THE CSB FOREFRONT

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Illustration by Ian Hsu



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Tommy Thompson Park. Illustration by Ian Hsu

From the Editors

e launch this volume by acknowledging that the Department of Cell & Systems Biology (CSB), including its graduate student community, stands on the traditional territory of many nations including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee and the Wendat peoples, in the land that is now home to many diverse First Nations, Inuit and Métis peoples.

Welcome to the second volume of The CSB Forefront! This year around, we have a change of hands in our editorial team. Dr. Francis Lee, our co-creator, successfully defended his PhD and is now enjoying life as a postdoc at the Santiago lab in the Swiss alps. The Forefront team expresses immense gratitude for his enthusiasm and dedication in getting this project off the ground. With excitement, we also welcome Sonhita Chakraborty to our team, who brings her enthusiasm for scientific editorial work to this volume.

We can all agree that we are in the midst of unprecedented trying times. Our struggles and those of people around the world are more complex, yet unifying. This year, we are struggling through social isolation, economic hardship, and the fear or grief of our loved ones or ourselves contracting a deadly virus. Social and political structures have been and continue to be shaken by the COVID-19 pandemic, often with mixed outcomes, however, always exposing their weaknesses. This is evidenced by the apparent unjust burden placed on the shoulders of communities at disadvantage, BIPOC people and people with disabilities. the struggles of science communication, are only a few of the issues that are keeping us up at night. We stand in support of the BlackLivesMatter movement in North America and the world, of the rapidly growing Feminist movements in Latin America and the world, and with all of their intersections with scientific research and communication. Diversity has always been at the backbone of the scientific discovery and we believe that science should be communicated equally to all and should be a place that, not only welcomes all, but also guarantees fair and equal treatment regardless of race, religion, gender, sexual orientation or disabilities.

We, the graduate students at CSB, have faced many of these challenges while aiming to maintain excellence in our work, a clear head, and a healthy life. We hope that this volume of our graduate newsletter serves as a hub to connect folks feeling the isolation peaking with the holidays, and importantly, serves as food for thought regarding our wellbeing, our responsibilities as scientist in formation, and our future professional decisions. We are here to serve as a platform for our grad community

Racial injustice, economic inequality, unequal access to health care, police brutality, professional burnout, and to voice our concerns and celebrate our achievements.

We feel compelled to shed light on the state of the world and how this affects our experiences. This volume, is therefore, of higher intensity than our inaugural one, as reflected by our cover, designed by the talented Ian Hsu. All content, including the writing, editing and illustrating has been created and curated by graduate students in our department. We truly hope you enjoy this volume and please contact us if you would like to join our team of talented and thoughtful content creators!

The Editors



Image of a transgenic C. elegans expressing mCherry fluorescent protein tag on histone H2B under a germline-specific promoter. Imaged by Tammy Lee

Profile: Prof. Arneet Saltzman

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s we continue with our Faculty Profiles series from the last edition where we talked to Dr. Heather McFarlane, we invited Professor Arneet Saltzman to join us in a zoom-call to chat about her path in science, her interests, work-life balance, and her take on some of the challenges in academia. After completing her PhD in the Molecular Genetics Department at the University of Toronto, Prof. Saltzman moved to Boston for a postdoc at the Harvard Medical School. She returned to her beloved Canadian land to start her lab at CSB in September 2017, to study chromatin regulation and gene expression in *C. elegans*. She is an avid reader and a great conversationalist. In the short time that she has been in the department, she has left a strong mark on her graduate students as an encouraging and approachable mentor.

How would you explain your research to the general public? Could you paint us a big picture here?

That's a very challenging question. Here is my usual approach: We are interested in how genes are turned on

by Hayley McKay and Tatiana Ruiz-Bedoya

thing I did was to try to catalogue all these different histone modification binding proteins.

How was the transition from working with cell cultures to working with *C. elegans*?

It was a challenge, but I actually thought it was really fun. *C. elegans* are fairly forgiving animals as far as cultivation goes, that's part of why they are abundant in the environment. There are a lot of community resources on *C. elegans* that I read through and taught myself about. One of the things you learn in graduate school, particularly if you're a PhD student, is how to learn new skills. So, when you're more experienced in the field, it's less daunting to try to pick up something new.

Could you tell us a little bit about how and when you first became interested in science?

I think I've always been interested in science, since I was a kid. I remember thinking that the Big Bang Theory was just the most amazing thing, how could anyone even come up with this theory! But one of the early things that really got me into research was a small high school biology project. We had to pick a Scientific American article and for some reason, I picked one about the RNA world hypothesis. At the time, I was really fascinated about the origin of life. It introduced me to the idea that you can know a lot of things and as far as we have come, there's still so much more to go. I thought that was really exciting and that probably also influenced my desire to do something related to RNA when I was a graduate student.

and off at the appropriate time and place. The long-term idea would be to understand the molecular machines that regulate genes, because a lot of those are very similar across different species, between humans and worms.

[...] I work in the chromatin field and I'm specifically interested in histone protein modifications and the proteins that bind to and recognize those different modifications. One of the questions I started out with was how do these proteins that recognize modifications do so in cell type- or developmental context-specific manner? I decided to use *C. elegans* as a model system and the first

What do you wish you had learned as a graduate student or postdoc while pursuing an academic path?

I came into the idea of wanting to be a researcher from a completely naive perspective. One of the things I learned along the way was that you have to be comfortable with some degree of uncertainty. Uncertainty, when it comes to experiments, and with career things.

I'm on the shy side. If you had told me in high school that my career as a researcher was going to involve a lot of public speaking, it's possible that I would have just said: *"Well, this is not for me"*. Public speaking is a challenge that I've had to face along the way.

I never realized as a graduate student that I could actually go to professors to talk about my work, my career, and get advice. Even people on your supervisory committee – you should feel like there are people you can approach outside of formal meetings, including other people in the department about your work.

What sort of hobbies do you engage in when you're not working?

I like cycling and jogging but I'm very bad at both of them. I like skiing – exercise and outdoor activities in general. I like reading, it takes me back to my childhood. I think that reading fiction or novels is also good for exercising the mind. In the last few years, I have also amassed a collection of science biographies and autobiographies that I've been reading; The last one I read was The Autobiography of a Transgender Scientist by Ben Barres it was an inspiring memoir.

How do you strike a work-life balance? Do you schedule time off?

I think it's important to schedule time off, because when you love what you do, sometimes you just want to keep going. I think taking time off is helpful to get a new perspective; you don't want to get too pigeonholed into one way of thinking if you don't have any breaks.

I like making a schedule for specific tasks I want to accomplish in the short term. In that way, I have a checklist of the things that I want to do that day, and I don't have to make the decision in the morning because I already have an idea. One thing I really like is getting away from technology. Sometimes I want to get my ideas down and not be distracted – actually use a physical notebook. And sometimes I'll do it outside or somewhere where I feel like I'm alone with my thoughts.

You've conducted research both in Canada and abroad. Are there any major differences between how research is done here and elsewhere?

I probably don't have enough experience to make any generalizations about the academic climate in different countries. I've always wanted to come back to Canada because I'm kind of biased. I'm from Toronto and I am a super proud Canadian, first generation born here on my dad's side, third on my mom's. Being a Canadian is an important part of my identity, and so when I worked in other places, I did feel they were all very nice places to work, but there is a part of me that did long for home.

What sort of challenges have you faced as a woman in STEM?

I think a lot of women I've talked to always have stories ranging from maybe inappropriate humor, to inappropriate comments to more severe kinds of harassment. For instance, when you're presenting your poster at a conference and you're a first-year graduate student and some senior male researcher comments on your appearance and makes you feel like they're not as interested in your work as they should be – it's very unfortunate. I think people are more aware of those tendencies than before, since there's more resources for people to complain and a culture that supports bringing up these issues.

There is also the challenge of imposter syndrome. Some of that might come from the outside with the way that people expect you to be or behave based on who you are. But there's also the internalized feelings of the imposter syndrome where you start to feel like you might not be worthy. And that's something that I think people who are women or from marginalized groups might be disproportionately affected by, so that's also a challenge.

How did you find comfort and alleviation of that

What are your strategies for mentally managing multiple research projects at once?

I actually don't think I am a particularly good so-called multitasker – I've never really understood the whole concept actually. I feel that I can work best when I'm really focused, so on one thing at a time. I think it gets easier than you would think, balancing different projects when there's more people involved. It's easier for me to think about the big picture of things and to let the graduate students and everybody else think about the more day-to-day details.

imposter syndrome?

I think it's like time management – it's an ongoing challenge. One thing I can say for sure is that talking about those feelings is really important.

If there was anything that you could change about academia to increase gender and ethnic diversity, what would it be?

I've been to a couple workshops and online training on unconscious bias. One was focused on unconscious bias and hiring in STEM, and the other one was on grant reviews. I learned a lot from both. Reference letters are really important for advancing careers of people who are your trainees, and there are studies showing that the words people use to describe female and male applicants in reference letters can be really biased, for example, using words like 'ambitious' for men and 'nurturing' for women. And so, these workshops showed ways in which you could improve your writing to make it less reflective of antiquated roles in terms of how you express positive things about both male and female trainees. That kind of training needs to become more standardized for faculty and people in positions of power.

