Interview with Dr. Rob Kozak

UTMJ Interview Team (Annie Yu and Ryan Daniel)

Dr. Rob Kozak

Photo courtesy of Sunnybrook Health Sciences Centre

Dr. Rob Kozak is a Clinical Microbiologist at the Sunnybrook Health Sciences Centre and the University of Toronto. He received his Doctor of Philosophy (PhD) in Microbiology and Immunology from McGill University in 2010. Since then, he has worked across the nation studying viruses such as Ebola, Crimean-Congo Hemorrhagic Fever Virus, Zika, and now SARS-CoV-2. Alongside Dr. Samira Mubareka and Dr. Arinjay Banerjee, Dr. Rob Kozak managed to isolate SARS-CoV-2 and is now at the forefront of studying the virus to hopefully develop a vaccine.

UTMJ: Why did you decide to go into the field of microbiology and immunology?

RK: I've been interested in microbiology since I was a kid since my mom actually worked in a microbiology laboratory – so she was certainly an inspiration. I read a lot of books like "The Coming Plague" and "The Band Played On". One of my favourites, "The Hot Zone", was about the outbreak of the Reston virus in the US, and that really got me hooked. I knew when I was choosing an undergraduate program that I wanted to study microbiology, and that turned into many more years of training (too many to count!). I have worked with some of Canada's top researchers in virology, both in human and animal health, and am very grateful for mentorship I received along the way.

UTMJ: Are you ever concerned with regards to your personal safety when working with highly virulent viruses, such as Ebola, Zika and now SARS-CoV-2?

RK: When working in any high-containment lab there are always risks. I was fortunate to have had many years of training during my PhD working in a CL3 (Containment Level 3 Laboratory). After that when I worked at the National Microbiology Laboratory in Winnipeg, I was working in CL4, the highest biosafety level, with Ebola virus. Before doing work in these types of labs, there is very rigorous training and strict protocols, so I had a good foundation of knowledge and experience before starting to work on SARS-CoV-2.

UTMJ: How did you get involved with the project to work on isolating the virus?

RK: Sunnybrook cared for Canada's first patient with SARS-CoV-2. From that first case to now, we have been fortunate to have excellent leadership, where we have had opportunities and been given resources to merge the clinical findings and the science. Dr. Mubareka (a clinician-scientist with a track record in coronavirus research) and I decided after that first case that isolating the virus was our top priority. We knew if this were possible, then we could share it with other labs for research as well as for use in diagnostic assays. Dr. Banerjee, a top-notch post-doctoral fellow from McMaster who also has done work on MERS-CoV, joined our team and we got to work on it.

UTMJ: What was the hardest part of isolating the virus?

RK: Although I have isolated novel viruses in the past, for me it is always the waiting. Cells are infected and then you have to wait a few days to see if there is cytopathic effect, indicating the virus is growing. Then you confirm the virus is there with PCR and eventually whole genome sequencing, all of which takes time. You wonder if it is going to be successful, or if you're going to have to start again from scratch. We really felt this pressure, since all the time you know that there are a lot of people who need to start working with this virus to start understanding pathogenesis and testing therapies. Our team was really lucky to have an expert like Dr. Banerjee with us, his experience really helped get things done faster.

UTMJ: How is research coordinated and expedited during pandemics?

RK: It is certainly a bit of a balancing act. Clinical duties take priority – which in a microbiology lab means we needed to continue with our day-to-day responsibilities, while working with our hospital colleagues to coordinate SARS-CoV-2 testing. Research is mostly done in your spare time, which means a lot of evenings and weekends (and luckily, I have a very supportive partner). I'm grateful to work with a team of clinicians and scientists and this has really helped spread the work around and get it done quicker.

UTMJ: When do you suspect we will be able to develop a vaccine to SARS-CoV-2?

