BYU Neuroscience

Nathan Anderson, Ph.D.
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Nathan Anderson is a cognitive neuroscientist who studies how the human brain supports episodic memory and mental imagery. His research combines functional MRI with introspective behavioral methods to investigate the neural mechanisms underlying these cognitive processes. Using precision MRI (also known as dense-sampling MRI), his lab collects large amounts of data from individual participants to create detailed, personalized maps of brain function.

Garrett Cardon, Ph.D.
Assistant Professor,
Communication Disorders
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Dr. Cardon is a cognitive neuroscientist and audiologist currently working on projects related to atypical sensory processing in autism and other developmental disabilities, as well as cortical plasticity in adults and children with hearing loss. To investigate brain-behavior relationships related to the above, he uses EEG and MRI/fMRI. Dr. Cardon is also investigating how to facilitate empathy between autistic and neurotypical individuals through both scientific and artistic representations of the mind.

Stefania Ashby, Ph.D.
Assistant Professor,
Psychology
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Dr. Ashby is interested in understanding how the brain supports our ability to form generalized semantic memories and how those memories impact decision-making. In particular, she is interested in examining how we process misinformation we frequently encounter online, in personal conversations, and on social media. Her research uses functional MRI (fMRI) and neural pattern analyses to examine how memories for misinformation and retractions are processed and stored in the brain. She also uses behavioral testing to study ways in which we can better process retractions to reduce the impact misinformation has on future decision-making.

Kaylie Carbine, Ph.D.
Assistant Professor,
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Kaylie Carbine is the Principal Investigator of the Cognitive Health and EEG/ERP Research (or CHEERs) Lab. Her research program tests how neural responses to food, such as reward sensitivity and attentional bias, relate to and are affected by health behaviors, including diet, sleep, and physical activity. To investigate these connections, she utilizes cognitive neuroscience methods, particularly electroencephalography (EEG) and event-related potentials (ERPs). Her work seamlessly transitions from testing fundamental neural processes to developing practical interventions that tackle real-world health challenges. As a mentor, Kaylie is passionate about guiding students—particularly those who are minority, underrepresented, or first-generation college students—in achieving their academic and professional aspirations. By integrating methodologies from neuroscience, cognitive, and health psychology, she engages students from diverse academic backgrounds in collaborative and interdisciplinary experiential learning.

Steven K. Charles, Ph.D.
Associate Professor,
Mechanical Engineering
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As a biomedical engineer, Dr. Charles investigates how humans control their movements, what goes wrong in movement disorders, and how to use technology to evaluate, assist, or rehabilitate patients with movement disorders. His research draws on knowledge and practices from biomechanics, neuroscience, robotics, and rehabilitation.

Derin Cobia, Ph.D.
Assistant Professor,
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Dr. Cobia's laboratory is focused on the implementation of computational anatomy tools to study neuropsychiatric diseases, particularly schizophrenia. His interests are in the clinical and biological heterogeneity that exists in schizophrenia by taking a cognitive neuroscience perspective. His work has involved linking cognitive and neurobiological characteristics to important clinical dimensions (e.g., negative symptoms) of the illness.

Jeffrey Edwards, Ph.D.
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By combining electrophysiology with pharmacology, molecular biology (qPCR), optogenetics, behavioral studies, and immunohistochemistry, Dr. Edwards lab investigates synaptic plasticity—the cellular mechanism that enables our brains to learn and adapt. Our research focuses on synaptic plasticity in two key brain regions: the hippocampus, which plays a central role in learning and memory, and the ventral tegmental area, the brain's reward pathway. The ultimate goal is to understand normal brain function and apply this knowledge to abnormal conditions, such as stress, PTSD, and Alzheimer's disease in the hippocampus, as well as the effects of drug exposure (e.g., psychedelics, morphine, THC, and polysubstance use) on the ventral tegmental area.

Shawn Gale, Ph.D.
Associate Professor,
Psychology
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Dr. Gale investigates the effects of infectious disease on neurocognitive and neuropsychiatric function. More broadly, he also studies neuroepidemiology including novel determinants associated with brain-behavior relationships.

Julianne Holt-Lunstad, Ph.D.
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Dr. Holt-Lunstad's research examines the association between our social relationships and physical health and longevity, the pathways (e.g., cardiovascular, neuroendocrine, genetic, metabolic, immune, and neural) by which this association occurs, potential moderating factors, and how relationships may be applied in interventions aimed at improving health and reducing risk. Her work is interdisciplinary and takes a multilevel approach—utilizing diverse methods (self-report, biological, and behavioral data) and concepts.

