THE CSB FOREFRONT

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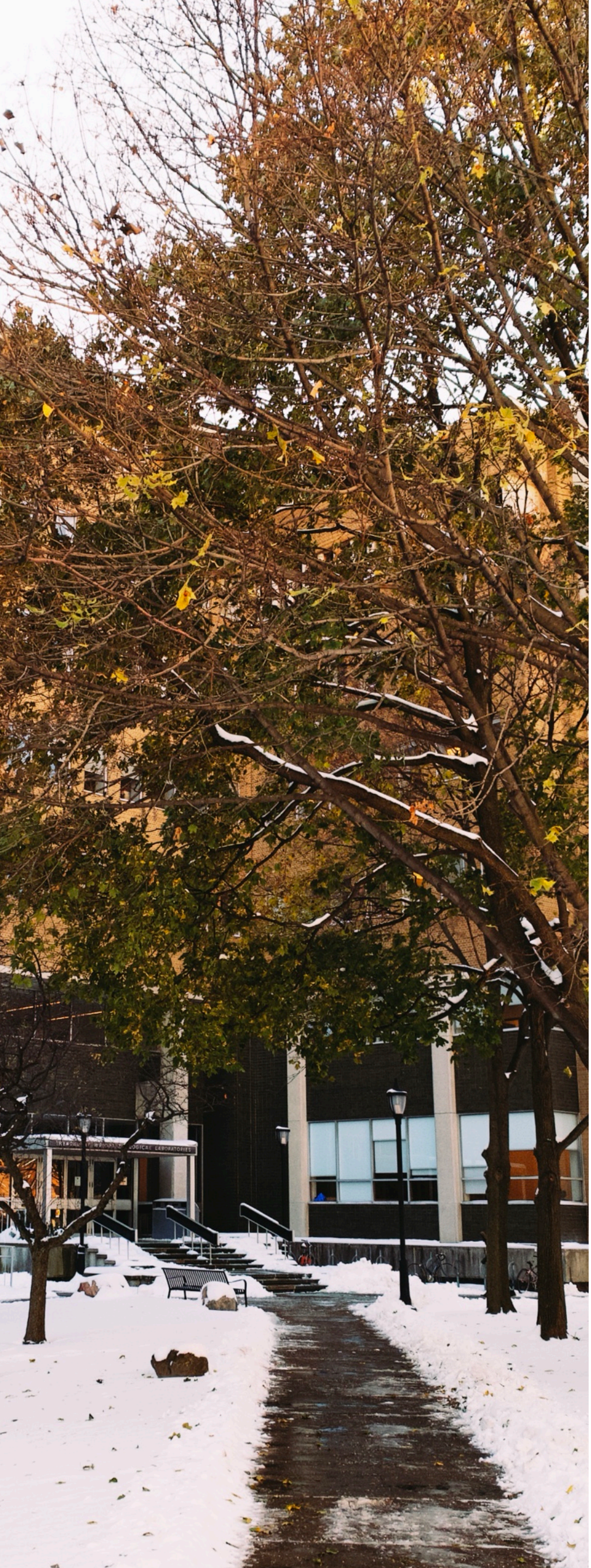
Winter 2019

Illustration by Ian Hsu



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Sunrise in Iceland. Taken by Francis Lee

From the Editors

Welcome to The CSB Forefront!

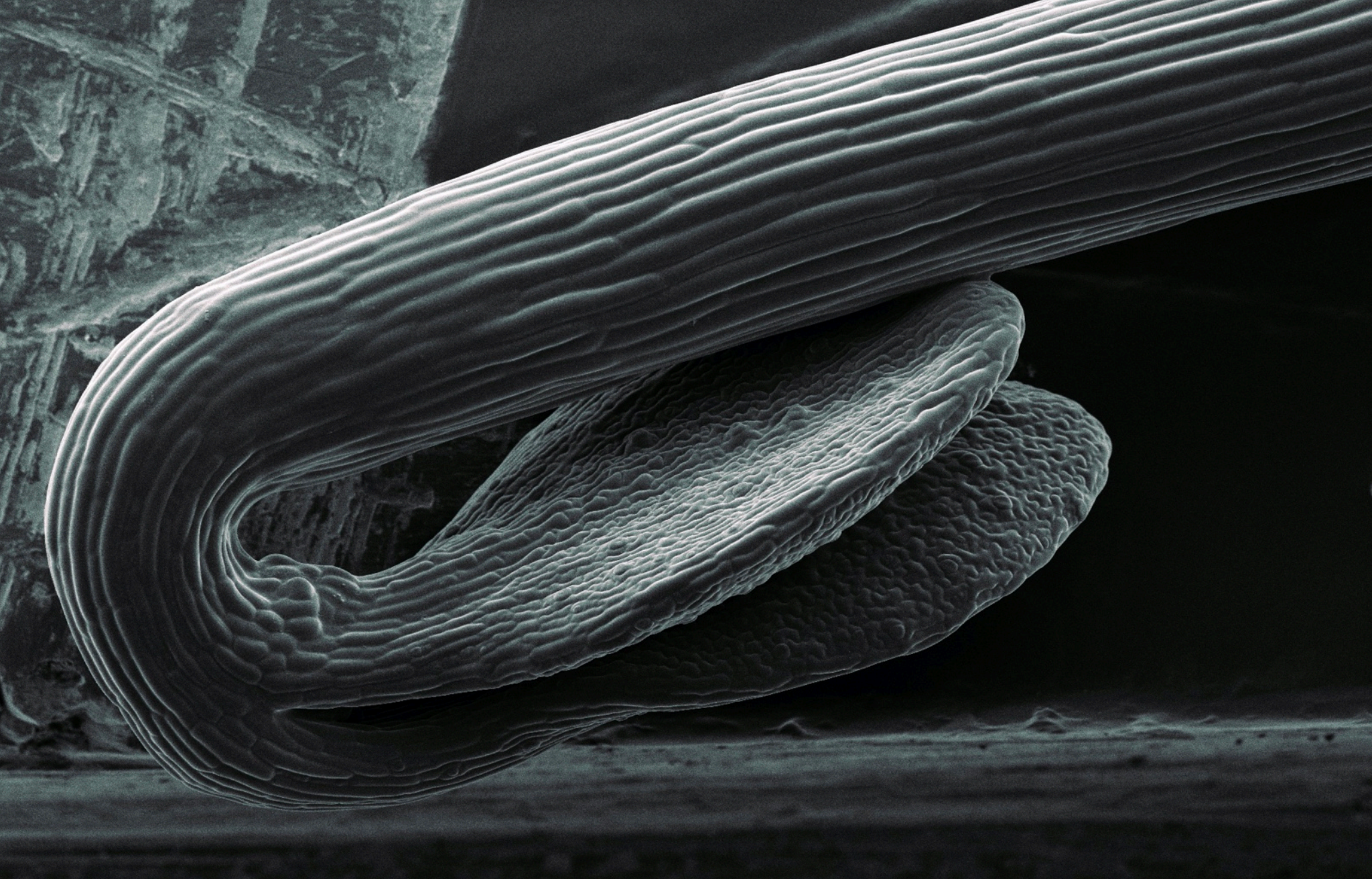
We are a digital magazine crafted by grad students at the Cell & Systems Biology Department at the University of Toronto in the spirit of opening a space for all grads to share their ideas, experiences, and to practice informal writing about and around scientific research. We want to provide a platform for promoting resources and information relevant to us while also strengthening our sense of community by celebrating our achievements and discussing our shared interest and struggles. We intend to make this a space where you can practice scientific communications and expand your portfolio by writing essays, reviews or editorial pieces with advice for your fellow grad students. The CSB Forefront will feature subjects ranging from our research to a broader view on academia, pop-science, science-fiction, philosophy of science, life as a grad student in Toronto, and showcasing art inspired in science and nature.

We are working on making this a safe and inclusive space, where EVERYONE is welcome to participate and express themselves via texts and visuals. We invite you to join The Forefront; come and share your ideas, reflect about our journey through grad school and help us celebrate the talents you have to offer!

In closing, we want to thank the enthusiastic Forefront Team for the incredible work and dedication they have put into creating this inaugural issue. We hope you enjoy it!

Fellow grads, don't hesitate to contact us with your ideas!

