

SYNAPSE

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BYU Neuroscience



MEET DR. JORDAN YORGASON

Neuroscience Faculty
Member as of 2018

When I first began College at Utah Valley State College (UVSC) in 2002, I had decided on becoming a violin maker. I had discovered a love for classical music and was obsessed. I wanted to make myself the perfect cello and play until my fingers bled. I would spend hours staring at instruments, memorizing their curves and the colors of their varnish. I loved the idea of working in a shop all day carving away at a beautiful piece of highly flamed maple while listening to Shostakovich in the background. I went on my mission to England, and came back just as determined to make instruments. I decided I would major in music so that I could teach music on the side.

The first semester after my mission, I signed up for a general biology course as part of my curriculum. Before this class I had no desire to become a scientist. But I loved the lectures and the concepts really clicked conceptually in my mind. I had never considered being a scientist. During that semester, I attended a talk from President Monson. He told us to challenge ourselves in our education. I felt inspired and knew that shifting from music to biological

sciences would be a definite challenge. It was decided! I would do a complete switch to studying something in the biological sciences. I talked to one of my closest high school friends who was studying neuroscience at BYU. He was performing research with Dr. Scott Steffensen and invited me to meet Dr. Steffensen.

Hearing his experiences, I decided to transfer the very next semester to BYU to start studying neuroscience. I started performing neuroscience research and also met and married my wife Marianne Thomas that same semester. In the lab, I taught myself how to program, and wrote some software for Dr. Steffensen. I learned how to perform intracranial implant surgeries. I took neuroscience classes from Dr. Mike Brown, and even had Dr. Rebekka Matheson as a Teaching Assistant for neuroanatomy. They were all fantastic teachers back then too by the way!

I loved this transition to science. Performing research, programming software, building things and making discoveries all came naturally and became my new obsession. I read papers and stayed awake at night contemplating different experiments we could do in the lab. After taking the Advanced Neuroscience course with Dr. Brown, I became his teaching assistant for a semester and loved working with fellow neuroscience students to understand difficult research papers.

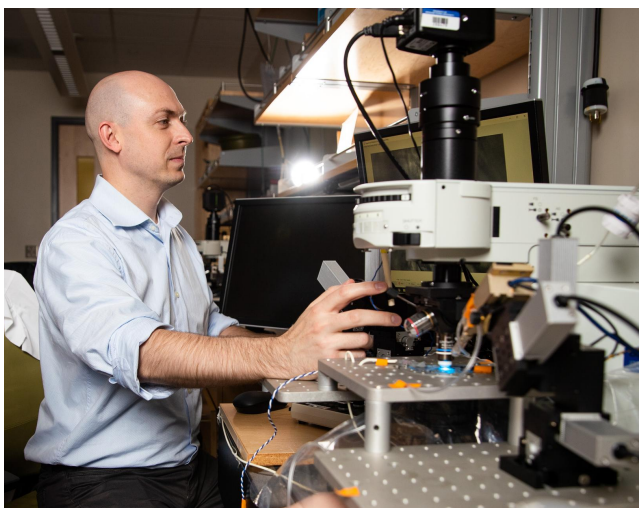
After graduating, I matriculated into a PhD program in North Carolina at Wake Forest University where I studied Neuropsychopharmacology with Drs. Sara Jones and Rodrigo

España. From Dr. Jones, I learned how to talk science while still speaking English. I learned to present with confidence and ask plenty of questions. From Dr. España, I learned electrochemistry techniques and the importance of being a perfectionist. He taught me how to operate a confocal microscope and take beautiful images.

In the lab, I wrote software for performing electrochemistry experiments and software for operant administration of drugs of abuse in rodents. These scientists were not just nerds in lab coats. They were also creators determined to help others with their creativity. Their creativity inspired me, despite the difficult nature of performing research. Together, we wrote papers detailing our discoveries on how stress affects mesolimbic dopamine circuitry.

Upon finishing my PhD degree, I moved to Portland Oregon to obtain postdoctoral training with Dr. John Williams at the Vollum Institute of Advanced Biomedical Research. Here I learned electrophysiology and multi-photon microscopy techniques. Dr. Williams taught me the importance of scientific reproducibility, rigor, ingenuity and of leading through service. He is one of the foremost experts in opioid and reward circuitry, and it was normal to see him mopping up the floor during routine lab cleanups. It was inspiring to see such an important person doing normal everyday things.

While there, I characterized a novel circuit involved in regulating dopamine release that is driven completely by local striatal cholinergic interneurons. We also studied the role of dopamine in olfactory glomeruli circuitry. In my time at both of these excellent Institutions, I couldn't help but notice how much BYU's neuroscience program had prepared me as an undergraduate student. The huge emphasis BYU's neuroscience program places on learning



the ins and outs of ion channels, the Nernst potential equation, receptor structure and function, as well as the thorough neuroanatomy examination helped prepare me effectively for the demands of my research.

In 2018, I was hired into the department of Physiology and Developmental Biology. My research continues to focus on understanding the neurocircuitry of natural and drug reward. I am an engineer at heart and you can often find me in the lab designing parts for microscopes, soldering together parts for my latest projects, or in my office writing code.

I love my laboratory and the individuals I work alongside. I have four graduate students that I currently work with. They are some of the most amazing individuals I know, and I feel honored to work with them. The undergrads I've worked with have also been amazing. I have several teams of undergraduates that work hard to solve problems and build upon the scientific community's knowledge of reward pathways. My students have increased my excitement for learning. Being a part of the BYU Neuroscience program is a great honor and I look forward to learning from my colleagues.

