**Radiating Innovation: The Evolution of Diagnostic Medicine**

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You're listening to the cancer assist podcast hosted by Dr Bill Evans and brought to you by the cancer Assistance Program. Wherever you are in your experience, we're here to provide help and hope as you navigate cancer prevention, treatment and care, help when you really need it.

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Welcome to the cancer sis show with your host, Dr Bill Evans, that would be me, and today I'm talking to Owen Roberts, who's the Chief Executive Officer of the Center for probe development and commercialization. Welcome, Owen,

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welcome. Thank you for having me. And that's quite a mouthful, that

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name isn't it is a long name, and we're going to go into it a bit in terms of explaining to our listenership what that all entails, and it's quite an interesting story for Hamilton and McMaster University. Before we start, I always say a little bit about the cancer assistance program for our listeners. Case you haven't heard it before, it's a charity in Hamilton that provides a variety of free services for cancer patients, including free rides to and from the cancer center or other medical connections with doctors and hospitals and what have you. It also provides equipment, loans, wheelchairs, ambulators, other pieces of equipment to help to keep patients safe in their homes, nutritional supports, urinary incontinence, supplies, amongst other things. So it's practical aids to cancer patients. And one of the things that the cancer assistance program supports is this podcast, in the hopes that by making people, the general public, aware, they feel more hopeful about cancer, helping patients as well with their particular journey by giving them more information about their illness and how they can be supported in their cancer journey. So that's the cancer Assistance Program, great charity here at Hamilton. It's amazing to me that there aren't similar cancer assistance programs elsewhere in our province and indeed across our listenership, which now goes to five continents, I'm amazed that there are people out there listening to us. So this will be an interesting program for me, and a bit of a different podcast for me, because we usually talk about cancers, various parts of the body, the support services that are available to patients in our community. This is about bringing new diagnostics and therapeutics to cancer patients and really from really capitalizing, I think correct me. Owen, gonna let you talk a minute from the Bright Minds and universities and commercializing that those ideas and getting them into the marketplace, something that I don't think universities have done particularly well in the past. But before we go there, why don't you tell us a bit about yourself. How did you get to where you are as the CEO of this Sure? Well,

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first off, though, I'd like to congratulate you on this great program. I mean, we've all been involved with cancer in some form or another throughout our lives, and it's a terrifying experience, and the help and the education that you get along the way is so important to making that you know that that this tough part of your life a little bit more bearable, and it's very important for the family. So first off, congratulations for what you do. Very important, Sarah, my little life and how I ended up, as I said before, to you earlier, Sarah, I was just a finance person who's gone wrong, took a wrong turn about 25 years ago and kept on going. From there, I actually is a I came through I was in structured finance for large US institutions in both New York, here and Europe and Toronto. And that was my background. And just around the 1999 period, I've been doing it for about 10 years, and good friend of mine came up to me and said, I had this idea to start up a biotech company. You know, would you be interested in starting up a biotech? And you're kind of one of those forks in the road of your life where I'm either going to be doing this and I gotta, like, fully commit to her. Is there something else I want to give a try for? So, you know, it was 1999 it was the biotech bubble, and everyone was making a lot of money. It seemed like a great way to make a lot of money real fast and then retire on my boat and never be seen again. And, of course, I jumped in with both feet. It was a and the biotech bubble burst. And but you know, it that that was okay. It's, I decided to stay around. Because, frankly, it's, you know, I really enjoyed my previous career in finance. I was very lucky with a lot of people in the areas I worked great, great teams. But the one thing about biotech, medical research, etc, if you're a curious person, it's almost an unending you. Exploration of new developments. Indeed, when I started in 2000 it was the Genome Project. The Human Genome Project was just coming to an end. And in fact, this is in large part a direct line from that human genome project to this today, talking to some of my colleagues about what it is we do now and how we target some very specific proteins, etc, with either probes or therapeutics. We didn't know when I started only, and I'm not, I like to think I'm not that old, but you know, 25 years ago, we were we didn't know all the proteins. We didn't know the functionality. It's an amazing amount of knowledge that's come through being a finance person you know, trying to learn why is this protein called ecbr, one here, but l2 there? And it's like, well, before the Human Genome Project, we didn't know they're the same protein we are same gene came from. And so we gave it two different names because we thought it did two different things. Well, protein, in this situation, did one thing, a protein over here, the same protein did something else. We didn't realize it was the same thing. And you know, you're driving blind in a lot of this and and it's really expanded what you can do. So anyways, deep learning

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curve from finance to this biotechnology,

