Behind the Breakthrough Podcast - University Health Network

Season 3 - Dr. Angela Cheung

Transcript

BTB

Welcome to Behind the Breakthrough, the podcast all about groundbreaking medical research and the people behind it at Toronto's University Health Network, Canada's largest research and teaching hospital. I'm your host, Christian Coté with us today on the podcast. Dr. Angela Chung, award winning senior scientist at UHN's Toronto General Hospital Research Institute. Dr. Cheung is pioneering research on the long term health effects of COVID 19. Work that is providing much needed evidence and informs clinical care for long haul COVID patients in Ontario and around the world. Dr. Angela Cheung, welcome to Behind the Breakthrough.

DR. ANGELA CHEUNG

Thank you, Christian, for having me here.

BTB

I want to go back first to the beginning of the pandemic. You know, your clinical and research expertise for the past two decades has focused on osteoporosis and post-menopausal health. Then the pandemic is declared in March 2020. Everything's put on hold. What was going through your mind as you grasp the gravity of the situation at that time?

DR. ANGELA CHEUNG

Well, I am a general internist, so I do look after patients in the acute care setting and also in the ambulatory setting as well. And yes, I've developed a career, especially in research around bone health. And I would say actually musculoskeletal health, because muscle is also very important for bone health and have really worked in the area of post-menopausal health for many years. So when the pandemic broke, we were all pulled into doing acute care. So I was helping out both in the acute care setting, looking after COVID patients, as well as covering other people, other colleagues to look after our sick patients when they are not well. And then I was also pulled into helping out in the ambulatory clinic. So this is the general internal medicine post-discharge clinic and also rapid referral clinic.

And so I was seeing patients with COVID 19 post COVID 19 and seeing a lot of new things. And I thought, you know, having the network that I have established across Canada through research in the bone health area as well as in the post-menopausal health area, as well as in the general internal medicine area. It's possible to pull together a team to look at COVID 19 across Canada. And so I approached my colleague, Dr. Margaret Herridge, who we work together some twenty five years ago looking at ARDS and post ARDS like after having acute respiratory distress syndrome and being a critically ill in the ICU, what happened to those patients after they recover? And so I chatted with her early on and said, You know, we should look at this together. And she has expertise in critical care and she's a respirologist and I have the general internal medicine crowd across Canada. And so she has been working in this area for many, many years as well. And so she has established a network of critical care physicians and scientists across Canada. So we basically pulled our two teams together.

BTB

So you make a decision quite early on in the pandemic to pivot your research and respond to the crisis. I'm curious what questions you are asking because we didn't really know that that there was going to be long term or long haulers, so to speak, in terms of COVID patients with long term symptoms and effects. So what were you asking yourself back then?

DR. ANGELA CHEUNG

Well, we know that from our ARDS work, that it does take some time for people who have been critically ill to recover. And so we in some ways we modeled after that study, obviously with many advances since, like twenty five years ago. And so we wanted to look at both the short term and long term outcomes of COVID 19. We want to set up a platform so that we can decrease patient burden but allow different investigators to ask specific questions. And so we want to be one spot where we can collect data in terms of clinical data, research data, bio specimen and really try to minimize the burden to the patient.

And so the overall objective was really just to look at short and long term outcomes and also caregivers, because we learn from our prior research that when someone is unwell, it not only affects them, but it affects their family and affects their family caregivers as well. And so, we wanted to really try to understand what kind of factors are determinants of these outcomes. We want to collect social demographic data, we want to collect clinical data, but more specifically in 2021, we are really looking at precision medicine. So there are many ways by looking at genetics, epigenomics, transcriptomics, metabolomics and other biomarkers we can better understand the disease process. And also better target therapies as well. And so that's why we wanted at the very beginning to provide a observational platform to study this disease. And we're fortunate to have 18 other centers who said, yes, we'll come in and help across Canada as well.

BTB

How did you muster that group together that quickly?

DR. ANGELA CHEUNG

People understand the importance of this and was willing to come together and collaborate? I think that's actually one of the positive things about this pandemic is that we broke down some silos and were able to work together across sort of clinical translational, you know, health policy type researchers and connect to the basic scientists as well.

BTB

So June of 2020, you officially launch along with Dr. Herridge, the Canadian COVID 19 prospective cohort study. I think I have that right. The first study in Canada to assess health outcomes for COVID 19 patients. Talk to us about the scope and scale of this study that you two set up?

