Western Faculty Profile:

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No conflicts of interest declared

Tell me about your education and career path

I'm a bioinformaticist. Bioinformatics is an interdisciplinary area combining computer science, biology, mathematics, and statistics, which is challenging because practitioner needs to be skilled in all these different fields to be successful.

It was a perfect fit for me because I had a background in computer science from high school and even before high school, I had a lot of fun programming on my VIC-20 (an old fashioned personal computer) using BASIC (the Beginner's All-Purpose Symbolic Instruction Code). After high school, I decided I wasn't the best programmer and I started getting really excited about evolutionary biology, so I completed a biology degree at the University of Toronto.

Following my bachelor's, I pursued a degree in mathematical biology at the University of British Columbia. At this time, I was getting interested in measuring certain parameters of evolution, specifically the context-dependent relationship between mutations. If you mutate an organism and evolve its offspring over time, you'd expect the offspring to recover from the mutation by flipping it back. But most of the time, a different gene, whose mutation wouldn't have been beneficial without the original mutation, is changed to fixed the problem. I ended up joining an experimental mutation lab that worked with viruses at the University of California, San Diego from which I earned a doctorate degree after about five years.

After my PhD, there was a rapidly growing interest in the field of bioinformatics: the human genome project was going on, sequencing was becoming more common, and PERL and R were becoming increasingly popular for working with sequence data. Revisiting my love for programming, I took on a post-doc position at the Anti-Viral Research Centre at San Diego, a bioinformatics lab that worked on HIV. There, I started contributing to open source software, such as a program called HYPHY (Hypothesis Testing using Phylogenies) which is commonly used for HIV. I also started using some machine learning (before it became cool) including natural language processing methods and Bayesian networks. From there, with all my training in biology, computer

science, and math, my career accelerated and I was eventually recruited here at Western University, where I've been for a year now.

What is the main focus of your lab?

Right now, the main focus of my lab is to try and develop new computational methods to study outbreaks. A lot of this is driven by a grant from Genome Canada that is supporting our work in developing a new R package called kamphir designed to help people fit complex models to pathogen genetic data. If you have a bunch of infection sequences, you can reconstruct how these infections are related through common ancestors, which is usually represented by a phylogeny tree. This package helps fit models to phylogeny trees by taking your model, simulating more trees, and adjusting the model parameters until the simulations are similar to your data. At this point, we can say the model has been "fitted" to your data. The intuition sounds very simple, but it's actually a very difficult task, especially when we need to compare datasets. Formally, this technique is known as approximate Bayesian computation.

What is the long term goal of your research?

I want to start working with other viruses. Most of my work is in HIV right now because it's such an important area within infectious disease. But we're constantly discovering new viruses that we know nothing about, and many of these evolve extremely quickly. An amount of data is being generated now, mainly because it's easier and we're essentially only limited by the questions we can think of. That's actually why I don't want to commit to a single long-term vision other than understanding virus evolution.

What are some hot areas of bioinformatics?

Real-time monitoring. The idea is that when you sample infections and generate genetic sequences, if you find infections that are very genetically similar, they could represent an outbreak. We can conclude this because if you have a rapid series of transmission, there's not a lot of time for the virus to accumulate genetic differences. Also, sequencing is becoming more common in the clinical management of infections, giving us the opportunity to compile a database of sequences that we can use to look for these clusters of similar infections to detect outbreaks in close to real time. If the sequences are associated with additional information, that information can even be used to focus the deployment of public health resources (for example, where would we have to get to in order to manage a current outbreak). Although these sequence analysis methods are becoming popular, they often don't work very well. Something our group is doing is to scrutinize current methods and come up with better ones.

Why Western?

Western was a rare opportunity to have an independent research career, which is increasingly difficult to get. My life partner was hired here as a professor as well, which was important for me. I'm also originally from Ontario and living expenses in London are affordable. Back when I was in Vancouver, my friends and I were all still living like grad students because nobody could afford a house.

What kind of advice would you give students interested in joining your lab?

The first question I ask students who want to join my lab is if they can code and a lot of times, the answer is no. That's usually okay, but I like to see initiative. Nowadays, there are a lot of resources online that teach programming and it's much easier to get started than ever before. Laptops and computers are now all equipped with compilers and development environments, and you can even write and run code in your browser now. If you've got some solid grades and you've shown the initiative to learn how to program and what my research is about, that'd be great – I'd be thrilled to take you on!

To learn more on Dr. Poon's lab and research, please visit his website:

https://www.schulich.uwo.ca/pathol/people/bios/faculty/poon_art.html