

# James Ryland Melchior, Ph.D.

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## Career Summary:

I have chosen a path of discovery that began with an interest in behavioral psychology and the basic tenants of B.F. Skinner's operant conditioning, in which reinforcement and punishment shape future behaviors. Through my master's work utilizing the medicinal leech, I gained an understanding of neurobiology and how discrete neural circuits govern specific downstream actions, including behavior. During my graduate studies, these ideas converged in the field of substance abuse. Here I learned how specific circuits encode reinforcement learning and motivated behavior by utilizing inherent affective responses to environmental cues, and how drugs of abuse pharmacologically insult these systems to drive addictive behaviors. As a postdoctoral trainee I have concentrated on understanding behaviorally-defined neural circuit activity at the level of synaptic physiology, as I believe the mechanisms of addiction and learning are rooted in the plasticity and function of specific synapses. I look forward to continuing research into the synaptic micro-circuitry underlying motivated behaviors while also implementing the principles of behavioral psychology to effectively train the next generation of neuroscience researchers.

## Education:

**Post-Doctoral Fellowship**, Synaptic Physiology, Vanderbilt University Medical Center, Nashville, TN., 2017- present. Advisor: Danny Winder, Ph.D., Department of Molecular Physiology and Biophysics

**Doctor of Philosophy**, Neuroscience, 2017, Wake Forest School of Medicine, Winston-Salem, NC. Dissertation: *Regulation of Dopamine Terminal Release in the Nucleus Accumbens: Implications for Alcohol Addiction*. Advisor: Sara Jones, Ph.D., Department of Physiology and Pharmacology.

**Master of Science**, Neurobiology, 2007, Western Michigan University, Kalamazoo, MI. Master's Thesis: *Modulatory Efferent Morphology and Target Allocation with Co-Innervating Leech Heart Motor Neurons*. Advisor: John Jellies, Ph.D., Department of Biological Sciences.

**Bachelor of Science**, Behavioral Psychology, 2001. College of Arts and Sciences, Western Michigan University, Kalamazoo, MI.

## Professional Experience:

2008-2011	<b>Laboratory Technician II</b> Department of Physiology and Pharmacology Wake Forest School of Medicine, Winston-Salem, NC
2006-2007	<b>Research Assistant</b> , Biotechnical Industry NanoVir, LLC, Kalamazoo, MI
2003-2006	<b>Teaching Assistant</b> Department of Biological Sciences Western Michigan University, Kalamazoo, MI

2002-2003                    **Research Technician**, Behavioral Pharmacology Laboratory  
Western Michigan University, Kalamazoo, MI

2001-2002                    **Laboratory Technician**, Genomics Laboratory  
Pharmacia Corporation, Kalamazoo, MI

### Teaching Experience:

2018-2020                    **Instructor**, Fast Scan Cyclic Voltammetry Lecture, NURO 8352 Methods and  
Experimental Design in Neuroscience Research, Vanderbilt University

2003-2006                    **Teaching Assistant**, Dept. of Biological Sciences, Western Michigan University  
- Instructed labs for Biology, Human Anatomy, and Human Physiology courses.

### Academic Honors and Professional Memberships:

2018                            **David K. Sundberg Award for Outstanding Graduate Student**  
Department of Physiology and Pharmacology  
Wake Forest School of Medicine, Winston-Salem, NC

2013                            **Wake Forest Alumni Student Travel Award**  
Gordon Research Conference on Catecholamines, West Dover, VT

2013-present                Member, Society for Neuroscience (SFN)

2013-present                Member, Research Society on Alcoholism (RSA)

2013-2017                    Member, Western North Carolina Chapter of SFN

### Grants and Funding:

2018-2021                    **F32 AA027409** (NIAAA) (Extended through 2/28/21)  
NIH Ruth L. Kirchstein Individual National Research Service Award  
*Dopaminergic Modulation of Excitatory Transmission in the BNST and  
Regulation by Ethanol*