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unbelievably lucky with some very patient people with me who held my hand and took the time to explain to me what it was that was going on, and kind of, as I used to say, dumbing it down for the finance guy and But slowly, after 25 years, I should have learned something. I should learn something by this I probably actually, you know what, my friends who knew me from the finance go, I can't believe you know this is like 25 years. I probably should know a lot more, but we'll go from there. So, but yeah, no. So started up a company in back in 2000 it was a it was focusing on antibiotics. We sold it in 2014 formed another company in 2014 also in any infectives, and then also got involved in a couple other pro projects, investors. I knew lawyers. I knew from you know, they had this, do you succeeded once? You must be able to succeed again. And you know, actually had, you know, fair bit of luck and success, and it worked on some interesting programs. And the one company that we had formed was just winding down because we were going to sell the assets again. And a colleague of mine, actually, one of my old board members, came up to me and said, Oh, and do you have time? We're restructuring the Center for probe development, commercialization, with a spin out of our manufacturing. Would you like to just help us get, you know, do this process, help them complete the process, look at the legal agreements, make sure that it was all done correctly. And they then asked, Well, would you be interested in, you know, restructuring and reforming and creating what is basically, I like to call cpdc 3.0 which is our third iteration of cbdc, but I'll get into that in just a few more moments. Okay, so that's how I got involved

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in it. Fascinating journey, not a straight line, but a very interesting

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it's biotech. There are very few straight lines in biotech. There are very few straight lines.

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But one of the challenges in universities, a lot of smart people doing a lot of incredible things through their research, publishing and journals, but that's often as far as it goes, but until maybe a major player sees the publication and picks it up and or maybe the people working in their research labs grab the information that's come out of the university and they commercialize it. It seems to me that Canadian universities, and maybe it's more generally true around the globe, have never been very good at commercialization, but in the last, I don't know, two decades, many have created offices to commercialize. I don't have a sense personally of how successful they'd been, but it's always made sense to me that they should try and take advantage of the intellectual property that's been developed within their four walls. So this is something that's come out of McMaster, and maybe you could give us the 1.0 version of the Center for probe and probe development and commercialization.

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So I will so CBI, CPD, Sal shortened the turn to cbdc, so we can keep this under to a half hour show. But cbdc 1.0 was and all of this that came out is the, you know, hard work and vision of Dr John Valiant. I'm now the next person who's had the torch passed on to me for but it really was from what John valen saw his involvement in how. And radio pharmaceuticals. And I'm going to use radio pharmaceuticals. Radio pharmaceuticals just means where you add a radio active isotope to a probe of some sort. I'll get into that a little bit later. That's where the probe term comes up. So you add a radio isotope to a probe, and then that radioisotope can travel to where the diseases that you're interested and either give out a little bit of emission, like low power, so that you can see it show up in what's called a PET scan, or other kinds of scanning equipment, or something that's a little bit more powerful, that will actually break down the DNA and start splitting the DNA of those cancer cells so the cancer cells can no longer function properly or divide, so that in the big picture is what he saw. And John's background in radio chemistry, he convinced McMaster there were these Center of Excellence grants. And so he was awarded a center of excellence grant to do probe development, the IE, the diagnostics, the initial diagnostics to in Canada and out McMaster University, radio pharmaceuticals, which is both diagnostics and therapeutics had been around for for a long time, but really, for a number of reasons, it really had not taken off, one of which I've already touched on, which is the Human Genome Project. Yeah, you want to send this isotope to do its function to a very precise protein. But if you don't know the proteins, how do you know where you're sending it? So it was almost like this. This technology had been in the background, but it finally found a home after the part of it from the human genomic project, part of you know, and many different things came together at the same time to make this a Bible field. What the nice thing about these diagnostics is the dose is so low, they are, you know, considered very, very safe if I'm going to give someone a dose of radioactive material that for diagnostic, it's about the same or less of the radio the radiation you get from being in an airplane. Yeah. So it's very low. It's very low. So these are very generally considered safe, but you need the equipment that could you know once the radio diagnostic is at a cancer cell, you need a machine that can now read that and so can see where that is. And the nice thing is, you can actually start to see volume of the cancer cells there as well. And it can be more precise than just looking at through an MRI or or other, you know, historical kinds of scan, often

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it's because it's picking up the function of the of the tumor, rather than the shape and size.