For increasing inclusion and diversity, it's going to take time to address the inequality in society. It is a privilege and a blessing that I've been able to pursue research as a career, and maybe some of that was because of opportunities I had when I was younger. Other people may not have access to the same openings. So, it's important to have programs where diverse groups of people have access to different prospects.

Generally, this is a systemic problem. You can try to change the system, but you also have to change the way people who are in positions of power think. I think one thing that's really important is not only thinking about *"How can we make things equitable?"* but *"How can people who do science really value diversity and inclusion?"* Having a diverse group is actually very positive for science because different people bring different perspectives and different ways to approach problems. I think there's still some people who don't see diversity as a good thing.

What is your advice for someone entering a mentorship role?

There are mentorship training programs that you can attend; formal training could be part of that. I try to also learn from those biographies of scientists I mentioned earlier. In my own work I specifically tell people when they start in the lab that I have a zero-tolerance policy for people being disrespectful towards others. Anywhere from something that you might think is a joke, but it's actually potentially offensive to people, to more serious things – none of that belongs in any workplace, let alone a lab which is a very tight knit workplace.

We all make mistakes, I'm not perfect either, but I try to promote an inclusive environment. I hope people know that I'm always trying and it's something that I value a lot. I try to make people feel comfortable to come to me with something that they don't like, even if it's something that I did. I think in all labs, people should be able to talk one on one with their mentor to say: *"These are some things that happened, is there a way we could make this better?"*

As PIs, we have to adjust our mindset to remember that we are in this position of power, even though we try to have the people in the lab feel like they're part of a team.

What has been your favorite part of being a PI?

My favourite thing is definitely celebrating the success of trainees and lab members.

Do you have any parting words of wisdom for anyone interested in pursuing research?

I think people should be fearless and do what they love. There's going to be adversity everywhere and sometimes it's not something that you can necessarily hide from no



Did you know that Dr. Mauricio Terebiznik's favourite fictional characters include El Chapulin Colorado, Walter White and Spock! He is also a Maradona fan!



COVID-19 SciForAll

SciForAll: Spreading the Word about the Importance of Structural Biology to COVID-19 Research

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by Germanna Righetto

ontinuing with our Faculty walking through a pandemic that has unsettled people's lives on a global scale, we can say that 2020 has been a year of change. Besides the introduction of masks and Zoom calls to our daily routines, another deep transformation introduced by the coronavirus pandemic is the faster pace at which research has been conducted and published. Scientists are engaged in a global effort to understand various aspects of the current outbreak, from the molecular biology of the virus to the genetics of the most vulnerable populations. One of the results of the efforts to unravel the virus biology was the publication of more than 400 protein structures related to SARS-CoV-2 in public databanks.

Motivated to decipher and simplify the large amounts of complex structural data available that is largely inaccessible to the general public, University of Toronto graduate students Amir Arellano Saab and Katrina Hass set out to build the SciForAll website. *"We tried to build an interactive and user-friendly platform that displays beautiful graphic representations of real science"*, explains Amir. *"With SciForAll, you do not need to be a specialized structural biologist (or a scientist, really) to be able to understand the importance and functions of viral proteins"*, he adds. The portal received a COVID-19 Student Engagement Award from the University of Toronto and it is also supported by TakingITGlobal and the Government of Canada. kids about how to decrease the spread of COVID-19. The highlight of the platform is the interactive pages about SARS-CoV-2 -related proteins, in which the user can gather information about the structure and function of several coronavirus proteins. The combination of highquality graphical representations, along with pop-ups with detailed information about the characteristics of each protein, helps the visitor understand the role of proteins in viral biology and infection. To reach a broader audience, the content of SciForAll is currently available in English, Simplified Chinese, Spanish, Hindi, and French.

All the great resources of the website can be accessed at <u>https://www.sciforall.org</u>.



The website provides a range of interesting sciencerelated content, such as explaining the importance of structural biology for drug discovery and giving tips for This protein is first assembled inside the human cell, and its main function is to take the genetic material of the virus and make copies of it, which are later used to make the proteins that the virus needs to become functional.

Hover your mouse over the yellow buttons to discover the cool features of this protein!

Nsp7 and N

These protein subunits stimulate the function of the RNA Polymerase. Scientists have removed and modified these regions, making the protein less efficient



University of Toronto, Mississauga Campus. Taken by Wassim Elkhatib

Studying the Evolution of the Nervous System in An Animal that Lacks One

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by Wassim Elkhatib

hat are Placozoans and how do they relate phylogenetically to other animals?

Placozoans are millimeter-sized animals that glide over hard surfaces grazing on algae in aquatic waters. They consist of only two cell layers, have no specialized organs or tissue, and are made up of only a few thousand cells at most (1). In spite of their simple anatomy and absence of a nervous system, they exhibit complex behaviours. The German zoologist Franz Eilhard Schulze was the first to describe *Trichoplax adhaerens*, a member of the Placozoan phylum in 1883. Today, the phylum Placozoa includes three named species, with *Trichoplax adhaerens* being the most commonly studied (*Figure 1*).

Phylogenetically, placozoans are basal to Cnidarians (jellyfish) and bilaterians (animals with bilateral symmetry) and evolved after Sponges and Ctenophores (comb jellies) (2). Placozoans are considered to be at an intermediate stage of evolutionary trajectory from single celled organisms to complex animals with muscle tissue and a nervous system. Therefore, studying these animals might help us answer some of the complex questions about early animal evolution.

Trichoplax Physiology and Behaviour

This unusual little critter is simply a bag of cells that is crawling around using its ventral cilia, and all they do is look for patches of algae to feed on (3, 4). Sometimes you see them pause and flatten out, other times they are rotating around and occasionally they fold and float to the surface (5). Things get a little more exciting when you start looking at their cell physiology. The common Trichoplax adhaerens (hereafter Trichoplax sp.) has six major cell types and none of them resemble canonical neurons or muscles (Figure 2) (1). Some of the highly studied cells are located on the ventral epithelium, including the ciliated cells and the lipophil cells that are involved in external digestion of algae (4). The secretory cells are more diverse. Single cell transcriptomic studies show an expansion in this cell type with populations of cells expressing unique peptides that control the flattening, rotating and folding behaviours (5). Secretory cells express voltage-gated calcium channels (Ca_v) that are vital for the exocytosis of neurotransmitters at the synapse, muscle contraction, and other functions. They also express exocytotic machinery found at synaptic terminals, yet there is no sign of a synapse in this animal. Recent work has shown that Trichoplax sp. globally secrete peptides from their secretory cells, perhaps using Cav channels and other exocytotic machinery. This global secretion is contagious and if one animal releases, for instance, a pausing peptide, all nearby animals would pause sequentially to feed on detected patches of algae (6). It is truly fascinating to see such simple animals all work together.



Figure 1. Left: Microscopy of Trichoplax adhaerens (by Wassim Elkhatib). Right: The branched Placozoan Polyplacotoma mediterranea (by Osigus & Schierwater).

Trichoplax and the Evolution of the Nervous System

The behaviours and social interactions demonstrated by this animal require a relatively fast and ordered cell-tocell communication. Many have tried looking for chemical synapses or vesicles using electron microscopy, but to no avail. You would think that this puzzle could be solved with electrical synapses, but Trichoplax sp. oddly lacks septate, gap junctions, which only leaves adherens junctions to have some sort of epithelium permeability (7). Moreover, using our lab-assembled transcriptome, we identified a nearly complete set of pre- and postsynaptic scaffolding genes. This includes all the SNARE proteins and the three types of voltage-gated calcium channels (Ca_V1, Ca_V2 and Ca_V3), making *Trichoplax sp.* the earliest diverging animal to harbor all three homologs! Meanwhile, Sponges and comb jellies - which are phylogenetically basal to Placozoans - have only a single Cav channel gene. Trichoplax sp. also expresses many metabotropic and ionotropic receptors such iGluR, DEG/ ENaCs, TRP and 665 GPCRs all found in the central and peripheral nervous system (8).



Figure 2. A graphical representation of the major cell types found in Trichoplax adhaerens. Illustration by: Carolyn Smith

Trichoplax sp. diverged at the cusp of nervous system evolution but it is not the only animal without nervous system. Sponges (Porifera) also lack a nervous system and were thought to be the oldest animals on earth. However, with the improvement in genome sequencing technology, comb jellies (Ctenophores) that were once thought to be closely related to jellyfish, dethroned Sponges as the oldest living animals (Figure 3). Surprisingly comb jellies do have a nervous system, but it is not well understood yet. This pattern sparked two unresolved theories about the evolution of the nervous system. One points at the nervous system first evolving in comb jellies and then, independently for a second time, in jellyfish. The second theory proposes one single event, where the nervous system evolved once in the common ancestor of comb jellies and all living animals but was lost in sponges and Placozoans. More studies will have to be done to unravel the mystery (2, 9).

What can we learn from studying Trichoplax?

When I first heard about Trichoplax sp., I was not able to foresee the amount of information we can learn from these animals. Their location on the phylogenetic tree of the kingdom Animalia is very important and can really help us understand the evolution of the nervous system. What really excited me was the fact that proteins in different animals work differently and it is possible that many of the proteins we have learned about in mammalian systems could be serving entirely different jobs in more basal animals. Understanding their core properties and how they function could teach us more about how and why proteins in mammalian systems do what they do. What I am realizing in my work is that proteins that serve a sensory function, diversify over time and adopt new properties. For example, the pH sensing DEG/ENaC ion channels in chordate nervous systems, play an important role in pain sensation, memory and learning (10). Meanwhile, in jellyfish DEG/ENaC homologs are peptide gated and are involved in muscle contraction (11). Things like this make me truly realize the adaptability of each protein in our body and how they evolve to optimize the job they perform. On the other hand, there are proteins like the calcium sensing protein calmodulin, which are very well conserved across animals.