2017-2018                    **T32 NS007491** (NINDS)  
*Ion Channels and Transporters*  
PI: Bjorn Knollmann

2014-2017                    **F31 AA023144** (NIAAA)  
NIH Ruth L. Kirchstein Individual National Research Service Award  
*Optical Isolation of Dopamine Signals and Regulation by Ethanol*

2013-2014                    **T32 AA007565** (NIAAA)  
*Multidisciplinary Training in the Biology of Addiction*  
PI: Brian McCool

Submitted:                    **K99/R00 AA029446** (NIAAA)  
NIH Pathway to Independence Award  
*Ethanol Modulation of Inhibitory Dopamine Signaling in the Dorsal BNST*

## Publications:

1. **Melchior JR**, Perez RE, Salimando GJ, Luchsinger JR, Basu A, Winder DG. Cocaine Augments Dopamine Mediated Inhibition of Neuronal Activity in the Dorsal Bed Nucleus of the Stria Terminalis. *Journal of Neuroscience*. 2021 May 20;41(27):5876–93. PMID: 34035141; PMCID: PMC8265809.
2. Harris NA, Isaac AT, Günther A, Merkel K, **Melchior J**, Xu M, Eguakun E, Perez R, Nabit BP, Flavin S, et al. Dorsal BNST  $\alpha$ 2A-Adrenergic Receptors Produce HCN-Dependent Excitatory Actions That Initiate Anxiogenic Behaviors. *Journal of Neuroscience*. 2018 Oct 17;38(42):8922-8942. PubMed PMID: 30150361; PubMed Central PMCID: PMC6191524.
3. Siciliano CA, Karkhanis AN, Holleran KM, **Melchior JR**, Jones SR. Cross-Species Alterations in Synaptic Dopamine Regulation After Chronic Alcohol Exposure. *Handbook of Experimental Pharmacology*. 2018 Apr 20. PubMed PMID: 29675581; PubMed Central PMCID: PMC6195853.
4. **Melchior JR**, Jones SR. Chronic ethanol exposure increases inhibition of optically targeted phasic dopamine release in the nucleus accumbens core and medial shell ex vivo. *Molecular and Cellular Neuroscience*. Dec;85:93-104, 2017. PubMed PMID: 28942046; PubMed Central PMCID: PMC5698100.
5. **Melchior JR**, Ferris MJ, Stuber GD, Riddle DR, Jones SR. Optogenetic versus electrical stimulation of dopamine terminals in the nucleus accumbens reveals local modulation of presynaptic release. *Journal of Neurochemistry*. Sep;134(5):833-44, 2015. PMCID: PMC4537642
6. Calipari ES, Ferris MJ, **Melchior JR**, Bermejo K, Salahpour A, Roberts DC, Jones SR. Methylphenidate and cocaine self-administration produce distinct dopamine terminal alterations. *Addiction Biology*. Mar;19(2):145-155, 2014. PMCID: PMC3390453
7. Ferris MJ, Calipari ES, **Melchior JR**, Roberts DC, España RA, Jones SR. Paradoxical tolerance to cocaine after initial supersensitivity in drug-use prone animals. *European Journal of Neuroscience*. Aug;38(4):2628-36, 2013. PMCID: PMC3748159
8. Ferris MJ, Calipari ES, Mateo Y, **Melchior JR**, Roberts DC, Jones SR. Cocaine self-administration produces pharmacodynamic tolerance: differential effects on the potency of dopamine transporter blockers, releasers, and methylphenidate. *Neuropsychopharmacology*. Jun;37(7):1708-16, 2012. PMCID: PMC3358740
9. España RA, **Melchior JR**, Roberts DC, Jones SR. Hypocretin 1/orexin A in the ventral tegmental area enhances dopamine responses to cocaine and promotes cocaine self-administration. *Psychopharmacology*. Mar;214(2):415-26, 2011. PMCID: PMC3085140

## Ad-hoc Reviewer:

Journal of Neurochemistry, ACS Chemical Neuroscience, European Journal of Neuroscience, Journal of Molecular Neuroscience, Analytical Chemistry, Neurophotonics

## Posters and Abstracts:

JR Melchior, DG Winder. Measuring Synaptic Physiology of Endogenous Dopamine Signals in the Dorsal Bed Nucleus of the Stria Terminalis. **Alcohol and the Nervous System (Gordon Research Conference)**; Galveston, TX, 2020.

