delay Discounting Behavior. Society for Neuroscience 2011 Annual Meeting: 839.12. Washington, DC.
7. **Smith CT**, Freeman-Daniels E, Boettiger CA (2011). Effects of Age and Alcohol Use Behavior on Impulsive Decision Making. Neurobiology of Adolescent Drinking in Adulthood (NADIA) 2011 Retreat. Chapel Hill, NC.
8. Le M\*, **Smith CT**, Boettiger CA (2011). Cognitive Impulsivity, Working Memory, and Genotype Effects. Celebration of Undergraduate Research, University of North Carolina at Chapel Hill. Chapel Hill, NC.  
\* undergraduate mentee presenter
9. **Smith CT**, Freeman-Daniels E, Boettiger CA (2010). Effects of Gender, Age, and Alcohol Use Behavior on Impulsive Decision Making. *Alcoholism: Clinical & Experimental Research*, 34, 119A.
10. Chanon VW, **Smith CT**, Kalka LS, Kampov-Polevo AB, Garbutt JC, Boettiger CA (2010). Effects Of Naltrexone On Alcohol Attentional Bias And Delay Discounting: A Pilot Study. *Alcoholism: Clinical & Experimental Research*, 34, 177A.
11. **Smith CT**, Boettiger CA (2010). Ovarian Cycle Effects on Immediate Reward Bias: a Window on PFC Dopamine. Cognitive Neurosci Soc 17:194. Montreal, QC, Canada.
12. Boettiger CA, **Smith CT** (2010). Immediate Reward Bias in Humans: Effects of Alcohol Use, Dopamine, Hormones, Age, and Gender. *Clinical and Translational Science* 3:S34.
13. **Smith CT**, Cloonan G, Lee A, Grisel JE (2008). Investigating the role of  $\beta$ -endorphin in mediating alcohol reward using *in vivo* microdialysis. Symposium for Young Neuroscientists and Professors of the SouthEast. Charleston, SC.
14. **Smith CT**, Cloonan G, Lee A, Grisel JE (2008). Role of  $\beta$ -endorphin in behavioral despair, stress, and anxiety. South Carolina IDeA Networks of Biomedical Research Excellence 2008 Research Symposium. Charleston, SC.
15. **Smith CT**, Cloonan G, Lee A, Grisel JE (2007). Role of  $\beta$ -endorphin in behavioral despair, stress, and anxiety. Faculty for Undergraduate Neuroscience Social and Poster Session. Society for Neuroscience 2007 Annual Meeting. San Diego, CA.

**Funding:**

**F31-AA020132 (Christopher Smith)**  
National Institute on Alcohol Abuse and Alcoholism

**8/2011 - 7/2014**  
**\$93,000**

**Now Versus Later Decision Making: Effects of Frontal Development and Alcohol Use**

This Predoctoral Fellowship was awarded to explore the neurobiological bases for the decline in the tendency to choose smaller, sooner rewards (“Now”) over larger, later rewards (“Later”) from late adolescence to early adulthood, a tendency that also characterizes individuals with alcohol use disorders. Studying developmental changes in the structure and function of frontal and subcortical brain structures that regulate *Now/Later*

decision-making using sMRI, fMRI, and DTI approaches may provide insight into why late adolescents are at increased risk for developing alcohol use disorders.

**NC TRACS 2K Pilot Grant (2KR391209)**

North Carolina Translational and Clinical Sciences (NC TraCS) Institute

**6/2012 - 5/2013**

**\$2000**

**Investigating the Impact of Genetic Polymorphisms in Dopaminergic Signaling on Immediate Reward Bias Behavior**

The objective of this study is to determine whether two common variable nucleotide tandem repeat polymorphisms associated with differential dopamine signaling in the striatum (DRD4 and DAT) can explain significant variance in immediate reward bias across individuals

**Teaching:**

**Instructional Assistant**, UNC Dept. of Psychology, Chapel Hill, NC

**Spring 2011**

Intro to Psychology (Psych 101)

Number Enrolled: 288

- Assisted in creation and grading of course assignments including exams and 5 2-page writing assignments with 2 other IAs.
- Managed online course material and online grade book via Blackboard system.
- Maintained weekly office hours for students.