Sincerely,
The Edit



Special Feature: New Faculty Prof. Heather McFarlane

Interview by Kurtis J. Clarke

Prof. Heather McFarlane joined the Cell and Systems Biology Faculty as an Assistant Professor and Canada Research Chair in Plant and Cell Biology the fall 2019 semester. She completed her B.Sc. (hon.) at UBC, her M.Sc. at McGill in Dr. Tamara Western's lab, and returned to UBC to pursue her Ph.D. with Dr. Lacey Samuels. Her Post-Doctoral work was done in Dr. Staffan Persson's lab during their time at both Max Planck Institute for Molecular Plant Physiology and the University of Melbourne. More about her current and previous work can be found at her lab website and you can also follow her lab on Twitter

Could you tell me about your research focus?

The lab is focused on determining the mechanisms of cell wall signalling and the mechanisms of cell wall changes that are triggered by those signalling events.

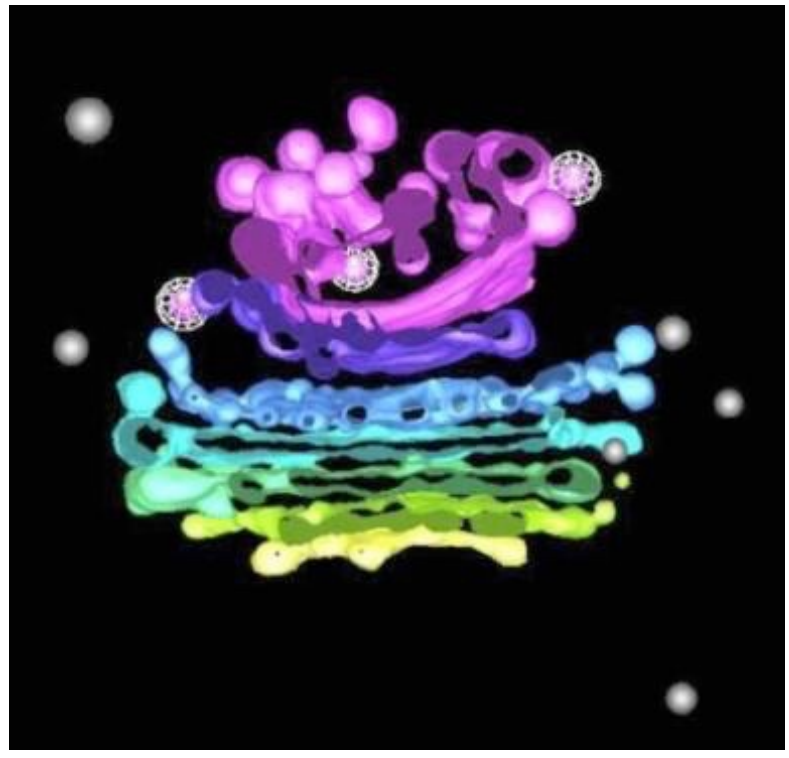
Why did you choose to do cell wall research?

They're so useful, not just to the plants where they are giving all the beautiful structures that we see. People make a big deal about the CN Tower about the kind of length to width ratio that the CNN tower was able to accomplish as the tallest free-standing building in its day. But trees are growing to that length to width ratio all the time. And they've been doing it for thousands, and millions of years of evolution [...]. But they're [cell walls] also our food, our clothing, our shelter, and our energy. So food it's our soluble fibre. Clothing, cotton, linen, rayon, are all cell wall material. Shelter, I love showing the picture of the new Art Gallery of Ontario as an example of wood as a beautiful building material.

You are very active in science outreach and worked on projects like "*Let's talk science*", "*Actua*", and "*tomatosphere*". Why do you do it? Do you have plans to continue?

I loved it. It was such a refreshing change of pace from lab working during my Ph.D.. "Let's Talk Science" and other outreach activities were great at taking me out of the lab and taking me out of this hyper focus on the projects that I was really excited about, because I love science, and forcing me to think about why other people should be interested in what I was doing in the lab, and in plants, and in cell walls.

What tactics or themes do you think are useful or have you developed during science outreach?



3D depiction of secretory organelles in a cell. Taken by Prof. Heather McFarlane

One thing that really helped was having a set of principles and goals for the program. A lot of the conflicts came out of differences in opinion about how things should work or how we should go about implementing a program. Because we had a set of overarching goals for the programs, they weren't rules they were more like guidelines about how we engage with different communities, we could always go back to those and say which of these two solutions that people are arguing about aligns with those goals better. So that's something I'm trying with the lab so we'll see how it goes.

How has becoming an academic been for you? How did you plan it? Did you plan it?

When I started my undergrad I wanted to come to U of T to do engineering science or go to Waterloo to do software engineering. But I did neither of those things because I worked before I went to university in software and realized that it was terrible. It was really a bad match for me. And all the way I've done

those life experiments, like just try the thing I think I might want to do and see how it goes. In the case of software it did not go well, but in the case of working in a biology lab, it turned out that I loved it.

What did you wish you learned as a grad student or early post-doc while pursuing an academic path?

Well, I feel like I'm still in the transition so it's hard for me to say what's gone well and what hasn't. I think I have a lot of colleagues who are a couple of years ahead of me who I asked for advice about how to prepare for interviews, how to write my job applications, and they were all so forthcoming about their experiences and that made it a lot easier for me. I hope to be equally forthcoming to people who are a year or two behind me because it made such a big difference. I felt way more prepared for what was an interview going to look like, what was a job talk supposed to look like, what was an application package supposed to look like. Because other people shared with me. So, I really believe in that pay-it-forward community.

Especially when things are changing so quickly you need keep on top of it with people that know what's actually going on.

Lacey was really helpful but at the same time she hadn't written a job application in 20 years or something. So, there is only so much she can say in terms of how interviews work nowadays.

And how did you meet those people? Just through working with them or collaborations?

Some of them were people I went to grad school with. So, Jacqueline Monaghan is at Queens University, she's the best, she was somebody who when I got my first interview I wrote to her. I said, "Hey Jackie I got an interview what do I do next?" [Laughs] and she was really fabulous about sharing her job talk and we skyped and chatted a bit about it. I just sort of reached out to people I knew who had done this recently.

In case you had never become a professor what would you have done?

I don't know. I honestly don't know and that's because I'm a big fan of this life experiment. I probably would have just done more life experiments. I would have tried other stuff. There was a point I had had a few job rejections and there was a job to be an editor in "Nature Plants" and I wrote the whole application. I didn't send it in the end. But I would have tried scientific publishing, I don't know anything about that. I have no idea what a day in the life of a scientific publisher would look like, and there are less dramatic ways than applying for a whole job. You can try things out, like "Plant Phys" has these associate editor positions where you write little features, little highlight blurbs, and you do it as a volunteer position for a year. So that would be a way you could try something in a low risk environment where you don't have to give up your current job. You see "what's it like if I have to write a lot more? Do I like that?"

I think for a lot of people it's easy to [...] glorify different jobs in your mind in terms of what they actually look like. But doing them or doing a small part of that job is really revealing in terms of whether it's actually fun or not.

Okay, time for the fun stuff, anything about your personal life? Anything you do for fun? You said you drink Whiskey or something?

I, that's a true story I would like to call myself a whiskey enthusiast. Rather than like [laughing] a booze hound. I do love whiskey. I like cooking. I play ice hockey, but I haven't found a team in Toronto yet I'm still looking. I'm sort of out of practice because in Melbourne we only played stick and puck a few times a year and I disagree with making an ice surface when its 40 degrees outside. What else do I do? Oh yeah, I'm in a book club. I'm reading some books. I knit. I feel like if I don't make time for things like this then they won't happen. Because science can just expand to fill up all the time.

Do you set time to take time off? Do you do a day? or do you put it into your schedule?

I'm a big fan of a calendar. For example, with reading I joined a book club and it is forcing me to read because there is a day that we will go and hang out and have a drink and talk about the book. So I'm on a schedule to read. Same with knitting, I hang out with people at a bar and knit. So I make time to do it because otherwise I love science so much that it would just expand to take up all of my time, but I recognize that is not how I actually do my best science if I spend 100% of my time thinking about science.

McFarlane Lab members. Taken by Tatiana Ruiz Bedoya

Illustration by Ian Hsu

Frankenstein, The Modern Prometheus: Blindness, Persistence and Creation

by Mathew Gene

An impassioned scientist at heart, hunched over his work and in poor health. Remind you of anyone? It is the main character of Mary Shelly's 1818 novel; Frankenstein; or, The Modern Prometheus. Over the last 200 years, Frankenstein has been put through countless lenses of analysis and remains as relevant today as it was when 20-year old Mary Shelly first published it. What captivated me on my second reading of this book is the main inflection point of Victor Frankenstein's journey: why do Victor and his creation simultaneously flee from each other upon the creature's awakening?

