Final Examination of

Daniel T. Christian

M.S., University of Wisconsin Oshkosh
Oshkosh, WI

For the Degree of

DOCTOR OF PHILOSOPHY

COMMITTEE IN CHARGE

Dwayne Godwin, Ph.D., Chairman
Graduate School of Arts and Science

Brian A. McCool, Ph.D., Advisor
Physiology and Pharmacology

Jeffrey L. Weiner, Ph.D.
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Scott E. Hemby, Ph.D.
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Thomas J. Martin, Ph.D.
Anesthesiology

Piedmont Triad Community Research Center Auditorium
August 28, 2012
11:00 a.m.
PROFESSOR IN CHARGE OF RESEARCH

Brian A. McCool, Ph.D.
Associate Professor
Physiology and Pharmacology
Wake Forest University School of Medicine

FIELDS OF GRADUATE STUDY

Major Subject: Physiology and Pharmacology

- Cell and Molecular Pharmacology
- Basic Physiology
- Systems Pharmacology
- Integrated Physiology and Pharmacology
- Quantitative Methods in Behavioral Science
- Behavioral Pharmacology
- Scientific Integrity
- Bioethics

SUMMARY OF DISSERTATION

A STUDY ON THE EFFECTS OF CHRONIC ALCOHOL AND WITHDRAWAL IN THE BASOLATERAL AMYGDALA OF SPRAGUE DAWLEY RATS: AFFERENT SPECIFIC MODIFICATION OF GLUAMATERGIC NEUROTRANSMISSION

The lateral and basolateral amygdala (BLA) are major amygdala subdivisions that process environmental stimuli in an associative process that ultimately results in anxiety-like or fearful behavioral responses. These nuclei receive glutamatergic input via two major pathways differentiated by their anatomical arrangement and the upstream brain areas giving rise to the pathways. The external capsule (EC) brings primarily cortical information while the stria terminalis/internal capsule (IC) brings information from more mid-line structures like medial prefrontal cortex and thalamus. Recent work suggests that long-term anxiogenic effects of alcohol withdrawal may be related to adaptations in BLA glutamatergic neurotransmission. The current studies serve to characterize glutamatergic signaling at multiple glutamatergic afferents into the BLA following chronic intermittent ethanol exposure (CIE) and withdrawal (WD). The current studies indicated that EC-BLA and IC-BLA inputs into the BLA can be electrically isolated in an electrophysiological slice recording setup, and remain isolated in the face of CIE and WD. These data allowed the characterization of input specific alterations in glutamate function following both CIE and WD. In chapter II, we conducted electrophysiological recordings to explore pre- and postsynaptic functional alterations to glutamatergic signaling at EC-BLA afferents. These studies indicate that EC-BLA afferents demonstrate increased AMPA mediated post-synaptic signaling in response to WD treatment, while demonstrating no alterations in putative pre-synaptic functional measures. Additionally, investigations of biochemical alterations in response to CIE and WD were measured using Western Blot techniques. Our findings detail dynamic increases in AMPA receptor surface expression and phosphorylation following both CIE and WD. Changes in protein expression and phosphorylation levels of kinases associated with AMPA receptors (CAMKII/PKC) are also dynamically regulated by CIE and WD. Chapter III presents data indicating IC-BLA afferents undergo functional alterations in presynaptic glutamate synaptic transmission following WD, but not CIE, with no measureable alterations to postsynaptic functional. These functional increases in presynaptic glutamate function are paralleled by an upregulation in the expression of vesicle associated proteins. Taken together, our data
parallel synaptic plasticity literature suggesting CIE and WD are inducing plastic-like alterations to glutamatergic signaling systems at both EC- and IC-BLA afferents.

SCHOLASTIC VITAE

EDUCATION

2012    Ph.D. Physiology and Pharmacology
         Wake Forest University School of Medicine
         Winston-Salem, North Carolina

2005    M.S., Experimental Physiology
         University of Wisconsin Oshkosh, Oshkosh, WI

2003    B.S., Psychology
         University of Wisconsin Oshkosh, Oshkosh, WI

PROFESSIONAL MEMBERSHIPS

2010 – Current    Western North Carolina Society for Neuroscience

2007 – Current    Research Society on Alcoholism

2006 – Current    American Association for the Advancement of Science

2004 – Current    Society for Neuroscience

2002 – 2006    American Psychological Association (Student Member)

AWARDS

2011    Enoch Gordis Predoctoral Research Award, Research Society on Alcoholism annual meeting, Atlanta GA

2007 – 2009 Predoctoral Trainee, Alcohol Training Grant, T32 AA
PUBLICATIONS

JOURNALS

1. **Christian DT**, Alexander, NJ, Diaz, MR, McCool, BA. Thalamic Glutamatergic Afferents into the Rat Basolateral Amygdala Exhibit Increased Presynaptic Glutamate Function Following Withdrawal from Chronic Intermittent Ethanol. *Accepted to Neuropharmacology*


REVIEWS


ABSTRACT / POSTER PRESENTATIONS