DR. ANGELA CHEUNG

We wanted to study two thousand patients across the spectrum of severity of illness. So we want a thousand to be non hospitalized, a thousand to be hospitalized. And within that 1000 patients that's hospitalized, we want to actually look at not only those in the ICU, but also those in acute care. So it's split between the two. And we wanted to study some caregivers as well. So this is spread across 18 centers across five provinces British Columbia, Manitoba, Alberta, Ontario and Quebec.

BTB

So I understand Dr. Cheung establishing the criteria or a set of common symptoms for someone to be deemed a long hauler is in itself challenging. Talk to us about what you've learned along the way here?

DR. ANGELA CHEUNG

There are many things we've learned along the way, and I would say that we're still learning. We don't have all the answers and we learned together with other international experts as well. So we're not really just in Canada siloed. We are quite connected to WHO, we are quite connected with other groups internationally as well. And if we go back to how it works for SARS-CoV-2, which is the virus, the way that it works is that it comes into, you know, if you get contact with it, it attacks our cells through something called the ACE2 receptor. This ACE2 receptor is the route by which the virus would get into the cells. But one of the issues is that this ACE2 receptor is found in many different tissues and organs. And that's also why we can get all sorts of symptoms from, you know, a cough and a cold, to headaches, to diarrhea, to myocarditis, meaning inflammation of the heart or affecting the kidney or the blood clots system or the brain. So it's because this ACE2 receptor is quite ubiquitous in our body.

BTB

I understand estimates are around the 10 percent mark of Canadians get COVID are at risk of becoming a long hauler. What do we know about why them?

DR. ANGELA CHEUNG

That's a great question. We're asking that question why them? So the estimates is really difficult because if we look at the literature, it varies from study to study how they count, who has long Covid? For studies that only restrict to a number of symptoms, like a list of 10 symptoms let's say, the numbers are lower, so it's closer to the nine to 10 percent. But if you actually allow people to have all sorts of symptoms, then it's actually much larger the percentage. And it also really varies where the cut off is. What do you mean by long Covid? Like is having it for four weeks long, is having it for three months long. And so there's also variation in how people are cutting off for the definition of long Covid. But as time goes on, I think there's some consensus and agreement among experts that were using what the W.H.O. just presented two weeks ago or so that it's more than 12 weeks of symptoms basically. You can have symptoms that sort of go away and then relapse again. But overall, sort of from your first acute onset of COVID 19 to defining that you have long COVID, we're using about 12 weeks.

BTB

And what are those determinants or against symptoms that qualify you or you determine a patient is a long hauler?

DR. ANGELA CHEUNG

That's a difficult question. I mean, I can tell you what the common symptoms are, but the problem is that there's really no one on two defining thing. If you look at the studies, including our own, there are more than 100 symptoms.

BTB

Wow.

DR. ANGELA CHEUNG

So and often people have not only one symptom, but multiple symptoms, these symptoms can persist over time as well. And so there's really no test currently. Anyway, that can define someone having long COVID. There's no one single symptom that can define someone having long COVID, it’s a constellation of factors. So if you have a viral illness that is within this pandemic and sounds like you had COVID and you actually have someone who can have a what we call an epidemiological link, I would say that it's highly likely that you have long COVID, so you don't really need a positive nasal swab PCR test per se, and the W.H.O. agrees with that. And actually, in the definition of long COVID, they said someone with a positive test or a presumed COVID 19 infection because at the very beginning of the pandemic, many

people were told to isolate at home because of limited resources, and we didn't not have the testing capabilities that we currently do.

BTB

You say there could be like 100 symptoms that long haulers would qualify for being called long haulers. Can you give us a sense of some of them?

DR. ANGELA CHEUNG

For sure. So fatigue is a common one. Short of breath, especially with exertion. So I can tell you that I have patients who are marathon runners and they find walking a block difficult because they have shortness of breath. Insomnia. So sleep disturbances are common. Aches and pains of various sorts, is common. Exercise intolerance is common. Headaches, brain fog, those are some of the common things. Some people actually lost their taste and smell or actually have distorted taste and smell, so they will tell me I smell smoke everywhere, you know, they come into my clinic and they say, I smell smoke anywhere I am. Let me just check. And certainly, we don't have smoke anywhere.

BTB

In your clinic with patients that would appear to have these long haul symptoms. What's the scope of severity that you're seeing?