Did you know that Prof. Daphne Goring's favourite superhero is Wonder Woman? The Thor series is on her top 10 too!

While the obvious answer for Victor is that he reanimated a grotesque corpse that was made from stitching together foreign body parts from separate people but in that assessment, lies a fatal flaw. For two years (which is the time frame to complete a Msc degree), he toils over his endeavor to breathe life into the lifeless, plundering fresh graves to obtain materials necessary for his experiment, thereby normalizing the morbid in him. In fact, in the initial moments of the creature's awakening, Victor becomes boisterous over its aesthetic appearance, self-congratulating himself over his ability to create such a magnificent being. Moments after, his creation suddenly flees from Victor's home and he falls ill soon afterward.

I argue Shelly may have unintentionally tried illustrating something significant here. In essence, this inflection point is the embodiment of scientific innovation. The isolated but motivated scientist (Victor) working towards excellence, achievement and discovery and the discovery itself (the creature), judged and manipulated by the world. Victor, a scientist who is mesmerized by his own work to the point where he was partially blinded by his tunnel vision, despite spending 2 years with the specimen. Victor and scientists cannot fully know the outcome and impact of their discovery and research until others outside their area of expertise interpret and mirror their work back to them. Meanwhile, the creature is a representation of scientific innovation itself. At the precipice proceeding the creature's birth, the world can never return to its previous state. Its awakening means that what was once only an imagination, an abstract concept, is actualized into the tangible world where now it embodies idealized potential. Whatever the original intention of the creation was is now gone. It is free to roam and interact with the world just as the creature does in the novel. Victor recognizes that he created an entity with limitless potential that is also not within his control. This ultimately terrifies him. He flees and is in denial of what he has done. Ideas and discoveries once injected into the broader cultural consciousness are irrevocably integrated. They run freely in the world just as does the creature. Take for example the atomic bomb. Once conceived, for good or evil intentions, Pandora's box is opened and only in its conception can we begin to understand the consequences.

Maybe this is a call to action and a cautionary tale for researchers and scientists alike. Victor works on his creature in complete isolation which mirrors how the scientific community can become; an insular echo chamber. It begs those in pursuit of knowledge to deeply understand our motivations and what we ourselves are bringing to life. While it may never be possible to fully understand the outcomes of our creations, we can at least

If Prof. Darrell Desveaux found himself in a deserted island and could only listen to a single CD, he would bring the opera "The Magic Flute" and learn German in the meantime.

take some responsibilities in making the effort to postulate over the effects of what we are animating into material reality. Additionally, we can speak the truth as much as possible, abstain from premature judgement of results, and avoid working in isolation (given Victor breaks all these maxims). In doing this we have a chance at mitigating some of the negative consequences that may unexpectedly arise from the acquisition of scientific knowledge. It is easy to lose perspective on why we started this intellectual journey in the first place.

The more I think about Frankenstein, the more questions arise. Is scientific innovation a value neutral proposition? Should we celebrate Victor's feat of animating the inanimate? What responsibility does the scientist have to their discoveries and innovations? I'm biased as someone within the scientific community, but I do believe that all things considered that we are better off with scientific innovation. Why? I suppose I believe it intrinsically, but that isn't very scientific of me is it?

"When you write, start with figures or methods, then start describing single experiments. Once you have that, discussion will come naturally. Intro always at the end!" - Prof. David Guttman

Yellowstone. Taken by Amir Arellano Saab

The Ramsay Wright Zoological Laboratories. Taken by Luis E. Abatti

PI Mini Interviews: Meet our Faculty

by Amir Arellano Saab

The high pressure of academic research can, at times, overshadow the humanity of those who we work with, or even our own. We gathered a group of Cell & Systems Biology Faculty Members and built a condensed interview piece to learn from their experiences in academia, get advice on grad school, and get to know them better. This can be a constructive reminder that they were all once in our shoes and they are here to help us thrive and enjoy our time as grad students.

In your opinion, what makes students succeed in grad school?

Vince Tropepe: "There's no single ingredient, but in my experience, two things stand out: curiosity (...) and resilience. When you're in a tough part of your program, you have to be able to leave the lab and do different things. Remember we're trying to understand the nature of things! So, don't be mad at yourself when things don't work out the way you want!"

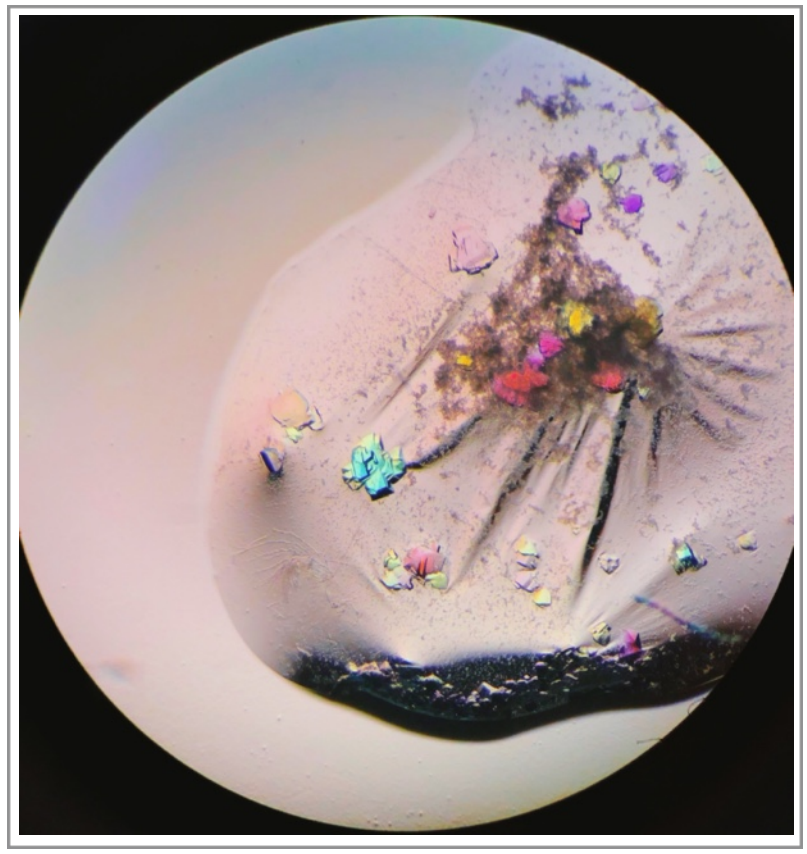
Jennifer Mitchell: "Perseverance and deep thinking of your experimental design are critical! Avoid doing too many redundant experiments by planning adequately."

Darrell Desveaux: "Communication with your peers as well as your mentors is essential! Keep up with the relevant literature! Don't lose track of who you are outside of the lab; don't only work hard in the lab, diversify your efforts."

Heather McFarlane: "Balance of tenacity and curiosity, tenacity will power you through when things don't work. this can often create a feedback loop of motivation."

What advice do you have for students running into research difficulties (i.e. not being able to obtain expected results, struggling to write a manuscript, etc.)

Heather McFarlane: "Bond with your community! Have people to brainstorm with and talk to people unfamiliar with your project."



ShHTL7 protein crystals under the microscope. Taken by Amir Arellano Saab

Melanie Woodin: "This is where supervisors and committees should take responsibility to help students with challenges. Be objective, assess if a project (or a part of one) is worth continuing; be always prepared to kill a project. Learning to write is an ongoing process, collecting figures and writing conclusions. Remember that you should not compare yourself to what other students do!"

Daphne Goring: "Don't focus on the endgame, enjoy each part of the scientific process! For writing, break down your project into small pieces and look at other examples from your lab. The more you read, the more vocabulary you acquire."

What is, in your opinion, a good strategy to keep motivation up during grad school?

Darrell Desveaux: "Find an anchor that can bring you back to reality, maybe you don't like one little experiment, but don't forget the

bigger picture. If you are not enjoying yourself, don't be afraid to change!"

Jennifer Mitchell: "Give yourself some space (take Friday nights off!), have hobbies and try to have a full life outside of science."

Vince Tropepe: "Have a good friend community to hang out with and to think about other things, don't neglect social relationships. Exercise is often helpful with this too!"