When I'm not working in the lab, you will find me spending time with my wife and 5 kids. We love hiking and cycling and playing our musical instruments together. Our kids are all scientists and musicians, and when they are not busy exploding test tubes, they are making a ruckus with their instruments.

Fun Fact: Dr. Yorgason loves playing the bass guitar and can blow a bubble with melted cheese.



DR. KEONI KAUWE

NEW POSITION FOR BYU NEUROSCIENTIST

On Tuesday, May 12, 2020, Dr. Keoni Kauwe, a professor of Biology and Neuroscience, was appointed as the 11th president of BYU Hawaii starting July 1, 2020. As a BYU Alumni, Dr. Kauwe has taught at BYU Provo for 11 years and will be greatly missed.

Dr. Kauwe is highly respected among students and faculty at BYU. The students love Dr. Kauwe and describe him as inspirational and caring. Students say that no matter how busy Dr. Kauwe is, he always makes time to meet with and help his students. Dr. Brown, who works with Dr. Kauwe said, "Kauwe is super friendly and very easy to talk to. He is always full of great ideas and is incredibly capable in everything he sets his mind to."

Dr. Kauwe is a world recognized leader in his research. Kauwe specializes in Alzheimer's disease genetics and has been very successful. His work is recognized nationally and internationally and his research is widely cited. Kauwe has made many important discoveries and has found more than a dozen new genetic risk factors for Alzheimer's disease. Dr. Kauwe will be continuing his research at BYU along with being president of BYU Hawaii.

Dr. Kauwe served as the chair of the biology department. In May 2019, the vice president of BYU, James Rasband appointed Dr. Kauwe as the Dean of BYU Graduate Studies. Dr. Rasband said "Dr. Kauwe is a gifted teacher and has been an extraordinarily productive researcher, gleaming external funding and nationwide plaudits while working alongside both graduate and undergraduate students in his lab."



5 Lessons I learned from my Neuroscience Degree

Graduating with Reflection in the Absence of Convocation

by Isaac Wu



I just graduated with a degree in Neuroscience without a plan to go to med school or grad school.

"Then what do you want to do with that?" People would always ask.

"Learn about the brain."

That was my answer every time. To me, a degree was always a gem of knowledge before it was a stepping stone. I hope my fellow graduating class of 2020 feel that way about their degrees too — we need to, now more than ever.

With jobs and internships blasted to smithereens, convocations cancelled, and glamorous grad trips put on hold, graduation must take on a new meaning. It must be a reflection on the gems of knowledge we gained from our degrees: the lessons learned that will forever change the way we look at, live in, and leave the world.

Here are 5 lessons I learned from my Neuroscience degree.

Lesson 1—Let Your Parents Take Pictures: Episodic Memory is the First to Go



I used to get annoyed when my mom wanted to take a selfie with us. I don't any more.

Why now?" we'd all ask as she whipped out her phone.

Why now?" we'd all ask as she whipped out her phone.

"To remember this!" she'd say.

As I studied aging and memory, I began to realize how good of a reason that really was. Generally, most of us can achieve "healthy aging" by learning new skills, being creative, and thinking and working in different ways. We can sail into the sunset of life with relative sharpness of mind, and even memory. For example, we won't forget how to drive a car or brush our teeth because our procedural, or "muscle", memory remains in good shape. Semantic memory — memory for facts — doesn't suffer much either, and can even get better as we age (think about your last game of trivia with mom and dad). One type of memory, however, is *not* immune to aging: episodic memory.

Episodic memory--memory for personal experiences--is shown to decline in accuracy as we get older. So, while my mom may be able to mince garlic, drive to Costco, and name the singer of *Suspicious Minds* with ease, she may *not* always remember what she ordered on the second time we went to that Ramen place in Palo Alto, and who was there. But a cue, like a picture, can be the magic wand for recalling the night a few siblings and I slurped away with her just down the street from Stanford.

Lesson 1. Be patient with your parents when they can't remember the little things, and support their requested selfies so they can.

Lesson 2 — Play Cards With Everyone : Remembering What Makes Us, Us



If you were observing the beginning of a card game, you wouldn't judge the players by their starting hands.

We've all been dealt a hand of cards. This hand isn't chosen and doesn't change. This hand is unique to us and has certain strengths and weaknesses. This hand is our genes.

Understanding the relationship between genes and behavior has changed the way I interact with others. Looking back at the times I discriminated against people because of their behavior, I could very well have been doing so because of their genes. I have been guilty of judging card players by their starting hands.

"It turned out all the 'over-reactors' I was so quick to label were just working with a unique card in their hand."

"Why is she overreacting?" I'd ask. "I wish he wasn't so impulsive," I'd think. I later learned in *Behavioral Neuroscience* that slow stress recovery and impulsivity are sometimes results of specific gene variants — a specific card in one's hand. I learned that one fourth of the population holds the slow-acting variant of COMT, which is an enzyme that aids in stress recovery. It turned out all the "over-reactors" I was so quick to label were just working with a unique card in their hand. Then I learned that a certain variant of the DRD4 gene, held by around 20% of the population, is implicated in addiction, impulsivity, higher risk-taking and even schizophrenia. Come to think about it, all those people I thought were "impulsive adrenaline junkies" had been dealt a joker at the beginning of the game.

Other behaviors can hardly be traced back to a single gene, but follow the "common variant" model. Autism follows this model, wherein a certain "recipe" of common gene variants may be the culprit. Individuals with autism might have a 5 of diamonds, an 8 of spades, and a jack of hearts — common cards all of us hold. But that specific combination may be just the one to produce the set of behaviors we've come to define as "autism."