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I mean, so going from 3.1 again, John Valliant really looked at as he built up from 2008 when this was first got the Center of Excellence grant from the government Canada, and it was hosted by McMaster. They focused on the probes and a lot of the research, etc, going around the probes. But at that time, also people were starting to see the the you know, and and understand how to make this on a therapeutic side as well. Therapeutics, you use a more powerful isotope, normally a metal and that has enough energy to break up the DNA. The diagnostics, all they do is glow, you know, gives a little bit of a glow for machine to pick up and a camera to pick up, and that's it. But the the therapeutics has to be able to break up the DNA, and that feel was just starting to expand, because the knowledge about where it's going, you know inside the body, how it was being excreted outside the body, how you could measure the amount of radiation, all these technologies, all these understandings, were being generated exactly so around 2014 John spun out the research side from cpdc and created fusion pharmaceuticals. And fusion pharmaceuticals grew from 2014 I became a public company, and I gotta get I should have had my dates down, but I think it was 2016 maybe 2018 someone's going to slap me around if I got that wrong. But you got went public on the NASDAQ, and around that time, and, you know, continue to grow and focus on the the therapeutic side. So. Diagnostic side kind of stayed behind. We focused at CBC, and what I'll call CBC 2.0 which was a little bit more in the manufacturing distribution across Canada. These diagnostics helping set up sites across Canada. You have to remember, so for a diagnostic, say you say you've traveled down from down to Toronto or down to Hamilton or somewhere for and you told you're going to get a scan for potential to check for, you know, potential cancer. You got to have your scan at nine o'clock. Well, the people who start preparing that dose that you're going to take and it's going to be injected into your vein. Start working on that about two o'clock in the morning of that day, and they prepare the lb, what we'll call the probe, or the cold the probe simply is that little segment of chemical matter that gets attracted to the Pro, the protein in the cancer. So the probe travels there. Sometimes they call them ligands, sometimes they call them probes. I wish they'd just pick one, you know, so people don't get confused. But we'll call them probes because it's in the name of of our company. So I'll stay with pros. So that probe goes to a protein and you just attach, normally, for a diagnostic, it's something like a fluorine 18 or gallium 68 which are, you know, less powerful isotopes. So they make, they make up the probe, and then at the end they attach the the isotope, be it gallium or fluorine. And so this is now about six o'clock in the morning, and so now they have to do it, do the QA, QC, make sure it's all ready to go. And everything worked right. They have enough radioactivity in the dose so they can be shipped off to the hospital. And you got just a few hours to get to the hospital, and it shows up at seven o'clock, and you have the patients all lined up ready to go, and you give the patients their dose, because for these isotopes, their Half Life is about 100 100 minutes. So very short. So you're, you know, get a get in line up, because you know the person you dose. At 8am you give X amount. But by 11 or noon, it's you got to give them more to get the dose up. And then by, you know, the end of the day, it's all washed out anyway, so this is just in time medicine. So for the diagnostics, you got to bring the people in, if you have anything go wrong along that pathway, you might not be able to dose the patient. And you have some person who, like, who's, you know, being told that they might have cancer and that they have been brought in. And this is the first step in how to figure out how to treat, how severe the treatment, how severe your cancer is. And if you have any kind of failure along the lines you know, you have unfortunate failure. You have some someone has to go up to you know a patient, and say, We're very sorry. It's not today. It's being dead, and we have to now figure out where you fit back in the queue, and it's very stressful. So being able to produce consistently and not have failures is is hard, and it's a just in time medicine, and that's something that cbdc and cbdc 2.0 was working very hard. We helped set up. We helped some other sites across Canada also get up to being consistent on delivery. We had a very nice joint venture with new HN called can probe, and we were doing probe trials with UHN. But these are very it's very stressful to be able to make these in a timely manner. Now

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the radio labeled isotope. Where is that made? Is it made in a nuclear reactor somewhere on campus at McMaster, or whereas, like radio label slurring or or gallium. So

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I'm going to generalize, so we can keep this under two days, I guess No, but I'll Jared to be in general. So as I mentioned, when you're doing a diagnostic, the isotope is a less powerful one, so it takes less energy to create it. So most diagnostic isotopes are either made on a cyclotron. The cyclotron basically speeds up neutrons and spin spins and then they hit a target in the in the case of fluorine, the targets oxygen, and so you knock off, you destabilize the oxygen. Becomes fluorine, 18. Another one that is done is gallium, 68 those ones that one can be done again in cyclotron, or they can actually have desktop generators that you know, slowly. Generate enough of this. So those ones less energy done in smaller, you know, places or insights on the therapeutic side. I know we're jumping around a little bit, but answer your question, that's a more powerful, you know, isotope, because you wanted to do something more than just, you know, break up the DNA. It's got to break when the DNA actually doesn't, you know, those those, they don't actually take that much to kind of split up, but you have to be focused. It has to be there. So those isotopes are often made as can be made a nuclear reactor can come from actually reprocessing nuclear waste. Canadian Nuclear Laboratories has a good supply of that. But those those take much more energy, and those are generally a metal of some form, so you're talking about actinium. Is you know, isotopes like that there. So they're kind of, they take more energy lutetium, which can be made at McMaster. They take the target, the original Metal, and they would put it in nuclear reactor, and the nuclear reactor bombards it for a fairly long period of time, and then pull it out. Then you have to some of them are Lutetium. Some of them are other things. So you have to purify your lutetium in that case, and then you can deliver it. But the nice part with that is the half life for that is days, much longer. So in the case of something like lutetium, it might be the raw they might be produced. And it is produced at McMaster. It could be produced at Bruce Power, just, you know, on the shores of Lake Huron. And they have a very Bruce Power has a very good program that they just started. They produce lutetium, but it's, there's enough time to get shipped either to, I can't remember, is it South Carolina or in Germany, to be refined and purified, and then it's actually shipped back to, in many cases, shipped back right back to here, to Hamilton, to get processed into the medical product. And even then, it still is days that it can be shipped, because the half life is so much longer. So you have time. It's not infinite time. It's not like the medicines that you would see at a pharmacy, which are on the shelf for months, years, etc, but they will last for a much longer period of time.