Heather McFarlane: "Think about why you're in grad school, have a purpose, don't forget the questions that got you into grad school. Think big picture."

Heather McFarlane: "Discuss expectations and have upfront conversations with your supervisor. I suggest you use the Independent Development Program from the Journal Science. Communicate your own expectations."

Darrell Desveaux: "If you feel like there can be a problem, don't throw it out there at the end of a meeting! Allocate enough time to talk to your supervisor. Do not isolate yourself!"

Melanie Woodin: "Use your committee members, they are there to support you. Use SGS's services, workshops, and embedded councilors!"

King's College Circle. Taken by Luis E. Abatti

What should a graduate student do if they have trouble communicating effectively with their supervisor?

Tony Harris: "Schedule meetings; when you go to a meeting, be prepared! Bring to the table problems and possible solutions for discussion."

Jennifer Mitchell: "Have regularly scheduled meetings, send summary emails after meetings, and try to develop some soft skills, such as proactive communication, listen to your instincts."

There is an ongoing conversation in the academic world about maintaining a good work-life balance; do you think this is achievable?

David Guttman: "It all depends on the stage in life you are at. When you are a student, you should have student expectations. Once you have a family everything changes. Try to set time aside for yourself. If you want to work 9-5, academia is not like that, but it is possible to find a balance once you move ahead in life. You become more efficient over time."

Tony Harris: "Separate time for work from time for your personal life. Do not feel guilty when you are at home and not working and vice versa. Realize that there are many things that you could be doing instead of working!"

Daphne Goring: "My philosophy is "I do not live in the lab, but when I am at the lab, I work hard." You do not need to be in the lab 24/7, you just need to be organized and give yourself some 'me time'."

If you were not a scientist, what do you think you would be doing now?

David Guttman: "I would open a blues bar; maybe I'll do it at some point during retirement!"

Melanie Woodin: "I would like to open a bike shop, or a flower shop!"

Tony Harris: "I am a passionate biologist, I would probably be a high school biology teacher."

Prof. Heather McFarlane's taste in music is so diverse that she would listen to Tchaikovsky's ballet, punk bands, and electronic, all in the same playlist!

Fall trees. Taken by Luis E. Abatti

Cannabis flower. Taken by Asrinus Subha

Transitioning to Industry: How legalization is changing Cannabis research

Transition from Academia to Industry

by Asrinus Subha

My name is Asrinus Subha and I am a graduate student alumna from the Cell & Systems Biology Department. I transitioned from academia to the cannabis industry last year. In January 2018, I got my M.Sc. from Dr. Peter McCourt's Lab with a research focused in chemical biology and plant genetics. Over the past year, I have been working for a start-up cannabis company called

Ascendant Laboratories Inc. as a Lab Technician. I have been able to apply the plant biology skills I acquired during my time in CSB in studying this extraordinary plant species that has become so popular to the public eye over the past months. I still remember the moment I told my PI while still in grad school that I was considering leaving academia. The stress. The fear. Saying the words, "I don't think I want this for myself" out loud and afterwards, the relief. At the time, I was juggling finishing my thesis, prepping for my defense, doing last few experiments, along with TA-ship. Meanwhile, I had also begun researching the job market and realized that the industry was a setting that better suited how I wanted to live and work. So, I made the decision to leave academia and pivot my skillset to a different direction. Of course, my experience was a little unique and I consider myself lucky to be able to transition so quickly to the cannabis industry right after graduation.

I could understand the challenges many alumni face who might want to leave academia but often don't know what things are like in "the real world." Since I left academia two years ago, some of the common questions I get are: "Why did you leave academia?" "Do I absolutely need a PhD?" and "Will everything be OK if I leave?"

Benefits of working in the industry

Aside from the big bucks, moving to industry allows for more freedom for how you spend your time, energy, and money. One of the biggest adjustments I made when transitioning to industry was how much

Asrinus Subha, M.Sc.

more free time I had and how much more relaxed I felt. I got my weekends back and being able to go home at 5pm most days and not needing to work overtime. Some of the former academics including myself, discovered new hobbies with the newfound time and money, like cooking, dancing, painting, and sports. Apart from the positive effects on personal lives, scientists who left academia and myself realized there is more freedom for the work with fewer concerns about whether the work could be publishable. The opportunity to collaborate can be especially meaningful for academics transitioning to industry. If you're struggling with something, you don't have to do it alone, there is a team, who expects you to check in with them periodically and not disappear to

work on a project for weeks or months at a time. There is a constant focus on moving fast, iterating and prioritizing based on market needs.

Taken by Hayley McKay

Our Core Values at Ascendant Laboratories: How Legalization is Changing Cannabis Research

As we prepare ourselves for the Canadian winter this year, it marks one year since cannabis was legalized. Exciting new studies continue to come out on a global scale and acknowledging the therapeutics potentials of this plant. Currently, there is an extensive research interest in Cannabis and/or cannabinoids as there are many knowledge gaps in the basic biology, pharmacology, epidemiology and clinical efficacy. “Our main goal is to make cannabis into a real horticultural crop,” said Dr. Shelley Lumba during an interview with Nature, an Assistant Professor in the Department of Cell and Systems Biology at the University of Toronto. For a once-forbidden plant, following October 17 of 2018, researchers around the world are now trying to understand how Cannabis works, how it grows, where it came from and what does it really do to us.

On June 7 2018, a global cannabinoid company called TerrAscend based in Mississauga was pleased to form a joint venture with Cistron Corp., co-founded by scientists Dr. Peter McCourt, Dr. Shelley Lumba and Dr. Dario Bonetta to launch Ascendant Laboratories Inc., a science company dedicated to the advancement of the cannabis industry through the development of improved plant genetics. So what does Ascendant Laboratories study? Their research involves from genotyping, to developing a gene panel for understanding the variations of these plants, to sex determination, to rapid powdery mildew detection; with an ultimate goal in improving quality and stabilization of cannabis growth and “phenos”- as growers like to call it, in a large industrial-scale setting.

Are Academic Research Skills Transferable to Industry?

Yes they are! It’s sometimes hard to remember in the hustle of research, but academics have many transferable skills, such as but not limited to, valuable communication skills, critical thinking and interpersonal skills. Whether it’s being able to comprehend a confusing data, or trying to problem-solve, or trying to communicate your methodology to a group of scientists, all these skills are

highly valued in industry. In a way, as you tackle your academic project, independently you are developing both valuable time and project management skills. The need to gather information, find funding and support, allocate scarce resources, and gain the technical and non-technical skills needed are all valuable aptitudes that can easily be transferable to both the biotechnology or the pharmaceutical industry.

Conclusion

Though transitions can be tough – but they're not impossible. You need to take a strategic approach to the move that works best for you. Weigh in your pros and cons, assess your transferable skills, update your resume and LinkedIn strategy often, brush up on interviewing skills, attend networking events and stay positive.

Did you know Prof. Melanie Woodin is a passionate cyclist? In addition to doing great science, she pedals through more than 5000 Km per year!

Back Campus. Taken by Luis E. Abatti

Illustration by Ian Hsu

Where to Next? Post-graduate school prospects

by Francis Lee

We help make science more successful

BenchSci

BenchSci, founded in 2015, has a central mission to "empower the world's scientists to run more successful experiments and to accelerate drug discovery". The core problem that BenchSci is tackling is to minimize the money that is wasted on reagents, starting with antibodies, that are prone to failure but often are not reported. By using artificial intelligence and machine learning, their goal is to aid you in selecting for proper reagents and experimental design. benchsci.com

CCRM supports the development & commercialization of regenerative medicines & associated enabling technologies, with a specific focus on cell & gene therapy

CCRM, located in the MaRS building, has a vision for regenerative medicine that potentially uses stem cells, biomaterials and molecules for treatment. Their mission is to create a sustainable ecosystem for regenerative medicine, and they desire to bring scientific discoveries from bench to the bedside. ccrm.ca

A love of art, a passion for science

Located in downtown Toronto, the AXS studio provides services in creating beautifully illustrated/animated scientific work. Their goal is to enable their customers, such as medical practitioners, patients or investors, to inform their audiences in a much more engaging way. axs3d.com

Committed to making a healthier you, one qii at a time.

