Science Student Council Presents

In Conversation With:

Anatomy and Cell Biology Researchers

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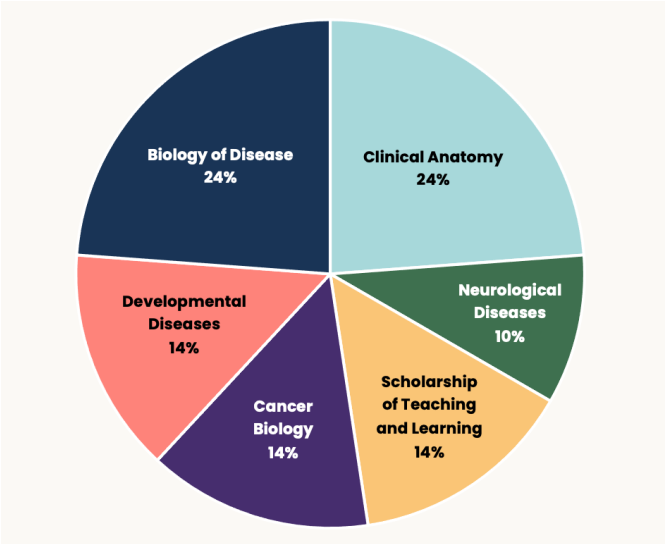
Project Overview

Over the course of the last couple of weeks, I have had the privilege of hearing about fascinating research and insightful advice from some of Anatomy and Cell Biology's researchers. I want to thank all 21 participants for being not only willing but enthusiastic about sharing their ongoing research and previous experiences with the undergraduate community. That said, I'd be inclined to believe that this project holds insight and inspiration for an audience greater than just undergraduate students, or even students for that matter.

I sought out to showcase Anatomy and Cell Biology's researchers and I was instead acquainted with the impressive range of research in the department, I learned about the power of hard work in combination with luck, and I've had my perception of what it means to be a researcher entirely redefined. Although the individuals that were interviewed ranged from 1st year post-graduate students to tenured professors, I came to discover what passions and perspectives they all shared in common. Ultimately, I've learned what happens when you have the courage to start the conversation. I hope you do too.

Beverly Gu
Anatomy and Cell Biology Department Representative (2020–2021)

Breakdown of Included Areas of Research



Cancer Biology

Dr. Alison Allan

Department Chair & Professor (Joint Appointment with Oncology)

More about her research
http://bit.ly/AllanInfo

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What are you currently working on?

"We're interested in studying the cellular and molecular mechanisms of cancer. In particular, the process of metastasis, which is what happens when the cancer cells spread from the primary tumor site (such as the breast or the prostate) to distant organ sites such as the brain, the bone or lung. We focus on two areas of research. We have a fundamental, basic science program that is aimed at understanding the process of metastasis, for example what are the genes and proteins are regulating metastasis? We're particularly interested in the secondary organ microenvironment, specifically in the lung, and how it attracts and supports the growth of the cancer cells. The other half of our research focuses more on the translational/clinical research, where we work with oncologists to develop a blood tests to track metastasis in patients and to understand how treatment is changing their response to metastasis. We have the whole spectrum from basic science all the way up to impacting patients."

"It actually could make a significant impact in the way radiation therapy is delivered"

Any future research goals you'd like to share?

"One of our continuing research goals with all of our studies is ensuring that that the studies are focused on impacting patients. Sometimes that might be 10 years from now, especially with our basic science studies that use cell and animal models. They're not going to necessarily impact patients right away. However, we always try to make sure that our research moves along that a trajectory that always has the patients in mind. We're really excited right now that we are a part of a big Phase 3 clinical trial in collaboration with one of my radiation oncology colleagues, Dr. David Palma. The trial will run probably for about five years, but we anticipate based on the results so far, that it actually could make a significant impact in the way that radiation therapy is delivered and in improving survival for patients. We are responsible for the translational laboratory part of the trial; analyzing blood biomarkers that could help identify which patients will benefit most from the specialized radiation therapy. This is really exciting for me and my trainees to be involved in this important study."

Aside from pursuing higher education, what are some steps that you took to kickstart your career?

"One of the main things that's important for a career in academic science is starting to network early. Even when you're an undergrad, definitely when you're a grad student, try to reach out and make connections—even if it's kind of scary, and they're big, important scientists. If you read a paper and you want to discuss it more, you should never be afraid to reach out and do that. Before COVID, scientists and trainees got to travel or have visiting speakers come to give talks, it was always good to network. You never know, down the road, when you're looking for a job or when you're doing an experiment that you can't figure out, having a network of people that you can reach out to is fundamental. Collaboration and teamwork are necessary to make those big steps forward in science. Learning how to do that and practicing doing that from an early career stage, even when you're an undergrad is really important."

"Collaboration and teamwork are necessary to make those big steps forward in science."

What drove you to a career in Anatomy and Cell Biology?

"I think there were two main things. I had my first research experience between second and third year in the summer, and I was hooked. Right away. I went to grad school and I loved it. I love learning. I loved sharing new information and generating new information. When I realized that there's a job where someone would actually pay you to do what you love, I saw that as pretty attractive in terms of a career choice. The second thing is that in research, and especially academic research, your work is never done. But that actually, even though it's lots of work, the career itself gives you a lot of flexibility and independence in how you manage your time. That means that you can choose what your days look like for the most part. You can balance things like family and other interests, probably more than almost every other kind of career that I can think of other than being an entrepreneur. You have freedom and independence choose what you do in your day.

What is your favourite thing about research or your job in general?

"There are two main things. The first is that I learn something new every day; sometimes from reading a paper, but honestly, very often from a student. That's why the second thing that I love the most about my job as an academic scientist—being able to work with really bright and smart people, particularly students who are young and fresh. They have all these crazy ideas, and you can provide a kind of framework within your research program to let them develop those ideas. Being able to work with bright, young people is one of my absolute favorite parts of the job."

What are you currently working on?

"We're looking at the mechanisms for ovarian cancer metastasis. There are two main reasons why we focus on this: the first is that ovarian cancer is different from most other cancers. When ovarian cancer patients have metastatic disease, it spreads all throughout the abdominal cavity; the mechanisms are probably very different for ovarian cancer than it is for other cancers. The second thing is, for most women when first diagnosed with ovarian cancer, it's actually already spread. About 85% of women will be first diagnosed at an advanced-stage of disease where it's already spread the abdominal cavity. We feel that it's absolutely imperative to understand this unique mode of metastasis, so that we can better treat women with advanced-stage disease and eradicate metastatic ovarian cancer.

What we've been focusing on for about the last decade in my lab is establishing an *in vitro* model of ovarian cancer metastasis that better mimics the way this disease spreads in a patient. We use either established cell lines or cells directly from patients that are being treated at the London Regional Cancer Program. We grow these cells in liquid suspension so that they're floating around exactly the way they can spread in a patient until they reattach and form secondary tumours. We mimic this process in the research lab and, by doing so, we can then isolate the proteins, DNA, and RNA to try to understand what signaling pathways are activated or inactivated to promote the survival of ovarian cancer cells and their ability to spread.

What we've been looking at for the last couple of years now, is a general process that we call "adaptation"-- the idea that there are reversible changes occurring in ovarian cancer cells to allow them to survive. One of these processes is what's considered a metabolic stress adaptation--they're shifting the way they utilize energy by changing their mitochondrial dynamics to promote cell survival. We think that this might be important, not only to understand the biology, but also to come up with new therapeutic targets. The goal is to develop a better strategy to eradicate metastatic disease, either alone or in combination with standard chemotherapy."

Dr. Trevor Shepherd

Associate Professor, Department of Obstetrics & Gynecology (Cross Appointment with Anatomy and Cell Biology)

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"If we can increase the number of women that might actually be cured of this disease, that's the ultimate goal."

What are some of your future research goals?

"It's imperative to think that any cancer researcher's future research goal is to see potential clinical application of their research. It's something that takes years, if not decades, to actually see that come to fruition. I see that as being my long-term future goal. Can we actually target these vulnerabilities that we discover in ovarian cancer cells with the new therapeutic? Can we develop the right translational or preclinical models and be one of the key scientists involved in a clinical trial? Our translational ovarian cancer research program has made use of a lot of ovarian tumour materials collected in collaboration with our clinician colleagues from patients who are being treated here in London. They are huge supporters of our program, not with just offering their tumour tissues and cells for us to perform research, but they help raise money for our research program. Importantly, there is the London Run for Ovarian Cancer that we go to every year. Our supporters really feel that they're a critical part of our research. It almost feels imperative that we give back, not just in terms of showing them our progress that we've made from year-to-year, but also to show them that at some point we may actually have a new therapeutic to extend the lives of women with advanced ovarian cancer. If we can increase the number of women that might actually be cured of this disease, that's the ultimate goal. I see that in my career lifetime as an ovarian cancer researcher, I will be able to make that sort of an impact whether or not it's in two years, five years, or 10 years from now. That's my ultimate goal."

What were some influential steps you took for your career?

"I think it really came about during my postdoc work at Dalhousie University, where I took as many opportunities as I could to step outside of my comfort zone. It's easier for scientists just to stay at the lab bench, do their own research, write their own papers and be very focused that way. But during that time, I got involved with the new cancer research training program that was being developed at Dalhousie and funded by the CIHR. A critical component of that research training program was not just to offer scholarships, but also to develop a learning program where students could interact with clinicians, learn about translational aspects of the disease, and many different types of research beyond the lab bench. I got to interact with undergrads, graduate students, and other postdocs from different disciplines. It made me learn about the multidisciplinary aspect of doing cancer research and education. To tell you the truth, it helped me develop new skills that I didn't have before. In some ways, it may have even helped me start up my own ovarian cancer research program here in London. I realized that throughout the rest of my career, I would need to collaborate in teaching and research, and to push myself outside of my comfort zone. It's not always easy to do in terms of interacting with other people and putting yourself and your ideas out there. But that's really the only way that our type of research should be done."

What drove you to a career in anatomy and cell biology?

"It's funny that you ask this question because, what even drove my choice to become a scientist in general, started in this department. I was a fourth-year undergrad student, and I needed a bit of extra money, so I got a work study position in Dr. Peeyush Lala's lab. I had the opportunity to do some molecular biology work, and cell biology, working alongside a PhD student in the lab. That's where I was bit by the research bug. I had had plans to go to medical school, but the people I was working with convinced me, "No, we really think you should try grad school." I went to McMaster University as a Master's student and I never looked back. Within six months I realized I wanted to do my PhD. Then after that, I went on to do a post-doc at Dalhousie University and that's where I started my focus on ovarian cancer. Eventually, I saw that there was a new scientist position available at the London Regional Cancer Program to come back to London, Ontario, specifically to do ovarian cancer research. I was successful at getting the position. It's exciting to see how the Anatomy & Cell Biology department has grown over time. We have some excellent cancer researchers and other cell biologists with whom I enjoy working alongside. So, it's exciting to teach and to do research, and mentor graduate students, all from this department."

What's your favourite thing about research?

"My favourite thing about research right now is actually the rare opportunity to jump back into the lab and do some of my own experiments. I don't know if my graduate students like it too much when I come back in and start doing some work because then I'm right alongside them. Sometimes I just get an idea and I actually try to test it myself. I still get very excited to do that. Really, that's the reason why we as scientists got into research, it's because we enjoyed doing lab work. We came up with a hypothesis, we did experiments to test it. You kind of lose some of that when you become a scientist running a lab—you're orchestrating everybody else. Sure, you've got your own ideas, but you sometimes lose the very thing that got you there, which is to do your own experiments. It invigorates you and gets you excited about research. Before you know it, my graduate students are going to see me back at the lab bench again."

"Really, that's the reason why we as scientists got into research, it's because we enjoyed doing lab work."

Do you have any advice for the undergrads?

"Take as many different opportunities as you can. I never thought as an undergrad student that I would have a work study position in a research lab. That's what started it all for me. You don't know from where that opportunity is going to come or where it will take you. You think you know what you enjoy, but it's not until you get in there and start working with the right people, trying out new things, that all of a sudden you are hooked. It helps you decide what your career may be. Obviously, there's many undergraduates and perhaps not that many positions available out there, but if you're excited about something, we as faculty take notice and we try to offer many opportunities to engaged students."