Mark Brinton, Ph.D.
Associate Professor,
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We perform interdisciplinary neural-engineering research at the intersection of electrical engineering and neuroscience. Current focus in developing natural and intuitive sensory-restoration technology for virtual and augmented reality, neurorehabilitation, and upper-limb prostheses, using noninvasive electrical stimulation. Students perform psychophysical experiments, computational modeling, and real-time movement decoding to study how stimulation parameters influence the intensity, naturalness, localization, and usefulness of evoked sensations.

Michael J. Larson, Ph.D.
Professor,
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Dr. Larson's research utilizes a convergence of information from neuropsychology and cognitive neuroscience methodologies to examine the mechanisms of cognitive control in healthy individuals and cognitive dysfunction following traumatic brain injury (TBI). He uses event related potentials (ERPs) and functional magnetic resonance imaging (fMRI) to show brain-based changes in how people monitor and manage their environment following head injury. He also studies how exercise influences cognitive functioning, the role of inhibitory control in food and diet behaviors, and the role of psychopathology (e.g., obsessive-compulsive disorder [OCD] and depression) in influencing cognitive control processes and concomitant brain activity.

Steven Luke, Ph.D.
Associate Professor,
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The major focus of Dr. Luke's research is reading, which is a complex activity that involves many different processes, most notably language and vision. He also studies other aspects of language, such as language development and word and sentence comprehension, as well as other visual tasks, such as scene perception and visual search. Many different groups participate in my studies, including children and adolescents, second language learners, and individuals from various clinical populations. His research primarily uses eye-tracking technology, although he also uses MRI and EEG to study how the brain understands and integrates visual and language information
during reading and other tasks.

Dawson Hedges, M.D.
Professor,
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In his cognitive epidemiology research, Dr. Hedges investigates factors that contribute to neurodegenerative diseases and neuropsychiatric outcomes with a particular focus on the effects of chronic infection and inflammation.

Preston Manwaring, Ph.D.
Associate Professor, Electrical and Computer Engineering
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Dr. Manwaring is a professor of computer engineering and neuroscience. He recently left the MedTech industry to research novel physiological sensors, medical devices for low- and middle-income countries, and neuro-monitoring and -modulation. His current projects include a contactless fetal heart monitor, a radio-frequency neuromodulation and monitoring device, a whole-body vibration platform and monitoring system to study attention and focus, a whole-body vibration treatment platform for eating disorder investigations, and a tilt-table device to study brain hemodynamics.

Eric Melonakos, Ph.D.
Assistant Professor,
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The Melonakos Lab is interested in how neural activity gives rise to consciousness. General anesthesia and sleep are two states defined by a reversible loss of consciousness, making them useful tools for studying which neural features are necessary to generate the conscious state. Synchronous neural activity is a hallmark of general anesthesia and sleep. However, the mechanisms and functions of synchronous neural activity under these and other states remain incompletely understood. The lab uses modern neuroscience techniques, such as in vivo calcium imaging, optogenetics, electrophysiology, and computational tools, to investigate the origins and functions of synchronous neural activity in rodent models.

Tricia Merkley, Ph.D.
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Dr. Merkley's research focuses on neuroimage analysis and neuropsychological assessment to investigate brain changes following traumatic brain injury and how they relate to neurobehavioral functioning during recovery. These studies consider effects of TBI in both pediatric and adult populations, with the recognition that traumatic brain injury can adversely affect future brain development in childhood, in addition to impacting cognitive abilities that were previously developed.

Jared Nielsen, Ph.D.
Assistant Professor,
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In the Nielsen Brain and Behavior Lab, they are interested in answering questions about the organization of the brain and how neurological and psychiatric illnesses disrupt its organization. To answer these questions, they use a variety of analytical techniques to extract quantitative information from MRI scans.

Ryley Parrish, Ph.D.
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The Parrish lab is addressing key questions related to epilepsy and seizure disorders. We are particularly interested in mechanisms of endogenous inhibitory restraint and spontaneous seizure termination. We also seek to understand the role of a cellular event known as a cortical spreading depression in seizure termination, a phenomenon which is also associated with migraines. Finally, the lab is working to understand the mechanisms of prolonged seizure activity, known as status epilepticus, which is often pharmacoresistant. The lab uses electrophysiology, optogenetics, live network imaging, and computer programming to address our biological questions.