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So some of our listeners would be familiar with PET scanning. So yes, yeah. And the situation there is just your radio labeling glucose with radioactive slurry, like your F 18, and then cancer cells are taking up because they tend to metabolize glucose more rapidly. So then they can be under a scanner and see the hot spots, which are the areas of cancer. And so staging. Here you're using different substrates to go in, which are part of the targeting, so you get very specific interaction. And you're particularly working on one for prostate cancer, right? Talk about that a bit, sure,

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sure. Well, I'm just gonna, I'll even step back just one second, because you're what you what you want is you want. In the case of the glue cloth, this is actually called FDG, F 18. So if you ever this is the most common radio probe radio diagnostic out there is FDG. It's it's generic, so it's cheap. It's fairly simple to make. It's a sugar with, as you said, an F 18 attached to it, which is fairly and fairly simple to do, said by the finance guy who's never put his hands under a hood. So I can also, it's very easy to do. I have no clue, but that's what I get told. So FDG, but FDG hits a lot of different cancers. Also, as you mentioned, though, it is basically a sugar. So it's showing where the glucose is being taken up. And as you said, relative to other cells. The cancer cells, which are growing rapidly, need to take up a lot of these sugars, so relatively too. So what you want to get is the biggest difference between the relatively, between a normal cell and the cancer cell, because then you can, you know, separate them on this on the screen, the question has become, I'll call I like to think of FDG as the first generation. I know there's a lot of academics who we say, No, 1960s we're doing this stuff now. But the real medical utility and PET scans, FDG, it's again, ubiquitous out there, but now they've said, Okay, well, you know, it's we're trying to get the difference between the cancer cell and the background normal cells. So let's start looking at, again, back to the human genome program, what kind of proteins might be. Specifically over produced at by a cancer in a cancer cell. So as a cancer cells grow and proliferate. Do they have one specific you know, can I find some protein that's unique to a cancer cell that's not really out there in the regular, regular, healthy cells, so I can differentiate between the two and PSA. I'm many men, I think, have had their PSA levels checked. That's for prostate cancer, prostate specific antigen, for antigen. Yeah, exactly. Membrane, okay. But, and actually, the membrane is important because it's on the outside, and that for our that's the PMSA, yeah, exactly. PSMA, you're absolutely right that. But that's why we're so interested in the membrane, because it's specific, more specific to prostate cancer than anything else. Now, your listeners and the other researchers say, well, actually, you know this. This cancer also seems to produce in that but for prostate cancer, it is quite large. So if you know that, which is, again, something we you know we barely knew 25 years ago, well then I maybe, if I, all I need to do is find a probe that binds to that membrane, the surface membrane with PSMA that binds to it, and if it binds to it, and I put a weak little floor, fluorine 18 or gallium, 68 attached to it, well, now I've got it radio labeled. I've taken an isotope and I've attached it to there, and I can see how dense it is and how, by how much it glows, I can actually get an idea of volume and etc. And even more important, if the disease is metastasized, ie, spread throughout the body and stage four cancers and generally metastasized, well, this becomes a big problem for something like prostate cancer or other cancers. Where has it gone in the body, and because now it's normally if you have prostate cancer. So whether they're looking at the prostate bed in the groin, and they may not know where it spreads throughout the body, but with these radio diagnostics, you inject it and it will go wherever the PSMA is. And you can now see, oh, you've metastasized. And it's here, it's here, it's here. We have to make sure we biopsy here, here and here. And the other thing is, you know, that's the diagnostic side. That's so we are involved with a clinical trial for a diagnostic called PSMA, 1007, and it has. There are a couple PSMA diagnostics out there. Each has its different characteristics. Each has its different utility. So, and I'm not here to go on, but promote, but also you would take their you know, at different stages of the disease, different diagnostics will have different utility. And so this could be, they're all important tools to have, and the more tools in the toolbox, the better.