Figure 3. A schematic phylogenetic tree of all animal phyla that exist today. The two hypotheses for the evolution of nervous system are presented as blue and red events; the blue vertical bar highlights the single origin of the nervous

system while the two red bars show separate emergence events. Crosses represent loss events. Interestingly animals divide into four major symmetrical groups (asymmetrical, bilateral, radial, bi-radial body symmetry). Illustration by: Adriano Senatore

Overall, what I want to relay is that sometimes in order to understand the complex systems we need to know the core functional properties of their proteins, and that can only be done by implementing a comparative approach into our studies. Therefore, to deepen our understanding of the nervous system we need to understand how it evolved, and *Trichoplax adhaerens* is a great model to study this, as it exists at the essence of the evolution of the nervous system.



Illustration and avatars by Amy Zhang

What is Science Communication? A Discussion with Some of CSB's Science Communicators

f you work in anything related to science, you've probably heard of the term "Science Communication." On the face of it, science communication or "scicomm," sounds like conversations held between science people. But that's not always true. Remember how you were trying to explain the research you're doing in the lab at those family gatherings? Remember those frustrating conversations you've had with friends who don't have a biology background? That's science communication. While some believe there is a one-way transmission of information from experts to the public, others believe science is two-way communication which requires public participation (i.e. 'Public Participation Paradigm'). From this perspective, scicomm is everywhere. The public's response is also key in the dialogue. Not only is the way we communicate science affecting policy decisions and determining which projects get funded, it is also shaping our society and our lifestyle. What if we can communicate climate change in a way that is convincing to political leaders? What if we were able to better communicate the urgent need to wear masks to help curb the spread of SARS-CoV-2 earlier on in the pandemic than we did? This is why scicomm is important. With social media platforms encouraging audience interactions on the rise, scicomm has never played a more prominent role in our everyday life. The general goals of scicomm are to improve the public's belief in science, generate social acceptance and moral trust. But *how*? *Where do we start*? *What can we do*?

by Tammy Lee & Hayley McKay

Learning how to better communicate science is no small task. University science programs at both the undergraduate and graduate level rarely include communication or writing courses in their requirements, so graduate students have to take it upon themselves to learn these skills. While there are lots of science communicators out there to talk to, we were interested in the ways in which members of our own CSB community are doing their part to better communicate science. We interviewed PhD students, **Tara McDonell** and **Natalie Hoffmann**, as well as CSB's very own departmental Research Communications Officer, **Dr. Neil Macpherson**, to learn how they communicate science and what advice they have for graduate students and scientists to improve their scicomm skills.

Natalie, a PhD student in the McFarlane lab,

studies how plant cell walls respond to stress and contributes to organizing the <u>Science</u> <u>Rendezvous festival</u> at UofT, an annual outdoor family festival with events across Canada where people can learn about science in an exciting, hands-on and fun environment.



Dr. Macpherson is a Senior Research Associate from the Mitchell lab, and the Research Communications Director of CSB where he writes engaging and accessible articles about new research from the department to promote the work done by our students and faculty.

Tara came all the way from Australia to work on the role of G9a/GLP in the development of zebrafish retina in the Tropepe Lab. She is passionate about science research and uses her online platforms to communicate both her research, as well as current topics in STEM and higher education. Learn more about what Tara does here.

What sparked your interest in science communication?

Like many of us, Natalie found it difficult to explain what she does every day in the lab to her friends and family. Conversations like these drove Natalie to be more involved in science communication. "How can I give a 30 second elevator pitch or explain it to make it interesting and relevant to someone that has no idea what I'm talking about or what I'm doing?"

As a postdoc, Neil would spend hours working at the lab bench while he was at Cambridge University. While he enjoyed the research work, he was getting tired of the monotony of the day to day bench work. "You do an experiment, and you often don't get the results you want. You've got to modify your protocol, and it's just not working. In the end, I decided I wanted to move beyond that." Neil started applying for jobs working in scientific publishing, and eventually landed on a job for BioMed Central (BMC). At BMC, Neil got involved with processing papers submitted to the journal, and attended conferences to interact with both researchers and industry professionals in order to get a better sense of the journal's audiences.

When Tara was in her final year of her undergrad, she came across some scicomm accounts on Instagram. "I realized that there was an actual little niche on Instagram of people communicating science in various different forms." At that time, she was interested in science outreach, so she began teaching undergraduate students. "Then this opportunity arose for me to do outreach, and I found that I really enjoyed teaching to non-scientists and people outside of my discipline." "If I'm doing [scicomm] in an outreach form, why not just try talking about whatever I want?" Since then, Tara has been

active both online and offline, communicating all sorts of sciences to different audiences.

Why is communicating science important?



"For example, I'm on an NSERC scholarship. That money comes from taxpayer dollars, but I feel like what I do on a daily basis or even a publication that I wrote doesn't really make its way back to the general public. I think it's really important to give back to the community in that regard." Natalie also notices a disconnect between scientists and non-experts - it is challenging for non-experts to understand what scientists are saying with all the crazy techniques and complicated wording.









"I feel like the way science is presented in society is kind of standoff-ish," remarks Neil. "It's like there's the scientists and there are the people, who are listening to the scientists." A method Neil likes to use to help non-experts understand and engage with a scientific topic is to turn it into a story. "When the public sees a story that a scientist says, 'here's how I made a COVID vaccine by expressing protein in plants,' and if you tell the story about how that whole idea of expressing your protein in plants came about, the public will be more engaged with that story."





"A good example is voting. Different parties will have different preferences for what and who they want to fund. Ultimately, that affects what kind of research is being done. If the general public doesn't understand this, that's not going to factor into who they may or may not vote for, and in turn that's going to factor into what's being studied and what is valued as important."

What does science communication look like? What would a role as a science communicator consist of?



Natalie is a huge fan of science fairs, *"it is all about explaining your research, the methods, and conclusion in three minutes to an audience that is very diverse."* Natalie was involved in organizing the science fair at the annual Science Rendezvous festival on the St. George campus. Science Rendezvous is a large-scale event that is free for everyone to learn about anything in STEAM (Science, Technology, Engineering, Art, and Math), where scientists organize demonstrations,

experiments, stage shows and more to encourage public engagement with science.

"Science communication can be writing grants, you can get hired by hospitals or university departments to help their professors or their clinician researchers to write the grants," says Neil. "With the government, the role of science communicators is more often going to be a policy role."

"For me, even when I was a research associate and I was working full time in the lab, I tried to organize other science communication events." Neil gathers a team of CSB graduate students every year to host CSB's booth at Science Rendezvous, "I wanted to present our amazing science to people." From that, he got into writing stories for the departmental website, which led to his current job as the CSB Research Communications Officer.



"It's a lot of things," says Tara, *"It could be physically, where you're in an auditorium and you're talking to a group of students."* As a TA, Tara has been involved in developing online content for an undergraduate CSB course due to the sudden shift to virtual platforms. While it's considered teaching, Tara thinks it is also communicating science. Tara also actively communicates science through social media platforms. We asked Tara how she navigates through such a wide range of media to choose from and what factors into deciding where to express her thoughts. *"It comes down to*"

who you want your audience to be, how you want them to engage, and what your intended message is, but also a space that you feel welcomed."

How do you engage people with differing/misinformed opinions about a science topic?

"One of the key things you've got to do is understand where they're coming from," says Neil, "and not dismiss their beliefs." "I think the first thing you have to talk about is the things you agree on because



you've got to establish a common frame of what something means to you." Neil also mentioned that knowing who your audience views as an authority can change the conversation. "One of the best climate change communicators is Katharine Hayhoe, who's also an evangelical Christian. When she's talking to people who see the Bible as the authority, she'll talk about the parts of the Bible that mention nurturing nature," Neil explains. "Try to engage with them on the things that you both feel are important." Tara believes that forming a relationship with your audience is important. "Not only allowing them to understand where you're coming from, but understanding where they're coming from. Because some people might have opinions based on personal experiences. Anyone who you're trying to engage with can have a closed mind on a topic, but if you provide a little bit of information, you can at least show them that there's another form of



e coming from, but understanding where they're coming from. Because some people might have opinions ased on personal experiences. Anyone who you're trying to engage with can have a closed mind on a topic, but if you provide a little bit of information, you can at least show them that there's another form of thinking." But sometimes, it isn't possible to have a constructive conversation if someone is steadfast in their way of thinking. In this case, it's best to "find a balance between communicating science in an effective way, but also not in a way that's taking a toll on you personally or professionally."

What are some pieces of advice you have for researchers trying to communicate their work to non-experts?

"I think practice is really important," says Natalie. When she was completing her Master's at the University of British Columbia, she TA-ed a second year biology course, where students had to write a press release for an article she chose. "It is ridiculously hard not only to understand the science paper, but to write a press release for the general public! It was very useful for me to read them and think about what is good and what could be better." Natalie thinks practicing reading, writing, and

getting feedback from others is really helpful.