Dr. Silvia Penuela

Associate Professor

More about her research
http://bit.ly/PenuelaLab

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What are you currently working on?

"My lab focuses on the cell biology of pannexin channels and the intercellular communication that happens through these channels. We focus on the way they work on normal skin and fat development, and the way they are dysregulated in cancers, mostly in melanoma and glioblastoma." ***Are there only those specific types of cancers that pannexins affect? Or is it more like a range?*** "There seem to be many cancers that actually have upregulation of pannexin 1. We see that normal cells need some pannexins at the beginning of their development, but then they tend to downregulate their expression. As the cancer progresses, some of the pannexin levels come up again. We have seen that melanoma, glioblastoma, have significant levels of pannexin 1 that when blocked with pharmacological inhibitors, we can revert these cancer cells to a more basic, more normal phenotype. We are hopeful that we can expand this to other cancers and see if some of these same targets could be used in the clinic."

Do you have any future research goals to share?

"It's always an evolving process. Because we tend to follow the data and follow the next interesting discovery. What we are trying to do with our area of pannexin channel biology, is seeing how they can be applied to the clinic. We are trying to see if some of the fundamental research that we are doing, in how these channels change the way that the cancer cells grow or how they metastasize can be applied In the future, using pannexin blockers and specific inhibitors of these pannexin channels to use them in clinic, particularly in cancer patients. The idea would be to combine that with immunotherapies and other treatments down the road and see if we can make a difference for patient outcomes."

"The idea would be to combine that with immunotherapies and other treatments down the road and see if we can make a difference for patient outcomes."

Aside from pursuing higher education, what are some key things you did for your career?

"The education part is very important—I did my master's and PhD in the US and postdoc after that, but I think the hands-on training and experience I had from early on in my career has been key. I started with volunteering in a lab, working summers in the lab even before graduate school. My postdoctoral experience also contributed a lot on top of the formal education, because I did my PhD in a different field. I had to re-learn everything in a new field for my postdoc, but that is the beauty of science –your skills are transferable for the next step. Also, during my postdoc, I was able to write grants, teach and write papers preparing for the work that a professor would do." ***Is there anything that you did as an undergrad that you would think would be beneficial for the listeners or the viewers of this project?*** "I think if you are interested in research, the earlier you can get involved the better. If you can volunteer in a lab or work for a summer in the lab, it is a good experience. It is always a good thing to start looking early at that because you also test yourself and see if you like research. Research can have wonderful days and tough days too. You must be prepared for that process of being a critical thinker, knowing how to ask questions with proper scientific methods. The earlier you can get exposed to that the better."

What drove you to a career in cell biology?

"What drove me and what excites me about cell biology is to understand the mechanism of how living things work. It is like looking at the "behind the scenes" of what controls life in the cell, and that signaling that happens in the cell is what really intrigued me."

"I like that every day is different."

What is your favourite thing about research or your career?

"There's a lot of good things in my job. I would say that what I love about research is that every day is different. There are some jobs where you just do the same thing day in, and day out, and it gets kind of mundane. Research is always changing. In my day to day, I am working on a completely different project from one day to the next, teaching, doing a different experiment, or traveling to a different part of the world and giving a talk about our research. I really like that variety that keeps me engaged and interested."

Do you have any thoughts to share for the undergrad community?

"It's a great thing to have this kind of initiative to reach out to students. Don't be shy and don't be afraid of asking questions, reaching out to professors. We are not weird distant people that you cannot talk to. We are very happy to talk about our research anytime, and those conversations with students are very important. As you explore your future career goals, keep an open mind and explore research as a very rewarding career choice."

Biology of Disease

Dr. Martin L. Duennwald

Associate Professor

More about his research
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Watch his interview
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"We have a direct link between a mutation, a molecular chaperone, and ALS."

What are you currently working on?

"My lab focuses on protein misfolding. In order to understand that, you want to think about how proteins work in ourselves. Every single protein in our cells has to into its unique shape to fulfill its function. This process, we call protein folding. We are interested in the dark side this process because in many diseases, and many stress conditions, this protein folding process, goes awry. This happens in neurodegenerative diseases, such as Amyotrophic Lateral Sclerosis (ALS), Parkinson's disease, Huntington's disease, and Alzheimer's disease, and many other age-related diseases–but also in cancer. So, we're interested in how proteins actually go from the folded state to the misfolded one, how it can cause disease, and find a way to fix this problem."

What are some future goals of yours?

"We have a couple of very interesting projects going on that probably going to keep us busy to the end of my career. One new initiative is on a gene that encodes a molecular chaperone-these are the helper proteins that help other proteins to fold properly and can even revert or prevent protein misfolding. My friend, Sali Farhan, who's now at McGill university, found a mutation in a gene that encodes a molecular chaperone when she was still at MIT. This mutation causes ALS. We have a direct link between a mutation, a molecular chaperone, and ALS. Now we're trying to find out how that mutation actually results in ALS. We believe that in even patients who don't carry this mutation, that neurodegeneration in those patients is also influenced by this molecular chaperone. So that's one big project. Another one is based on tRNAs. We think that they contribute to many different diseases. In a great collaboration with colleagues here at Western—Dr. Patrick O'Donoghue in human biochemistry, Dr. Chris Brandl in biochemistry and Dr. Amanda Moehring in biology—together we see how mistranslating tRNAs contributes to diseases. We're just scratching at the very tip of the iceberg; tRNAs have been neglected for almost two decades in research. We have to pick up the slack. Lots of interesting things to do, and it's a great team."

How did you approach getting to the career that you have?

"I didn't plan a career, but I would never recommend that to anyone else. That's just how it happened to me. I'm being honest here; I just followed my heart because research is something I really love doing. I spent a lot of time as a PhD student in the lab, worked really hard, read a lot—Fridays were dedicated to going into the library and reading journals all day. I thought I could have more freedom and academia, picking what kind of research topics I was going to work on rather than in industry. That's why I was more driven towards academia. When I was a postdoc at MIT or had my own lab as a faculty position at the Boston Biomedical Research Institute, frankly, I started missing teaching. A traditional academic environment where I do both research and teaching was actually ideal for me. I never really considered any alternatives; I would consider this a big risk. I got lucky. I recommend keeping your eyes open. There are so many other opportunities out there. Look around a little bit."

Why did you choose a career in cell biology?

"I have always been interested, even as a kid, in how things work. Discovering certain mechanisms, whether it's a machine or a living organism, has always fascinated me. My strength is more in analyzing these things than building new things. Looking at how genetic information flows from our genes to a phenotype and proteins has fascinated me all along. I really fell in love with science and an academic career. Now, it's really enjoyable to see what my trainees, the graduate students and the undergrads are accomplishing—putting this all together and discovering new things every day."

What is your favourite thing about research?

"It is probably the fact that we discover things that no one has seen before in the lab. So, when a student comes to the office, we discuss their results, and they point towards a different explanation of a mechanism, we can establish new paradigms and contribute to very important problems. For example, there's no cure for any of the neurodegenerative diseases that I mentioned. Maybe our research can contribute to that. By discovering new things, having an open mind, and going about these problems in an unbiased manner is challenging, but it's also a lot of fun."

Anything to share with the undergrad community?

"Try out different researchers—contact myself, my colleagues, and come to the lab. You can do research now from home. There are many fascinating bioinformatics research tools. Follow your heart and try different things out–you will find something that really piques your interest. I think research experience—the analytical thinking and the communication, the teamwork—are very important skills to acquire and hone for any kind of career. Most colleagues are happy to host students, talk about research projects, so reach out to us and start the conversation."

What are you currently working on?

"We're working on two broad projects. The first of which has to do with the import of an antioxidant enzyme called catalase into an organelle called the peroxisome. We have found over the years that as cells and animals age, import of catalase begins to decrease and it remains in the cytoplasm. We have shown that this has effects for the oxidation balance of the cell. The first project is trying to identify why that would be the case. Why is it that the cells don't import catalase as effectively? The second project involves the disease manifestations of improper import. There are many of age- related diseases that we know are the product of oxidation imbalance. We'd like to know what would happen if we put catalase, in a form that would be imported into the peroxisomes, into disease models, whether it will have changed the redox balance in these diseases and resolve clinical manifestations."

Any future research goals you'd like to share?

"Research is a real continuum. I am very interested in the biology of why a cell should fail to import a critically important antioxidant enzyme, and we still don't know the answer to that. We have a partial answer. We think maybe even a reasonably good answer. However, it is still not complete. The other aspect of my work is that there are many other oxidative diseases. Those are the kinds of diseases that I'm still interested in. Although I am right now working on the effect of catalase on the neurobiology of Alzheimer's disease and the biology of hearing loss, I am about to begin a project with collaborators on wound healing. Wound healing, particularly chronic wounds, are known to have cells which have lost this internal redox balance, can neither divide, nor do their normal function. Probably in the next six months, wound healing will become a much bigger part of my research project, in addition to all the rest of the neurobiology. The continuum just continues to spread as my interest gets piqued."

Dr. Paul Walton

Associate Professor

More about his research
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"You can have great ideas on your own, but as long as you keep them to yourself, you'd never know whether they're really great ideas or just attractive ideas. And there's quite a difference between the two."

What was an important step you took for your career?

"The best thing for me as far as my research goes is the one summer while I was in my last year as an undergraduate student, I worked in a research lab at the University of Sherbrooke. That taught me how to design experiments and how to perform experiments in such a way that the answers that you get from the experiment are as reliable as can be. Although you may not know the answer to the question, at least you've built something that isn't just crumbly. If you design experiments properly, although you may not understand them, you will at least know they are telling you something reliable. So that summer that I spent at the University of Sherbrooke taught me how to be a scientist."

Why choose a career in cell biology?

"I was always a really curious kid. I was always interested in answering questions. I find questions far from being bothersome or anxiety-inducing. I find questions to be the most interesting things around. Becoming a scientist was a way that I could surround myself with people who also like to answer questions. I eventually worked my way into the cell biology aspect of it, because there are lots of good questions in cell biology. Mostly it was my innate curiosity and the opportunity to spend my life indulging that curiosity."

What is your favourite thing about research?

"Without question, my favorite thing about research is my colleagues. Colleagues are unbelievably important, not only at an intellectual level, but they're also very important at a social level. They're the kinds of people that make you feel like you are not the only person with this insatiable curiosity. They are the people that you can bounce ideas off of. They are the most important part of my research. The idea that scientists work alone... That probably hasn't been true in almost a century now. It's certainly not true now. You can have great ideas on your own, but as long as you keep them to yourself, you'd never know whether they're great ideas or just attractive ideas. And there's quite a difference between the two."

Any words to share with the undergrad community?

"Let's not forget, science is hard. It's difficult to do this job. It's not easy. We make it look easy because right now we're relaxed. It's a difficult job. My advice is to find something that is very interesting to you because when the work gets tough, the interest will carry you through the difficult parts of it. Search around in the early stages, for the things that you find really interesting, because that's going to be helpful down the road."

"They're the kinds of people that make you feel like you are not the only person with this insatiable curiosity."

Dr. Dale W. Laird

Professor

More about his research
http://bit.ly/LairdLab

Watch his interview
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What are you currently working on?

"My laboratory is working on connexins and gap junction proteins. Connexins establish direct cell-cell communication channels between adjacent cells. They're found extensively throughout the human body and we've been tracking their roles for several decades. We're trying to understand how they work, how they're important in human health, as well as what happens when a person harbours a mutation in a connexin gene. How do those mutations manifest in disease?"

Any future research goals you'd like to share?