DR. ANGELA CHEUNG

Oh, there's a wide range. There are people who are well, because of the can cough study. We are tracking those who have recovered as well. But some people are really unwell. They can't even come in to see us. So some are living far away. They have trouble getting out of bed and sitting for a short period of time makes them totally exhausted. Some of those we do virtually, but it's never as good as seeing the patient in person. So the sickest person that I saw came into the clinic by an ambulance and he was young. He was in his late teens, early 20s, and he came with his parents, who are very worried, and he had to lie down in a dark room with eye covers and earplugs because all those things create headaches for him. And so I would say there's a whole wide range, but some people are quite affected.

BTB

And I'm curious, do you see a profile at all emerging in terms of those who are at risk of becoming a COVID long hauler?

DR. ANGELA CHEUNG

I would say that people in the 45 to 75 age range are at higher risk and that we see more females with long COVID than men. So more women than men. But I don't know how much

of that is because the men are sicker. They come into the hospital, they go to the ICU, whereas women tend to have milder symptoms acutely. But then they have it for longer.

BTB

A year and a half later, now or more, in your study, what is your research revealing in terms of the trajectory of symptoms and illness for long haulers? Like what's the range of how long they experience these symptoms?

DR. ANGELA CHEUNG

Quite long. One of our patients is like a year and a half long.

BTB

Wow.

DR. ANGELA CHEUNG

There are quite a few kind of like that. I would say that people in general do get better over time. We've been teaching by trial and error and based on other literature around post-viral illnesses, we've been teaching our patients a few thing. For example, teaching them to rest and pace themselves, meaning thinking of if you have, like, a part of energy that you're allotted for today, you can't use your credit card to get more. You are only allowed to do that. So basically to prioritize what you need to do and not go over your budget. So by resting and pacing yourself, people do get better. We also learned that breathing exercises, especially for those who are not hospitalized their lungs in terms of the shortness of breath, is not really a lung issue is mainly a muscle issue.

So when you take a deep breath in, you use your muscles, the diaphragm are two pieces of muscles. So when you open your chest, your diaphragm goes down the muscle contracts and pulls it down and your intercostal muscles contract and pull your ribcage out. So it is the expansion of the lung, which is passive that makes you breathe, and a lot of people post-COVID are not breathing deeply. And so we teach them how to do breathing exercises and concentrate on the breath, and that helps as well. So there are few sort of tricks and techniques that we have learned that these things help patients recover.

BTB

I mean, is there a drug regimen at all, any other kind of treatment or is it simply rest, breathing exercises?

DR. ANGELA CHEUNG

So it depends. For example, some people have a very fast heart rate at resting. So, you know, at rest, we tell them to take their heart rate in the morning and we tell them to take it midday after doing something and we tell them to take it again at night. If the heart rate is consistently very high, we can give medications to try to lower it so that they tolerate it better.

BTB

I know it's early, but have you discovered or learned anything about the potential for relapse?

DR. ANGELA CHEUNG

Yes. We find that patients would recover and then they go back to work and then it relapses. And so we teach patients to try to modify their work initially when they go back to work so that it's a more gradual thing rather than have bad relapses and they have to go off work again.

BTB

I've also heard an intangible symptom here or effect of long haul COVID. And that's some patients I've read refer to it as the pain that can't be seen. And when you first hand accounts of long haulers, there's this sense of frustration that they don't feel heard or believed. Has that arisen as a factor in your clinic or in your research?

DR. ANGELA CHEUNG

Yes, I certainly hear it from patients. They're very frustrated because this is something that in general people don't understand. And so when they see their physician and the physician do all sorts of tests and they look all normal, then they think is it psychological? While there is psychological issues with some of our patients. I, you know, not dissimilar to other unexpected illness, let's say. We do see anxiety and depression in patients, but it is more because of the physical symptoms rather than sort of the other way around. And so patients are often brushed off and say, you know, it’s your anxiety it’s your depression? And I think, you know, if you were a marathon runner and you can't walk and you don't know when you can walk again. I'm sure that is scary. I'm sure that causes anxiety.

Really no different from someone getting cancer and you don't know, you know, are you going to survive five years? Now usually what I do is I reassure patients that while I understand that they're frustrated and no one knows very well how to improve in terms of how to improve their health. But in general, it's not something that kills them. And we try to work with them to find solutions. So one of the other studies that we are doing is called Reclaim. It's recovering from COVID 19 lingering symptoms. Adaptive integrative medicine trial. It's also funded by CIHR, and we are testing three different therapies for long COVID. And so we hope to start recruiting in January 2022.