Perhaps Neil would agree with Natalie. "A big part of writing is getting feedback," says Neil, "it's always good to show your work to someone who's not a scientist."

Other pieces of advice from Neil are to "try to avoid technical language" and "don't get bogged down in details." "This is something I learned in publishing," remarks Neil, "you never start with 'recent studies have shown...' or 'a new paper from so and so shows...'. This doesn't grab your audience. So, your first sentence, or your headline, has to draw the audience in."

> "If you're going to try science communication, start looking at what's trending in the space you might be interested in," says Tara. "Look up accessibility resources and try to make your work as accessible as possible."

Tara thinks science communicators should try to reach everybody when it comes to inclusion. Tara recommended looking at resources for making videos and talks more accessible, "you can just google it, like how to make a colorblind friendly image, [put] closed captioning, and also look at getting any type of diversity or inclusion training."

If there is one takeaway, it's that **knowing your audience is key**! It's important to think about who you are talking to and what their frame of reference looks like in order to engage in a dialogue about the science you are trying to communicate. Effective science communication revolves around making an emotional connection with your audience which will help you build trust. It is unreasonable to expect non-experts to blindly take what all scientists say at face value, which is why scientists and science communicators need to put more effort into empathizing with their audience in order to build this trust.

Another key theme that came up during our interviews was the importance of storytelling. Regurgitating the results of a paper is not enough to get non-experts excited about a science topic, you have to add some human elements to make the story exciting and compelling to keep your audience's interest. Finally, the importance of accessibility and inclusion was a highlight, as it is crucial for ensuring everyone has the opportunity to interact with science. After all, science is for everyone, so science communicators need to make sure they are actively working to reach and engage with as many people as possible.



SciComm Resources

Articles

<u>Initiatives</u>

Science Rendezvous

Pint of Science

Soapbox Science

Exploring by the Seat of Your Pants

Skype a Scientist

The Story Collider

Let's Talk Science

Visions of Science

RCI Science

Three Minute Thesis

<u>The Communicating Science Conference for</u> <u>Graduate Students</u>

<u>A Beginner's Guide to Science Communication</u> <u>Opportunities in Canada</u>

Explaining science won't fix information illiteracy.

Do you trust science? These five factors play a big role

Key findings about Americans' confidence in science and their views on scientists' role in society

Uniting Toronto science communicators: U of T alumni, students attend first-ever SciCommTO conference

Did you know? Dr. Rutsuko Ito's favourite superhero is Captain Marvel! "Her invincibility and journey are amazing!"





Working with the biochemistry of plant-specialized compounds, Dr. Eliana Gonzalez-Vigil's favourite villain is obvious: Poison Ivy!



Elucidating the Mental Health Crisis in Academia

ental health" and "mental illness" are often wrongly used interchangeably. Mental health applies to all of us, but not everyone develops a mental illness. Similar to how we take care of our physical health by exercising and eating healthy, it is equally important to take care of our mental health. Yet, why is it easier to discuss our physical health with a doctor (i.e. when we break a bone or develop a cold), but it is more difficult to talk to someone when our mental health is suffering? Poor mental health does not need to be permanent. Whether it is with medication, counselling or setting aside some "me time", it is possible to be mentally well. Unfortunately, poor mental health is very prominent in academia.

There are numerous factors that contribute to poor mental health in academia, including: imposter syndrome, financial concerns, poor supervisor relationships, and toxic lab dynamics. Most people completely give up their hobbies and stop having a social life so that they can give their full attention to their work. I was also guilty of this myself — I used to be in the lab 14 hours a day, 7 days a week and the lab was practically my home. Later, I realized that I was actually crippling my growth as a scientist. This is a very common work model in academia and probably one of the main contributors to the mental health crisis we are currently facing. There is this idea that long work hours lead to more data and more publications, and this is engrained in the mindset of many academics. Don't get me wrong, you do need to work hard in order to get results, but perhaps we need to emphasize the need to work smart and efficiently rather than working long hours.

by Tenjin Choden (Norzin) Shrestha

The culture of working long hours also induces feelings of isolation and guilt. Many academics feel isolated from their non-academic friends and family, as we are busy working in our labs. Moreover, it's extremely difficult to explain our lifestyle to those outside of academia. We also tend to feel guilty as we cannot spend as much time with them as we used to, which often leads to strained relationships. Having a good support system is crucial while going through such a demanding experience in graduate school. Excluding our friends and family, this support system usually consists of our supervisor and colleagues in the lab. Now, imagine if our relationship with our supervisor and/or colleagues isn't a healthy one... wouldn't that pose as an immense source of stress? As a student, our academic and professional future relies heavily on guidance from our supervisor. If our relationship with our mentor isn't conducive to understanding and growth, this can disrupt our mental health significantly, and become a major source of anxiety.

Another common source of suffering for academics is imposter syndrome. I think almost everyone has felt inadequate and doubted their own accomplishments at some point in their graduate careers. Not only do we have to work hard (and smart), we are also "tested" at every stage of our careers, whether it is with committee meetings, presenting posters/talks at conferences, and defending our work at the end of graduate school. So, in this competitive and sometimes hostile environment (depending on the lab you're working in), a failed experiment or a failed project can send us to a very dark place mentally. In reality, failure is a part of life and sometimes, things don't work out as we had planned or envisioned. In times like these, we really ought to remind ourselves that some failed experiments have resulted in scientific breakthroughs!

Graduate school is a very challenging experience, however, there are other professions that are equally, if not more, challenging. What are we doing that is debilitating the mental health of our communities? I think it's crucial to point out that even though the majority of work published on mental health focuses on graduate students, there are other members of our community who are also suffering (i.e. post-doctorate fellows, faculty members and lab staff). If they were experiencing mental health issues in school and didn't seek help, then their poor mental health has not been addressed their whole career!

Everything that I have touched upon so far is a part of the global mental health problem. It's not just restricted to our department or to the University of Toronto. Nevertheless, if we want to see change, we have to start small and that would be here at CSB. Financial concerns, inside and outside of academia, are major contributors of stress, anxiety and depression. Compared to other departments, serving as a teaching assistant (TA) is a part of our stipend. So, in addition to conducting experiments, we have to be a TA, while also taking some grad courses. For those of us who want to stay in academia and become professors, this is the ideal situation as we have a guaranteed position. For others who plan on working in industry, venturing outside of academia and industry or who have terrible time-management and multi-tasking skills, it is extremely stressful and more of a nuisance. Then, there are those of us who have families to support and the current stipend is really not enough!

When I started my PhD, I wasn't aware of the mental health crisis in academia. As I progressed through graduate school, I began to notice many friends slip from being mentally healthy to developing anxiety, depression and some who even contemplated suicide. Being on the caregiver side of the struggle, it was heartbreaking to watch such brilliant and strong individuals suffer. In my pursuit to help them, I realized that the department didn't have any resources in place to help those who were suffering. There was no conversation around mental health and absolutely no awareness of the current crisis. It was then that I decided it was time to take action and founded the St. George CSB Wellness Committee. The committee consists of graduate students, a post-doctoral fellow, a staff member and faculty members. I believe that the best way to tackle this crisis is by working together. This committee will hopefully be useful for those who don't feel comfortable disclosing their feelings to their social circle or for those without one (such as international members, labs with only one student, and domestic but out of province members of our community). The goal of the committee is to increase awareness surrounding the mental health crisis, while advocating for the wellbeing of everyone at CSB. So, if you are reading this and you are suffering, please reach out to someone. It doesn't matter who. Just someone. Sometimes, just the act of talking helps.

If you are experiencing emotional distress and would rather speak to someone outside of our department or university, please contact one of the following crisis lines:

<u>Good2Talk</u>: 1-866-925-5454 <u>Gerstein Centre Mental Health Crisis Helpline</u>: 416-929-5200 <u>Toronto Distress Centres</u>: 416-408-4357 <u>Crisis Services Canada</u>: 1-833-456-4566 <u>Kids Help Phone</u>: 1-800-668-6868

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Illustration by Ian Hsu

Food Fight: What Watermelons Tell Us About Anti-Science Propaganda

OVID-19 has brought the world to its knees. It has killed nearly one and a half million people and induced the sharpest economic contraction in modern history. If nothing else, it has shown the power of the natural world over human civilization and emphasized the precarity of our existence. Given these facts, one might have expected a surge in support for the only thing which can save us: namely, science. But instead, COVID-19 has sparked a sort of anti-science inferno. For years, this fire has smoldered behind the scenes, but now it has finally burst forth and threatens to burn us all if we don't extinguish it soon. To fight this now raging fire, we must ask what has fed it.