RK: Most vaccine candidates are currently in preclinical development, but a few have progressed to Phase I (safety stud-

ies). It's been really exciting to see how quickly the global scientific community has come together to put forward multiple approaches and platforms. I'm working with Dr. Gary Kobinger, who developed a vaccine against Ebola virus, as well as other scientists in Quebec to develop and test promising candidates. I know how experienced the team is, and how hard everyone is working, so this gives me great hope. I would like to be optimistic and say that there will be vaccine candidates in Phase III trials in the next 8-12 months.

UTMJ: What is the process of development like and what are some of the main barriers?

RK: There are multiple strategies for vaccine development, including using different parts of the virus so the body can "recognize" it later, as well as different delivery systems to generate an immune response. One of the major challenges is predicting which combination is going to be successful for a given pathogen. For example, there are a few chronic viruses that to date, and not for lack of trying, scientists have not been successful in generating a protective vaccine (namely HIV and hepatitis C). Nonetheless, one strategy is to select an antigen from the virus (a protein) and put that antigen into a vaccine platform for delivery. This can be a viral vector (like adenoviruses) or DNA (like a plasmid) or a protein (like what is done with the influenza vaccine). Our group has completed this first stage, and now we are moving on to evaluate whether the vaccines induce a strong immune response in animals, and whether it is protective when animals are challenged with SARS-CoV-2. We are using titred virus stock for this – another reason why isolating and growing the virus from patients was so important. Following safety and efficacy studies in animals, it will then be studied for safety among healthy human volunteers. Phase III studies in humans is where it is determined whether the vaccine is actually protective. Each phase of the development and testing in animals and humans takes time. You have to vaccinate and then wait. Timing, dosing (whether additional doses are needed, time to protection), and production are the next steps. The good news is that there are many groups working on this all over the world, so I'm optimistic we are going to have 3 or 4 really great vaccines against SARS-CoV-2.

UTMJ: What current therapeutics are being tested to treat COVID-19?

RK: Some clinical trials for therapies among very sick patients have already been published. Many more are underway both for outpatients (patients who are positive, but well enough to be sent home to isolate) and for patients who require hospitalization. The clinical trials thus far are looking at a range of different drugs and approaches. Some are experimental, like the antiviral Remdesivir, and some are drugs that are being repurposed, such as chloroquine. There are also currently several trials using convalescent sera from patients who have recovered from COVID-19. All of this is very exciting since Sunnybrook is involved in several of these trials, so I am working with many motivated healthcare providers all of whom are working to find treatment options. As a microbiologist it is great to play a small role in these studies by supporting testing during the trials.

UTMJ: Can you speak to the collaboration between different nations and groups across the world that led to isolating the virus?

RK: Since the first cases in Canada, we have really seen collaboration and knowledge sharing between with both Canadian and international groups. As an example, when we started working to isolate the virus, I reached out to scientists Dr. Julian Druce and Dr. Ian Macaky in Australia. These groups had recently isolated the virus from patient samples there. They were extremely collaborative and shared protocols and recommendations. It saved us a tremendous amount of time to not have to start from scratch and optimize protocols to be successful. I also received support and suggestions from colleagues in China. Now we are working to characterize the virus in different cell lines, and have been fortunate to have colleagues in Toronto, Guelph, and Quebec who have shared cell lines without hesitation.

It's truly inspiring to see some many groups sharing knowledge and resources. That's how we are going to beat this thing!

UTMJ: What advice do you have for Canadians during this uncertain time?

RK: Be hopeful and work together, these are characteristics that make Canadians great. There are many people working hard on the front lines, including, but not just, healthcare providers. Individuals in these settings are giving 110%. We've seen some truly inspiring efforts by Canadians to help support each other in any way they can and helping those in need to the best of their ability. From a research perspective, scientists in Canada and all over the world are learning more about the virus everyday–so staying positive that there will be vaccines and therapeutics in the near future is important. Lastly, we need to continue to follow the advice of public health experts (even if it changes over time), to ensure we keep working together to end COVID-19.