Perry Ridge Ph.D.
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Biology
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Dr. Ridge's laboratory focuses on the genetics of Alzheimer's disease and developing computational methods/algorithms to interpret data mined from complex genomic datasets. Dr. Ridge's current research areas include:

- Studying the relationship of the mitochondrial genome to Alzheimer's disease.
- Performing family-based studies to identify rare genetic risk factors for disease
- Determining the functional effects of synonymous
  mutations in known Alzheimer's disease genes
- Developing algorithms to predict the translational effects of genomic variants and to perform haplotype-based association studies.

Finally, Dr. Ridge is part of the recently funded Natives Engaged in Alzheimer's Research grant—a large collaboration of several academic institutions to build a cohort of American Indians, Alaskan Natives, Native Hawaiians, and Pacific Islanders. Dr. Ridge is co-director of the bio specimen repository and his laboratory will lead genetic analyses of the cohort.

Michael R. Stark, Ph.D.
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Dr. Stark's research focuses on early nervous system development in vertebrates. He has been primarily interested in how cells make fate decisions to become a certain cell type in the nervous system. Some of his research has addressed questions related to patterning of the nervous system, neuronal cell determination, and the molecular steps leading to cellular differentiation. More recent projects in the lab have focused on CNS development and neural tube defects in the early embryo that lead to anencephaly and spina bifida.

Trace Stay
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Dr. Stay's lab is focused on studying how sensory signals are represented and transformed into motor outputs in neural circuits. This provides both an opportunity to carefully delineate healthy function in specific sensory systems as well as describing principles of adaptation that could apply across multiple circuits. We focus on the vestibulo-ocular reflex for its high plasticity and circumscribed anatomical circuit. Using in vivo electrophysiology, optogenetics, and behavioral assays, we seek to understand 1) how vestibular and visual signals are combined and transformed through the cerebellum and brainstem, and 2) what external factors influence long-term retention of learned changes in motor skill memory. Ultimately this research could potentially help develop treatments for individuals with vestibular deficits (e.g. a vestibular implant), and provide insight into neural mechanisms underlying behavioral learning. Undergraduate researchers at any level of experience are encouraged to contact Dr. Stay to express interest.

Sterling Sudweeks, Ph.D.
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Dr. Sudweeks studies neurotransmitter receptors that act as ion channels. These ligand-gated ion channels are involved in synaptic transmission and are implicated in several pathological conditions. They are also the pharmacological targets in many therapeutic situations. These ion channels are expressed in both the central and peripheral nervous systems. Specific receptors for the neurotransmitters gamma-aminobutyric acid (GABA), serotonin (5-HT3), glycine (GlyR), and acetylcholine (nAChRs) are all members of the ligand-gated ion channel superfamily.

Arminda Suli, Ph.D.
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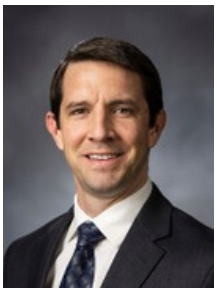
Dr. Suli's research focuses in understanding the development and formation of neurocircuits at the genetic and molecular level. There are two main projects in the lab: 1. Understanding the formation of synapses in mechanosensory hair cells, the specialized sensory cells that mediate hearing and balance in mammals and are additionally used in fish and amphibians as part of the lateral line sensory system to detect prey and predators. 2. Identification and development of neurons in the midbrain that receive and integrate inputs from multiple sensory systems, such visual, auditory and somatosensory, and which coordinate appropriate motor response to external stimuli.



Seth Taylor, Ph.D.
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Dr. Taylor researches the molecules involved in guiding the formation of proper connections between cells in the nervous system. He uses a combination of molecular biology, genetics, microscopy and RNA sequencing to understand these developmental events and processes.
His research specialties include: Confocal Microscopy, Single-cell RNA Sequencing, and Cellular Neuroscience.

Dixon Woodbury, Ph.D.
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Dr. Woodbury's research is in molecular neuroscience and focuses on membrane biophysics, particularly vesicle/membrane fusion and its regulation by SNARE proteins. SNARE proteins form the molecular motor that drives exocytosis and are the target of tetanus and botulinum toxin. Additional research looks at effects of alcohols and cholesterol on exocytosis. More information about the Woodbury lab can be found at woodburylab.byu.edu.