"Over the years, we've worked on studying connexins and their relationship to diseases that manifest in a number of different tissues. More recently, we've gotten into understanding their role in the epidermis of the skin, which renews itself on a regular basis. There are upwards of eight different connexins that are expressed in the skin. So, we're interested in why this particular tissue has so many different connexins. If you have a mutation in any one of five different connexins found in skin, the associated disease can be very severe and even life shortening. So, we're interested in understanding how the connexin becomes so abnormal that in fact it allows the disease to form in the skin." ***I know that some of your other colleagues also work on connexin-like junctions. Do you collaborate with any of them?*** "Definitely. One of them is Silvia Penuela. She was actually one of my post-doctoral fellows who trained with me and then got a job at Western. Her laboratory is actually working on a channel that's a little bit different. It's called a pannexin channel. We used to think that maybe they were similar to gap junction channels, but we now think that they're in fact quite different. As a matter of fact, we've just started a new collaboration now to write a review on how pannexins are associated with cancer."

"That's what makes them so much fun to study, because you could talk to a neuroscientist, a cardiac biologist, somebody who studies any organ in the body, and there's usually a gap junction story there."

What was an important step you took for your career?

"I'm trained as a biochemist. I did my PhD at UBC in a biochemistry laboratory that was particularly interested in a lot of cell biological concepts. At that time, many new and innovative cell imaging tools were being developed. I became really interested in how imaging technology could be used to study cells as a whole, rather than breaking them up and studying them from a biochemical point of view. If you're going to do cell imaging, you eventually become a cell biologist more than a biochemist. I took that training and went to Caltech in California where cellular imaging was a big driver for my postdoctoral training. Cell imaging actually turned out to be one of the key things I continued with throughout my career." ***I think the new intersection between cell biology and all of that tech is really interesting.*** "Certainly, technology is always changing, and the resolution property of images is getting so much better. If we look at research and medicine, imaging has really become a big part of our society." ***Absolutely. I remember being fascinated with the freeze-fracture image of gap junctions with the bumps on the cell surface.*** "That's what makes them so much fun to study because, you can talk to a neuroscientist, a cardiac biologist, or somebody who studies any other organ, and there's usually a gap junction story to be told. Over the years, my laboratory has studied gap junctions in many organ systems in some form or another."

Why choose a career in cell biology?

"Some things just happen serendipitously. One of the reasons that I applied to UBC was because I saw a poster on the wall when I was an undergrad student at the University of Prince Edward Island. Going 3000 miles away to do my PhD seemed intriguing, so that's what I ended up doing. The other key step happened during my post-doctoral training. I was working at Caltech and my supervisor gave me the opportunity to network. Rather than him doing all the phone calls and faxing to establish collaborations, he said, "No, you call them, talk to them, and you decide what to do." That was really empowering, being able to go out and establish my career as an independent. I was in the business of making antibodies to gap junction proteins at that time. Of course, a nice way to make friends is to send them antibodies for their research. Many of those collaborations and friendships lasted throughout my whole career. Because this is a very personalized business, relationships are really important in what we do."

"That was really empowering, being able to go out and establish my career as an independent."

What is your favourite thing about research?

"By far, my favorite thing is the autonomy. My team can work on the topics we want to work on. We can write the grants that we want to write. I can recruit the students and the staff that I want to hire. It is a great privilege to be able to have a job that allows you to have that much control over how you manage your days, how you run your career, how you set up your year. There are very few people that are in that kind of situation in their job. As a tenured faculty position, autonomy is one of the greatest joys".

What are you currently working on?

"I'm a second-year master's student and Dr. Laird's lab and I'm working on a project that's focused on connexins. They are proteins that are important for cell signaling and communication between adjacent cells and are found throughout the body. The epidermis in particular expresses eight different connections. One of those is connexin 30.3, which is what my project is focused on. Connexin 30.3 is quite understudied, and we don't really understand how it works as well as other connexins. When connexin 30.3 in the epidermis is mutated, it can lead to a disease called erythrokeratodermia veriabilis et progressiva, or EKVP. This is a genetic skin disorder that's caused by mutations to connexin 30.3, and the three mutants that I'm looking at have been classified as trafficking-defective mutants. So, these mutants are unable to traffic from the ER to the cell surface, where they normally function. Then through some mechanism, this is causing the skin disease that causes these reddish patches and hyperkeratosis. So, the goal of my project is to characterize these mutants and try and elucidate the mechanism by which they cause disease. To do that, we're using a variety of different treatments or co-expressions to try and rescue these trafficking-defective units to the cell surface. This should help figure out why these mutants are causing disease and hopefully inform on any future therapeutic or treatment strategy as none currently exists."

What are some of your future goals?

"Short-term goals, of course, are going to be completing my thesis, hopefully being able to become a published author. But other than that, generally my future goal is just to keep my mind open and options open. I'm willing to try different jobs, even different industries if the opportunity arises. I would love to be in a position where I can balance all the things that I love about being in science and being in research." ***I love that your main focus is to keep your eyes open. It's great advice.*** "When I first came to Western, I was pretty dead set like, "I'm going to apply to med school, become a doctor". As I went on, I realized, "Oh, I love doing research and experiments". That opened my mind up to other possibilities to the other careers. Sometimes you just got to take a chance and try something out and if it works, it works. If it doesn't then, you know, at least you've learned something from that experience."

Rhett Figliuzzi

Graduate Student
MSc Clinical Anatomy Candidate

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"I took a chance and applied and I'm so thankful I did, because I've learned so much over the past two years."

What were important steps you took to get to where you are now?

"A big part of it was that I figured out what I didn't want to do. In my fourth year, I did an internship try and gain some real-world experience in the science field. Overall that internship was a great experience, but the work itself just wasn't something I could see myself doing in the future. So, I started to consider what my other options were. I knew what I didn't like, and that meant that I knew what areas to try and explore. I didn't know if I wanted to do graduate studies. I took a chance and applied and I'm so thankful I did, because I've learned so much over the past two years. Additionally, building relationships with people in the faculty with students that were a year or two ahead of me, asking them on what they liked, and what they experienced has helped me get to this point. I think that's the nice thing about ACB—it's a pretty tight knit department and it's pretty easy to just start talking to another graduate student or a faculty member."

What drove you to cell biology?

"For me, I wasn't really sure what I was going to do. In second year, I was in Honours Spec. biology, and I still think back to like that second-year cell biology course which was at the time by far my favorite course that I had taken. That really got me thinking that that might be something that I want to continue doing that I could see myself doing in the future. So, I shifted into the Medical Cell Biology undergraduate program, and eventually got to this point of doing a master's in ACB. But for me, I think what really drew me to cell biology, is that I've always been fascinated by how small pieces or a small function or event can all work together and function as a whole–such as a single connexin in the epidermis that somehow is causing disease. I find it fascinating how things can be broken down to smaller pieces and figuring out how these pieces all work together to function as a cell, as a tissue, as an organ. I think that overarching idea is what really drew me to cell biology."

What is your favourite thing about research?

"There's a lot that I like about research. You know, experiments are going to go wrong. You're going to get perplexing results. But when things go right, and you learn something new from an experiment, it's such a good satisfactory feeling. All that hard work finally pays off and I get something that will hopefully build upon the knowledge that we have. More about research in general, my favorite thing is probably the collaboration and discussion. You learn really quickly that you're never going to know everything about a topic, and that's where other people with knowledge in different fields come together to come up with creative solutions to problems. Another great part about research being able to learn as much as possible from faculty members. Sometimes not even about the science itself, but things like how to present, how to write well, how to communicate a story. I've definitely learned a lot in that regards from Dale. That's another really great part about research, being able to share that story with others, collect their advice, and then try to build on your project from there."

Ornela Kljakic

Graduate Student
PhD Candidate

Watch her interview
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"it was how I approached the opportunity and took advantage of it."

What are you currently working on?

"I'm working on my PhD degree in Dr. Marco and Vania Prado's lab at Robarts Research Institute. My project focuses on investigating how the cholinergic system of the brain regulates behavior, and how changes in the system can lead to debilitating aspects of disorders such as Parkinson's disease and substance abuse. I use a variety of different novel approaches to look at acetylcholine's impact. For instance, I use transgenic mouse models, genetic sensors and automated touch pads. I examine different factors in the hopes of determining how acetylcholine regulates movement, cognition, even aspects of social behavior."

"If you don't understand the basic concepts, you can't create new therapies. I'm team basic science."

Any future research goals you'd like to share?

"Right now, I'm just trying to focus on completing a very thorough and comprehensive thesis. I really hope that my thesis can expand our understanding of the cholinergic system. While my project might not be immediately clinically significant, I hope that all the research I've done will lay down a good foundation for future projects. Many basic science projects get overlooked because they don't have immediate clinical significance, but without them, we wouldn't be able to develop novel therapies or approaches to treatment. For instance, the COVID vaccine would not have been possible if it wasn't for grad students and professors working on basic science projects. My current goal is to make a thesis that significantly contributes to the field. Hopefully that leads to novel treatments and disease therapies in the future." ***I like your view on that just because something is not directly clinically relevant, doesn't mean that it has no value.*** "I still go to conferences and people are like, well, what's the clinical importance of this. And I am like, everything doesn't need a clinical importance. If you don't understand basic concepts, you can't create new therapies. I'm team basic science."

What steps were influential to getting you to where you are now?

"It was probably the Scholar's Electives program, not just because of the opportunity, because the opportunity was great, but it was how I approached the opportunity and took advantage of it. My goal in the program was to try to get a variety of different perspectives on research and to try to just get a more general understanding of science. I ended up doing so many different projects and that really helped me figure out what I liked and what I was actually interested in. For instance, my very first project was on plants; I did plant research on chloroplast division and moonlighting proteins. That project gave me such a solid understanding basic cell biology. Then I switched over into a breast cancer project, looked at breast cancer cell lines, and metastasis. Now I'm looking at animal models, specifically mouse models and looking at behavioral and molecular consequences. Many people are probably scared of trying plant research. But if it wasn't for me trying plant research, I would have never figured out that I actually liked research and enjoyed performing experiments. Ultimately, it was being open to whatever came my way and not being scared off by things that I found scary or different."

What drove you to Anatomy and Cell Biology?

"I guess it was science in general. I was always interested in trying to figure out how things work, and I always liked doing experiments. So, I thought I'd do science at Western and see how it goes. I got lucky enough to be part of the Scholar's Elective program and I ended up in an anatomy and cell biology lab. I just loved the experience there and just continued on with it. I found that I loved learning basic molecular approaches to research, and now, animal and behavioral approaches too. I was actually in the Medical Cell Biology program in undergrad. In that program, I took the neurobiology of mental illness fourth year course which I loved. That course switched me into a neuroscience direction versus a pure anatomy direction. I loved my undergrad here."

"It was being open to whatever came my way and not being scared off by things that I found scary or different."

What is your favourite thing about research?

"I really like conducting the experiments. I never thought I would say that. I thought I was interested in the research reading, but I realized that I really like coming up with a question and hands-on answering the question. One of the coolest things about my project right now is live recording neurotransmitters in mouse models; I'm recording acetylcholine and dopamine and how they change while mice are performing a cognitive task. When does acetylcholine rise? When does it fall? I hope it expands our understanding of signaling, but I think it's also fun to play with the mice and put them on touch pads."

Clinical Anatomy

What are you currently working on?

"My work is primarily focused on improving surgery with a fundamental understanding of our knowledge of human anatomy. Right now, I'm collaborating with a group of urologists at Victoria Hospital and we're working to try to improve post-surgical outcomes. After pediatric patients have a procedure called a ureteric reimplantation surgery, they have a complication called urinary dysfunction—they have urinary retention in their bladder. The reason that it's caused is because they have damaged some of the nerves innervating the bladder. The issue is that we don't really know where those nerves are. When they go in to do the surgery, it is tricky for them to manage them and keep them safe. What we're trying to do is use human gross dissection, as well as a number of different cellular biology techniques, to be able to identify these nerves, figure out where they are, and then use that information to approach the surgery from a different perspective so that we can keep those nerves safe."

Any future research goals you'd like to share?

"One of the things that we are interested in doing is trying to figure out a better way to visualize tiny nerves in the periphery. There is this really neat technique that has been used quite extensively in the central nervous system called diffusion tensor imaging–it is a type of MRI. It creates these beautiful, colorful images of white matter tracks throughout the central nervous system. What we are trying to do is figure out if we can optimize the scanning protocols for DTI to be able to use it in the periphery and specifically to be able to image axon paths within these tiny little plexuses or networks of nerves in the deep abdomen and pelvis."