DoseBiome is a Canadian biotechnology startup that applies microbiome research to develop new foods and drinks that would potentially help to enhance beneficial gut and oral microbiome. The first product that they have developed is “Qii”, which is a tea with varying flavours that uses xylitol and natural extracts. dosebiome.com

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These are only a few companies in the GTA that you can think about applying after your graduate studies! The best way to start searching for ideas is to join the CSB department’s LinkedIn webpage where our CSB communication director (Neil Macpherson) posts about job opportunities regularly.

“The best players don’t go where the puck has been, but where it will be” - Wayne Gretzky. Oh man! I wish I had said that quote! - Prof. Darrell Desveaux.

Saint George street. Illustration by Ian Hsu

Where and How do we live? Housing and Life Quality of CSB Grads

by Tatiana R. Bedoya

Toronto is the largest metropolitan area in Canada and is the second fastest growing city in all North America, according to Statistics Canada and the US Census Bureau. It is no secret to any Torontonian that the current housing market is fiercely competitive, and it's predicted to only get more intense in following years. Population growth predictors estimate that Toronto will grow at a faster pace on the next 20 years than it has during the last decade. Offer of affordable housing is currently in steep decline and even with the current adjustments in minimum wage ($29,120), low income households (<$29,120) are incapable of keeping up. The imbalance between student wages

and the general cost of living in Toronto needs to be an open and honest discussion we are all willing to have. To show the effect of this issue on CSB students, we designed a general housing and life quality survey to attempt to understand better where and how do CSB grads live. A total of 74 CSB grad students responded in the survey. We gathered data from all three campuses, a majority of grads in the funded cohort and a close balance between Master and PhD students (**Figure 1**).

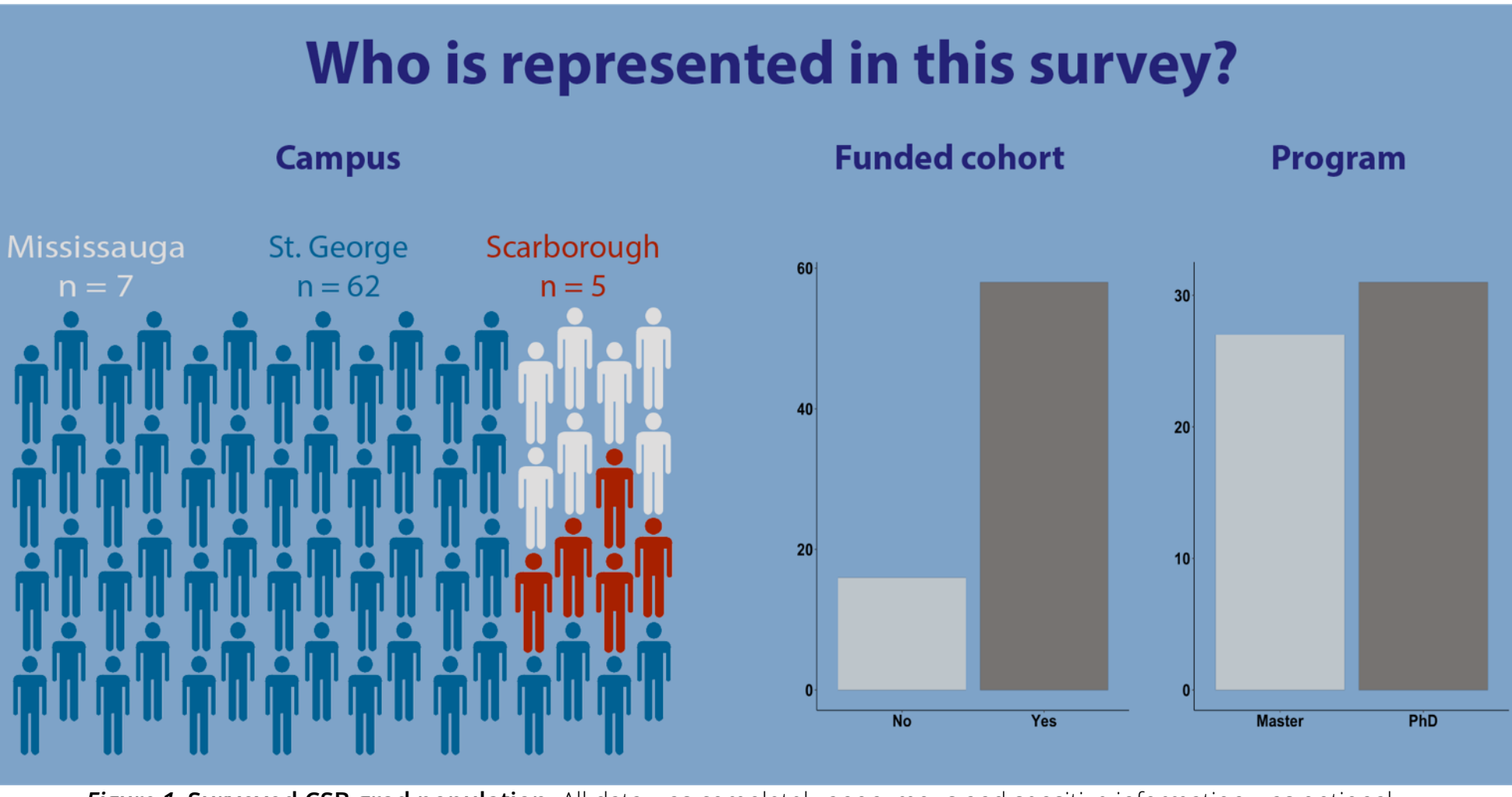


Figure 1: **Surveyed CSB grad population.** All data was completely anonymous and sensitive information was optional.

The effect of housing on grad student finances

Our data showed that the median monthly rent for CSB grads is $1000 and the median monthly income is $1583. This means that disposable income, the difference between the two, is $583 **(Figure 2)**. These are the available funds for transportation, data plans, food, clothing, and other expenditures that are heavily influenced by the growing cost of living. The distribution of rent is bimodal (green) given that 20% of the surveyed grads live with their parents and only 4% currently live in U of T Family Housing. The income distribution (dark blue) is also strongly bimodal if we include the population outside of the funded cohort. Several peaks towards the right side of the income distribution likely represent grads with external funding. It is important to note that the international population has major restrictions to apply for governmental funding and are therefore heavily concentrated in around the basic stipend peak (~$19000/year).

The majority (88%) of grads are rent-payers. When including all surveyed grads, the median of rent/income ratio was 0.60, which

increased to 0.67 when excluding people who live with their parents and those outside of the funded cohort, or to 0.65 when excluding only the former. This means that rent-paying grads use an average of 65% of their income to cover just rent. The CMHC standard for affordable housing sets a threshold for