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And particularly, I'm just thinking of an individual I know who you know has had treatment for his prostate cancer, and his PSA was normal for protracted period of time, and then it started to rise. But other imaging, you know, the anatomical imaging we can do with a CT scan or an MRI, didn't show anything. And so they didn't know, really where it was coming from. They ended up providing radiotherapy to the prostate bed, so to speak, right where the prostate was. It was kind of like shooting in the dark, whereas what you're describing is a way of actually finding where the PSA was coming from, because of it's got PSMA, namely the membrane antigen, and there's enough of it, you can find the location. And maybe we should be shooting with your radiotherapy to a different site, or using a systemic therapy to manage the disease, so and see how this is a very valuable diagnostic tool

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well, and actually we have, you know, obviously gone to the next step is, okay, take the same probe, attach a more powerful radio isotope to it, and now you have a therapeutic. Now you have a therapeutic. Now you have a therapeutic. Now, I won't get into all the chemistry in between, but that's basically it. You take it more powerful. Some people like to say, Okay, we're attaching a little cellular bomb to a zoo probe, so that, you know, I don't like the term bomb because it sounds more violent than it actually is. You know, really, if you step back, so many of us have had, you know, no people have had radiation treatment where they, you know, they try and blast the cancer with radiation, which does the exact same thing. You give it enough energy that the DNA is no longer lined up as functional, etc, and so it can't reproduce, because the DNA is no longer functional. So,

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but the external radiation has got to go through a lot of normal tissue. Where is your your radio pharmaceutical is just right in proximity, right up close to it. So

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that's the idea. And we've gotten, you know, one of the, some of the biggest advancements in the last couple years has been how to, you know, understand how the dose of the radiation that's being given, how to find the isotope that, you know, matches up nicely to how long the probe is going to be there. So you don't have other isotopes floating around in the body, etc. And so you're trying to manage the the dose of of the the radiation. And it's, you know, it sounds easy, but it's, it's a lot of it's, it's quite complex, but you're absolutely right. So the the the Health Canada just recently authorized the first radio therapeutic for disease in Canada, and surprise, surprise, it's for prostate cancer. And it is, in fact, you know, targets PSMA, and it's called pluvicto, and it's not a product. Io, did I have any sand? No virus has it? And you know, it may become available. And marketing can assurely, there's a little, as any one who's being in pharmaceuticals or biotech knows, just getting registered and getting healthcare and approval, that's step one. Then you have to go, Okay, how do you train the doctors to understand this? How do you get, you know, compensated for this? How do you get you know this? And also, there's a whole you know, you don't snap your fingers the next day, and everyone suddenly knows, oh, I know how to dose people with this. I know the perfect patient for this. We got a long way to go. And you know, for right now, it was only, I believe it was only registered for meta people who have stage four message, metastatic cancer, so spread throughout the body. And you can see how valuable that would be, because you will go find where the diseases in the body come back, but you have to remember, people who are at stage four are very sick, and so it's, it's tough, but that's, that's generally, you know, the path for new drugs. It's always given first to the sickest, unfortunately, as we continue to understand, and then everyone you know, health can and the FDA, as frustrating as they can be, but they're frustrating because they're there, because their first job is safety. Yeah, gotta pretend. So they're exactly and so they're they work that way for safety. So no matter you know, you can, yeah, as a drug developer, you can say, you know, I wish that, but at the end of the day, that's the right thing. Well, as a FDA person once told me, you know, the safest thing I can do is not approve a drug, because no one will ever yell because, but if I approve a drug and someone gets sick, I can end up in front of a, you know, above committee and getting yelled at. It's like so if you know, if I want to go home at the end of the day, I get paid the same whether it approves a drug or not. So it's actually in my incentive not to approve any drugs I should, you know, and then I could, you know, never be bugged. So they do a good job. You're not gonna get any complaints from about about either the FDA or Health Canada. For me, it's

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interesting, I think, though, how this may impact who even delivers cancer therapies in the future. Because, you know, typically, it's nuclear medicine, people will understand a lot of the dosing and deliver and delivered radioisotopes to patients for diagnostic purposes for eons, right? And at one point they did a lot of the diagnostics. Because when I was a young oncologist, you ordered radionuclide brain scans, liver scans, bone scans, and then along came CT, then MRI, and we order a lot fewer of the nuclear medicine scans, because they're little less clear, shall we say, in defining the anatomy. And I think in some respects, nuclear medicine, we kind of went into quasi dormancy, and it wasn't that interesting a career. But this is going to change the dynamics. I know. When pet came along, there was a great resurgence of interest by nuclear medicine physicians, and as more and more of these targeted kinds of radio diagnostics and radio pharmaceuticals come in, then they're going to become an increasingly important player in the treatment of of cancer patients. It strikes me. So it's we're in an interesting phase right now. I would say,

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I would completely agree, and but, and you were, I think you're hinting or going along the exact same path. It's, it's always several things come together at the same time. You know, we had to have the Human Genome Project, but the technology, about the PET scan, you know, the clinicians who knew how to use it, etc, and all these. Is coming together at the same time. And all of a sudden, you take a big leap forward, and then you go, go along. And then there's, you know, five years later, someone comes up with something else. So you know, what you're seeing here is what happens when several, I several important steps come together at the same time. The utility of radio diagnostics took a couple things. I talked about the human genome project before, so that we at least knew the proteins that were specifically targeting. But this PET scan technology, you know, all of a sudden, you know, it's a step increase from MRI or CT scans. You know, no one's going to, you know, move from MRI to pet, if it's only at the margin, something better. But when it becomes evident that, wow, I can see the volume. I can see the size a little bit