While I never dared call an autistic person weird, I was no stranger to passing that judgment on "normal" people I found socially clumsy. Understanding the neurobiology of autism (or lack thereof) called for a shift in paradigm: "autism" is a set of traits, just like any other set of traits produced by any given hand of common cards. If every single person could have their genotype mapped and behavior closely observed, we would find more correlations between certain behavior sets and gene variant combinations. Then everyone would have a "disorder." So if today I run into someone I'm tempted to call weird, annoying, or anything else, I can remember that these traits are the results of unique card combinations, a lot like the ones in my own hand.

Now, you'd might as well rescind my degree if I were claiming we were all puppets of our DNA. If there is any certainty in neuroscience, it's that our brains are plastic: we can change the way experiences and genes have programmed us to think and behave (more on that in Lesson #4). A DRD4 holder can learn to tame his impulsivity. Someone with the slower COMT variant can work to reframe her stressors. And those who behave a little differently in social situations can find confidence and connection in society. Nevertheless, everyone has to start — and end — with the genes they've been dealt, and only time, experience, and patience can help us fulfill the potential therein.

Lesson 2. Never judge a player by their starting hand and play fairly with everyone — we're all learning to play our cards right.

"Never judge a player by their starting hand and play fairly with everyone — we're all learning to play our cards right."

Lesson 3 — The Best Way to Do Dishes : Letting Dish Soap Do Its Job.



Imagine you had to learn how to wash dishes all over again, but this time only through observation. You'd soon find there are different styles.

You may enjoy the efficiency of the filler-uppers, who turn their sink into a soapy swimming hole for the evening. The brute-forcers might excite you as they pour soap straight onto the dish and scrub frantically under a running faucet. But understanding the chemistry may call you down a different path.

Soap cleans dishes — I didn't need a chemistry class to tell me that. What I *did* need it to tell me

was *how*. Water — a polar molecule — and grease — a nonpolar molecule — don't mix. This is where dish soap comes in. Soap is an amphipathic molecule: it's both polar and nonpolar. It can grab the grease and hold on with its nonpolar tail as its polar head follows water down the drain. Understanding this, we can see how soap can't possibly do its thing when violently swished around in a pool or under a waterfall. It needs to do its job in steps: 1) bind to the grease, 2) get washed down the drain.

Lesson 3. The best way to wash dishes is a quick rinse to remove the leftover food scraps followed by a soapy scrub sans water, and then a thorough rinse under the faucet. "Wash, rinse, repeat," simple. But for me, it's now a simplicity that isn't blind. For me, the magic of dish soap is, as Oliver Wendell Holmes said, a "simplicity that lies on the other side of complexity."

Lesson 4 — Why "It's Not Good For Man to Be Alone": On Potentiation and Proximity.



"Marketing degrees are useless."

"He's just following the crowd."

"She's just doing that because..."

"Musical Dance Theatre majors are wasting their time."

Left alone, I would think thoughts like these. Left alone for longer, I would start to believe them. This is the dark side of potentiation, or how thoughts become "ingrained" in our brains. Understanding potentiation helped me break unhealthy trains of thought, and build healthier ones. To understand potentiation, however, you'll need a crash course in neuroanatomy.

"Understanding potentiation helped me break unhealthy trains of thought, and build healthier ones."

A rake is a great model for a neuron. The teeth of the rake represent the dendrites, the receiving end of a neuron. These dendrite “teeth” converge onto the head of the rake, which represents the cell body, a control center that processes input from the dendrites. From the head protrudes the long rake handle representing the axon, or “giving” end of the neuron. If the cell body “decides” to send a message to the next cell, it shoots an electrical impulse — an action potential — down the axon. The axon then communicates to the dendrite of the next cell. If you string a bunch of rakes together end-to-end, with the handle of one rake feeding into one of the teeth of the next, you have a neural pathway.

"Proximity will shatter your belief about someone and give you a chance to build something beautiful in its place."

The first time I thought, “marketing degrees are useless,” an entire neural pathway fired. Zooming into the connections, or synapses, between neurons in the pathway, we can begin to understand how our thoughts become potentiated.

Take the first neuron in the pathway: when an action potential shot down its axon and reached the end, it released chemicals — neurotransmitters — that travelled across the synapse toward the dendrite of the second neuron. When the dendrite received the neurotransmitter, it sent input to its cell body, much like one of the skinny teeth of a rake feeds into the head. As I kept thinking, “marketing degrees are useless,” the cell body continued to receive input from this dendrite and charge began to build up. When the amount of charge reached a threshold, the cell body shot an action potential down its axon to communicate to the next cell, but this had repercussions. An action potential did not only shoot *forward*, down the axon rake handle, but also *backwards*, throughout the dendrite teeth in the form of *backpropagating* action potential. So long as I kept thinking “marketing degrees are useless” without interruption, one of these teeth was still busy receiving input from the first neuron.

When the action potential of the first neuron met the *backpropagating* action potential of the second at their synapse, potentiation ensued: the connection between the first and second neuron was strengthened. The first now released neurotransmitter with every thought, the second neuron was more sensitive to that neurotransmitter, and as a result, it became a lot easier for me to think that marketing degrees were useless.

Until of course, I talked to a marketing student, and learned a new idea that would prove valuable at work.

I thought my neighbor was just following the crowd until I talked to him on the way to church and learned his genuine motivations.

I was sure why my friend was acting irritated until she told me otherwise.

I was so convinced that Musical Dance Theatre majors were wasting their time until I interviewed one.