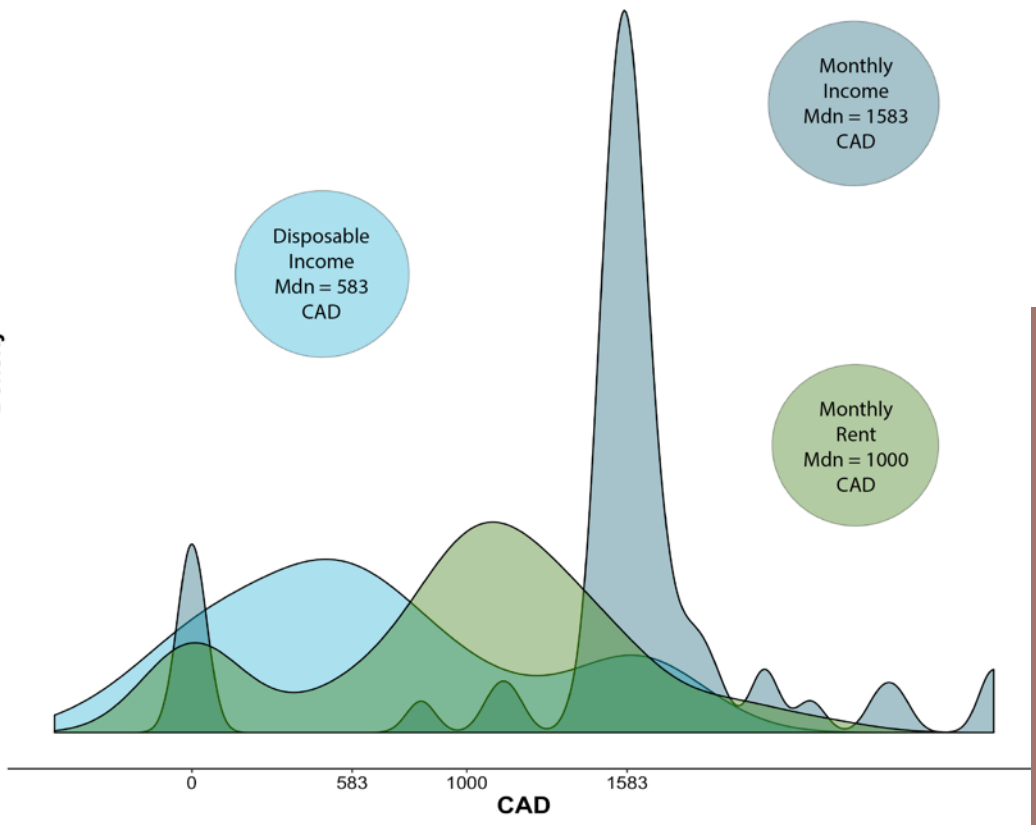
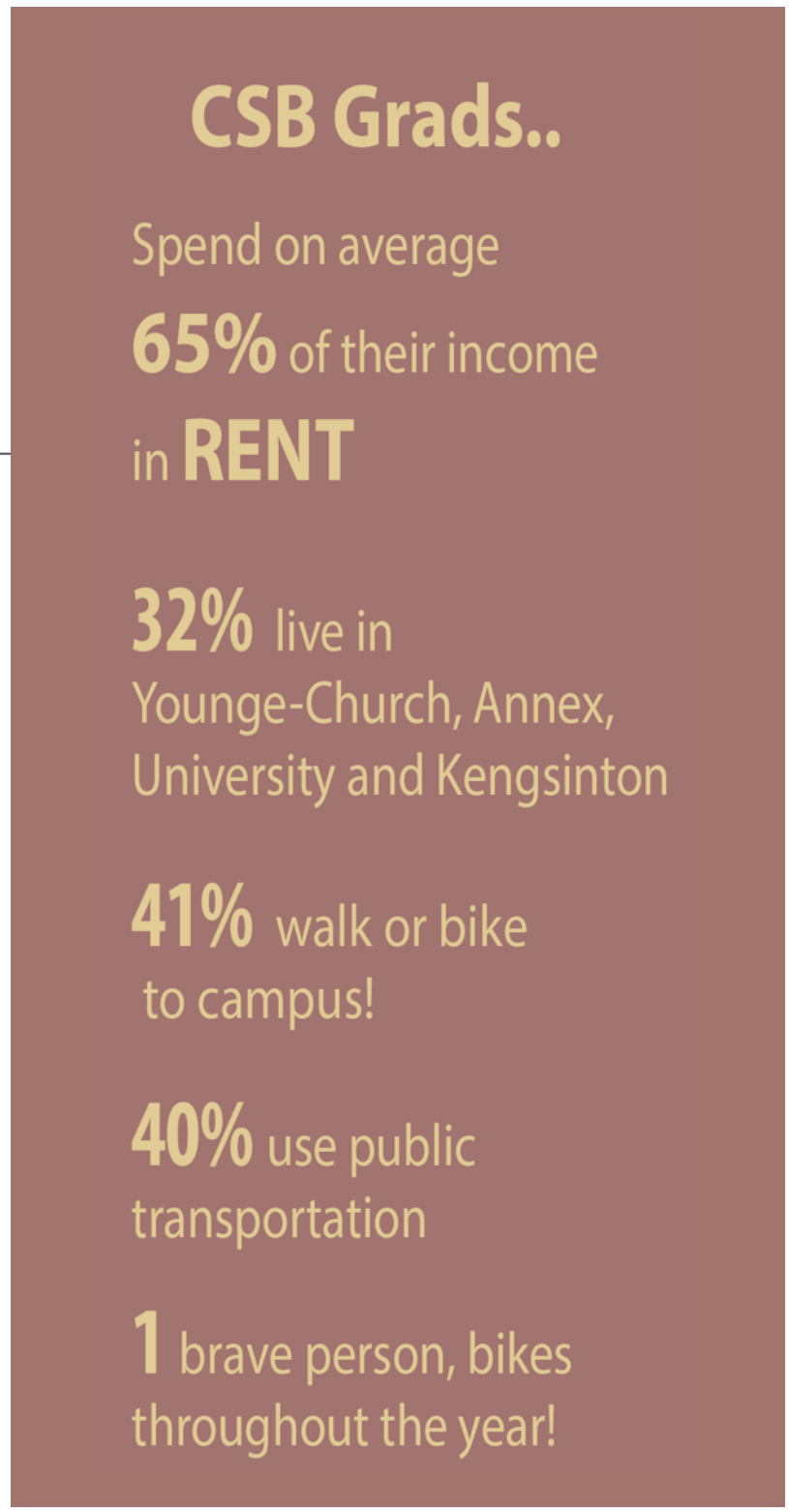


Figure 2: **Income, Rent and Disposable Income density distributions.** Data from all surveyed students was included in this graph. Median values were calculated based only on the funded cohort population, but values did not differ significantly when included (Mdn = $1504, $906, $515 respectively).

rent/income ratio in no more than 30%. **This means that CSB grad students are paying at least $300 above what a hypothetical household on minimum wage should**. Although this phenomenon is not unique to graduate students, if we consider the range of our disposable income and the rising living cost of Toronto, the situation turns particularly dire.

Since rent is the major expenditure, we looked at whether grads are concentrated in hubs of affordable housing. We found that the CSB grad population lives scattered across town with a small concentration in the Annex and the Church-Younge corridor. Surprisingly, the expected negative correlation between rent and commute time was very weak and there was no clear differential pattern of rent prices based on neighbourhood or living arrangement (**Figure 3**). The vast majority live in apartments, which fits with the current housing market in



Toronto. Considering that housing is rent-controlled, people tend to move less, as it is highly unlikely that leaving an ongoing contract is more attractive than succumbing to the wild housing inflation. This might explain the lack of a neighbourhood-driven rent prices, combined with the obvious fact that the more roommates you are willing to live with, the cheaper your rent gets, regardless of the neighbourhood.

Our financial strategies: How are we making it work?

The short answer is a combination of creativity, time sacrifice and luck. To our surprise, **more than half of our grad population currently has or has had a side job.** Additionally, all grads capable of saving money either receive financial help from family or don't have rent obligations as they live with their parents. However, if you are not willing to have an additional job or if you can't