To answer this question, I want to go back in time to June 26, 2009; back to the depths of the Great Recession. Around the world, economies had ground to a halt and millions had lost their jobs. A few days earlier, the WHO had declared the first global pandemic in forty years: H1N1. But for most people, the biggest news story of the week had been the death of Michael Jackson. In Washington DC, the House of Representatives had just passed the American Clean Energy and Security Act, a bill which aimed to limit America's carbon pollution and modernize its energy economy. Among the bill's many provisions was a directive to set up a cap and trade system. Under this system America would cap its CO₂ production at a certain level each year; private businesses would then purchase and trade shares of this CO₂ budget for their own use. The explicit goal was to create an incentive for businesses to move to clean energy. In other words, a completely sensible and rational proposal to fight climate change.

by Michael Bunsick

But for many on the political right, things were not as they seemed. That night, Fox News aired a segment with Glenn Beck interviewing Phil Kerpen, a lobbyist from American's for Prosperity, about the bill. At one memorable point in the interview, Beck pulled out a watermelon and began slicing through it. Turning to Kerpen he said "You like watermelon? I think this is a watermelon bill." To which Kerpen replied "I think you're exactly right. This bill is green on the outside — the thinnest green on the outside, and on the inside, it's deep Communist red...this is just an excuse for central planning, central control of our economy." That's right, for many conservatives, a common-sense strategy to fight climate change was really a communist plot to take over the country. You might laugh at the absurdity, but this clip exemplifies the rhetoric that right-wing propaganda outfits have pumped into the public discourse over the past decade; the type of rhetoric which has, by slow and imperceptible steps, eroded public trust in both scientists and science in general. It has infected millions with a sort of intellectual schizophrenia which causes them to see nefarious plots and secret cabals behind every sciencebased policy. But what end does all this serve?

For all its silliness, the Glenn Beck segment underscores a fundamental point about the climate change debate: it was never about science; it was about economics. This conclusion becomes inescapable when we think about why Beck chose to interview a lobbyist from Americans for Prosperity. Founded in 2004, Americans for Prosperity serves as the central hub in a network of political organizations run by fossil fuel tycoon Charles Koch. Broadly speaking, this network aims to dismantle the modern regulatory state. However, in practice much of its lobbying efforts have focused on eliminating regulations related to pollution and the environment: the things which directly impact Koch Industries' bottom line. To enact this agenda the Koch network funds three types of ventures: think tanks which write policy papers casting doubt on the veracity of climate science; advocacy groups claiming to represent vast constituencies devoted to environmental deregulation; and political party committees which fund Republican politicians willing to toe the Koch line.

Together these efforts have created a bizarre political symbiosis: A Republican Party which adopts the Koch network's policy positions in return for money and political support. However, for the whole system to work, people must vote for the Republican Party. And here a difficult problem arises: the policy positions the Koch network advocate lack broad public support. To get around this fact, Republicans have turned to propaganda like Fox News and conservative AM talk radio. The Glenn Beck segment we saw earlier was a small part of this larger operation.

Broadly speaking, their propaganda campaign adopted a two-pronged argument. The first prong of the attack aimed to delegitimize the scientific basis of climate change itself. Talk show hosts would often argue that climate scientists had fabricated their data or that corrupt granting agencies forced scientists to lie to get more funding. In other words, scientists had invented climate change whole cloth. Other times the talk show hosts would concede climate change's reality, but then argue that human activity had no impact on global temperatures. Despite the obvious contradictions, many people held both views simultaneously. But that was the entire point. Such lies and obfuscation created a pervasive sense of doubt. A sense that all the dire talk about climate disaster derived from shaky, if not fraudulent data; that scientists' expert knowledge is nothing more than an elaborate charade.

People's suspicion of climate science left them vulnerable to the second prong of the propaganda campaign. This prong argued that a vague, communist conspiracy saw

climate change as a vehicle to advance its political agenda. With this, everything fell into place. It explained why Democrats pushed so hard for policies based on "dubious" science: they were in league with the communists. As a result, all legislation and regulations aimed at combating climate change became nothing less than Stalinist power grabs. This framing allowed the Republican Party to present itself as a bulwark against the eco-communists. In exchange for people's votes, Republicans promised to use their power to stop the communists from taking over the economy with their climate agenda. In this way the Republican and the Koch network managed to smuggle their highly unpopular, pro-fossil fuel agenda into the mainstream. And in the process, they created a highly pliant base prone to manipulation with propaganda. The pandemic of misinformation raging today began with this base.

When looking at the reaction to COVID19 restrictions today, one sees the same pattern of misinformation playing out. Wealthy investors and tycoons oppose the lockdowns which depress their profits. As a result, they turn to propaganda to convince the public that "COVID is a hoax." That the epidemiologists have made up the virus or at least have exaggerated its danger. Why would scientists do this? Because they're socialists who want to control people's lives and force people to wear masks. This sort of rhetoric has crippled America's ability to respond to the pandemic and it offers us a scary picture of how the fight against climate change may shape up if we don't fight back.

All of this is to say one thing: the misinformation that pervades public discourse around science did not arise by accident. It is not the result of nihilists peddling misinformation for their own amusement. Nor is it the result of scientists failing to communicate with the public. Rather, it comes from the deliberate infection of our public discourse with lies, lies told for political and economic gain. To fight this misinformation scientists must understand they are not in a fight over the truth of science; they are in a fight over its policy implications. They must learn how to fight on this terrain, or they risk losing the war.

Danforth & Don Valley. Illustration by Ian Hsu

CSB's COVID-19 Lockdown Hobbies

by Hayley McKay

fter the COVID-19 lockdown began, a lot of grad students and staff found themselves with some extra time on their hands. Since they couldn't continue working in the lab, they came up with some creative ways to pass the time (along with watching Netflix and baking banana bread, of course). Check out some of CSB's amazing new hobbies – they might just inspire you to pick up a new hobby of your own!

garden!" – Hayley McKay, Lumba Lab

"I tried building the pergola with Arabidopsis but turns out it has very poor structural strength" - Saad Hussain, Nambara Lab

"I have been eager to return to my project ever since quarantine started, and so to help me relax and exercise patience, I began to assemble and paint this miniature platoon of Chaos warriors from the Warhammer series." – Eduardo Garcia, Reber Lab

"Since I haven't been able to continue growing my research organisms during the COVID lockdown, I decided to test my green thumb and start growing vegetables. Here are some tomatoes, peppers, lettuce, spinach and herbs I can proudly say I harvested from my own

"I have collected currencies from all around the world for several years now. During the lockdown, I had some extra time to organize it better and update each bill's information on my collecting binder. If you're curious, one of my most exotic coins is from the Roman Empire and is dated from the year~300 A.D.!" – Amir Arellano Saab, McCourt Lab

"I started my own little balcony garden during the lockdown. In addition to some other fruits, herbs and veggies, I was successful in growing just over a dozen peach ghost peppers and decided to try my hand at making preserves. Ghost pepper jelly anyone?" – Amanda Facciol, Gerlai Lab

"Inspired by nature in the city, I attempted to assemble some rock sculptures, representing some abstract "buildings", at Tommy Thompson Park." – Thanh Nguyen, Teaching Lab Technician

"Since I have not been able to come to work, I find my zen moments in caring for my garden watching the angel's trumpets." – Thanh Nguyen, Teaching Lab Technician

"One COVID hobby I acquired during lockdown is performing handstands. The two walls of the narrow hallway of my place are surprisingly useful for learning how to do handstands." – Ian Hsu, Moses Lab

Illustration by Cynthia Wong

Who lives, Who dies, Who tells your story? An attempt at understanding the transformative power of *Hamilton*

he musical that has taken the world by storm is now available on DisneyPlus. Maybe you, like me, decided to bite the bullet and bought yourself a month-long subscription to watch the musical and catch up on old nostalgic movies from your childhood. I mean, why not; you're mostly staying at home, anyway. For those of you who only know Hamilton as a city in south western Ontario, just inspect the tendollar American bill; it graces the face of one of America's founding fathers Alexander Hamilton.

Ron Chernow's biography, aptly named *Alexander* Hamilton, inspired Lin-Manuel Miranda to turn the biography into a musical. The two-and-a-half-hour production features a diverse cast of different creeds and colour, catchy showtunes, less than traditional hip-hop music, and eloquent yet genius lyrics that tell a story of one of America's lesser-known founding fathers. From his impoverished roots in the island of Nevis, Hamilton trains himself to become a lawyer before participating in America's war of freedom. He climbs the ranks from being George Washington's aide before the war, to ultimately serve as the first Secretary of the Treasury. In the wake of his pre-mature demise, Hamilton had earned many accolades, including writing the Federalist Papers. The musical has piqued people's interest in history, presented through the exceptional craft of storytelling.

by Sonhita Chakraborty

Shira Lurie from the Department of History and Canadian studies program here at the University, now even offers an American history course from the perspective of the musical [1]. So far, conversation has been mostly about the historical accuracies (and inaccuracies) of the musical, the widespread gun violence and the emergence of underrepresented minority groups in the arts. But outside its pedagogical and historical relevance, I can't help but wonder why a single musical has become so fascinating and so... addictive!?

I did some digging around and it turns out some more professional people might already have answers. Musicologist Thomas Peach shares his theory on the addictiveness of Hamilton with *Popular Science*'s Nicole Dieker;

"Addictiveness relies on being compelled to repeat something which creates a response...We are repeating music not only for its musical value, but to re-live physical and emotional responses which accompany it" [2].

Grammy award-winning recording engineer Tim Latham, who has previously worked in the music industry and collaborated with Miranda in his Broadway production *In the Heights*, knows the importance of having a wide dynamic range and tempo with subtle variations [2].

There is also something to be said about sound quality and recording. In another interview with Jason Lederman of Popular Science, sound designers Nevin Steinberg and Jason Crystal breakdown what goes on behind the scenes to create the beautifully woven pieces that pull on our heart strings. Meyer Sound's Source Independent measurement (SIM) serves as a tool to assess "how sound signals move through and interact with the venue" [3]. The placement of two speakers at the venue can be very telling of how sound is absorbed by the room. Next, the DiGiCo SD7-T digital mixing console churns the sounds from the stage. However, limited by digital signal processing (DSP) power, all sounds cannot be mixed. Attaining optimal acoustic resolution ensures a crisp sound reaches the audience. As Steinberg puts it "Overspeculating and fiddling too much with the acoustic resolution can hurt the sound of a production more than it helps."