Dr. Tyler Beveridge

Assistant Professor

More about his research
http://bit.ly/BeveridgeInfo

Watch his interview
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Any advice for the undergrad community?

"Take blinders down for yourself. If you feel like you know what you want to do, try to disprove yourself. Try to show yourself that that's not what you want to do. If you keep coming back to it, then it's probably something you really like. By doing that, you will explore and start to learn that there's so many different things out there than what you originally had as your perspective. I know that's how it was for me. The job I have right now didn't really exist when I started in undergrad. Without me having that open mind to explore and create a position for myself, I would have never found it. That would be my best piece of advice–don't feel like you have to pigeon-hole yourself because you actually can be a hybrid of different things and find your niche there."

What are some influential steps you took for your career?

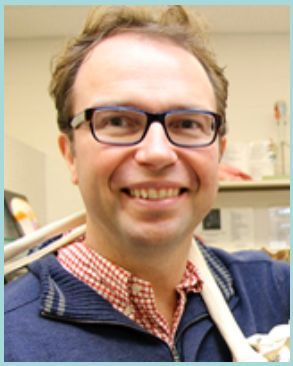
"The 'step' was a big turning point for me; that turning point was to stop worrying about what I should be doing. It happened in my master's when I thought I wanted to go to med school. I thought my desire to work with my hands would be best served in surgery. And then, I was denied admission to med school. I decided that I just going to do what I wanted to do, which was to continue dissecting the nerves that I had started to figure out in my master's. I saw it as side-stepping from my track to go to med school—it was a bit of a cynicism mixed with apathy with the med school process. That's actually how I got into my PhD. That ability for me to let go of everything I thought I should be doing and just start doing something because I was interested in it was a big mind shift for me. It has really is given me a niche in research, and my niche is different than everybody else's. Every research lab has got a different feel to it. Once you find your niche, then it's a really great place to be. Now, as I've alluded to in a previous question, I work side-by-side with surgeons, and I do it in a way that is sort of developing new approaches to surgery. I don't do surgeries on patients, but I help develop the surgeries that are done on patients, which is pretty exciting to do."

Why did you choose to study anatomy?

"I was exposed to anatomy the first time in second year undergrad, and it stood out to me as a very hands-on field. I really liked the fact that you could see exactly what you were studying. You could hold it, you could move it, and trace different nerves and arteries and veins. I have always liked working with my hands in every sort of capacity. Growing up on a farm myself, I was always very a hands-on person. The field that I ended up in, studying autonomic nerves, tiny threads in the abdomen and pelvis, came from a desire of wanting something to do that was very meticulous. When I first started this work, I was faced with people telling me the reason that these nerves have not been described before is because they are so small and tricky. I took that as like a challenge. If we can employ our new age microscopes and dissection loupes, we might be able to figure some of this out. So, it was that drive of combining things that and very meticulous with hands-on work."

What is your favourite thing about research?

"The best thing about research is that what you are doing now is not what you are going to be doing in a couple of years—you have a lot of academic intellectual freedom to follow things that you are passionate about. If I decide tomorrow that I don't like pelvic nerves and abdominal nerves, I can completely switch gears. I think it is pretty exciting that in five, ten years' time, I'm going to be doing something completely different than what I just told you on the first question. I don't think many jobs offer that. Many professional programs train you to become really great at one thing, and you are paid to do that over and over again at a very high level. Whereas, as a researcher, you are paid to keep figuring out new things. You're always learning."



Dr. Tim Wilson

Associate Professor

More about his research
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"Careers in many ways are like an Odyssey, and the toughest part on a long Odyssey is taking that first step."

What are you currently working on?

"We're currently working on two lines of research. The first line relates to human haptic abilities and how it interacts with our spatial abilities. This is important in environments of technical expertise, including medicine, dentistry, and engineering. Not only do you have to understand the orientation of your hands touching "stuff", but you also need to understand the orientation of your body with the stuff. We know quite well now that people with good spatial abilities tend to stream into STEM disciplines, but are haptic abilities also important too? Currently, my Master's of Clinical Anatomy graduate student, Michelle Sveistrup, is exploring behavioural linkages, eye tracking, between haptic and spatial ability. We call it "HAT" and spatial ability we call "SAT". The other line of research is a clinical one. We study the repercussions of MMA—no, not mixed martial arts but maxillomandibular advancement. My lab interacts with a great team in Schulich dentistry who performs these surgeries on cadavers. We then manipulate the cadavers and try to understand how sliding the maxilla and jaw forward affects the ability to breathe. MMA is the final surgery for people when they cannot overcome significant sleep apnea, meaning slowing or stopping breathing during sleep resulting in many health-related consequences. Kody Wolfstadt, another Master's of Clinical Anatomy student is examining the work of breathing after this surgery."

What are some of your future goals?

"Career-wise, I still enjoy the unknown. I really enjoy exploration. It's in my blood, it took me 8 years to do my undergrad as I explore to Mali for a year and then lived in France for four years. Those kinds of adventures enable lots of happenstance events and helped me develop courage, they were driven by the need to explore. If we focus it back down on job, this satiation of my curiosity is driving me all the time. During my own undergrad I didn't really know what a PhD was until I started chatting with graduate students and profs. I was like, "PhD, what is that about? Oh, Is that a prof? You get to develop experiments and answer interesting questions? That's not so bad". That curiosity that developed into something fun. Now I've developed these research goals to make further strides in areas that are often hidden behind the curtains to the general public. I would like to push both research streams forward—one in neuroscience and one clinically-focused."

What are some influential steps you took for your career?

"It definitely involved trying to maintain a level of integrity all the way, ensuring that whomever I worked with, I did the best job I could. I simply do not give up. When I was in the position of working under people, I think they enjoyed that grit and creativity to get stuff done. This combination allowed me to take advantage of in my post-doctoral fellowship. I had skills in one area, blood flow measurement, and applied them to vestibular neuroscience. Yes, I was nervous to fail but I still applied, got an interview, and the rest was history. After my post-doc, I did the same thing again bringing me to Western; there was 'this' anatomy teaching job in Health Sciences. I didn't think I was qualified but I put my best foot forward and had a wonderful interview. There was an extra piece in that interview: I had to give a "philosophy of teaching" lecture in addition to an anatomical one. Nobody ever spoke about philosophy when I was a student. I dove in, explaining the way I viewed my role, and what I would do in that job and it was a hit. Ever since then, I've been a prof! That slide show is now over 17 years old and still I look back on it now and agree with every word. Was it a gamble? Yes, but it worked out wonderfully and I encourage that attitude in grad students today."

What drove you to the career you have now in anatomy?

"In a way, 'drove' is implying that I was in control. I've done research on happenstance and how it plays a massive role in where you are right now. We can bend happenstance, and that's about as much as we can "drive it" by being prepared to take opportunities. I lined myself up through kinesiology at Waterloo and then Western and that prepared me with knowledge of anatomy, physiology, as well as the social underpinnings of how people work together. After my PhD, I went to the U.S. I got my street creds as a neuroscientist studying blood flow control in animal models. I realized I was not attracted that type of research mainly because I love animals. Coming back to Western Health Sciences as a contract position, one has to keep one's eyes open, and an anatomy position arose in Schulich. With "Wilsonian" methods, I thought, "Oh, I better try this". Coming to ACB opened up new opportunities: to work with graduate students! Many people often say, "Find your passion", but I would suggest that you don't have to actually find a passion, you create them. Even if you don't achieve the primary goal, you set others in between and some will be achieved. The steps to get "there" are never clear and there are multiple paths to success. Careers in many ways are like an Odyssey, and the toughest part is taking that first step."

What is your favourite thing about research?

"Aside from discovery and answering questions that help advance our understanding of my corner of science, my favorite thing is people, particularly students. I really like getting to know grad students. Seeing what makes them tick through our interactions on the professional level of the CRIPT lab, social gatherings, and helping to forge Individual Development Plans and watching them evolve and develop into new thinkers. In everything that I do with them, I consider that plan and what their goals might be. So, my favorite thing is getting to know their goals and playing a role in helping make that happen. That is one of the most creative things that I think I can do. This work will never be a paper, nor will one get a raise for that. What you will get though, is a student comment, "That was awesome. Thanks". And that's good enough for me. I'm lucky that I have a really good balance of teaching and research to enable those interactions. I enjoy it very, very much."

What are you currently working on?

"Currently I'm working with Dr. Tim Wilson on an anatomy project. We're looking at the effects of maxillomandibular advancement surgery on both facial alteration and its impact on airway resistance." ***Is there anything else that you currently do that feeds into that goal towards medicine?*** "Yeah. In addition to doing the research, I also TA and I think that being a TA has really helped to enhance my communication skills and just overall teamwork aspects, which is really important down the line. When you want to. You know, share your results of the research and just being involved in a dynamic environment, such as a medicine, you need those communication skills all the time. I think that TA has really helped to strengthen those. In addition, I do dissection labs in which we investigate anatomy on such a detailed level, and we go in day in, day out every week, just dissecting our cadaver and learning all of this incredible anatomy, which is such a unique opportunity. I hope to use all of my skills both dissecting and my knowledge of anatomy down the line."

Do you have any future goals you'd like to share?

"I definitely want to be involved in medicine and specifically, I think I want to be a trauma surgeon or emergency surgeon. I had an experience where I volunteered in Israel for six weeks after my first year of university with the paramedic force near Tel Aviv in Israel. That firsthand experience of being on the front lines of medicine really showed me that I work well under pressure and that I want to be involved on that first line of defense. That pushed me towards trauma surgery. But what I realized specifically is that my love for anatomy and my love for research has made me want to be able to save even more lives than just the people that I treat, and to affect many more people both around me and especially in the future. I want to be able to develop and enhance surgical techniques, which means getting involved with research. That is a big part of my aspiration."

Kody Wolfstadt

MSc Clinical Anatomy Candidate

Watch his interview
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"I got this feeling that I was the first person in the world to generate that data, the first person in the world to build that graph with that substance. "

Were there any particularly influential steps in your career so far?

"There's a couple of things that I think that are very important. Number one would be being able to have like an honest conversation with yourself—just sitting down as early as possible, trying to plan out your goals and develop a pathway to get there. Even if you don't know what you want to do specifically, just try to lay out all of your options and try to figure out what's the best way to get there. Then, start to do some of those things early. For example, to get into this master's program, you probably need research experience. So, after third year I got involved with the MJA lab at Ryerson university, with Dr. Marc Adler, doing organic chemistry research. Although it wasn't directly linked to anatomy, getting that initial research involvement is such a crucial step in becoming generally experienced. That led me to since get involved with the McMaster, arthroplasty collaborative doing systematic review with Dr. Seper Ekhtiari on total hip replacements. I think that just getting started early in the research process has really helped me to get to my master's program. Additionally, I think that informational interviews are such an important tool to get to know people and to build a network. Before getting into this program, I reached out to some of the students and some of the faculty involved to learn a lot more about the program. That really gave me an introduction to what the master's clinical anatomy program was all about, and definitely led to me being here today."

What attracted you to research in Anatomy and Cell Biology?

"I'm interested in doing medicine and I'm in the Master's of Clinical Anatomy program and so I have a really big interest in both developing, enhancing surgical techniques down the line. A good way to start that is to get involved with research involving surgery and Dr. Tim Wilson. When he told me about the maxillomandibular advancement project, I got really interested. He's a great man to work with."

What is your favourite thing about research?

"What I love most about research is just the sense of novelty that you get. No matter what you're doing, being the mundane day to day task of cleaning pipettes like I did the organic chemistry lab, or reviewing articles for data extraction, you're always doing something novel. It's the first time that anyone's ever done it. For example, when I was working in the organic chemistry lab, I used cyclical voltammetry. When getting those graphs, I got this feeling that I was the first person in the world to generate that data, the first person in the world to build that exact graph with that exact substance. I strive towards that with every research opportunity that I have. It gives me a sense of purpose. Like I said, even with the most mundane of tasks, everything you do is building up to answering a question that no one's ever asked before. It invigorates your curiosity and that drive to look for the unknown. Even after you finish up a research experience, you're always going to be looking for the next thing to go on, the next thing to find, which is honestly something that drives you towards research."