It turns out, Musical Dance Theatre majors spend multiple days understanding the inner world of character they dance, sing, and act on behalf of. They do what I hadn't done: get *proximate* to those who so desperately need their understanding.

Students of the Bible agree that when the Creator stated, “It's not good for man to be alone,” he was hinting at a partner. But there's another reason it's not good for man to be alone: Partners and everyone else were meant to be loved, and when we are left alone to think about them, our thinking is flawed. When we are left alone for longer, we begin to believe ourselves.

Lesson 4. It's not good for man to be alone because thoughts potentiate, so get proximate to others. Proximity will shatter your belief about someone and give you a chance to build something beautiful in its place.

Lesson 5 – Mercy Softens, Trust Ennobles.



A few weeks into my last semester, I made a realization. In response to it, I wrote the following email to my professor and meant it:

Hi Dr. _____,

I made a mistake: I did not check the exam availability days. I assumed it ran for 4 days and thought I could still take it today. May I

still take the exam, not for credit, but just as a benchmark for myself? I know you don't allow exams to be taken home, so I can take it during a TA office hour or one of yours? Let me know what you advise.

thank you,

Isaac Wu

He said yes.

The morning of the exam, I was upset. My roommates had done something I couldn't let go of. As I walked with my professor of *Advanced Neuroscience* to the empty computer lab, my mind hardened with grudges. As we neared the entrance, he spoke up and told me the test I was about to take was actually going to be for credit and that there were no penalties.

Every thought was silenced — something had changed inside.

I felt the muscles in my face relax.

I let go of the roommate thing.

I was softened.

He was letting me off the hook when he had every reason not to, and it stopped me cold. At that point, the points were immaterial: My accumulated GPA was high and essentially set in stone and I'd already had a job lined up. Nevertheless, his mercy had softened me.

*"I did my absolute best —
his trust had ennobled me."*

I was getting my things settled when he spoke up again, saying that he needed to go teach another class, and I should slide my test under his door when I was finished. He then said, "I know there are so many ways you can cheat, and I know you won't use them. Do great." He slipped out the door and I was alone in the large computer lab. I completed my midterm in silence, with a pencil and nothing else. I did my absolute best — his trust had ennobled me.

I grabbed my phone and took the above picture. I wanted to remember this moment forever.

I didn't need the picture. I would continue to put forth incredible effort in that class to learn everything I possibly could, to perform as well as I could, and to do it all with the utmost honesty. A few months later, I only needed a fifteen out of

one hundred on my quarantined, un-proctored final to pass the class. With the COVID-converted grading system, anything above a C would be a "Pass" that wouldn't affect my GPA. Still, I studied as if every future neurosurgery patient or grad school application depended on it, though I knew I'd never have either of the two.

He didn't have to let me take the test for credit but he did. He could've gotten someone to proctor but he didn't.

Lesson 5. Mercy softens, trust ennobles.

Congrats, Grad.

These gems won't lose their shine.

Because there are more selfies to be taken

...more card games to be played,

...more house chores to be enriched by a scientific lens,

...proximities to be enjoyed,

...mercy and trust to be given.

*"Whatever we emerge with during
this world-wide pandemic is a
graduation, a step toward a life
more insightful and moral."*

We are all graduating with something:

a Neuroscience Degree at BYU, a marketing degree somewhere else (and a useful one at that!), more time at home with family. Whatever we emerge with during this world-wide pandemic is a graduation, a step toward a life more insightful and moral. Write down the lessons learned — these are the things worth celebrating. Congrats, Grad.

Your Fellow Graduate





WHEATLEY LEADERSHIP SCHOLARSHIP

Award Recipient Eliza White

A junior majoring in neuroscience, Eliza White is a recipient of the prestigious 2020-2023 Jack & Mary Lois Wheatley Leadership Scholarship. The scholarship supports two years of undergraduate study and the first year of graduate study at the scholar's school of choice.

The scholarship is unique in that students do not apply directly for the scholarship; instead, they are nominated by faculty who have noticed their character, leadership abilities, and scholarly potential.

In addition to her neuroscience studies, Eliza is minoring in mathematics. Eliza has always enjoyed math, but in high school she became interested in the workings of the brain while taking a psychology class.

"Eliza is also very well-rounded... she brings an artistic eye to her study of science."

Wanting to continue studying neuroscience and math at the University, Eliza set her sights on obtaining a Ph.D. Computational Neuroscience, a rapidly growing field of research that uses mathematical models and theoretical analysis to further understand brain function and process of the Central Nervous System.

Eliza's passion for neuroscience research is deeply personal due to having sustained a brain injury in high school. In addition, she has family members that have various auto-immune diseases that affect the brain.

Neuroscience professor Dr. Matheson describes Eliza as "... having a strong thirst to learn all she can about neuroscience, motivated by a personal history of overcoming—and thriving after—neural injury. Her intellectual maturity shows when she relates what she learns back to the individual and to its implications for delivery of health care and improving the medical systems. Eliza is also very well-rounded, pursuing leadership in community arts and theatre groups. She brings an artistic eye to her study of science."

Eliza said, "I am excited to eventually participate in and contribute to the expanding world of neuroscience, as well as finding potential causes of and cures for CNS diseases that affect so many people around us." Eliza would like to thank the neuroscience faculty and department for their continued support, influence, and confidence in her aspirations.

Looking forward to continuing her studies and research at BYU, Eliza would also like to thank the Wheatlys and the Wheatley Institution for this incredible scholarship that, "is turning my goal of researching with a Ph.D. in Computational Neuroscience into a reality." She is honored and feels blessed to represent the Wheatley's and the Wheatly Institution.