JR Melchior, DG Winder. Measuring Synaptic Physiology of Endogenous Dopamine Signals in the Dorsal Bed Nucleus of the Stria Terminalis. **Catecholamines (Gordon Research Conference)**; Newry, ME, 2019.

JR Melchior, SR Jones. Ethanol Differentially Modulates Optogenetically Stimulated Dopamine Release in Nucleus Accumbens Core and Medial Shell ex vivo. **Catecholamines (Gordon Research Conference)**; Newry, ME, 2017.

JR Melchior, SR Jones. Chronic Chemogenetic Activation of Dopamine Neurons Does Not Induce Changes in Dopamine Terminal Dynamics. **Wake Forest Program in Neuroscience**, Student Research Day. Wake Forest School of Medicine, 2016.

JR Melchior, SR Jones. Chronic Chemogenetic Activation of Dopamine Neurons Does Not Induce Changes in Dopamine Terminal Dynamics. **Alcohol and the Nervous System (Gordon Research Conference)**; Galveston, TX, 2016.

JR Melchior, SR Jones. Examining Dopamine Terminal Plasticity in the Nucleus Accumbens Shell Following Chronic Ethanol. **Catecholamines (Gordon Research Conference)**; Newry, ME, 2015.

JR Melchior, SR Jones. Optical vs Electrical Stimulation of Dopamine Release in Nucleus Accumbens Slices: Regulation by Local Circuitry. **Wake Forest Program in Neuroscience**, Student Research Day. Wake Forest School of Medicine, 2015.

JR Melchior, SR Jones. Optical vs Electrical Stimulation of Dopamine Release in Nucleus Accumbens Slices: Regulation by Local Circuitry. Program No. 129.17. 2014 Neuroscience Meeting Planner. Washington, DC: **Society for Neuroscience**, 2014. Online.

JR Melchior, SR Jones. Optogenetic Insights into Ethanol Effects on Presynaptic Dopamine Terminal Dynamics. Abstract code 3772D26. **Annual Meeting of the Research Society on Alcoholism**; Bellevue, WA, 2014.

J. Jellies, J. Melchior. Spatial heterogeneity in co-innervation of an invertebrate muscle by multiple uniquely identified efferents. Program No. 290.13. 2007 Neuroscience Meeting Planner. San Diego, CA: **Society for Neuroscience**, 2007. Online.

J.A. Jellies, E. McCormick, R. Patel, J. Melchior. Innervation density of identified FMRFamide positive efferents in the leech may be developmentally regulated by competition. Program No. 30.10 2006 Neuroscience Meeting Planner. Atlanta, GA: **Society for Neuroscience**, 2006. Online.

J. Melchior, J.E. Berger, J. Jellies. Two identified efferents project to a common target along very different pathways. Program No. 481.1 2005 Abstract Viewer and Itinerary Planner. Washington, DC: **Society for Neuroscience**, 2005. Online.

J.E. Berger, J. Melchior, J. Jellies. Developmental regulation of peptidergic efferent neuron arbors on a target muscle in the leech. Program No. 368.4 2005 Abstract Viewer and Itinerary Planner. Washington, DC: **Society for Neuroscience**, 2005. Online.

## Departmental Presentations:

Melchior, JR (2020, October) *Cocaine Augments Dopamine Mediated Cellular Inhibition in the Dorsal Bed Nucleus of the Stria Terminalis*. Departmental Seminar, Molecular Physiology and Biophysics, Vanderbilt University, Nashville, TN.