Emma Jayne

MSc Clinical Anatomy Candidate

Watch her interview
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"The best thing about research is the family you gain."

What are you currently working on?

"I am in the Clinical Anatomy stream and what I've been trying to do is identify the topography of the vesical portion of the inferior hypogastric plexus—which is the main nerve plexus within the pelvis, and I'm trying to determine the location of the branches specifically innervating the bladder. This project is to help nerve-sparing ureteric reimplantation surgery. It's a surgery that's commonly done in the pediatric population to treat vesicoureteral reflux, urine traveling back into the kidneys, where they actually move the ureters higher on the posterior aspect of the bladder. But, sometimes they find that postoperatively, they have complications such as urinary retention and bladder dysfunction. It's been proposed that it's due to some type of nerve damage to the inferior hypogastric plexus, but they don't exactly know where this is happening or to what degree. Nerve sparing techniques have been employed but haven't been very successful. So, what my project has been trying to identify is whether these nerves innervating the bladder are in endopelvic fascial planes and seeing if we can help inform nerve sparing techniques for this urological surgery, as well as trying to identify nerve fibers surrounding the ureterovesical junction, the site at which the surgery is taking place. I'm trying to identify if there's certain regions of the uterovesical junction that have a varying density of nerve fibers and creating a heat map using Western blot techniques."

Thoughts on your future research or career goals?

"As a grad student, you're always thinking about, "What your future is going to look like?". I am very interested in medicine. My main ideas have always been that I love working with kids and that I love science. Everything that Clinical Anatomy has brought me, I love. My clinical research job also really opened my eyes up to the fact that this is what I want to do. I want to work with kids. I want to help them. I also love teaching, I love being in anatomy, and I love the research project that I'm doing with Dr. Beveridge. I can definitely see myself moving on to teach anatomy, maybe at the college level. I might dip my toes back into clinical research again. Those are all things that are still on my mind. Those are my plans right now, and they might change in a week or so."

What were some influential experiences in your career so far?

"The clinical research position, I believe, was what gave me the experience to be able to be qualified for this master's, but also made me realize an aspect of research that I enjoyed. My community involvement has also given me the skills suitable for the clinical anatomy program—in being able to work in a small, tight knit group of people and learning how to be collaborative in research. From high school onwards, I've always volunteered to teach kids how to play hockey, I taught kids how to swim, I worked for the epilepsy center, running kids' programs, during my time in undergrad. More recently, I helped out a Youth Committee in Thorndale to write a grant to start up a youth center in this small town and to be able to implement and promote youth activities and programs. So, all those experiences gave me the skills to be able to be successful in this master's."

What drove you to research in Anatomy and Cell Biology?

"Coming out of undergrad, I was very unsure about how I felt about research. I had contemplated doing a fourth-year undergraduate thesis for a long time and didn't end up doing it. I was kind of on a teeter-totter about how I felt about research. What drove me into wanting to do research in ACB is that I loved anatomy. I took a year before coming into this master's to work a clinical research job at Victoria Hospital for a pediatric neurologist and I got to know clinical research. So, working with sponsors, helping to run clinical trials, and interacting with patients and the circle of care got me interested into what research would look like. Research in ACB is still more basic science and lab bench-related, but I'm working with Dr. Beveridge, whose work is very surgically and clinically based. I've got to meld these two experiences together. So, that clinical research experience really drove me to be like, "You know what? I think I can do this." ***I totally agree. I think that learning more about Dr. Beveridge's research has definitely shifted my perspective.*** "You have to find your niche. If you ended up trying to do a thesis that you really don't have any interest in, it makes the nitty gritty of research really difficult."

What is your favourite thing about research?

"What I love is the community aspect of ACB. In the clinical anatomy program, you have eight or nine people that are like your best buds and can go to for anything. I had to switch gears with one of my methods, I went in to do a Western blot and I had no idea how to do that. So, I got to learn Western blot alongside one of my colleagues who's in Clinical Anatomy with PhD students and other master's students. That goes to show how collaborative ACB is and how welcoming labs are in ACB. It's nice to know that there's always a helping hand to support you. The best thing about research is the family you gain." ***That's a recurring theme, loving the fact that you have colleagues and teammates.*** "The thing is, the department is your backbone because what you're doing every day is difficult. 90% of the time, research is going wrong, and sometimes you get the piece that's right. Yes, you have to be independent, but there's always going to be somebody there along each step that's going to either make it easier for you or challenge you."

What are you currently working on?

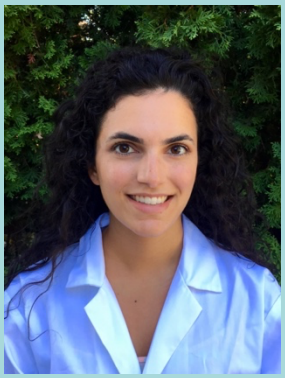
"I'm in my second year of my Master's in Clinical Anatomy and I'm working on my project all of this year. I just finished a pelvic floor therapy workshop for community physiotherapists. That was really the big bulk of my project, which finished just a few weeks ago, actually. I'm currently working on analyzing data for the pre- and post-knowledge tests that I administered for them, as well as some of their demographic questions. I also recently started to write the first draft of my manuscript, which is due next month."

What are some of your future research and career goals?

"I wasn't always one for research. I was involved in some research throughout my undergrad, just small things here and there to help other students. So, research really wasn't my main priority at the beginning, and even doing the course-based Master's and doing my research, I still feel that it isn't really something that I want to pursue long-term. My big goal really is to teach gross anatomy to post-secondary students—so either undergrad level or even professional students. But I do understand that if you're teaching at a university, you may have some research components, but ultimately, I really just want to teach. I didn't know that I wanted to do that until I came to the program. So that's kind of why this is like my saving grace. It really does make me happy, and I get really excited when I'm teaching, and I realized that, "This is it Gab! You got it; you've figured it out"."

Is there anything you'd like to say to the undergrad community?

"Take your time, don't rush into anything only because you're scared. Everyone's scared. No one has it figured out. We're all learning as we go along. I know everyone's struggling trying to figure out what to do and even a lot of my friends and family members, they just knew right off the bat and I thought to myself, "There's no way that all of us know what we want to do". So, connect with those people who are scared as well. Know that it's okay to be scared and to try new things."



Gabriella Alagha

MSc Clinical Anatomy Candidate

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"there's always the opportunity to learn, and that really is my big drive to continue into research later on"

What were some influential experiences in your career so far?

"My key steps involved a lot of patience. I was kind of immersing myself into all these different things to figure out what it is that I like, and all in all, I ended up not liking any of those things. But, knowing what I don't like has brought me closer to knowing what I do like. I think it's really important to be patient and to trust the process, as well as taking a lot of time to do your research and not rushing into certain things just because you're unsure of what's next, which is kind of what I did at first. But then eventually it works out and you accept that, "Okay, this didn't work out. So, what am I going to try next?" Being accepting of that and everything else that was going on in my life really helped."

"it was really the best decision that I made, because it brought me to where I want to be and made me figure out what I want to do with the rest of my life"

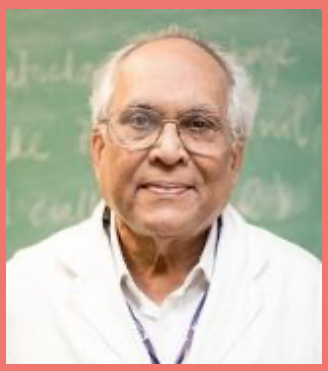
What drove you to research in Anatomy and Cell Biology?

"It's kind of a long process, took me a couple of years to finally get here. Right after undergrad, I started my Master's in Windsor doing a thesis-based Master's. I found out a few months later that it wasn't for me. I ended up applying to this program but before that, I realized that I really need to take my time to figure out what it is that I want for the next few steps. The good thing about doing what I did was that I realized I didn't want to do with thesis-based Master's. So that kind of drove me to looking more into those course-based Master's. I did a lot of research in other programs and I really found that this clinical program was the program that I wanted. Eventually I got there, and it really was the best decision that I made, because it brought me to where I want to be and made me figure out what I want to do with the rest of my life."

What is your favourite thing about research?

"Honestly, it's the amount that I've learned in less than a year. I never would have imagined myself doing the things that I'm doing now. Even if research isn't my top one, maybe even top three things I want to do, I've learned so much about the research process. It kind of brings me back to knowing that I didn't really like research to begin with, but now that I've done my project in an area that I enjoy, I've realized that it's about what I've learned. Just even the topic that I was doing with the anatomy of the pelvic floor and dysfunction of the pelvic floor—that on top of the actual research component—just the content that I've learned has really been a huge learning experience. That's kind of one of the benefits of research. It can be a little bit repetitive, but there's always the opportunity to learn, and that really is my big drive to continue into research later on."

Developmental Diseases



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"Ultimate happiness means following your passion."

What are you currently working on?

"We currently have two projects. We have accomplished quite a bit, but currently placental biology and the other is cancer biology. My focus in cancer right now is on breast cancer. These two projects are very interrelated. They might look very disparate, but they're actually very closely related."

"We have some excellent promising results, and we'd like to go into human trials maybe in the next couple of years."

What are some of your future research goals?

"Right now, my basic research is being translated in the clinic. There are two areas. One is in placental biology—we discovered a new biomarker for a disease called preeclampsia. But the number of patients studied was not large enough; you want to verify results with a large group of subjects of various ethnicities. Right now, I'm collaborating with a very famous institute in India. They are recruiting a large patient population to see in which patients this biomarker is valid. That's number one. Number two is in our breast cancer research; we have identified a new therapeutic target. We are now trying this in the next-best-to-human model called "patient-derived xenografts". You take an individual patient's cancer tissue and put it into a mouse model–this is an immunodeficient mouse with human hematopoietic STEM cells grafted into the mouse, therefore the mouse is humanized. It will not reject the tumor and it's similar to a mini human. It can accept therapy. We have some excellent promising results, and we'd like to go into human trials maybe in next couple of years in collaboration with the medical oncologists. We would like to combine these particular drugs, called EP4 receptor antagonists, and immune checkpoint inhibitors. I have just finished a grant application and hopefully, we can translate this therapy into human trials."

What are some steps that were influential to your career?

"I started as an MD, then did a PhD in medical biophysics. My joy was in research and my supervisor, who was a famous physicist, trained me into a newer discipline. I applied physics when I was doing research in the USA—I was there for five years. Seeking a career became very important for me—I loved research so much. At that time, I was also seeing patients at the clinic. I was jointly appointed in the Laboratory of Radiobiology doing research, and also as a clinical assistant professor in the Department of Hematology and Immunology. So there, I used to see patients, but gradually found that living two lives is very difficult, and my priority was in research. I could have practiced medicine, but I decided - although I may remain poorer, research is my joy." ***Many of your colleagues would also agree with following your dreams your passions.*** "That's what I did. I would advise everyone that if you do that, you won't be disappointed. Ultimate happiness means following your passion."

"I used to see patients, but gradually found that living two lives is very difficult, and my priority was in research."

What drove you to a career in Anatomy and Cell Biology?

"See, Anatomy used to be a department which nearly included all the disciplines of morphology—starting from gross anatomy to the finest structures visualized with electron microscope. More and more, it has included cell biology. There is no barrier–the cell and molecular biology is part of anatomy now. How I joined anatomy is an interesting story. I was doing research in hematology oncology, at the University of California, San Francisco Medical Center, and moved to Canada, working at the Chalk River nuclear laboratories. I got bored there because my joy was being at the university level where you have graduate students. Interestingly, Dr. C. P. Leblond, the chair of Anatomy at McGill University, whom I can call the father of histology and cell biology—he invited me and recruited me to that department. Okay. So that became my department. My research thrived. When I became the Chairman here, we changed the name of our department to Anatomy and Cell Biology. So, that's how I came to anatomy and cell biology." ***So, you were the one to create the name anatomy and cell biology?*** "Yes, because we were doing more and more cell biology. Others were also doing cell biology in different departments. But finally, the senate agreed that there was no conflict. So, they allowed us to change the name."