BTB

That's amazing. Do you have any projections yet on how far into the future long haulers will be needing clinical care?

DR. ANGELA CHEUNG

That's a good question, I think most people will recover if they follow some of our educational sort of directions. There may be a small percentage that will still need care after a year, I think, because of the scale of the pandemic. You know, so many people affected, even if it's a small percentage of that bigger number, we will see a fair number of patients with these issues. And I think the greater the bigger impact is really on the economy because many of these patients may not be able to go back to their previous level of work. And what we have looked at, I would say that about 10 percent of patients are not back to their baseline at three months and can't go back to work at three months. That's going to really affect sort of how we in Canada recover, and we will need to pay some attention to the health impacts, the long term health impacts of COVID 19.

BTB

What I was going to say then how does the health care system need to respond in terms of caring for and treating long haulers in, say, the months and years ahead? Like, is this a new clinical practice in the in the offing?

DR. ANGELA CHEUNG

Just prior to our meeting here, I was with GeMQIN and Ontario Health discussing this issue, and I think most of us feel that yes, while currently we may require some specialty care for these patients, but it's going to be like HIV, where the primary care physicians are going to be involved and they will sort of, over time, learn what works and will be looking after these patients.

BTB

I'm curious about the, you know, the sort of the nuts and bolts of research during this period you know, in terms of publishing, because it's such a fast moving time and pressure filled, right? Because you're trying to solve a very, you know, wide ranging issue, how do you approach this urgency to publish as much or as quickly as possible while, you know, adhering to applying rigour to your writing and your research?

DR. ANGELA CHEUNG

This is a bit different. Publishing is only one way for knowledge translation. What we have done for CANCOV is we are connected with various bodies. CITF, so that is the Canadian Immunity Task Force. We update them on what we would otherwise call preliminary data. Sort of we share with them in real time what's going on, what we have learned, what we have found. We did the same with Ontario Health. We did the same with Ontario Science

Table. And there's also an international discussion group around COVID as well. And so we have shared with all these places and continue to do so as well.

You know, you always have to juggle patient care and education to other physicians. So we're doing something, called ECHO. UHN is actually doing this on COVID 19. And so ECHO is trying to reach out to community health practitioners, mostly primary care physicians, but not necessarily, and teach them what we know currently up to date, what works, what doesn't work. And then the last piece is the publication piece. And so we have concentrated our efforts mostly on the first few things, partly because it's a pandemic. We want to make sure that patients are looked after and that information timely information gets out as well.

BTB

Your study, which you just mentioned the Canadian COVID 19 prospective cohort study, or CANCOV, has gone from, I understand a six month study to 12 months, and now it's been expanded to three years. What's the focus for you into 2022-2023?

DR. ANGELA CHEUNG

I have to say that initially I thought, especially for the non-hospitalized group, I thought six months was more than adequate, (laughing) well we all learn right? So I would say that we have extended to a year and past a year, and we actually have to thank all the participants in helping us learn about this because their donation of time, the donation of bloods is super important to all of us sort of making a difference. And so in 2022 and 2023, we're looking for support to extend the study because CIHR funding actually ended. It's only a year long for the one year study, and we're also looking for funding to really try to do these extensive T-cell assays to better understand sort of how it affects T-cells and also to look at biomarkers. And I have to tell you these tests are expensive. Like one test, so one set of tests is about $500. And so with a patient with multiple time points and we have 2000 patients, you can add that up. The T-cell assays by themselves is expensive as well. So we are actively looking for support.

BTB

You're listening to Behind the Breakthrough, the podcast all about groundbreaking medical research and the people behind it at Toronto's University Health Network, Canada's largest research and teaching hospital. I'm your host, Christian Coté. We're speaking today with Dr. Angela Cheung, award winning senior scientist at UHN’s Toronto General Hospital Research Institute. Dr. Cheung's pioneering research is made possible, in part thanks to generous donor support. So if you'd like to contribute to her groundbreaking medical research and help pay for these assay tests, please go to www.uhnfoundation.ca/podcast.

Angela, I want to go back in time now. You're born and raised in Hong Kong. Your dad was a pediatrician and when you were young, I understand you helped out around his office and

you would even field patient phone calls at home. What influence do you think your dad and that experience that exposure had on your career path?