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more. I can manage it with the technologies, because you have PET CT, so now I see the function of the tumor, and you see the anatomical location, same time. That and beautiful. You

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think of the utility that that gives you as a clinician, as a doctor. So those technological steps, that's what that was, brings it together. And then you had people like Dr John Valiant, who had been interested in this space for a very long period of time, and all of a sudden, you know that. And it's not just him, but you know others. Then their technology takes it off. And we're getting right now, more and more researchers, because the field is taking off. It's very interesting, and we do a great job here at Kevin. You know, on the research side in this space, we do a lot, and it's only recently now that we could be recognized, which is quite nice, both here in Hamilton at McMaster, which has a research facility in the in McGill, and in the in the Quebec corridor of Sherwood Sarah, they have quite a good radio pharmaceutical space and research. And of course, there's a triumph for research facilities out by UBC in Vancouver, so and there's a great deal of great work being done there. So we've been very lucky, and only recently. It's quite interesting. You know, the rest of the world has recognized it long before, as can in our typical Canadian passion, we don't even realize it, but in the last six months, and there's a small company that called Artemis out of Vancouver that generates, that has gallium generators, just got bought for 90 million US. Point bio, which the previous seat, one of the previous CEOs of cbdc started up here in can, Canada, just got bought by Lilly for 1.4 billion US. And then at a sorry fusion pharmaceuticals just got bought by AstraZeneca for 2.4 billion, which is, you know, the rest of the world is seeing the value that's here. Another when we went from cptc 2.0 to CBTC 3.0 was when we spun out our manufacturing into a company called Adam B, which is still located at McMaster, but is building a large facility up by the Hamilton airport. And it attracted well more than $90 million Canadian to build the facilities there. But they become, they, they manufacture the radio therapies, ie, those longer live the pros with a longer live isotopes for all of North America. And they do a fantastic job. And they have contracts with, you know, all the major pharmaceuticals. They're, they're, they're very busy. So I

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think a lot of Canadians are totally unaware of this success story. It's

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got well hidden success story. Three of those companies are within, you know, miles of us, 100 kilometers we're sitting. And that's, you know, 4 billion US Canadian of value that people have said we want to buy these. You know, the comment the rest of the world comes in a season. Well,

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let's take a brief break here and we'll come back. I want to talk more about sort of the process of commercialization, from going from the university research through to being traded on NASDAQ or whatever. So we'll be right back in a moment. We'd like to

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take a moment to thank our generous supporters, the Hutton Family Fund and Banco creative studio, who make the cancer assist podcast possible. The cancer Assistance Program is as busy as ever, providing essential support to patients and their families. We remain committed to providing free services for patients in our community, including transportation and equipment, loans, personal care and comfort items, parking and practical education. These services are made possible by the generosity of our donors, through one time gifts, monthly donations, third party fundraising, corporate sponsorships and volunteer opportunities. Visit cancerassist.ca to see how you can make a difference in the lives of cancer. Pay. Patients and their families.

40:04

We're talking to Owen Roberts, the Chief Executive Officer of the Center for probe development and commercialization, or for short, cpdc, and really interested to hear how this has developed in Canada and spun off some really valuable companies with excellent contributions to the world of diagnostics and therapeutics in cancer, and it starts in the research labs of universities. And as we talked about a little bit in the first half, universities don't have a great history of bringing their research results to market, so to speak, and commercializing them. So maybe you could tell us a little bit of how do you go about doing that? What are the practical steps that a researcher would take in order to move from his wet lab to actually having a company that's making money.