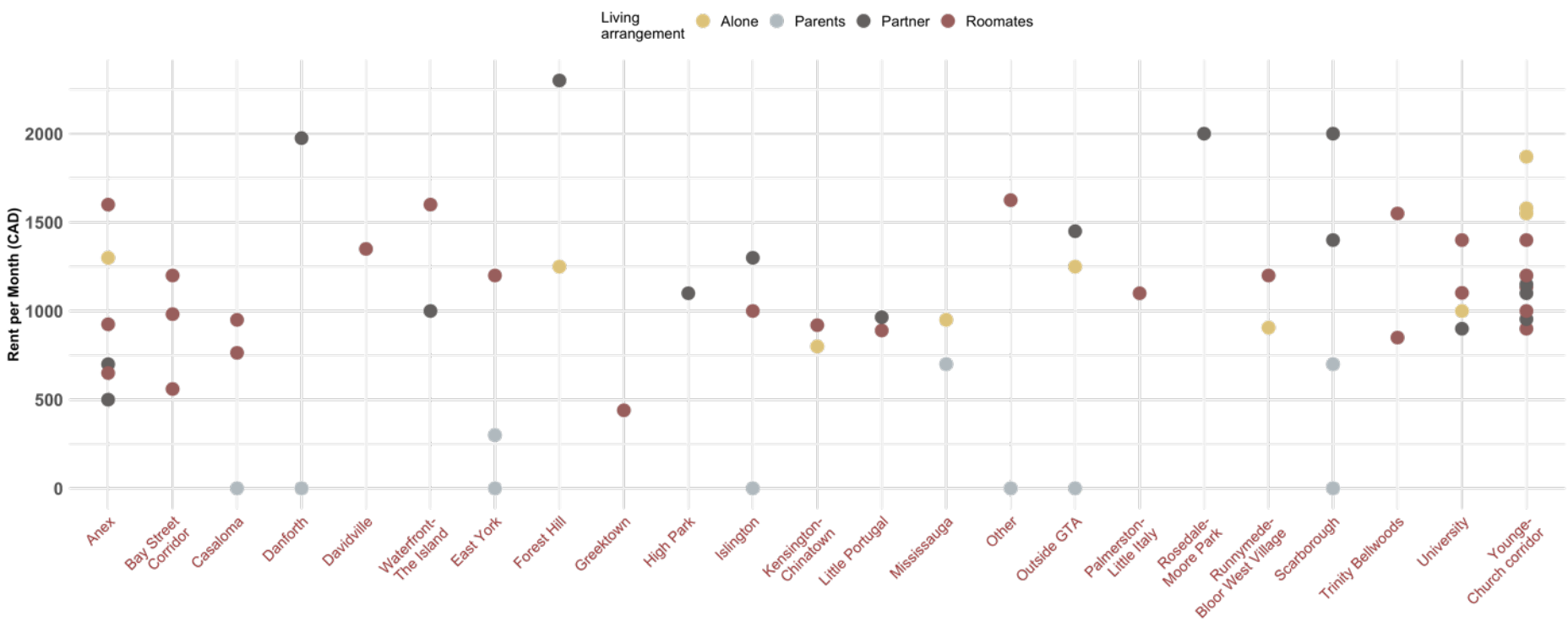


***Figure 3*: Rent per month by neighbourhood and living arrangement.**

Grad school is hardly ever a stage of life to be in financial surplus. Nonetheless, income adjustment based on the cost of living in Toronto is falling behind at an alarming rate. In 2004, stipend after tuition was around $15000, which was slightly above the standard minimum wage for Ontario for the same year. **In 2019, the median CSB grad stipend after tuition falls behind by 35% from the current minimum wage.** As a departmental effort, annual stipend after tuition has been adjusted by $500, which will bring this disparity down to 33% by 2020.

get family assistance, is likely that you fall in the 30% of rent-payers who are acquiring debt. Less than 10% of students drive, which means the vast majority of us avoid the cost of gas and parking. This, nonetheless, does not save those living far enough to need to spend over $150 per month on a TTC pass (or $130 for MiWay), which is over a quarter of their disposable income.

It is admirable that grads are able to work an average 50 hours per week on research* plus TA while holding an additional job. However,

that is also not an ideal scenario for research productivity. It is important to think about the way in which these factors may affect the current and future composition of our grad community. The breath of this conversation deserves to expand from academic performance and well-being to diversity and inclusion issues.

We wondered if this survey could help us understand how housing affordability and other factors come into explaining the overall well-being of CSB grads. There was no direct correlation between self-reported physical/mental health and the rent/income ratio. On a scale from 1-10, 8% of grads reported their physical/mental health to be above 8 or “excellent”, and 23% reported it as “very poor” (< 3). Those reporting low mental health (1-4), attributed their discomfort to one or a combination of the following: financial struggles (74%), mentorship not working out (65%), life prospects after grad school (61%) ,medical issues (39%), and lack of time for life outside of work (75%).

It is clear that the housing and financial situation for grad students at CSB is difficult. Jumping past the argument of tuition fees adding up to total annual income, our population is still below the expendable minimum income bracket and has found ways to compensate for it, some of which might not be ideal. By no means is this a simple situation and likely there isn't a silver bullet. We encourage everyone to maintain this conversation as open and active as possible. It is crucial that we focus our efforts towards discussing creative ways to ask further questions and plausible strategies address these issues, both between grads and with the administrative body of CSB.

55% of grads have **SIDE JOBS**

40% get **FINANCIAL AID** from family, regardless of their living arragement

Only 19% of grads manage **without** side jobs or family assistance

2/3 of CSB grads are breaking even or going into debt

85% of people able to save money, either **DON'T PAY RENT** or get **FINANCIAL ASSISTANCE**

If Prof. Jennifer Mitchell was not a scientist, she would enjoy working with wood, she has a talent for building things!

*It is important to note that self-reported working hours tend to be inflated

Palm trees in Venice Beach, California. Taken by Luis E. Abatti

Transition from bench to desk: When to stop and think?

by Steven Chen

Research productivity is directly correlated with the number of hours spent in the lab. This statement is a hotly debated topic between CSB graduate students, which often leads to the internal dialogue where one questions: “What proportion of my 24 hours should be spent in the lab?” Does scientific jackpot exist at the end of a seemingly endless stream of experiments? These questions all revolve around the idea that there is an ideal formula for maximizing scientific success. A formula that maximizes data generation given the right or enough input. Here, I will discuss how my experiences working in the lab over the past 5 years have shaped my biases on research productivity. Furthermore, I will reveal how these experiences have prompted me to transition from being bench-oriented to spending increasing amount of time at the desk.

After my first year here at UofT, I was lucky enough to enrol as a summer intern in the laboratory of Dr. Jun-Yi Leu at the Academia Sinica, Taiwan's most prestigious research institution. After landing in Taiwan, Jun-Yi paired me with Dr. Krishna Swamy, a distinguished post-doctorate fellow from India, so I may help with his project. As an eager and often hot-blooded undergraduate student, I fully embraced the Taiwanese work ethic system of Zérèn zhì, which we can call the accountability system. This 'system' is ubiquitous in East Asia where there are no mandatory limits on working hours. The company is always prioritized over the individual. It is thus the responsibility of the employee to ensure that the demands of the company are met even if it means that significant costs are incurred by employees.

Sunset at the Santa Monica Pier, California. Taken by Luis E. Abatti

Although to a lesser degree, the Zérèn zhì has also crept into the Taiwanese academic system, affecting both students and professors. Experimental productivity was the holy grail of importance while little time was spent in contemplation of why and how. This way of thinking affected me the most during the first three weeks of my internship where nothing was working on the bench, even the simplest of PCR reactions. Under the Zérèn zhì ethos, I spent in excess of 14 hours a day on the bench, vigorously following experimental protocols. Despite these exhaustive effort negative results piled on and my internal chatter began to creep up and got louder and louder. Was I not trying hard enough? Were my skills not refined enough? Was I not suited for scientific research? This myriad of self-deprecating comments led me to compensate by spending more time conducting experiments – without truly understanding all the biology and chemistry. As the number of failures piled up, I became increasingly discouraged. Nevertheless, it has an happy ending; I eventually mastered a range of techniques to successfully complete the aims that I was given but much of this knowledge was gained through trial and error. In hindsight, a lot of

grief could have been avoided if I simply seeked helped from others sooner, spent time at the desk looking up past papers or reading discussion forums on ResearchGate. It became apparent to me that spending 3 hours at the desk may be worth as much as 3 weeks in the lab.

A lesson from my experiences is that to maximize productivity, a balance between bench and desk work is important. Many landmark scientific findings came serendipitously. The most famous example is the discovery of penicillin – where Alexander Fleming carelessly discovered the first antibiotic, by examining a moldy contaminant on his plate. A similar example is from Martin Chalfie, one of the Chemistry Nobel Laureates that pioneered the use of fluorescent proteins in molecular biology . He credits Osamu Shimomura as he discarded post-experiment jellyfish tissue into a sink containing calcium which allowed them to discover Green Fluorescent Protein in Aquarius victorius. The occasional sloppiness may lead to surprisingly unexpected outcomes. However, dear readers, I would caution you that blind experimentation can also be more fatal than doing nothing at all. A quote by Louis Pasteur reads, “Chance favours only the prepared mind”. In both cases involving Alexander Fleming and Osamu Shimomura, their discoveries were dependent on careful observations. While “play” should be encouraged in the lab, I believe there are several prerequisites that must be met prior to conducting such exploratory work. First, we should have sufficient trainings and experiences in the basics. Understanding the basics involves a fundamental understanding of “biological rules”, which can be defined by our current understandings of the molecular world. For example, we often think that polypeptide chains, the primary structure that makes proteins, are translated based on a genetic code composed of 64 tri-nucleotide codon triplets – that is if we temporarily ignore an area of synthetic biology known as the expanded genetic code. Only by adhering to this biological rule can we can build an infinite number of constructs to study proteins using an ever-expanding toolkit of methods *in vitro* and *in vivo*. A second prerequisite is a well-thought-out reason for conducting such an experiment. Am I enough of an expert in this area to interpret an unexpected result? What biological questions might this experiment answer? Why would I or anyone else want to know the answer? Lastly, a third prerequisite is one originating from a microeconomic theory known as the opportunity cost. If I spend time and resources conducting this experiment, will the potential costs associate with such a choice result in the greatest value out of any of the alternatives that were not taken? This last question may be the hardest one to answer, especially in science, where the results may be unexpected. Maybe reading a paper that I have yet to get around to is a better use of my time. Or maybe I can be learning a new technique from the lab next door. In my opinion, if one has considered these three prerequisites, conducting a crazy experiment occasionally can be worthwhile and fun – once in a while. However, the belief that simply increasing the frequency of

experiments will increase the chances of success is untrue.

