

**BIOMEDICAL & VETERINARY SCIENCES  
GRADUATE PROGRAM**



**ANNOUNCES**

The Master of Science Seminar and Examination of

**Alexander James Murray**  
**“The Interaction of Early Growth Response Gene 1  
and Myocyte Enhancer Factor 2C in the Murine  
Cortex”**

**Wednesday, August 4th, 2021**

**9:00AM**

**268 Steger Hall-North Wing**

**Zoom link:**

**<https://virginiatech.zoom.us/s/897106778>**



### **Bio**

Originally from Portsmouth, Virginia, Alexander (Alex) has . He earned his BS (Biological Sciences) at Virginia Tech in 2016 while conducting undergraduate research in the Epigenomics and Computational Biology lab under Dr. Hehuang (David) Xie. Following his undergraduate work, Alex returned to Dr. Xie's lab to work as a lab technician for a time while applying to programs. He was then accepted into the BMVS graduate program and once again returned to the Epigenomics and Computational Biology lab where he studied transcription factors and their role in development within the brain. Following his defense, Alex will be moving to Northern Virginia to explore future career options

### **Funded by**

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VMCVM Office of Research and Graduate Studies

## Lay Language Abstract

Early growth response gene – 1 (EGR1), is a protein that can be found in animals such as fruit flies, mice, rats and humans. In the mammals it is found, it is expressed within the cardiovascular, endocrine, digestive, immune, musculo-skeletal and central nervous systems (CNS). Within the CNS, EGR1 has come to be known as an essential element that is necessary to many functions involved in the development of the brain. EGR1 is known to play a role in how the early brain develops in response to environmental stimuli, formation of certain memory types and synapse architecture. Many gene networks involved in growth and development rely on EGR1 to regulate functions such as synapse reformation after exposure to the environment. EGR1 is known to have numerous partners with whom it interacts to perform its job and is also involved in epigenetic regulation, which is a process by which genes are silenced or activated without changing DNA sequences in the genome. EGR1 in epigenetics is a direct partnership with Ten-eleven translocation methylcytosine dioxygenase 1 (TET1) which can demethylate DNA at EGR1 target sites in the genome, increasing the probability of gene transcription. In memory development, EGR1 plays a key role ensuring short-term auditory fear memory can be converted to long-term memory, and also ensures long-term spatial memory. Additionally, when mammals such as humans or mice are developing and we do not experience something key, such as maternal care, this lack of crucial early life experience may play a large role in predisposing us to diseases as post-traumatic stress disorder (PTSD) and schizophrenia later on in life.

The Epigenomics and Computational Biology lab has worked and identified a possible partner of EGR1, myocyte enhancer factor 2C (MEF2C). MEF2C works in many processes and tissues, such as the brain, similar to EGR1 and also directly controls Egr1's transcription after visual stimulation in mice but so far any protein-protein interaction has yet to be proven. Our data suggests that there is a co-regulatory model and interaction between EGR1 and MEF2C which may play a role in why these two genes control similar processes within the brain. This work provides evidence of an protein-protein interaction of EGR1 and MEF2C in cultured cells and in the cortical region of mice, providing a foundation for future study of the interaction of these proteins and how they interact to initiate cascading events following neuronal stimulation.

## Publications

Sun, Z., Xu, X., He, J., **Murray, A.**, Sun, Sun, M., Wei, X., Wang, X., McCoig, E., Xie, E., Jiang, X., Li, Liwu., Zhu, J., Chen, J., Morozov, A., Pickrell, A., Theus, M., Xie, H. EGR1 recruits TET1 to shape the brain methylome during development and upon neuronal activity. *Nat Commun* 10, 3892 (2019)

## Presentations

Murray, A. Fan, J., Armstrong, N., Xu, X., Alajoleen, R., Xie, H. VMCVM 31st Annual Research Symposium, March, 2021, Blacksburg, VA.  
"Development of memory, learning and behavior mediated by Egr1 in cortical and hippocampal neurons."

Murray, A., Banerjee, S., Xu, X., Wei, X., Salom, H., Armstrong, N., Xie, H. VMCVM 30th Annual Research Symposium, November 2019, Blacksburg, VA. "Brain Epigenome programming mediated by neuronal activity-dependent transcription factors".

## Examination Graduate Committee

### **Major Advisor/Chair:**

Hehuang (David) Xie, Ph.D.  
Associate Professor  
Department of Biomedical Sciences and Pathology

### **Graduate Advising Committee Members:**

Ansar Ahmed, BVSc, Ph.D.  
Associate Dean, Research and Graduate Studies, VMCVM  
Director, Summer Veterinary Scholars Research Program  
Professor of Immunology  
Professor, Faculty of Health Sciences  
Virginia-Maryland College of Veterinary Sciences

Michael Fox, Ph.D.  
Professor  
Director, School of Neuroscience, College of Science  
Fralin Biomedical Research Institute at VTC

Sarah M. Clinton, Ph.D.  
Associate Professor and Associate Director for the School of Neuroscience  
School of Neuroscience

Timothy Jarome, Ph.D.  
Assistant Professor  
School of Neuroscience



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