The Wheatley Leadership Scholarship is a three-year program intended to support two years of undergraduate study, followed by one year of graduate study. Recipients of this award are chosen based on the leadership qualities they have in various aspects of their lives as they contribute to the world around them. Leadership involves more than attaining leadership positions; it also includes the ability and desire to work with others to achieve beyond just one's own goals.



Alumni Spotlight

Kathryn Hixson

Kathryn Hixson, a native of Logan, Utah graduated with her B.S. in Neuroscience from BYU in 2011. During her studies, she did a summer internship at Baylor College of Medicine where she learned what was entailed in getting the PhD, MD, or MD/PhD degree. She decided that a life of research to find better treatments and cures for neurological diseases is her passion. After graduation, Kathryn, her hedgehog and her husband moved to Boston where she began a Graduate Program in Neuroscience at Boston University School of Medicine.

As a PhD student, Kathryn joined the Lab of Translational Epilepsy, working with Dr. Shelley Russek in the department of Pharmacology. Her thesis research focused on identifying the role of the JAK/STAT signaling pathway in acquired epilepsies. She characterized the effect of targeting the pathway as a novel disease-modifying therapeutic approach using gene expression analysis.

"She decided that a life of research to find better treatments and cures for neurological diseases is her passion."

Outside of the lab, she also spent time advocating for girls and women in science. She served as board member of the Graduate Women in Science and Engineering group at Boston University, helping to plan professional development and social events for women in science.



She also organized a community with fellow PhD students who were mothers, taught elementary school girls as a club mentor for Science Club for Girls, and served in her ward's YW presidency for almost the entire duration of her degree (5.5 years). She organized a ward mentoring program to help the youth, most of whom were 1st generation immigrants, with test prep, college applications, job opportunities, and obtaining scholarships.

In spring 2019, Kathryn received her Ph.D. in Neuroscience with a specialization in

Pharmacology and joined the University of North Carolina Catalyst for Rare Diseases in July 2019 as a postdoctoral fellow. The Catalyst for Rare Diseases seeks to understand the functional effects that genetic mutations have on disease.

At the Catalyst, Kathryn's research focuses on two rare neurological diseases:

- **Malan Syndrome:** Kathryn forged a relationship with the Malan Syndrome foundation, a rare genetic disorder that effects craniofacial features, musculoskeletal abnormalities, intellectual disability, and seizures. She is now studying the effects of a mutation in the Nuclear Factor 1 X gene that causes the disease. The only treatments available are supportive and treat individual disease symptoms. Dr. Hixson's research seeks to find the cause of Malan Syndrome, including novel treatments that may ultimately lead to a cure. In order to accomplish this, Dr. Hixson will create a stem cell line with the gene mutation that patients have, characterize what is disrupted in those cells, then perform a drug screen to find novel therapeutic options that will correct the abnormalities in the stem cells and, hopefully, one day in human patients as well.

- **Autosomal recessive spastic ataxia of Charlevoix-Saguenay (ARSACS):** A progressive neurodegenerative disorder that targets the cerebellum and causes movement abnormalities starting around 2 years of age

that ultimately lead to the patient being wheelchair bound. Kathryn is studying the effects of mutations in the Sacs1 gene, the cause of the disease, particularly the marked tau overexpression, a trait of many neurodegenerative disorders, and the effects of using a gene therapy approach as a potential treatment.

"Dr. Hixson's research seeks to find the cause of Malan Syndrome, including novel treatments that may ultimately lead to a cure."

Kathryn was recently awarded the Young Investigator Draft award, a grant given by the Uplifting Athletes organization, a group that seeks to raise awareness and funding for rare diseases to conduct her Malan Syndrome work. She lives in Durham, NC with her family and enjoys spending time with her husband, two children, Elliott (b. 2016) and baby Lillian (b. 2020) and her dog, a goldendoodle. She loves baking, cake decorating, swimming, and watching Netflix.

Kathryn is happy to chat with any students interested in learning more about the PhD experience, choosing between graduate and medical school, and women interested in discussing how to manage family and a full-time research career. If you are interested, please reach out to Kathryn at kathrynmhixson@gmail.com





Alumni Spotlight

Ryan Brown

Born in Orem, Utah and raised in Arkansas, Ryan Brown attended BYU and graduated in 2015 with a degree in Neuroscience and a minor in Chemistry.

At BYU, Ryan worked in the Infant Development lab in the Psychology Department with Dr. Ross Flom, PhD, for nearly a year. He studied infant looking time phenomena and says he learned incredible things about what it takes to conduct human research. He loved his experiences in the lab and recommends getting as much research experience as possible while at BYU.

Ryan enjoyed many of the NEURO classes he took at BYU. Ryan specifically enjoyed NEURO 380 with Dr. Dawson Hedges because he learned a lot of valuable information about the interplay between neurotransmitters and receptors. He says there is a lot of information to take in, but the subject matter is groundbreaking and fascinating. Ryan says people love to ask questions about his experiences in the BYU Neuroscience program once they found out he has a degree in neuroscience.

"Ryan came to realize there are no shortcuts when it comes to studying the hard sciences."

When asked if there was advice from a professor that helped him, Ryan said "I had some really down-to-earth experiences with Dr. Brown*, where I felt the urgency of what we were learning. But he always made me feel like I shouldn't stress out if I was rightly prepared.

*Ryan Brown is not related to Dr. Brown.



Dr. Steffensen was amazing in terms of involving the spiritual aspects. Not only was he great at teaching, but I could feel the light of his testimony during our classes."