DR. ANGELA CHEUNG

I think that was really invaluable exposure. My dad had a very busy practice and usually worked very long hours, and by the time that he would come home, he collapsed and try to rest. And so often, you know, my mom is fielding the calls and I'm fielding the calls, and I think we learn like I learned a lot through that experience and how to talk to patients, how to calm sort of anxious parents because he he was a pediatrician and learning some medical stuff along the way as well.

BTB

Just happened to pick that up. (laughing) And you're just 18 years old when you enter Johns Hopkins University School in Baltimore, you're on your own. You're in a new country. No family. Many of us would, I'm sure, find that prospect a little daunting. What was your approach to this challenge?

DR. ANGELA CHEUNG

Well, I actually came for college, so at 18, I went to college in Pennsylvania and three years later got into Johns Hopkins and studied medicine there. But initially, when I came over, I was quite homesick, not because of missing the people, but it's hearing the language. So the predominant language there was Cantonese and also missing the food. When I first came, I was in a small town outside of Philadelphia. A place called Bryn Mawr it's a beautiful place, but it's a small town. I grew up in a city, so no access to Chinese food, not like Toronto. So I was quite homesick. Those three years of being in college and studying, I learned a lot of things, met a lot of good people, learned the customs. I was part time working while I was doing all of that, and I think those job experiences were also helpful as well.

BTB

Talk to us about as your career unfolded, the role of mentorship and how it you know, shaped your career?

DR. ANGELA CHEUNG

I think mentorship is really important. I think early on I had very good both female and male mentors, and I really appreciated that. So for example, I remember when I was finishing up my Ph.D. at Harvard University and coming back to Toronto for a staff position, one of my mentors told me, you know, pay for childcare. At the time, I did not have kids okay. So make sure you pay for childcare, even if you think it cost you like an arm and a leg at the time, pay for it because it's time limited. And I think that advice was very helpful to me. She also advised me, so this is a very senior woman in general, internal medicine at Harvard. She told

me that, pick the things you like to do. For example, if you like to read bedtime stories to your kids, do that. Don't spend time on laundry or cleaning the kitchen. Someone else can do that for you. And so I think those were really helpful advices.

BTB

And what's your approach now, in turn, as a mentor in your career?

DR. ANGELA CHEUNG

I try to mentor younger physicians, scientists in a similar manner, not only around professional development, but around sort of home life as well, and work life balance. Because sometimes decisions are made, not purely professionally. You often have to make decisions as a family in terms of where you go in terms of what kind of job you take. And so I like to do that and, you know, things that I learned along the way. You know, how many different ways to apply for funding, for example, I try to share with my mentees as well. Because initially I thought there's only one way and that's CIHR, but it's not true. There are many different ways, and you know, it's only over time that you learn these things.

BTB

Talk to us about when you faced obstacles in research challenges, failure. How do you manage that? Because we're not really taught how to deal with failure.

DR. ANGELA CHEUNG

I am not sure that I would view things as failure if your experiment didn't work out or you run a trial and the trial was null. I think we learn something each time we do something and it gets us closer to what we want to find. We want to try to find the truth. So I'm not married to any one specific hypothesis. That's why we're scientists, right? And so I like to use the example of Edison around sort of the light bulb, how he tried so many times and it didn't work. Well, it's like one time closer to finding how you may get it to work. And so I think that principle is really important.

BTB

I read where Elizabeth Blackburn once said she's a Nobel Prize winner. She was asked about the virtues of successful scientists, and she mentions resilience and persistence, as well as being opportunistic and creative. Does that resonate for you?

DR. ANGELA CHEUNG

Yes, I think you have to be creative. You also need to think outside of the box because often the solutions are not what everyone is discussing, and you have to figure a way of trying to step a little bit away and look at the picture because often when you are too into something, you are blinded by whatever everyone else is saying and then you don't really have any new

ideas because you are constantly hearing what everyone else is saying. And so you need to be creative and think outside of the box.

BTB

And what about asking the right questions?

DR. ANGELA CHEUNG

That's important, too. But I think that you learn from experience when you are not asking the right question, you don't get the right answer. So framing the question, that's actually sort of one of the one of the many things that I teach my mentees like, you've got to frame your question right and appropriately as well. Make sure you can answer it with the funding that you got to answer it. So framing the question is really important.

BTB

During the pandemic, you've done a lot of media which puts you in the public eye. What's your take on the value for scientists to communicate what you do in a way that's accessible to a mainstream audience?