But it doesn't end there! Even neuroscientists have pondered about these ear worms [4]. A fine balance of originality and familiarity gives us the dopamine release we need to feel happy [4, 5]. Our brains crave novelty. This might explain why simplistic popular music with repetitive structures might wear us out easily and lose its appeal, explains psychologist Philip Russel at the University of Aberdeen [4]. The musical also exploits notions in positive psychology. The major and recurring members of the cast display positive qualities ranging from bravery, kindness and comradery. When in dire straits, they even show remorse or forgiveness. These benevolent archetypes motivate us to be our best selves through *"cinematic elevation"*. The powerful ballads they sing sway us to their cause of overcoming hurdles of injustice and we too, from our seats, aspire for freedom and to be part of a cause bigger than ourselves [6].

With its many layers and intricacies, Latham suggests the following: "It is a very dense record ...and it does require multiple listenings to absorb the whole thing" [2]. I believe this to be true for any good piece of music, from Bach to Daft Punk. Theatre geek or not, if I have intrigued you even in the slightest, I strongly encourage you to watch *Hamilton: An American Musical*.

Did you know that Dr. Adriano Senatore is a talented guitarist? He even used to teach guitar lessons at a music school!

Victoria College. Illustration by Ian Hsu

PI Mini Interviews: Meet our Faculty

by Amir A. Arellano Saab

Adriano Senatore

Angela Lange

Christina Guzzo

Eliana Gonzalez-Vigil

John Calarco

ife in academia can be quite isolating. It can often feel like we are the only ones struggling with an experiment, a manuscript, and an imbalanced life. This year, we decided to pick the brains of CSB PIs from all three campuses to get to know them a little better, and ask their advice on grad school, work-life balance, inclusion, and motivation. We hope that this small section makes you feel heard and relatable, and that the advice provided by our fantastic faculty members makes you reflect on what you can and cannot change. Remember, we are all part of the CSB community! Even though it might not always feel like that, many of your fellow students, colleagues, staff, and faculty have experienced what you might be going through; you are not alone!

1) Can you describe, in one sentence, the work that excites you the most about your lab?

Angela Lange: The new tools afforded by genome and transcriptome analysis have enabled us to advance physiological studies which I so enjoy!

Eliana Gonzalez-Vigil: Gathering proof that so-called plant secondary metabolites are not secondary for plants, they are plant chemical weapons.

Adriano Senatore: I am very excited about various projects going on in the lab, which are interrelated in their focus on the evolution of electrical and synaptic signaling in the nervous system.

Rutsuko Ito: I am equally thrilled about all lines of research in my lab, but recent exciting developments include the elucidation of hippocampal circuits that underlie decision making under motivational conflict.

John Calarco: I am mostly fascinated by how diversity in RNA species has shaped the differentiation and function of the nervous system, and how this mechanism can evolve.

Mauricio Terebiznik: The process of discovery and accompanying this discovery and synergism with my mentees, as well as the reflection of this in a student or trainee are some of my most fulfilling experiences!

Christina Guzzo: I find really cool all the work we do, but particularly, those "AHA!" moments when the results are completely unexpected are what I enjoy the most, because they make me rethink and reevaluate my perspectives!

2) In your opinion, what are some characteristics of students that are successful in grad school?

Angela Lange: It is important to have the fortitude to press on when your experiments do not work, combined with good problem-solving skills to troubleshoot.

Adriano Senatore: There are many ways to become successful in research, as well as different underlying motivations. Some useful characteristics are tenacity, and a willingness to troubleshoot.

Christina Guzzo: There are a lot, including work ethic, time management, prioritization, and good experiment planning. You need to work on the ability to see the big picture but at the same time be detail oriented. One last thing (really important)- self-care!

3) What advice do you have for students running into research difficulties, such as writing or getting experiments to work?

John Calarco: Never (never, never, never) give up, consider alternative possibilities for your experiments, recognize when you want to change strategies, and make sure you have good controls! Never lose sight of the bigger picture (don't get dragged by minutia).

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

Mauricio Terebiznik: Think about why you lost motivation, be realistic in your expectations; keep in mind that you want to do this (grad school) because of a reason, keep that in sight. Seek a mentor to be able to put your failure in perspective. Don't compare yourself to other students and try to balance your interests with the ones of your PI.

John Calarco: A good lab environment with your colleagues is necessary. Don't doubt yourself if all the technicalities of your experiment are ok. Include balance in your life, come out for air once in a while, and be positive!

Christina Guzzo: Always have a low-hanging fruit (a short-term goal or project you can come back to). It doesn't have to be publishable as long as it is meaningful to you and it achieves something; short term rewards are quite important so that you get small wins along the way (maybe a review paper). Talk to your supervisor about this strategy!

5) Do you have a role model or person/character that you look up to for inspiration?

John Calarco: When I wanted to be a soccer player, Roberto Baggio was my inspiration! In terms of science, Sidney Brenner and Seymour Benzer (molecular biology and genetics scientists) were great inspirations to solve developmental and behaviour problems in biology.

Christina Guzzo: I suggest you have multiple role models, as people are not perfect. One for family life, one for mentoring, etc. In terms of science, Anthony Fauci was a great mentor for me, as he makes intricate details accessible to the public. He always says, *"tell me about this project as if you were in an airplane at 30,000 feet"*. I always think that you can be as famous as him but still consider trainees, and their importance in science.

Mauricio Terebiznik: I always wanted to be a scientist; my PhD and Postdoc supervisors are my role models. But keep in mind that not everyone is perfect, some people can be role models for things you should not do!

Rutsuko Ito: Remember that null results can still be part of your thesis and can be a significant contribution to the field. As for writing, write the methods and results section first, then attempt the introduction and discussion once you've got into the groove of writing. Also, don't hesitate to reach out to your supervisor for help!

Eliana Gonzalez-Vigil: If experiments worked the first time, our training and knowledge would be so limited. Take difficulties as opportunities to come out stronger!

6) What should a graduate student do if they have troubles communicating effectively with their supervisor?

Eliana Gonzalez-Vigil: Don't stop the dialogue with your supervisor, try alternative formats if required: e-mail, written reports. Make communication a regular component so neither you nor your supervisor can avoid it.

Angela Lange: Graduate students should always be prepared prior to meeting with their supervisor. This might involve a presentation, notes, rough experimental

outlines, etc. If the issue is more than this, then the supervisory committee members are there as a graduate student's ally to help them through this difficulty. They may understand the supervisor differently and be able to provide advice.

Rutsuko Ito: Establish good communication habits with your supervisor early on – find a way that suits you both – be it through email, regular face to face meetings, or even WhatsApp. Ask to meet with your supervisor regularly if that helps keep that channel open. You may also want to consider bringing in an intermediary (perhaps an advisor) if troubles persist.

7) What do you think graduate students could do to promote a more inclusive and fairer academic environment?

Adriano Senatore: It is encouraging to see graduate students, postdocs and faculty thinking and talking about diversity and inclusion at the University of Toronto. I think that continuing along this path is important. Scientific research is a collective effort to understand the nature of things, and to solve common problems. If one considers that, then it is easy to see that this is best achieved though contributions from individuals with varying backgrounds, perspectives, and skills.

Rutsuko Ito: Graduate students first need to be educated and mentored by their supervisors in order to be aware of the issues surrounding inclusivity and fairness in academia, as there is unfortunately a lot of inequity and biases in this environment. Perhaps it would be helpful if seminars addressing these topics could be held.

Eliana Gonzalez-Vigil: Take some time to reflect on your personal unconscious biases. We all have them, that is not the problem. The problem is if we let them control our actions.

8) Do professors procrastinate? Can you suggest a mechanism to avoid excessive procrastination?

Mauricio Terebiznik: For sure! We push away things we don't like doing. Stablish priorities, organize yourself, do a little bit every day to avoid feeling overwhelmed.

ourselves and feel great after we have accomplished something difficult. So, experimenting with ways to sustainably improve our engagement and productivity is one thing we can do. This might include strategies for demarking work time and family/leisure time.

Here is a word of wisdom for all our incoming grads!

You need to develop a routine so that you keep on track and do not waste time. You only get out of research what you put in (**Angela Lange**).

Get to speak and to know as many fellow students as you can get their advice and take advantage of all virtual offerings! (John Calarco)

Don't do the bare minimum to get out of slumps, give all you have! Make sure you're a happy person; celebrate little wins and remind yourself how far you've come (**Christina Guzzo**).

Grad school is an important step, take it seriously, and try to enjoy your time here; if you lose interest be honest with yourself! (Mauricio Terebiznik)

Make time to find your community. This is particularly important for students that come from other cities or countries. We all need a support group, a home away from home (Eliana Gonzalez-Vigil).

Don't get sidetracked by overcommitting

Angela Lange: Yes, similar to others, some professors procrastinate. In receiving a request, I think it is important to read the request once and to deal with it as quickly as possible. Priority lists are also important for larger jobs.