Ryan reports that Neuroscience taught him how to be results-oriented. He was originally intrigued by the subject matter because he thought he could learn mental tricks for enhancing his effectiveness as a student. Ryan came to realize there are no shortcuts when it comes to studying the hard sciences. But he says he did gain a lot of insights about the brain, including principles about how human memory works. He says he continues to apply these principles as a lifelong student and professional.

By participating in the Neuroscience program, Ryan says he learned to dive deep and take care of business when it comes to studying. He says, "When you are faced with either watching Netflix or studying for Neuroanatomy, allow yourself to decompress. But then get back to studying what you love. You will get so much more out of your BYU experience if you maintain a healthy balance." He says his neuroscience degree prepared him for executing decisions on a broader scale in his professional life.

As a Senior at BYU, Ryan applied to several medical schools and was wait listed. "That experience was tough for me, but I decided to start applying for different jobs and leverage my neuroscience background." Shortly after Ryan graduated, he was hired-on as a legal assistant at a Top 100 law firm in downtown Kansas City, Missouri.

At the law firm, Ryan worked in the intellectual property department and took on clientele from various Fortune 500 Companies. He was also exposed to cutting-edge technologies in biomedicine, telecommunications, and transportation, and learned how to prepare and submit a patent application to the United States Patent and Trademark Office. At one point, he even studied to take the Patent Bar. Ryan says, "My law firm experience was amazing, but I wanted to do more and see more. I ended-up moving back to Utah for a sales position and they were impressed that I had a neuroscience degree."

Ryan is now working for a company called LACO Technologies in Salt Lake City. He works in sales as an Account Manager. He sells vacuum technology systems and leak detection

equipment. Ryan reports that "the industry is wide open" and that his company is frequently approached by companies like NASA, Tesla, and Apple to build thermal vacuum systems and vacuum chambers for them. Ryan loves what he does and is looking forward to the future.

"In a lot of ways, the neuroscience degree has helped me become the well-rounded professional I have always seen in myself."

Ryan is 100% glad he studied Neuroscience. He said "you never know where life is going to take you, but Heavenly Father has led me in every step." His neuroscience degree allowed him to get technical experience and a science background without feeling too much pressure to go to professional school or have career focused purely on research. "In a lot of ways, the neuroscience degree has helped me become the well-rounded professional I have always seen in myself. I have been exposed to all different types of people and career paths as a result."

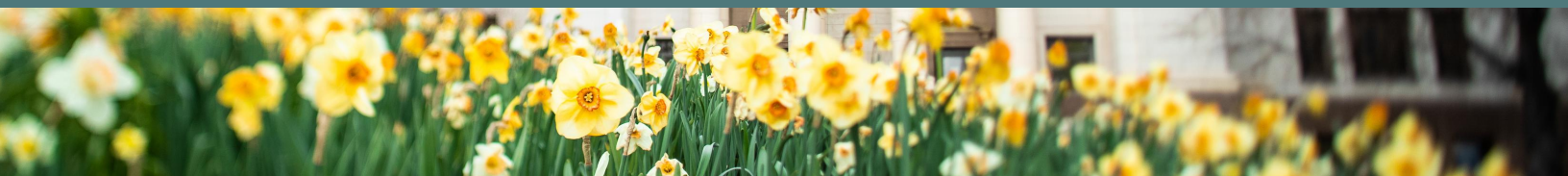
Ryan has since decided to pursue a master's degree in BYU's Executive Master of Public Administration program. He is planning on using his BYU EMPA degree to pursue a career in sales management or healthcare administration.

Ryan loves going skiing at Sundance with his brother who is also currently attending BYU. He also enjoys great cinema and encourages students to take TMA 102, an introductory class to film and media.



GRADUATE STUDENT SPOTLIGHT

SARA JANE HARTER



The youngest of five children, Sara Jane Harter was born in Yellowknife, Canada to American parents. They lived in Canada for 8 years and Australia for 5 years. She started university at Washington State University and Eastern Washington University before transferring to BYU to finish her undergraduate degree in neuroscience. Then she continued at BYU for her graduate program and graduated with a masters in Neuroscience in Winter 2020. She now lives in Sacramento, CA, where her husband is attending medical school.

Sara's research included using whole-cell electrophysiological techniques to determine effects of acute, chronic, and withdrawal exposure to morphine and methamphetamine on lateral paracapsular cells (LPCs) in the basolateral amygdala (BLA). Her projects also involved rodent handling, harvesting and slicing daily neural samples with a vibratome, anxiety behavioral experiments, and two-electrode patch clamp electrophysiology on *xenopus laevis* oocytes.

"Sara was incredibly blessed to work with an incredible team and had support from amazing people."

One surprising thing that she learned was how the quality of an individual's research is largely determined by the team they work with and not only with one individual's efforts. Sara was incredibly blessed to work with an incredible team and had support from amazing people.




Working with a team made a huge difference in what she was able to accomplish in her research, what she was able to learn, and problems that she was able to solve along the way. Sara was also surprised to learn that effects she expected to see with various methamphetamine exposure protocols were not significant whereas other effects were significant.

"The effects were far more dynamic than I anticipated. While I was surprised by some of the results, my entire research experience has taught me that you can never really predict how your project is going to end."



GRADUATE STUDENT SPOTLIGHT

JOAKIM RONSTROEM



My name is Joakim and I am from Sweden. I grew up in Stockholm which is the capital of Sweden. Growing up I did not think that I would be studying in the United States. But I was called as a missionary to Minnesota and really enjoyed living here. I therefore decided to study in the US and did so first as an undergraduate student at BYU-Idaho where I majored in neuroscience.