DR. ANGELA CHEUNG

So twenty five years ago, my mentor said, don't talk to media. (laughing) And he said, you know, the media would twist your words and take it out of context. And I have to say that certainly I have experienced that. But there's so much more positive things that come out from sort of being engaged with social media as well and media because that's another way of knowledge translation. And as an academic, we need to learn those skills. I wouldn't say I have masters, those skills. I'm still learning. But it can be a powerful tool for knowledge translation. It's way faster than trying to publish a study, present at a scientific meeting and then have that paper picked up somewhere? Usually, science from coming out to practice, we used to say it takes more than 10 years. We can't wait 10 years in a pandemic, so we need to figure out faster ways of doing things.

BTB

There's another aspect to the COVID 19 pandemic that I've observed is that, of course, medical science has this unprecedented public profile, it seems nowadays. And in many respects, it seems like a once in a lifetime opportunity to demonstrate how essential and intertwined it is with health care. My question to you is as the pandemic eventually recedes or fades over time, is there a concern, medical science, medical research and its value will also fade?

DR. ANGELA CHEUNG

I don't think so. I think one thing the pandemic has done is really try to link the clinical scientists with the basic scientists. And I hope that doesn't fade. I hope that, you know, yes. In the media, there's going to be, you know, ebb and flow of different focus. But medical science is so intertwined with health and well-being, which is a very important part to, you know, everything that we do. And so I don't think it will fade per se, but there may be less coverage over time. One thing that you know we all struggle with is the misinformation in the media as well. And how can we deal with that, right? You know, one of my colleagues suggested we should have a debunking site. And it's hard. It's it's like more than a full time job trying to debunk, you know, misinformation.

BTB

Absolutely. Yeah. When you reflect on the success of your career to date, are there lessons you can share that might help young people navigate so that it helps them on their career journey?

DR. ANGELA CHEUNG

I think there are many things I think some of the factors you mentioned as well. Resilience is important. You know, you may be applying to 20 grants and one grant can get funding right. And when you see that things may not be going well, it's not a reflection on you. It may be a reflection on sort of how you approach a topic or how you ask that question or not the right agency in terms of like trying to find funding or support. And so you just have to reassess. So I think resilience is really important. And I think the other piece is about keeping your eyes open to ideas. As I mentioned, you sometimes have to think out of the box. It's good to be able to do that and be open to new ideas. When you ask the specific question, I think, with those two things, persevering is another good trait because there are many more rejections than they are acceptances of, whether it's a grant funding or a paper or whatever. For young people, if you talk to any of us who have been doing this for a while, there are many sort of failures before we can have one success. And so just need to work hard, persevere and have resilience and think out of the box.

BTB

Why do you do what you do?

DR. ANGELA CHEUNG

I enjoy doing what I do. I like to be able to ask questions and try to find answers. I like looking after patients. I like to try to fill a gap in knowledge as well as, you know, science. I like to move things forward if I can.

BTB

So when you look back at your decision at age 18 to leave home in Hong Kong and pursue your education and your career, what do you think of that young woman's decision?

DR. ANGELA CHEUNG

I think it was the right decision. I'm not sure I would have gone into research if I have stayed in Hong Kong and gotten into medical school in Hong Kong. I'm not sure I would have had the opportunity to go to Hopkins and Harvard to pursue education. So I think it was the right decision.

BTB

And your dad, your parents, what would do they think of all the success you've had in health care?

DR. ANGELA CHEUNG

When I got into medical school, my parents asked me, Are you sure this is what you want to do? My dad passed away already, but my parents have always been very traditional. They just want me to be happy, and they have always wanted me to pursue whatever I want. But they just want to make sure that that's what I want. So, yeah, so I think that have been they have always been very supportive.

BTB

That's great. Dr Angela Cheung, award winning senior scientist at UHN’s Toronto General Hospital Research Institute Thank you for sharing your groundbreaking research with us and continued success.

DR. ANGELA CHEUNG

Thanks, Christian.

BTB

Dr. Cheung's research is made possible, in part thanks to generous donor support. If you'd like to contribute to her pioneering medical research on long haul COVID. Please go to www.uhnfoundation.ca/podcast. And for more on our podcast, go to our website. www.behindthebreakthrough.ca and let us know what you think. We crave feedback. That's a wrap for this edition of Behind the Breakthrough. The podcasts all about groundbreaking medical research and the people behind it at the University Health Network in Toronto, Canada's largest research and teaching hospital. I'm your host, Christian Coté. Thanks for listening.

End.