"So that became my department. My research thrived. When I became chairman here, we changed the name to Anatomy and Cell Biology."

Could you elaborate more about your early career successes?

"I started as a medical scientist. We had done a lot of clinically oriented work and in the late eighties and early nineties, after I came to Western as the Chairman of the department of Anatomy and Cell Biology; we discovered many new things in cancer immunology. We applied those findings to mouse models. This was the first time in the history that we could cure several cancers in mice when they were already metastatic. We used a combination therapy with an aspirin-like drug called indomethacin and an immune activating cytokine called interleukin-2. This combination therapy was extremely successful in the mouse models. We then conducted a human trial with this drug combination here at Western, and it was very promising in highly advanced melanomas and kidney cancers that failed other therapies. These were the early days of immunotherapy. There is a new surge of immunotherapy right now, and this is because of the discovery of immune checkpoint inhibitors."

What is your favourite thing about research or your career?

"In my job, you'd be happy to know, is to interact with my students and postdoc trainees. That's the happiest thing I can do. I have not given up research primarily because of my students. I had a Zoom meeting this very morning with my lab group, and Dr. Steve Renaud's which is next door to our lab, so we share our lab meetings. We had a beautiful presentation this morning from one of the students. I have one PhD and two honors students now and they are doing beautifully, one in cancer and two in placental biology. These interactions with students are my joys. Afterwards, I sent her several papers that she is going to read and get back to me. These are my happiest interactions. As a matter of fact, some of my past graduate students and post-docs have been highly successful. One post-doc is now at Brandon–she became an associate professor very quickly and she got Canada Research Chair Tier 2, which is unthinkable at that age. I'm currently advising her; so last night, in a Zoom meeting with her, one of her students and one of my students are writing some papers–using our unpublished data. These kinds of things are joy. I don't care that it took us about two hours! In the end, the students are happy. This is what I enjoy most."

Do you have any words for the undergrad community?

"I would like to share to those who really enjoy the research, I know that faculty positions are very hard to get, but there are alternate career paths. The timing right now is not good. But still, those who are really interested, they'll try those paths. If I see someone whose passion is not truly there, I tell them, "Well, you could go this way. You don't need to pursue and get frustrated". ***A lot of people might honestly need to hear that.*** "One of my past students–whom you may or may not know, is Charles Graham, he was the chairman of Anatomy and Cell Biology at Queen's. It's a joy to see the next generation students, and one of them is Steve Renaud. He's my student's student–like my grandson. It's wonderful to have that. This is a second family to me."

What are you currently working on?

"We look at how development modulates genetic and environmental inputs to produce variation at the phenotypic level. Specifically, our group is interested in skull development with a big focus on generation of phenotypic variation using different mouse models of genetic and environmental disruptions. In terms of genetic disruptions, right now we are focusing on Gja1, which encodes the gap junctional protein connexin 43. Connexin 43 is known to be very important in bone biology and bone development. We're trying to understand what specific developmental processes, such as bone cell proliferation or differentiation, that may either exacerbate the initial genetic disruption or help compensate for it. In terms of environmental disruptions, we've started working with a prenatal alcohol model. Prenatal alcohol exposure has major consequences for skull and face development, often leading to craniofacial anomalies. We're also collaborating with Dr. Brian Allman here in ACB, and Dr. Dan Hardy in Phys. Pharm. to understand what the effects of prenatal alcohol exposure are on a more holistic, systems biology scale. Dr. Allman does a lot of work with neuroscience and Dr. Hardy does a lot of work on metabolic and growth restriction, which are also known outcomes from exposure to alcohol prenatally."

What are some of your future research goals?

Well, as a researcher, you're always thinking to the future and adapting your approach. For me, that includes following the questions that are of interest to me, regardless of the techniques required or the cost. It doesn't mean that I will be able to pursue all questions, but it's the idea that I will continue to try to raise the necessary money, to learn those new techniques, and to be willing to be a rookie right up to the time that I retire. Although it's nice to have that feeling of expertise, and that competency is important because we can't always fake it until we make it in science, but teaming up with folks that are experts and being willing to go through the uncomfortableness of learning is my future goal. I want to constantly push myself outside my comfort zone."

Dr. Katherine Willmore

Assistant Professor

More about her research
http://bit.ly/WillmoreInfo

Watch her interview
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"we're all just people trying to answer fun questions–or what we think are fun questions"

Are there any key steps that you took to start your career?

"I guess the biggest one was always looking for mentors at every stage of my career development. Starting in undergrad, I looked for opportunities to pursue research and mentors; I've continued to stay in touch with these mentors to this day. They get to know you as well, so they can tell when you're starting to fall into old patterns and help you get through them."

What drove you to a career in research?

"I think it's being able to think about and try to solve really complex problems. But you can do that on your own. What I love about the academic environment is that you're doing it in collaboration with other people. I really like the social part, I'm social in my personal life, so it's really nice that I can be social in my professional life too. There are not many folks that want to talk about really nerdy things for extended periods of time. So, it's really nice to have that outlet at work."

"What I love about the academic environment is that you're doing it in collaboration with other people."

What's your favourite thing about research?

"It's the people. It's getting to know people and creating relationships. It's my favorite part. I love the science, but getting to work with people, getting to know them is the most rewarding aspect of research. It is so personal. We say things like, "Oh, don't take it personally", but it's your ideas and your creativity you're sharing. You're tied to the people that you spend years with working on projects."

Is there anything you'd like to share with the undergrad community?

"I think that there's a lot of folks that don't know what research is all about. Students see their instructors hurried in the classroom and then running back to the lab. Which is fine, but it is worth asking your professors about their research if you are interested. I know a lot of students would find that really scary, but we're all just people trying to answer fun questions, or what we think are fun questions."

Dr. Stephen Renaud

Assistant Professor

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What are you currently working on?

"My lab is invested in understanding fundamental placental development and what happens when the placenta does not function properly. Since the placenta is responsible for providing the environment for the baby during those critical first nine months of its existence, then improper formation of the placenta can have both acute problems for the neonate as well as lifelong problems for affected children. My lab is interested in uncovering the role of inflammation, immune cells, and diet in shaping the way the placenta develops. We are also looking at the potential outcome on the development of babies' organ systems when the placenta doesn't function properly."

"uncovering the role of inflammation, immune cells, and diet in shaping the way the placenta develops"

Any future research goals to share?

I'd like to be able to provide some insight into the mysteries of placental development and solve some of the key puzzles that have been plaguing researchers for many years. I hope my research can make a difference to improving diagnoses of prevalent pregnancy-related complications, like preeclampsia, fetal growth restriction, preterm birth. These are highly prevalent problems that we don't know how to solve. The diagnoses are getting better, and certainly the knowledge is getting there. If I was able to contribute to that, I would consider that to be a big plus."

"the opportunity to make a difference by solving complex biological problems in the hopes of improving lives"

Are there any key steps that you took to start your career?

"I think learning never stops—if you want to continue in research, then you have to pursue higher education. But certainly, one of the key steps that helped jumpstart my career was to work on my ability to communicate effectively. Writing is instrumental in having any sort of success as an academic. I would also say it was important to get out of my comfort zone to explore new avenues and new territories. For me, I went to live in a different country to pursue further education, experience, and opportunity for five or six years. Despite being far away from home and out of my comfort zone, I was very fortunate to join a fantastic lab there and gain some new technical expertise and unique perspectives on how to perform more innovative research. It goes a long way when you're willing to take a chance."

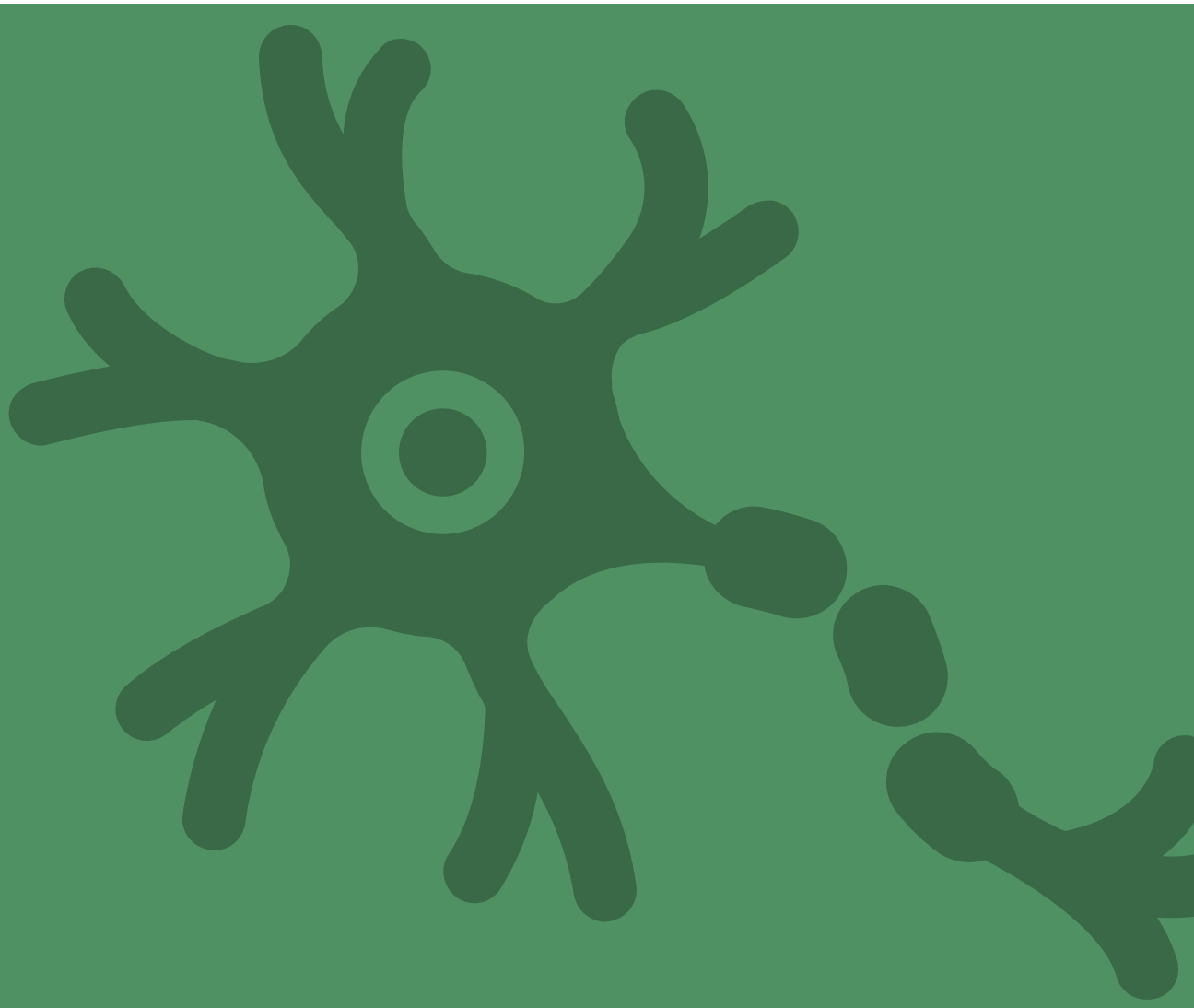
What drove you to your current career?

"What drove me to research in general is the opportunity to make a difference by solving complex biological problems in the hopes of improving lives. There's a lot of really neat aspects to research, including the opportunity to work with ambitious students and the chance to form collaborations all over the world. You get to meet people from many different cultures, and you all have the same kind of overall goals in mind." ***Just kind of out of my own curiosity, is there any one topic, that really grabbed your interest?*** "I've always been interested in inflammation, but I actually think the most interesting aspect of placental development is from an evolutionary perspective. I find it amazing that if you think about all our different organ systems that have developed over the course of evolution, they're consistently present in many different species. Conversely, placentas aren't present in many of them because it is one of the newest organs that has evolved. We evolved from an egg-laying species where reproduction was happening outside the womb. Placental development was about incorporating that inside the womb as a survival strategy. Essentially, the placenta needed to form in the context of a competent immune system and for us, it needed to figure out a way to survive and thrive for up to nine months. It's a really fascinating evolutionary problem."