Adriano Senatore: Yes, I think so, especially now with the ongoing pandemic where most of us have had to set up home offices. Finding ways to separate personal life from work life under these circumstances has not been without challenges. However, it is good to remember what got us here in the first place. I am sure most of us have an intrinsic desire to challenge and improve to TAships or administrative duties; get into a good writing habit early – don't leave it to the end of your PhD to write papers/thesis and keep abreast of the literature (**Rutsuko Ito**).

Expect that you will come out of your graduate studies a different person, with skills useful not only in science but many other contexts in day-to-day life! (Adriano Senatore)

Illustration by Ian Hsu

No one will read my thesis and that's okay

ince the pandemic started, I've been nibbling away at my thesis. Enough to get by, make progress, and satisfy my supervisor, but not enough to excise my own guilt. What required my urgent attention months ago started to fade into the abyss. The motivations I initially had when I started my project had been eroded by obstacles and failures which were only accelerated by the pandemic, which had decimated many of my scheduled academic activities. I had previously prided myself on having a well-articulated career ethos, but the vicissitudes of academic rigor wear one down and often pushes us towards bitter cynicism. Which leaves me at the title of this article. In times where the will to thriving and flourishing is superseded by instinctual survival, how can I defend the amount of time and energy I'm pouring into my thesis (aside from obviously wanting to graduate)?

by Mathew Gene

"...for the growing good of the world is partly dependent on unhistoric acts; and that things are not so ill with you and me as they might have been, is half owing to the number who lived faithfully a hidden life, and rest in unvisited tombs." — George Eliot, Middlemarch

It is often difficult to see the pragmatic utility in what we are researching, and that isn't easy to reconcile. However, it has value to someone. Regardless of how big your audience is, a community, no matter how disparate, I believe is out there silently watching. Don't mistake their distant stoic nature as indifference, a hushed appreciation still has large ripple effects.

When I've asked colleagues about why they're pursing their field, I often receive banal and clichéd answers. But I partly understand that. Generally speaking, the poetical

Surely some people will read my thesis! My supervisor... my committee... and... well, I'm not entirely sure. Given that half of academic papers are allegedly left unread, am I really making any impact? And those are academic journals, just how often are people accessing dissertations? articulation of our deepest motivations doesn't tend to be considered a scientific skill. Instead, we prefer things to be concise, pithy, and to the point (which obviously has its merits). We're simply not trained in personal self expression, that's reserved for the humanities. But research is the itch that can never be satisfied. For there is always an intrusive scientific question or thought that occupies us throughout relaxed quotation life. This I argue is why we are here, because of an itch that is insatiable, but can be calmed. A divine dissatisfaction. I need constant reminders, so much gets in the way of doing science. It's a constant cycle of returning to the child-like awe for it. Ultimately, we all take a leap of faith whether we know it or not; that knowing is better than not knowing, despite how devastating the consequences of knowing can be. "Writing isn't about making money, getting famous, getting dates, getting laid, or making friends. In the end, it's about enriching the lives of those who will read your work, and enriching your own life, as well. It's about getting up, getting well, and getting over. Getting happy, okay? Getting happy." — Stephen King, On Writing

Cherry Beach. Illustration by Ian Hsu

The CSB Graduate Student Union: What we have done and what we want to accomplish.

he CSBGU is a graduate student organization that actively works to build meaningful contributions towards the professional and social development of students across CSB. Over the past few years, we have accomplished many milestones; nevertheless, more needs to be done. In this short piece, we provide an overview of our most successful activities, as well as our plans for the future, with the idea of attracting more talented graduate students and postdocs to help us increase the sense of community within our Department.

What we have achieved:

Professional activities

One of the main reasons for the existence of the CSBGU is to actively promote the professional development of our community. We have made progress by organizing Career and Professional Development events and seminars; for example, earlier this year, we held a couple of webinars with Michael Johnson, Senior Regional Manager at Nikon Instruments, and with Leo Wan, CEO and co-founder at the Toronto-based biotech, Ranomics (cheers to Claresta Adityani, Rosiey Yang, and Steven Chen for organizing!).

by Amir A. Arellano-Saab, Tirthankar Ray, Kevin Xue, and June Bang

science! We are also proud to have formed The CSBGU Guest Speakers Committee. The function of this committee is to select and invite world-renowned speakers to give a seminar and interact with grads and postdocs over lunch and dinner. To date, we have been pleased to host Prof. Samuel Sheppard, Director of Bioinformatics at the Milner Centre for Evolution in the University of Bath, as well as Prof. Arjun Raj from the Department of Genetics at the University of Pennsylvania (thanks to Fernando Valencia for chairing this effort).

Next, to give CSB grads the opportunity to showcase their research in a judgement-free space, we organized the Grad Seminar Series, where grads from across the Department were invited to give a short talk and participate in pizza lunches and lively discussions. We thank grads who gave talks and those who came and participated in discussions and shared their love for

Prof. Samuel Sheppard visited CSB on September 2019. After a fascinating seminar, he met with a group of grad students to share his experience, friendly mentoring advice, and spread his cheerful motivation for microbial evolutionary genomics. We then shared some Ontario-crafted ciders with dinner. We will be looking forward to your next visit to Toronto!

One of our latest achievements has been the implementation of the CSB Technology Grant. When the COVID-19 pandemic forced all grads into lockdown and transition towards virtual teaching/learning, our idea was to make the existing CSB travel funds accessible for grads with technology needs. We are very grateful with our Departmental Officials for unanimously supporting this proposal. Now, graduate students can access this financial aid should they need to update their work hardware, enroll into online courses, or purchase research-related software (kudos to Amir Arellano-Saab for spearheading this initiative!).

During the early stages of lab reopening, our Union reps distributed free non-medical masks to any grad student in need so that they could continue with their activities in a safe manner (credit for this idea goes to Ahmed Elbassiouny!).

Social and personal development initiatives.

Another big reason for our existence, is the implementation of community-building activities that contribute towards the social and personal development of the CSB graduate community. As an example of these activities, our Ombudsperson, Kathryn McTavish, came up with the (now online) CSBGU Coffee Breaks, a monthly safe space where anyone within CSB can join, grab a coffee or treat, and talk to their peers about anything!

On the fun side, we have been able to organize many events and parties. Some of the most memorable ones include the Halloween Pumpkin Carving Contest, the attendance to a Toronto Blue Jays Baseball game, our St. Patrick's Day party, two camping trips, and the first CSBGU Trivia Night. For these events, we thank all our union reps, particularly Nawrah Khader, Kevin Xue, Tiegh Taylor, Ahmed Elbassiouny, Claresta Adityani, Mouska Patang, Amad Bhatti, Jin Meng, Mahmoud Bitar, Elina Kadriu, Sarzana Hossain, and Wassim Elkhatib.

Very importantly, and with the help of all of you, we have organized multiple charity raffles during the annual Holiday Parties; in the past two years we were able to raise and donate **over \$1700** to the United Nations High Commissioner for Refugees and Dr. Jay's Children's Grief Centre (big cheers to Kevin Xue and Jin Meng for their efforts!).

In the midst of world-wide mobilizations against systematic racism, we held the first Racism and Inclusion Forum for grads/postdocts in our Department (thanks to Kathryn McTavish for the organization and Tatiana Ruiz Bedoya for the idea), with the objective of creating a safe space where all trainees could come together to share and discuss their experiences. We focused on ideas to tackle the effects that systematic racism might have in our department, working towards increasing equity, diversity and inclusion at the trainee level in CSB. Finally, the findings of a Department-wide survey carried out by our organization, and a summary of the forum discussion were forwarded to the Department's heads, along with a series of recommendations for the improvement of everyone's experience.

Winners of best costume in Halloween 2019. We will be looking forward to when is safe to celebrate together again!

The future: what we envision for the CSBGU in 2020-2021.

With all we've accomplished, we have no intention of

Cheerful (and tired) grads at the 2019 camping trip to Georgina island.

stopping now. The COVID-19 pandemic has introduced many additional challenges in planning and executing events, but the social and professional development of CSB graduate students is still just as important and our council will pivot towards designing events that are either online or follow social distancing guidelines.

The success of our online Career and Professional Development webinars encourages us to move other events online, such as the 1st year navigation seminar (led by Brittany Dugan) and the Graduate Seminar Series (organized this year by Eduardo Ramirez Rodriguez and Steven Chen). We also look forward to planning fun events such as our pandemic-times game nights and the Holiday gingerbread house competition. As the year goes on, guidelines will surely change. Our council is filled with dedicated, hard-working, and creative individuals that will ensure our events are safe yet continue to benefit graduate students. While the CSBGU is here to represent graduate students (**you!**), there is plenty more that we can do. So, if you are reading this and you have an idea for us – whether it's a potential event, a change you would like to see, an initiative, anything – please don't hesitate to reach out to us; shoot us an email or follow us on social media! We thrive on graduate student input and would love to hear more from the community that we serve.

When we asked Dr. Rutsuko Ito about the possibility of being transformed into a piece of lab equipment, she said "I wouldn't want to be any lab equipment, it gets handled and broken all the time!"

If Dr. John Calarco was not a scientist, he would like to be a soccer player! "More realistically, though, I'd be doing something in the natural sciences or engineering."

If Dr. Christina Guzzo was suddenly transformed into a piece of lab equipment, she would choose to be a bench top centrifuge! "Small, speedy, compact, and efficient... just like me!"

If Dr. Adriano Senatore was suddenly transformed into a piece of lab equipment, he would choose to be a trusty micropipettor! "Perhaps because I've used them so much!"