I hope I have convinced you that the amount of time spent at the bench may often be more efficiently used at the desk. It is only after we have exhausted all the alternatives for answering a particular question should we default to carefully designing an experiment. A targeted experiment with a strong rationale often answers more interesting questions compared to poorly thought-out bulk experimentation.

Did you know that Prof. Vince Tropepe's favourite superhero is The Flash? He likes him because of his speed and precision!

Ocean waves at the Santa Monica Beach, California. Taken by Luis E. Abatti

Town in Iceland. Taken by Francis Lee

Cite me: meet the amazing 2019 first author grads

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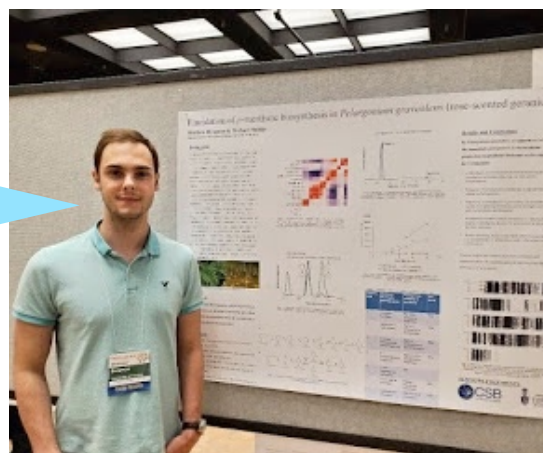

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Windmills, Holland. Taken by Amir Arellano Saab

Summer Conferences 2019

World Congress in Parasitic Plants (WCPP)

The International Parasitic Plant Society, July 2019

Review by Amir Arellano Saab

I had the opportunity to attend the World Congress in Parasitic Plants held in Amsterdam, where I received the Fellowship for Young Scientists to present my project titled “Structural and Biochemical Characterization of Strigolactone Receptors”. The conference itself is medium in size with approximately 130 participants, and it attracts the most renowned scientists in the fields of parasitic plants and chemical biology.

As its name indicates, the WCPP is quite specific and tailored towards research in parasitic plants, but I was amazed to find so much diversity within that small branch of plant science; the conference was divided into several sessions such as parasitic plant-host interaction, molecules and

biochemistry, and ecology, phylogeny and evolution. The registration was not cheap (~600€), but lunch, dinner, fancy coffee breaks, and a boat tour around Amsterdam's canals were included.

There were several opportunities to network (which is probably the main objective of conferences these days) and talks about science (including with your competitors!), and possible collaborations would happen at every coffee break and poster sessions. Definitively a great conference if you are interested in parasitic plants and want to visit cool venues and cities at the same time!

Microbial Population Biology - Gordon Research Conference (GRC)

The Structure, Ecology and Evolution of Interactions Within Microbial Populations, July 2019

Review by Tatiana Ruiz Bedoya

This spring I attended my first GRC conference. Given all the glowing comments and the well-known prominence of GRC conferences across fields, I was anticipating a big kick of impostor syndrome. After spending one week in the woods of New Hampshire with more than 8 hours of science per day, day in and day out, I can say all my positive expectations were exceeded. Not only was the research, without a doubt, beyond mind-blowing but the culture of this meeting made it particularly special. There was a vibrant atmosphere of motivation and enthusiasm across all attendees, from junior graduate students to prominent professors. Everyone was approachable and ready to talk, science and otherwise, fuelling many meaningful

Proctor Academy

conversations and new friendships. The conference covered questions revolving microbial population dynamics from ecological, functional and evolutionary perspectives. How do population-level dynamics arise? At what level is selection acting? If evolution is a collective phenomenon, then what trade-offs do microbial populations face when adapting to hosts or changing environments? Can we model this complexity? How do mutations accumulate in tumours, viruses or horizontally transmitted elements? The breadth was thought-provoking and exhilarating. To top it up, there was hiking, swimming, volleyball, amazing food and even a thoughtfully crafted Power Hour where we discussed how can we address issues related to inclusion, diversity and equity in our day-to-day lives in academia. I cannot recommend this conference enough.

Plant Biology 2019

American Society of Plant Biologist, August 2019

Review by Francis Lee

ASPB Plant Biology is one of the major plant conferences held in the US every year. I flew out to San Jose, California to a venue that housed approximately 1200 participants around the world. At first, I was worried I would feel isolated and not connect with anybody based on my previous experiences at big conferences. Fortunately, I was able to attend a satellite symposium at Stanford University (usually in big conferences there are small symposiums, so keep your eyes out) where I interacted with a small group of students and PIs, which carried over into the PB2019.

Things that stood out to me about this conference:

- Plant Biology does not provide lunch, which renders an opportunity to network.
- Networking workshops tend to be inefficient. If there is a specific researcher that you would like to interact with, it would be better to email them beforehand and invite them to your poster.
- They have a cool phone app that you can use to keep track of all the concurrent talks and posters.

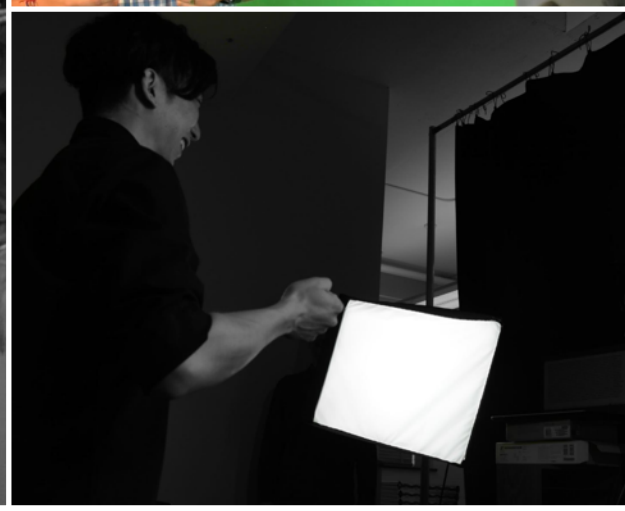
- The conference now has an e-poster session where instead of printing you can present your poster via the screen. However people have heavily complained about how it sucked.
- There are specific themes for each major symposium that dictates what kind of researchers will be presenting. It is wise to check them out before attending PB2019.

As long as you have a specific goal in mind, like advertising yourself for a postdoc position, attending PB conferences is not a bad idea since they are closer in proximity compared to other major conferences while being one of the biggest plant biology conferences.

Did you know that Prof. Tony Harris' favourite superhero is Indiana Jones? Raiders of the Lost Ark is his go-to movie!

If stranded in a deserted island, Prof. David Guttman would listen to The Harder They Come by Jimmy Cliff to keep his spirit up!

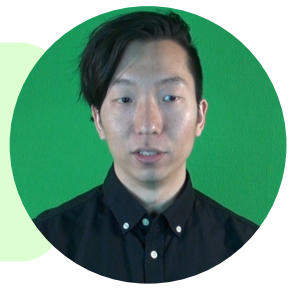
Red Sea, Saudi Arabia. Taken by Cynthia Wong



Make Your Thesis Into A Video!

"Structural Biology shines light into the functionality and inhibition of parasitic receptors." - *Amir Arellano Saab*

"Molecular landscape of cell-to-cell communication unveils mate discriminations in hermaphrodites." - *Francis Lee*



The CSB Forefront has a new exciting project!

If you are passionate about your research and want to hone in on your pitching skill, we invite you to join us in turning your research into an elevator pitch video! They will be uploaded to the official CSB YouTube channel.This is a wonderful opportunity to showcase your research while sharpening your pitching skills and you can even use it for your CV/LinkedIn profile. If you would like to participate but don't know where to start, we are also organizing a workshop, led by some CSB faculty members, on the know-how of how to properly construct an elevator pitch.

Contact Francis (hyunkyung.lee@mail.utoronto.ca) or Tatiana (tatiana.ruizbedoya@utoronto.ca) any time to be part of this initiative!

Credits: Neil Macpherson (audio, visuals, and direction), Amir Arellano Saab and Francis Lee (elevator pitches)

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