Melchior, JR (2020, August) *Cocaine Augments Dopamine Mediated Inhibitory Signaling in the Dorsal Bed Nucleus of the Stria Terminalis*. Work in Progress Seminar Series, Vanderbilt Center for Addiction Research, Vanderbilt University, Nashville, TN.

Melchior, JR (2019, February) *Examining Catecholamine Release in the Dorsal Bed Nucleus of the Stria Terminalis*. Departmental Seminar, Molecular Physiology and Biophysics, Vanderbilt University, Nashville, TN.

Melchior, JR (2017, August) *Regulation of Dopamine Terminal Release in the Nucleus Accumbens: Implications for Alcohol Addiction*. Dissertation Presentation, Wake Forest School of Medicine, Winston-Salem, NC.

Melchior, JR (2015, October) *Using Designer Receptors to Investigate the Influence of Dopamine Signaling on Behavior*. Neuroscience Departmental Seminar, Wake Forest School of Medicine, Winston-Salem, NC.

Melchior, JR (2015, April). *Optical vs Electrical Stimulation of Dopamine Release in Nucleus Accumbens Slices: Regulation by Local Circuitry*. Neuroscience Departmental Seminar, Wake Forest School of Medicine, Winston-Salem, NC.

Melchior, JR (2014, April). *Optical Isolation of Dopamine Signaling in the Nucleus Accumbens: Regulation by Local Circuitry*. Neuroscience Departmental Seminar, Wake Forest School of Medicine, Winston-Salem, NC.

Melchior, JR (2013, April). *Optical Isolation of Dopamine Signaling in the Nucleus Accumbens*. Neuroscience Departmental Seminar, Wake Forest School of Medicine, Winston-Salem, NC.

Melchior, JR (2012, June). *Minipump Amphetamine Administration and Dopamine Signaling in the Nucleus Accumbens*. Neuroscience Graduate Student Seminar, Wake Forest School of Medicine, Winston-Salem, NC.

Melchior, JR (2007, August). *Innervation of Heart Tubes in the Leech by Two Uniquely Identified Efferents*. M.S. Thesis Presentation, Western Michigan University Department of Biological Sciences, Kalamazoo, MI.

## Research Techniques:

**Microsurgery:** I am proficient in intra-cranial injections. I have performed over 300 surgeries targeting viral injections into the ventral tegmental area, the dorsal raphe nucleus, the BNST or the locus coeruleus of mice and rats. I have experience implanting chronic indwelling jugular catheters in rats for psychostimulant self-administration. I also have experience performing micro-dissections of anesthetized leech embryos for isolation and targeting of identified neurons.

**Histology:** I have extensive experience in immunohistochemistry and fluorescence microscopy; I designed the current immunohistology protocol used by several neuroscience labs within the department at Wake Forest. I also have experience performing fluorescent *in situ* histology of mRNA transcripts (RNA scope) and confocal microscopy. Experience with mice, rats and leeches.

**Physiology:** I am proficient in cyclic voltammetry, *ex vivo*; including fabrication of epoxied electrodes for repeated use and stability. I also have experience performing single cell, transmembrane voltage recording in the leech, including microinjection of various intracellular tracers by electrophysiological techniques to generate multiple fluorescent labels. I am proficient in whole-cell patch clamp electrophysiology and *ex vivo* pharmacology.

**Animal Models:** I have experience with all aspects of mouse husbandry including breeding, DNA extraction and genotyping; also harvesting ova from pregnant transgenic females for re-derivation and cryopreservation. I have experience with husbandry of the Medicinal Leech, *Hirudo Medicinalis*.

**Behavioral Analysis:** I have conducted studies of the effect of various psychoactive drugs on behavior in mice and rats including operant self-administration, locomotor activity, conditioned place preference and voluntary drinking. I also have experience using chronic intermittent ethanol vapor chamber models.

## References:

### **Danny Winder, Ph.D.**

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Director, Vanderbilt Center for Addiction Research  
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### **Rodrigo España, Ph.D.**

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