What's your favourite thing about research?

"It's the opportunity to work on a complex biological problem with very motivated ambitious students where you can shape their way of thinking about problems. You get to watch students grow and become really proficient in performing certain techniques until they become the masters. I really cherish that. Also, I've mentioned this before as well, but since research is being done around the world, you get to meet many really interesting people with a shared love of a certain aspect of research. You have this shared passion in common with them."

"It goes a long way when you're willing to take a chance."



Neurological Diseases

What are you currently working on?

"Our research revolves around trying to understand how mid-life vascular risk factors, such as hypertension and diabetes, can not only increase one's risk of stroke, but also cognitive impairment and dementia. We're very interested in trying to understand individuals in their forties and fifties with high blood pressure are more vulnerable to developing dementia and Alzheimer's disease. The molecular mechanisms that we're teeing in on involve inflammation. We're interested in understanding how vascular inflammation can prime the brain's inflammatory response and its contributions to cognitive impairment and dementia."

Any future research or career goals to share?

"The mantra of my research team is, "Go where the science is telling you where to go." There have been many times where we've come into a research project with a certain idea or a hypothesis, and it ends up being completely proven wrong. Then our research really takes a right-hand turn. You have to go where the science is going. ***Something that I want to influence through this project is this common narrative that research is individualistic or non-collaborative.*** "I think that's so wrong. If you look at research programs that are really successful, whether that's in training outstanding students or attracting international funding, they all require a collaborative and often global approach. Answering complex questions requires complementary expertise and complimentary approaches. You simply cannot be an expert in all things. If you are not collaborating, you are not driving team- driven research, and you have no shot in this field."

Dr. Shawn Whitehead

Associate Professor

More about his research
http://bit.ly/WhiteheadLab

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"you're not only discovering knowledge for the sake of discovering knowledge, but you're inspiring the next generation to also be knowledge seekers. And that is very, very rewarding."

What important steps did you take to kickstart your career?

"I think it's always good to have multiple interests. Whatever you do, do it "excellently", if that's an actual word. Striving for excellence is really critical, no matter what you do. The reality is, when you get into research, you are required to do many things at an elite level. So, having that experience is really critical. For students coming in and contemplating coming into grad school, one of the things I actively look for in CVs is if the student has a history of doing something at an excellent level. It really doesn't matter what it is. We've had students in our lab that were varsity swimmers or professional musicians. It tells me that these students can work independently, and that these students can do something at a high level because they're passionate about it. I would say for me, it was finding as many opportunities as possible to sort of do those types of activities."

What drove you to a research career in Anatomy and Cell Biology?

"Before I get into my answer, I would say science is not restricted to any discipline. There was nothing that particularly drove me to anatomy and cell biology other than they were the department that was willing to hire me. What drove me into research as a vocation was just the thought of waking up every day and being excited to discover knowledge – to do something new and innovative or ground-breaking. At the end of the day, it's about getting up in the morning and feeling like you can make a difference. I know it sounds corny and cheesy, but really that's what it's all about." ***I'm seeing a lot of similarities between you and your colleagues, which is really great to see.*** "Well, it's also about moments like this, interacting with students. I have a passion for teaching and training and seeing the next generation achieve their goals. That's all part of it—you're not only discovering knowledge for the sake of discovering knowledge, but you're inspiring the next generation to also be knowledge seekers. And that is very, very rewarding."

What's your favourite thing about research?

"I think my favorite part of my job is training and interacting with students. Number one, it keeps you young, which is great. But number two, you have so much to learn from people with different backgrounds. That's the beauty of research—when you are doing collaborative-based research and you are training students from all over the globe, it's an amazing experience to learn everybody else's perspective. It really does make an enriching research and knowledge environment."

Is there anything you'd like to share with the undergrad community?

"Hang in there. You guys are amazing students. One of the best parts of my job is interacting with students like yourself. I'm always blown away with how well you guys have your lives together. It doesn't feel like it, right? We all feel like we're not measuring out. That's just part of the deal. I would just say that you guys are doing an unbelievable job and it's going to get better."

What are you currently working on?

"My laboratory is located at Robarts Research Institute and I run a molecular neurobiology lab. We're really interested in asking cellular and molecular questions about the nervous system and we focus on traumatic injury, the whole breadth of injury from very mild concussion to severe brain injury as well as vascular injuries like strokes. My lab is trying to determine what's happening at the molecular level so that we can get ideas about therapeutics to make recovery better. We have therefore two types of strategies that we investigate. One relates to how we control the inflammation that is triggered by injury. Inflammation has good and bad to it, but if it's too intense, then you get more damage than healing. Because the brain and the spinal cord control inflammation, when you have damage to the brain and the spinal cord, you lose that control. Inflammation can go unchecked. We also have a program towards encouraging nerve regrowth. This comes from my background in embryology, where I was interested in studying how nerves find targets in the developing embryo. We try to apply some of the same ideas to ask the question: if the nerves knew how to connect and grow in the embryo, why can't we get them to do that after injury in the spinal cord or the brain?"

What goals do you have for your research?

"Most of our projects have a therapeutic goal. I'm at the stage with at least two of the technologies that I'd love to make it to clinic. We have an anti-inflammatory strategy for reducing the inflammatory response after spinal cord injury and brain injury. We've seen that it may also help in certain forms of systemic inflammatory responses when the body responds with too much inflammation. We're doing these studies with my colleagues Dr. Greg Debekan, and Dr. Lynn Weaver. We've got patents out there and thinking about clinical trials. We also have a program in my lab to develop small molecules, which are drugs, for encouraging nerve growth. This program is not as far along as the anti-Inflammatory strategy. We ask: How do you formulate a small molecule to encourage nerve growth? How do you manage the pharmacokinetics and pharmacodynamics? Finally, on a more basic science level, we're doing all sorts of studies to see if we can tease apart the link between a history of concussion or repeated brain injuries and the later development of dementia or Alzheimer's. Why does having concussions predispose you for disease?"

Dr. Arthur Brown

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"Most of our projects have a therapeutic goal."

Was there anything that was particularly influential for your career?

"It would've been the great people that I've met. I think people think scientists are clustered in small little dark rooms and have no social skills and just do their own work. But really my career has been mostly fueled by colleagues and mentors who Influenced me. When I was in fourth year, I was really influenced by an embryology professor who really got me excited about questions like how do you get from a single celled embryo to a multi-cellular being? What are the genes that control it and what happens when it goes wrong? Why does it go right so often? That fourth-year class taught by Dr. Rappaport at U of T really turned me on to science in general and embryology in particular. I had key development as a graduate student with Janet Rossant and in Toronto, who really let me be independent in the lab. I could go in and really work on my own with enough independence that I could spread my wings but not so much that I could get lost.

Here at UWO and particularly at Robarts, I came to develop a research program to study embryology and how nerves grow, and but it morphed within about five years from when I started into a neurotrauma research program. I became almost totally involved in studies of spinal cord and brain Injury because of my colleagues who were already experts in this field. These colleagues who had neighboring labs were welcoming and friendly. We sat down, drank coffee together, and we talked about each other's science problems until I started to collaborate with them. All my work is collaborative. All my work is because of them. I go the breadth from molecule to cell, to pathology, to behaviour, not because I know all of those things, but because I can collaborate with people who know all those things and ask the interesting questions with them. My career has really been shaped by others who have been willing to collaborate. I've been fortunate to be surrounded by great people. The friends that you make in graduate school, being in the same lab or neighboring labs, they go off to Boston and you go off somewhere else. They're going to be the ones you call in five and eight years and say, "Hey, I have a mouse and I don't know how to image it. Can you help me?" They're going to be the ones, very often, who help you out. The relationships and the friendships you make will form the foundations for your science."

What's your favourite thing about research?

"At end of the day, it's fun. It's simply fun. I'm happy to go to work. I like having the opportunity to think about things. There's not a lot of jobs where you're paid to think. I set aside time and to just think about my work. The fun of science is its creative side — trying to figure out what to do next. Why does "it" work like that? What did that result mean? The fun of cogitating on those things and talking about it with colleagues, students, post-docs, all that is just so much fun."

"The relationships and the friendships you make will form the foundations for your science."

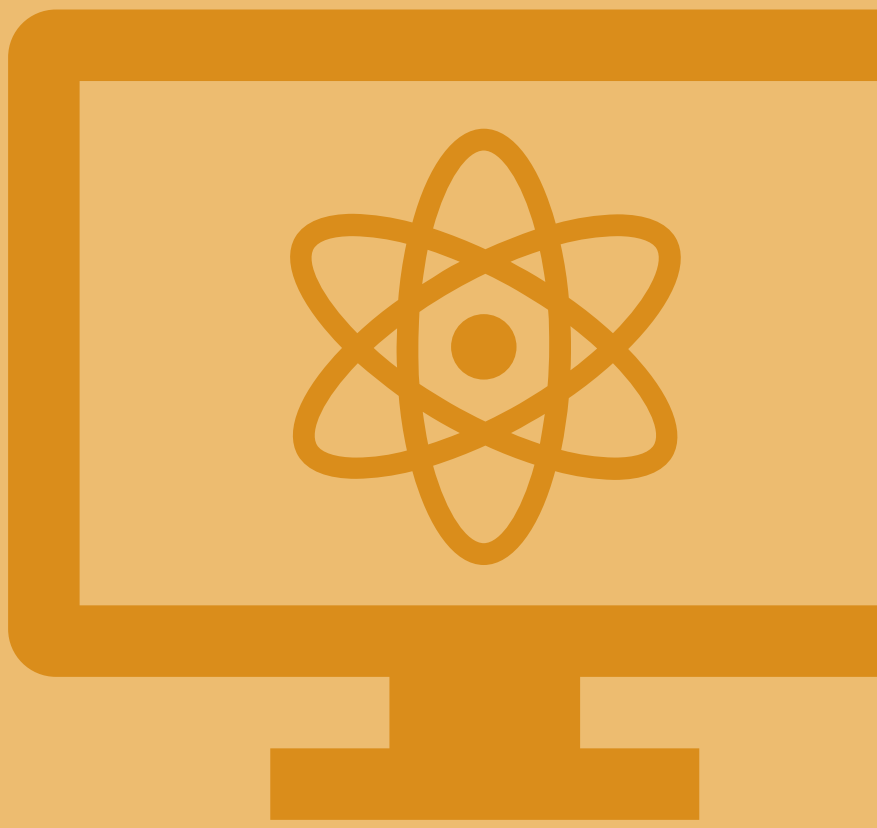
Why choose a career in research?

"First of all, I was attracted by the fact that research has a clinical significance. I felt very strongly as a student that I wanted to do something that could at least potentially have clinical importance. I also liked the way science surprises me. It's fun to design experiments and it's great to get what you expect, but it's much more interesting to get what you don't expect to find. It's like mining in a cave — it's great to find a new vein that you didn't know was there. Now you can go down a brand-new route that no one's been on. That's really exciting. There's a lot of beauty in science and that's not just in the results that you obtain, which may sometimes be aesthetically beautiful, but even well-designed experiments have a beauty. There's something really beautiful about it, a certain elegance to the scientific method that I really find attractive as well. Graduate students and fourth-year students, if you feel a sense of wonder and see the beauty in the science, I don't think you're going to lose that. A lot of things go on in a scientific career, but most of my colleagues will agree that we still feel the same. We all still find the science itself engaging. No matter how many years we've been in it."

"if you feel a sense of wonder and see the beauty in the science, I don't think you're going to lose that"

Any words for the undergraduate community?