41:01

Well, it's pretty hard. The business, the business of biotech, is a tough one. You're a clinician and yourself. The mindset that a researcher has to overcome is they can't think of themselves as the science. You can't fall in love the science. You have to think of the clinician like yourself and say, Why is this clinician? What do they want that they will then prescribe and call for this? What is the target product profile of that a clinician will want to use? And does my technology drive towards a unique product profile? So what is it? I have this wonderful bit of technology, okay, I get people approach me all the time and say, I have this great idea, this great idea. Okay, why is a doc going to prescribe what you're going through? What is the target part profile? Okay, the target is going to be, once a day. Is it is going to be, you know, let's go, let's say a radio therapeutic. Okay, what's the disease? Because, remember, you're going to do a clinical trial at some time, and you're going to do this clinical trial, and clinical trial, if you go back to your high school science. So you're going to write out, I am going to dose a patient once every week, once every two weeks, once every month. You know, what's it going to be and what's the advantage of dosing once a week, or once every two weeks, or once every four weeks? Is that an advantage to a clinician? Like does the clinician even care? Maybe they don't. Maybe they prefer to see every four weeks. Maybe they want to see every two weeks because they might want to change the dose if they're not seeing the response they want. Is there an advantage to that? Well, ask a clinician. Don't ask me. Ask a clinician, what is it they want out of this? What do they need from this? And does your science apply to that? And then once you know, okay, this is going to dosing. I'm going to assume, because we're doing radiotherapeutics, is going to be IV. But does it have to cross the blood brain barrier? Do you want it to cross the blood brain barrier? You probably don't want it to cross the blood brain barrier. Because if you're doing a therapy, why do you want to have anything floating around the brain if you're trying to do, you know, ovarian cancer. Say that's say that's your target. I'm going to do ovarian cancer. Well, if it doesn't cross the blood brain barrier, that's a benefit. Okay, so how's it going to be excreted? Well, I don't want, if I'm doing ovarian cancer, I probably don't want it being excreted out of the body through the kidneys, because then I'm getting, you know, glowing around the kidneys and stuff, and I can't really see what's happening around the ovaries. I'd rather have excreted out of the liver, perhaps. So okay, so what do we have? We're up to something that we want dosed once every four weeks, because that's what the clinician wants. We don't want to excrete it out of the kidneys, because we're going after ovarian cancer for a safety profile. We want this, this and this, and maybe we don't want it crossing the blood brain barrier and going to the brain, because that's one less or major organ that we don't have to worry about what the side effects are. And you you start thinking about it, you say, Okay, this is my my product profile. Find a clinician and say, Do you like this? If I created something, because I think I have a technology that will make this would you prescribe it? Would you find some utility to it? You'll be surprised. So often the docs will go, no, no, I have something else that's pretty much just the same. And so your technology may be, I have a different isotope that has some kind of, like, slightly unique characteristic, but to the clinician, they're like, yeah, that may be at the margin. That would help. But really, what I want is this. So my comment to people in academia who are looking at biotech, talk to the clinician you. Forgetting who your customers, your think you know your customer because you think you know biology, anything. My customer is biology, and that biology, I got this thing that does this biologically or you know, but the customer is the clinician, the person who's going to prescribe this. Sometimes the thing that you actually invent is a way to get a patient out of a hospital quicker, or something they can take it home, which is not this case. This isn't this is not a whole medication business, but you had these are all things that what you'll be surprised why? If you don't talk to clinicians, you may be surprised of why they chose something, why they it can sometimes be, well, this would be great, but to monitor it, I need this kind of equipment, and this kind of equipment is unavailable in my hospital or in Canada, or it's so unique that it'd be too expensive to make it practical. Now, many, many, many decisions that you don't think of So to your question, why do we sometimes academics fail? And it's not at all just a Canadian disease. It's this is, I have this conversation all the time. Someone is just the brilliant, brilliant science, and you couldn't complain about the science, it's just fantastic. But you're like, what's your product? What is it? You forgetting your customer? You know

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about the customer? I might add, you talked about how the customer is the physician. That's a key customer, but I'd say the patient is also the customer. But the things that resonate with the patient, maybe the four weeks, as opposed to the weekly treatment or something for sure, and then even the payers, because the payers are so conscious these days of what everything costs, which is often egregious in terms of its amount. So the things that make or keep people at a hospital or get them discharged sooner or make travel to and from a hospital or other healthcare facility easier. All those things become factors. So it's multi multifaceted, but knowing kind of the audience of sorts, I

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think this is one of the things from the audience who are often, this case, very much the patient. Remember that your doctor and your clinician is often the gatekeeper, yeah, for the medications to get moved absolutely and, you know, we, we always refer to them as knowledge leaders or whatever. There are champions in the space. They tend to be, you know, the younger guns who are really keen. And, you know, this isn't, yeah, the two of us are exceptions to that, of course. But anyways, the very king, but, you know, they're the ones who will promote and put the energy and like, Hey, this is a good you know, we need to screen some very important

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first step right to know that you've got something that prescribers would actually want to need, yeah? Having done that, though, it seems to me like there's some other steps that are equally challenging to get over, like, especially if you want to kind of move towards becoming a company. Like most researchers have no idea, yeah, how to create a company, right? No, they