Let's talk about Racism and Equity in Academia

eople have faced prejudice and discrimination for centuries. The struggle to reach equity, diversity and inclusion (EDI) in all aspects of society predates our time; none of the patterns of abuse, discrimination and deep inequality we are seeing today are new. However, the worldwide BlackLivesMatter (BLM) movement, #BlackInThelvory, and the COVID-19 pandemic have brought a deep sense of urgency to a conversation that can be new to many. As biologists we can agree on the importance of diversity, and as we face these social struggles, we can either stay silent or raise our own voices. To honor this call of action against systemic racism, we need to start by restating the obvious: racism is deeply engrained in society, including academic institutions, and has been overlooked for decades. We need to introspect and reflect upon our own roles, our conscious and subconscious biases, educate ourselves, challenge the silence, and actively engage in anti-racism work in the spaces we inhabit.

Racism in academia

Racism doesn't stop at geopolitical boundaries and it is certainly not restricted to only certain organizations; scientific institutions are far from exempt from the social responsibility of stopping the perpetuation of inequality. Racism is old as time and steeped in extensive denial and a multitude of myths, some of which are very close to home. Professor Malinda Smith from University of Calgary and colleagues have <u>addressed</u> the misconception of believing that racial discrimination is an issue of our neighbours in the south, or that universities are particularly liberal and therefore equitable places. The idea of <u>academic meritocracy</u> is inevitably challenged by the undeniable fact that minorities experience life in graduate school differently.

by Tatiana Ruiz-Bedoya, edited by Sonhita Chakraborty

Torontonians self-identify as visible minorities according to the <u>2016 census</u>. Of them, 3.5% identify as black and 4.9% as First Nations or indigenous. In a <u>conversation</u> with CBC's The Current and <u>Huda Hassan</u> (PhD in Women and Gender Studies from UofT), Prof. Smith explained how racial representation degrades as you move from undergraduate to professional leadership settings. Reflecting on the fact that that around 40% undergraduates entering 1st year in Canada are visible minorities, Prof. Smith said:

"I looked at U15, which are the top research universities and was surprised, actually astonished, to find that there was such a homogeneity, almost exclusively white. There are no women of colour or Aboriginal women in any leadership position. I don't just mean presidents. I mean vice presidents, research, vice-provosts—any of the senior leadership positions—almost exclusively a club of whiteness…in the top research universities in Canada, whatever province you are in."

The data, or lack thereof

Following the effort of this newsletter to collect data and report on the CSB graduate community, this piece originally intended to analyse racial representation in CSB trainees based on aggregated data collected through an anonymous survey. However, multiple university and governmental administrative workers, including the Anti-Racism Directorate, strongly recommended I sought legal advice to ensure abidance with the Ontario Privacy Law, the Anti-Racism Act (ARA), and the Anti-Racism Data Standards (ARDS). Racial identity data is indeed sensitive. However, my frustration was later met with surprise when further enquiry into the matter exposed that this lack of data on race is a nation-wide pattern that has restrained the conversation on racism in this country for a long time. There are enormous dangers in this kind of racial blindness, like the reinforcement of fables of equality. This narrative of myths is, however, far from exclusive to Canada and I can personally relate to it: Latin

Although Toronto rightfully prides itself on its cultural diversity, this diverse population faces deep inequity in the higher education system. Around 22.3 % of the Canadian national population and more than 50% of

American countries have historically silenced the conversation about racial inequalities by associating race mixing with <u>racial democracy</u>, to the point of dropping race variables from most censuses during most of the 20th century. The consequence has been widespread ignorance about the <u>dreadful inequalities</u> black communities face. In fact, while embodying 38% of the total population, Black Latin Americans comprise close to 50% of the poor and represent only 12% of those that access high school.

Only since 2016 has the Canada census started reporting data on race, and not simply the traditional immigration status of its inhabitants. Moreover, never before in history have UofT and a worryingly large number of other institutions reported student racial or ethnic affiliations as part of their demographics, which have focused mainly on gender. Why has it taken this long for institutions to understand the importance of this data? My conversation with <u>Aamer Esmail</u> of the Anti-Racism and Cultural Diversity Office (<u>ARCDO</u>) at UofT was particularly enlightening as he helped me unpack some of these thoughts:

"...while we know that many institutions have been slower to collect much needed data, we also know that once the process begins, there are questions to consider. How do you ask these questions? How do people analyze the data? I suspect that people have been probably waiting to get it right. So, now the emphasis has been, not on whether it is important, I think it has been important for a while for people, but it's on, even if it's not perfect, let's start doing it, because the impact of waiting much longer has very visibly been reflected on what's happening in stories of exclusion, violence and racism."

What can we do?

Raising awareness about prejudice starts by recognizing and supporting those who have been fighting for EDI advances for decades. We can take on the responsibility and accountability to call out behaviour that does not align with values of EDI. We need to acknowledge that institutional EDI work is not only overwhelming and emotional, but also often underappreciated and poorly compensated. Moreover, the responsibility has historically befallen <u>disproportionately</u> on the shoulders of BIPOC people. If you don't identify as BIPOC, then consider what allyship looks like in this work. Support one another, uplift one another, and have those difficult but much needed conversations because, as Aamer also pointed out, it is a highly nuanced problem: things from an intersectional approach and ask...how does this apply to other experiences of gender identity, sexuality, faiths, immigration statuses? The idea here is not that we don't make decisions, but it is that we make better and more informed decisions which also allow space for feedback and detours until we get things right."

45% of CSB trainees report to have experienced racism or discrimination in their study/ work environment 0 3% of them reported the issue has been resolved 65% of CSB trainees are unaware of the anti-racism resources available to them

With over 20 years of experience in developing EDI strategies, focusing on Youth, Community and LGBTQ2S+ Engagement, Aamer helped me reflect on many aspects of EDI work, ranging from the term "racial minority" to the relative impact of equity or diversity efforts and whether one can really exist without the others. Overall, he emphasized the importance of getting comfortable with not finding simple answers, but rather to prioritize further questions, reflections and conversations:

"My personal experience has been that I've always been in the big fights... and been exhausted and burnt out, because you're wanting that big change to happen. As I get older, I'm like, no, no, I'm going to celebrate the little wins because that is fuel for me to continue."

"Something to consider is that these conversations have been happening for a while and things are happening on the back end that we may not see. Decision making from an institutional setting is very complex. It's not just about 'Let's just make this happen', as decisions impact people differently. Even if you think something will really help all racialized communities, you have to continue to consider Sadly, it is often true that all this hard work is invisible in our day-to-day experiences. During the first Racism and Inclusion Forum for CSB trainees, we learnt that 45% of surveyed grads and postdocs reported to have experienced racism/discrimination. Despite this apparent prevalence in discrimination, more than 65% of trainees are unaware of any of anti-racism resources. The lack of data or the possibility of collecting it constrain us from addressing the question of how racism specifically affects our graduate experience and scientific prospects. It is a quest we can't undertake at the moment, but this doesn't mean it won't happen. The global awakening call has created extra momentum that has fueled many hopeful projects at UofT and other Canadian Universities.

One example of the reaction to this awakening is the launch of the Anti-black racism Task Force, committed to address anti-back racism in the Toronto tri-campus community. Their website is filled with resources, workshops and articles. Professor and Vice Dean Maydianne Andrade is one of the UofT heads leading this conversation through the Toronto Initiative for Diversity & Excellence (TIDE) and her podcast "The New Normal", where she discusses equity and social issues in times of pandemic. The Vice-Provost Students Office designed this year's student survey hoping to gather information on the experiences of underrepresented groups. ARCDO in collaboration with Hill Studio, have launched the Restore <u>@UofT</u> program for the U of T community to address the impacts of racism through restorative activities. Finally, in our very own ESC building, an EEB initiative led by faculty and graduate students was born: BREWS. They conducted an online survey and have put together a quantitative report on the pervasive lack of representation and equity in the field, and propose a plan forward to address it. All of these projects bring me

hope that EDI work will be a well-known, incentivised and better compensated part of the current and future generations of scientists.

This process has convinced me that I need to do more to understand my place in a structurally biased system, and I hope this article convinces some of you of the same. While we reach to educate ourselves, find and share resources, Aamer believes a few things will help:

"Take care of yourself as this work and experience can feel overwhelming and emotional. Find some community including other people who are interested in the subject. Do not rely on BIPOC people to provide emotional support. In fact, ensure they are being supported as needed. And try to celebrate the small steps as you pause and reflect about the direction of the steps you are taking. It is very important for you to critically self-reflect. The questions to ask yourself would be: Why is this important to me? What did I learn today that was new or that felt difficult? How is this connected to the other things that I'm also learning or want to learn about? Being able to connect the dots between anti-racism and poverty, or poverty and heteropatriarchy, or heteropatriarchy and tuition fees... It might sound like a stretch but there is a connection. Figuring it out and how you are connected will be important on this lifelong journey."

Did you know that Dr. Mauricio Terebiznik is a nature aficionando? He loves camping, kayaking and fossil collecting when outdoors!

If Dr. Angela Lange was suddenly transformed into a piece of lab equipment, she would choose to be any kind of microscope, so that "I can observe all the living matter in a variety of ways!"

Ramsay Wright Zoology Laboratories, St. George Campus. Illustration by Ian Hsu

CiteMe!

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