My plans were to become a medical doctor and I decided that I was going to do my medical training in Sweden since our education is free in Sweden. I applied and was accepted into medical school in Stockholm and started studying there. However, research has been of great interest to me and I decided I wanted to pursue a graduate degree. I decided to put my medical education on hold and get a PhD in neuroscience.

That's how I got here. My experience at BYU-Idaho had been great so I decided to come to BYU Provo for graduate school. I have been impressed by the students and professors at this university. BYU has been able to deliver a high-quality education with lots of learning and teaching experiences that have helped me develop skills that have made me become a better scientist.

"Knowing that our work may one day be able to change their lives make our efforts worthwhile."

I find the brain very fascinating and there is so much that we do not know about it. There are so many people that have diseases or conditions



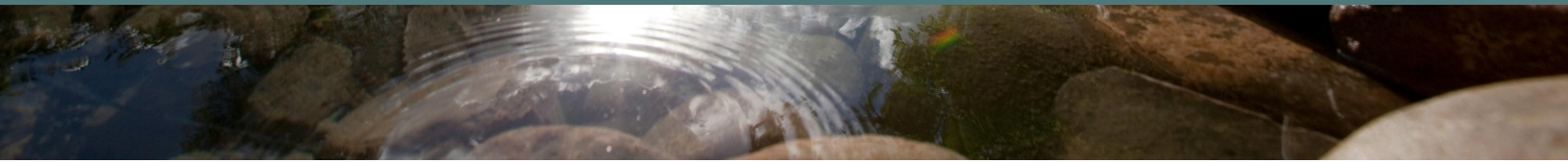
that are related to the brain that we do not understand yet. Knowing that our work may one day be able to change their lives make our efforts worthwhile. Another aspect of being a graduate student is the continual learning. On top of that there are many opportunities to teach other students in the lab but also in a classroom setting which I find very satisfying.

In my spare time I enjoy exercising and being outdoors. I ran a marathon back in 2016 in Stockholm. The mountain scenery is very different from back home in Sweden, so I try to take advantage of that. I also try to play a tune or two on my guitar when I get some free time.



GRADUATE STUDENT SPOTLIGHT

BENJAMIN CARTER



I grew up in Charlottesville, Virginia. Like any other kid growing up in rural America, I spent a lot of my time working outside on a potpourri of projects-everything from mowing lawns to removing brush, felling trees, building fences and stone walls. When I had free time, I often chose to spend it hiking and swimming in the state forests along the Blue Ridge Parkway. My favorite was named Sugar Hollow, whose name was derived from the sugar used to sweeten the apple cider and moonshine distilled there into the mid 20th century.

My parents forced me to learn to play the violin at some point, which I am sure they regretted due to the pitchy nature of that particular instrument. Their long suffering was eventually rewarded when I achieved some moderate degree of skill and joined the high school orchestra as first chair violinist.

At about the time I was passing through grade school, I began to notice that people were different, not in terms of outer appearance but in terms of their inner characters. While it was not a Nobel worthy observation, it had a profound effect upon me as I began to observe those around me. Perhaps it was also driven by the fact that I recognized myself as an oddball. This planted a seed of curiosity in my mind to one day learn about the source of that differentiation and the principles whereupon it was predicated.

While in high school I had the opportunity to take a class in psychology, and while Freud and Jung and the investigation of the mind was interesting, it also discussed basic neurobiology, anatomy, research design and analysis. This was my first



introduction to concrete things I could measure in relation to the mind. This fed my curiosity, and it slowly began to transform into a defined interest. Ever since that point I have been studying the brain in some fashion. Once I discovered the neuroscience program at BYU, I settled into the discipline.

My favorite fact about the brain, or one that I have spent a great deal thinking about recently is that of its role in prediction. In observing individuals and their actions I am constantly reminded that many of our actions are the result of our brain actively gathering information about the surrounding environment via the senses, assimilating that knowledge with prior experience and current



objectives, and then charting a course of action based on the most probable and advantageous outcomes. The speed of this process is fantastic, so much so much of what we do on a daily basis occurs with little conscious thought. This begs the question - which and what proportion of our daily actions are fully intentional, the sort which we would expect intelligent agents to effect? Which are merely the result of automation, intended to fulfill some basic need or desire? Which are the result of conditioning (high-jacking the predictive capacity of the brain) by the environment, or intentional manipulation (by ourselves and others)?

"We are taught that one of mankind's true possessions is the ability to choose. If this is true then we had better come to a conscious understanding of it and use it."

This question occupies my mind regularly, and while the answer will vary between persons I think it an important one because it drives to the root of the agency of man. We are taught that one of mankind's true possessions is the ability to choose. If this is true then we had better come to a conscious understanding of it and use it. The study of the brain offers important keys to that end.

I have many favorite quotes, most are found in the works of Frank Herbert, J.R.R. Tolkien and C.S. Lewis. When time is short, I find Bill Watterson's Calvin and Hobbes to be particularly prescient. One quote that I find particularly poignant today would be one penned by Solzhenitsyn - "the line separating good and evil passes not through states, nor between classes, nor between political parties either, but right through every human heart, and through all human hearts. This line shifts. Inside us, it

"Be grateful for what you have, thank the Lord for what you haven't had to suffer through. Don't look for something to make your life happy, instead do what will make it meaningful."

oscillates with the years. Even within hearts overwhelmed by evil, one small bridgehead of good is retained; and even in the best of all hearts, there remains a small corner of evil."