**Mentoring:**

**Undergraduate Psychology Honors Thesis advisor for Michael Parrish (2013-14 academic year)**

Thesis title: Investigating Neural Networks Associated with Now vs Later Choice Using Resting State fMRI

**Undergraduate Psychology Honors Thesis advisor for Scott Oppler (2013-14 academic year)**

Thesis title: Investigating the Role of Striatal Dopamine on Reward Valuation Sensitivity: Interactions Between DRD2 and DAT Genetic Polymorphisms

**Psychology 395 Research Project advisor for Michael Parrish (Spring 2013)**

Project title: A Comparison of Methods for Resting State Functional Connectivity MRI Analyses

**Psychology 395 Research Project advisor for Scott Oppler (Spring 2013)**

Project title: Investigating the Role of Striatal Dopamine on Impulsive Choice Behavior

**Psychology 395 Research Project advisor for Yecenia Sierra (Fall 2012-Spring 2013)**

Project title: Estradiol is related to Impulsive Choice Behavior and Trait Impulsivity (Spring 2013)

Project title: How menstrual cycle hormones affect frontal-dependent function (Fall 2012)

**Undergraduate Psychology Honors Thesis advisor for Martina Le (2010-11 academic year)**

Thesis title: Cognitive Impulsivity, Working Memory, and Genotype Effects

**Biology 395 Research Project advisor for Ankita Desai (Summer 2011)**

Project title: Effect of C957T DRD2 on ICR

Directly supervised undergraduate research volunteers:

Melisa Menciloglu (Fal 2013-present)

Rachel Kaplan (Spring 2012)

Chelsea Lang (Fall 2011)

Jose Lopez (Fall 2010 - Spring 2011)

### Professional Development:

#### Multi-Modality Short Course

May 2013

Athinoula A. Martinos Center for Biomedical Imaging, Boston, MA

-Two-week program focused on a variety of techniques for studying brain structure and function including MRI, PET, MEG, EEG, DTI, MRS, NIRS, and TMS. Exposure to Freesurfer program for structural MRI analyses and FS/Fast for functional MRI analyses.

#### Neuroimaging Training Program

July 2012

University of California, Los Angeles

- Two-week program focused on advanced neuroimaging analysis methods including multivoxel pattern analysis, machine learning, and new data collection approaches. Afternoon workshops and a final group project focused on using MATLAB, Psychtoolbox, and FSL software to design imaging experiments and collect and analyze resting state, functional, and diffusion imaging MRI data.

#### Training Course in fMRI

August 2011

University of Michigan, Ann Arbor, MI

- Two-week program focused on introduction to fMRI physics, study design, and introduction to data analysis; experience with MATLAB and SPM software to assist in fMRI data analysis.

#### Teaching Certificate

Summer 2011

Summer Teaching and Pedagogy Series, UNC Chapel Hill, Chapel Hill, NC

UNC Center for Faculty Excellence and Training Initiative in Biomedical and Biological Sciences

- Series of lectures focused on strategies to actively engage undergraduate students in lecture classes, integrating technology in the classroom, and developing better teaching skills.

### Professional Affiliations:

Society for Neuroscience (member since 2007)

Cognitive Neuroscience Society (member since 2009)

Research Society on Alcoholism (member since 2009)

### Service

Peer Reviewer, *Neuropsychologia*

December 2013

### Press

Article on UNC Office of Undergraduate Research Blog

Undergraduates as an Asset in Neurobiology

<http://ourblog.web.unc.edu/2014/01/14/undergrads-as-an-asset-in-neurobiology/>

Spring 2014

Featured Research Article in *Carolina Scientific Magazine*

Uncovering addiction (2012), *Carolina Scientific*, 5 (1), 20-21. (Available by request)

Fall 2012