"You should know that research is totally different from undergrad and that might be good, and it might be bad. In undergrad, we generally feed you material. You will have you go away, memorize textbooks, and then spit it back to us. But when you get to graduate school, it all changes. We assume you know all those things, and no one wants to teach it to you. You have to go figure it out and become the master of your own ship. You decide where you go, and you decide how hard you work. You get to do that independently, which I think some people might find scary. It's a huge opportunity to have fun and to do your own research. As a graduate student, you're learning not for someone else, not for an exam, but because you're interested in something. If people think that that's a life they'd be interested in, I say go for it. Go do a master's and you're going to have a thesis in two years, maybe a publication. If you decide after that that it's not right, then go do something else, but it's an opportunity at the end of fourth year to actually pursue knowledge. Not because someone's standing over you with a whip, but because you're actually interested. You know, you may never get that chance again. I would grasp it if I was interested."



Scholarship of Teaching and Learning

What were your most memorable projects?

"There have been so many different research projects, but there are two things I want to mention. Both of them are related to exploration and discovery–that's a passion. Early on in my career during my master's program, I looked at the development of embryos of invertebrates, specifically leeches. This has been explored many times by others, but I was able to discover this particular part that wasn't seen previously because people were not sectioning the embryos in three dimensions. So, I was able to discover something new which was only possible by applying a particular new technique to the field. This was a highlight, discovering something new. The other highlight was also a discovery; I developed an in vitro system to study the migration of tumor cells through a layer of endothelial cells that line blood vessels. How can we study this in vitro using microscopy? I established a system using confocal microscopy, and all of a sudden, we were able to see things that nobody ever has seen. That system that gave me the impetus for applying for funding. I got a grant that led to the position here at Western, and I used that system to study the migration of white blood cells, and that was very successful. So, these are highlights driven by the passion of discovery."

"This was a highlight, discovering something new."

Why did you choose research in cell biology?

"This is interesting because a lot of people will probably say the same thing. Often, it's happenstance–it's the way life actually happens. In my case, having a master's in zoology, I left Germany, and came to Canada because I met my Canadian wife. I decided to do a PhD and find the right supervisors all through connections. I ended up in Toronto in the department of anatomy and cell biology, which doesn't exist anymore. Again, that's mentorship. People said, "Hey, I like what I've seen in you. I'll take you on as a student". It doesn't really matter what field you're in. If you have a passion for discovery, you can make a discovery anywhere, develop passion, and be successful in any field."

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"Research is not a one person show and as more people that get involved, the more fun it is."

What important steps did you take to kickstart your career?

"Everybody's personality is different. The first thing is to be cognisant of who you are and what drives you. Then to apply that to your work. You can't be good in everything, right. But you have to identify what you are good at and how to best apply that to wherever you are. Be persistent and don't give up the first time when things don't work out. Persistence was huge in my career. Apply your skills, learn new ones, and work hard. I think if you're focused on the things that you love doing, you automatically get good at it. It's like, if you love playing piano, you don't mind practicing and you get good at it. I think it's important to find that sweet spot where you apply your skills and your personality to the field."

Was there anything else about your career that you would like to mention or highlight?

"Yes, but I want to plug a little bit about the academic environment. What's so great about the academic environment is it allows you to discover yourself because it's so broad. You can apply sort of like running a business. You have to promote what you're doing. You get a chance to mentor people and, what happened to me, they give you a chance even to change your career on a significant way. I was so driven by discovery and research, and now my passion is teaching. What other kind of environment allows you to totally switch from one focus to another? This passion for teaching, I had to learn and develop, I never knew that I had it. But the academic environment allowed me to discover that and then move over to it. This is what I really love now—seeing the light bulbs going on in students whenever they say, "Oh, wow. I had no idea". To be part of that, that mentorship or that growth, is huge. This is what I love right now. This drives me."

"This is what I really love now—seeing the light bulbs going on in students."

What's your favourite thing about research?

"It has changed over the years. When I was researching, I've thought, "Okay, I want to be alone". I'm an introvert. This is my thing, looking through the microscope, I could spend hours to just go and explore and try to make sense of what I'm seeing, but that has changed now. You know, talking to people and encouraging people to do or to discover what their thing is and being part of their education. This is basically what gives me joy and this is what I love doing."

Any thoughts or advice for the undergrad community?

"It's so easy to give advice, and especially in these times is really hard. But one thing I learned: don't be a loner, even though that's your inclination. Share your experience of others and learn from others. Research is not a one person show and as more people get involved, the more fun it is."

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"We're in the process of evaluating if it actually makes a difference in their learning."

What are you currently working on?

"I have three graduate students from the clinical anatomy program that are working with me. We're developing educational modules for occupational therapy students–that's two of them. My other student is working on developing modules and a workshop for physiotherapists. The occupational therapy modules were for just basic anatomy. The OT program accepts students who don't necessarily have a science background. So, if you have someone coming in and they'd never taken anatomy, it's a steep learning curve. We have created introductory anatomy modules for these students and we're in the process of evaluating them to see if it actually makes a difference for their learning. The other project is looking at neuroanatomy for these students as well. We want to find out what topics are most challenging, both what they perceive and based on previous test results. Then we will develop some workshops or modules around those. The PT project is looking at pelvic floor health, which is a huge area in physiotherapy; however, in the program that they get, they actually don't do any pelvic floor anatomy. We've developed anatomy modules and a workshop for practicing physiotherapists who want to come back and find out what pelvic floor physiotherapy is all about. So those are my current projects–mainly anatomy education and evaluating the effectiveness. ***I mentioned to you before that a lot of people don't get to see the side of kind of research in anatomy education.*** Yeah, and previously I had worked on online education and studying the histology 3309 course. I did a lot on attendance–both face-to-face attendance and attending the videos. That research has actually informed how I've set up that my current courses."

Do you have any future research goals to share?

"All researchers would like to get a big grant that would fund a major broad project. So definitely I'd like to do that, but it's a lot of work to put all those applications together. I need a chunk of time to sort of work away at it and get it ready. But definitely I'd like to be able to do something like that; it not only funds the next few years of your research, but it's also an acknowledgement that what you're doing is important, that other people agree that this needs to be done, and they'll provide the funding for it."

What are some important steps that you took to build your career?

"Once you start down a pathway and you kind of think that this is what you want to do, then critically evaluate your own CV and qualifications. What do you need to do to get to the next step that you want to do? Years ago, I had a master's degree and I had kept in touch with Dr. Rogers from our department who taught histology. I was previously more involved with histology teaching than anatomy teaching and I had run the histology labs for a few years. I got a lot of experience giving these lectures and I thought, "Oh, this is really fun". But, in order to get a full-time permanent position, you absolutely had to have a PhD. So much later in life, I had three kids at the time. I thought, "If I want to do this, then I have to get a PhD". So, I started a PhD. And then the rest, I guess, kept going from there."

What led you to choose a career in anatomy?

I came to anatomy after finishing my undergrad and I wasn't sure what I wanted to do. I knew that I liked working in lab, so I had taken a few lab courses. I really liked the hands on trying to do experiments. It was actually the program that I was in–it was a very, very small cohort–we had really a lot of attention paid to us. We got to do some really neat experiments and I just love that experience. What drove me was just sort of wanting to do more in a lab and see what it was like. So, I applied for a master's program and that started it all. I just had fun in the lab. It's a lot of fun to work and try to do experiments and sort of trial and error, learning from your mistakes. I wasn't sure exactly what I wanted to do. I certainly didn't start university saying I want to be an anatomy professor that wasn't on my radar at all. It's just sort of one step after the other, one door opens and then you're like, "Okay, I'm going to try that". It's kind of led me to where I am now. I have to say, I love my job. It's so much fun. I like working with students. My colleagues are great. The subject is so much fun to teach."

"It's always fun to learn new things. That's what keeps us going. Keeps us curious."

What is your favourite thing about research?

"My favorite thing about research and my job is that there's a lot of variety. So, with research, you are at times on your own working away, you do some writing, you compute statistics. Then you get to share it and do presentations–there are lots of meetings where all the different anatomy instructors will get together, share ideas, and present their work. It's a lot of fun. You get to keep learning–that's one thing that I like about my job and research in general. You are constantly learning new things and adapting. As far as instructing, this year we've certainly had to learn a lot of new things. Now I know how to edit videos, which I never knew before. It's always fun to learn new things. That's what keeps us going. Keeps us curious, I guess."

What are you currently working on?

"As a dedicated medical educator, I don't have a tenure track faculty position—most of my time is taken up with teaching as opposed to research. It's not a typical faculty appointment. It's helpful that my research relates to my teaching and so I study the scholarship of teaching. Recently, I've been working on a project where we are looking at basic science knowledge retention in medical education. What we have been doing for the past few years is we've been looking further up the chain. As medical students move through the curriculum, what are the expectations of them? What basic sciences are they expected to know? What we do is we assess the students on that knowledge. Are they retaining that knowledge from their earlier preclinical years? The reason why we're doing this is it allows us to take a look at our curriculum to see if we need to make any tweaks or changes to make sure that they're getting the fundamental knowledge that they need as they move forward."

Do you have any future research goals to share?

"I'm focused on basic sciences in undergraduate medical education. The reason being is that as the wealth of knowledge in medicine grows, the time we have to teach everything diminishes. Often that is at the expense of basic sciences and they get eliminated from curricula. One of the things that I'm working towards right now is taking this nationally. I'm talking with a lot of anatomists across Canada and we're putting together a project to look at anatomy curricula across the country and discussing whether or not there should be a standardized curriculum. Should all medical schools be teaching the same anatomy? Probably. It would make sense if there is standard anatomy content that medical students need to know to succeed as they go forward in their careers. And that's not currently how it's set up, currently each institution decides what anatomy to teach and at what depth. It is a very lofty goal, but I want to initiate a discussion about how we teach the basic sciences in a medical curriculum. Another aspect of my future research goal is wanting to translate the current research into the post- graduate level. Once the medical students have graduated and they're in their residency programs, how is their basic science knowledge retention? How did they learn the fundamentals that they needed from medical school? Adapting what we've done to the PGME level, to see how basic science knowledge is retained as the graduates move through their careers. ***I know you said that you think it's a lofty goal, but I mean, it takes people with lofty goals to make that level of change.***"

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What are some important steps that you took to build your career?

"When I was doing my master's degree, I decided that I wanted to teach cadaveric anatomy at the university level. In order to do that, you have to have a PhD. The PhD was basically my stepping stone to get to where I wanted to be. Anatomy is a very unique subject to teach, due to the amount of contact hours it takes to teach anatomy versus teaching other subjects, especially at the professional school level. As a result, many anatomy-teaching faculty positions are dedicated educator positions. Many of our graduates, myself included, have been able to gain faculty positions straight out of a PhD. I did everything that I could while I was a graduate student to gain experiences in teaching. I wanted my CV to be very strong in teaching when I was going out and looking for faculty positions. I did things like the teaching certificate from the Centre for Teaching and Learning and asking the professors of courses that I was a teaching assistant in for more responsibilities in the course. I also found teaching jobs outside of the university while I was a graduate student; I taught at a dental hygiene college, and I actually taught at the University of Waterloo in their optometry program. It was a lot in addition to my graduate work, but it was also what I enjoyed doing. That was where my passion lied and that's where my passion still lies to this day. Once you decide where you want to go, it's about making yourself marketable in that area."

What drove you to a career in anatomy?

"I did a kinesiology undergrad, and then I went into a master's because I didn't know what I wanted to do career-wise. My first TA-ship was teaching anatomy in my first term of my master's degree. I always loved anatomy when I took it as a student, but then I fell in love with teaching anatomy. From then on out, I just geared everything I did towards gaining skills in teaching anatomy."

"Once you decide where you want to go, it's about making yourself marketable in that area."

What is your favourite thing about research?

"My favorite thing about research is seeing changes occur because of the research. In teaching, specifically having evidence to back up why you're doing what you're doing. It just makes sense to me. We talk about evidence-based medicine all the time because we want our students to use evidence-based medicine throughout their careers. But I also want to use evidence-based teaching. I want to make sure that I'm doing what is best for the students, so that they can gain the most amount of knowledge that they require to move forward and be successful. That's definitely my favorite part—impacting change with the data."

"I want to make sure that I'm doing what is best for the students."

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