Advice to current college students: if you think school is bad, wait until you try life. As Thomas Hobbes said "Life is nasty, brutish, and short." It is inherently a tragedy. The key is to not get so caught up in the drudgery and depression of it all. I think Jenkin Lloyd Jones said it best:

"Anyone who imagines that bliss is normal is going to waste a lot of time running around shouting that he's been robbed. The fact is that most putts don't drop. Most beef is tough. Most children grow up to be just ordinary people. Most successful marriages require a high degree of mutual toleration. Most jobs are more often dull than otherwise. . . .Life is like an old-time rail journey—delays, sidetracks, smoke, dust, cinders, and jolts, interspersed only occasionally by beautiful vistas and thrilling bursts of speed. The trick is to thank the Lord for letting you have the ride."

Be grateful for what you have, thank the Lord for what you haven't had to suffer through. Don't look for something to make your life happy, instead do what will make it meaningful. If you don't know what that is, then start with what's in arm's reach and then gradually work your way outward. I hope the first thing you encounter in that search is always Christ and His Gospel.

LIFE DURING COVID-19

*UNEXPECTED BLESSINGS
AND HARDSHIPS*

**How have you been able to
continue serving others
during COVID-19?**

My husband and I bought a meal for his uncle after an aunt passed away battling Covid-19. Being apart during times of mourning is hard, but gifts and words of encouragement can go a long way in helping us feel connected and loved.

**What has been hard during
Covid-19?**

Probably the hardest thing about this time is that our baby daughter died of a rare disease just before the U.S. enacted stricter guidelines for staying home. We are grateful we got to hold her funeral before the restrictions on gatherings, and have continued to find ways to honor her memory, like planting and weeding a memorial flower garden in our front yard and writing about her on a family blog. I don't know if I have felt really happy during this time because it coincides with Abigail's death. But we have felt surrounded by love and support through sharing our journey on our blog.

**What do you miss most about
BYU while staying home?**

I miss the bright, active ambience on campus and interacting with teachers and classmates in person.

-Katrina Lantz

What have you done to stay positive and happy?

"I go on a lot of walks just thinking about what I have to be grateful for. I am the happiest when I am spending time with my friends and am grateful to be able to talk to them more now that we are all in quarantine, even if we can't see each other in person."

-Dasani DelRosario

"I didn't always. But I tried to look for the good happening and enjoy all of the funny memes and situations that happened. I also enjoyed more time with my husband!"

-Maci Jacobson

What do you miss most about BYU while staying home?

"I miss interacting with other students and participating in campus life. I miss the social aspect as well as the physical aspect of going to class. I also miss the spiritual atmosphere of campus."

-Sara Linderman

"I miss interacting with my professors and students. I also miss being on campus with reliable wifi, good people, and the beautiful landscape!"

-Maci Jacobson

"BYU has opportunities and support everywhere you turn. Those are still available, but there was something about visually seeing the support BYU gives you everyday on campus."

-Julia Cornwell

How have you been able to continue to serve others during Covid-19?

"I began volunteering for Red Cross at their blood drives. I am also a volunteer for a hospice company and since I cannot go see my patients, I have been writing them letters to let them know I'm still here for them."

-Kennedy Madrid

"I have been able to reach out to friends and express my gratitude for them and their influence in my life. I have also been able to cook and clean for my family and friends."

-Sara Linderman

"I have been dropping off treats and notes, talk to my neighbors when I see them outside, sending texts and giving phone calls. I have also been writing letters and doing family history work."

-Rachel Nuttall Parco

"I have helped my mother sew masks for our friends and coworkers at home and have been able to teach some lessons in my institute class over zoom to my home stake. I try to be there for everyone who needs a friend right now, because I know this time has been hard for me so it must be hard for other people, even if they don't show it."

-Dasani DelRosario

*All these responses are from BYU students and used with permission.

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Honestly, the thing that has kept my spirits up the most during this difficult transition for me is coming closer to God and no longer making excuses to not pray or read scriptures every day.

- DASANI DELROSARIO

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Neuroscience Endowment Fund

Dear colleagues,
students, and alumni

Imagine if you could help students achieve their educational goals and learn through experience. The Neuroscience Endowment Fund will provide funding for:

- Scholarships
- Internships
- Experiential learning experiences

All funds go directly to the students. We are asking for your help as we can not do this without you. Please join us in supporting students in their neuroscience education.

If you wish to donate, please follow the link below:

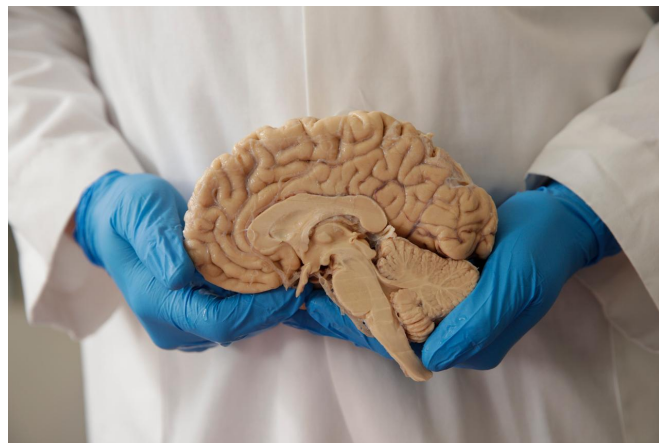
<https://donate.churchofjesuschrist.org/donations/byu/univ-wide-priorities.html?cde2=799-home>

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- Enter an amount and then scroll down to the Frequency and Method of Payment sections
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BYU Neuroscience

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