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how to raise capital. Well, raising capital is always a challenge, and raising raising capital is especially early stage. So biotech is very risky. I'm unaware of any industry that has a higher failure rate than biotech. Oh, really, yeah, you know, people say, you know, it is pretty risky, too, it is. And you know, technology stuff, but you learn very quickly that you failed, you know, you make a product, you know, and you can sell it quite quickly. You can get it out, and you can see if it has traction, and within two or three years it's not getting sales, you know, it's not working. So it's done in two or three years in biotech. Okay, let's say I have a conversation with you as clinician, other clinicians, and then I also talked to a patient group, and from the patient group, you know, this is, you know, seems attractive, seems attractive. So everyone, I'm getting all the signals at the at the top. So I come up with my target product profile. Job one, have a target product profile. You will never hit exactly your target product profile, but you need to have, you need to at least have a target of where you're going, because if you have no target of where you're going, you're going to go nowhere. You're just going to go round and round circles and go from there. In biotech, generally speaking, you have a target. In this case, let's say, let's say I was doing something like PSMA. Go back 15 years. I have a target for PSMA. Okay, that's my target. Now I have to make some chemistry that will stick to that target. And so I come up and I'll do this, you know, in vitro, which basically means in test tubes to me. So I'll see if there's some binding here. Great. I have binding this, this, this chemical, molecules. To this PSMA protein, and this could be fantastic. So now I go from intest tube to in animal or in vivo. Okay, great. I take the same chemical matter, inject it into a mouse or a rat, and it breaks up in the plasma. Okay, start again. Okay. Now I need a molecule that will stick to this and not get broken up by by by plasma, so I get from there. Okay, in it goes, Great. Now let's put it back into into the mouse. And yeah, I guess it would have stuck to to the PSM, any but it also seems to stick to the liver, the kidneys, everything else is not okay. Give me another one. And then you go back, and you go and you go on the circular route, and then finally you got one that shows you have what I like to call a hit, or a lead. Or a lead. A hit is when you just have something that sticks a lead is when I put it into a mouse or a rat or some small rodent, and it actually seems to travel through the rat system and glues itself to that protein, that magical protein that I was hoping it would glue to, that it glued to and attest to, and now it glues to in a mouse. So if only we were all mice, we'd have cured every freaking mouse disease on the planet, because we've done so many experiences of us, it's a real pity we're not

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mice, and then mice are not manned, and then go do the whole thing all over again in a clinical trial.

51:26

I've Yes, in fact, we go through that. So then I so now it's, it sticks nicely to the to the it's really in vivo. Okay, I've done that. Then let's go back and look at my target product profile. I wanted it to be, I dose this period of time. Okay, well, this one is sticking to it, but it excretes like in minutes. So it doesn't stay long enough. It breaks up in the liver too fast. So okay, so I got I'm getting closer, but I gotta now work on getting past the liver a few times, a few passes, so it's not excreted as much. And okay, it's getting past the liver, but it's really hitting the kidneys hard, so I got to find something that gets past the liver, it doesn't hurt the kidneys as much. And so this is lead improvement. I mean, improving my lead, you know, so that I find a lead that matches my target product profile. And then once you get to the nice lead, then you say, Okay, I think in mouse and everything, it's working well. Now I gotta go through and do what's called preclinical trials, healthcare and the FDA has a beautiful written list. These are the experiments you need to do before we'll let you put anything in human and there's, here's all the safety tests. Here's what you have to know about. You have to, you have to be able to tell Health Canada and the FDA, yeah, it works. But why does it work? You know, we're kind of curious like, you know, those days of, you know, chewing on bark and feeling better because it has, you know, Asa or whatever in it, they don't accept that anymore. They Well, it just works. You know, they like to have an eye Well, what? What is it that you think is happening here? Yeah, what's the mechanism of action that's taking place here? They want to know that, you know? And then the other thing that always gets skipped, always gets missed, because I look at these things all the time, you need to be able to go up to healthcare, in the FDA, and say, I'm making this. This is how I make it, and this is how I know I've made it. And these are all the steps. These are all the assays I'm proving these assays work. I know all when I make this. I know what all the little impurities are that might come up, and the impurity level will never be more than this. And those impurities are not noxious, right? So you have to do the next stage. After you get permission to do what's called ind, investigative new drug, you start your clinical trials. I will get back to your How do you start a company? But now with the IND, now, I promise, but now with your ind, I said, Okay, I came within 80% of my target product profile, I'm now, you think I've spent money before. I'm now going to put these things into humans. I'm really spend money now. Before that, I'm going to go back to you one more time and said, Look, I'm about to put a lot of money into some trials. You still think you would want to do this, and you might come up to me go, Yeah, well, five years ago, I wanted it, but these guys did something that's better than yours, so I probably wouldn't want this now. So you this happens. It's part of the game. It's not the game. It's part of drug discovery. But if I go to my pool of clinicians and they say, Yeah, we still think this is great. And we probably had your letters sent to the FDA as well, saying these people would like to see this, because the FDA is always saying, Why are you giving this to humans? Like, yeah, you think it's safe, and this is what you can't just say it's safe. She's like, what is it that you expect to come out? Right? And I put you all back to my comment, before your high school science experiment, you're going to write out your experiment first. You don't. See what the experiment was. After you get the result, to make it fix, you're going to say, This is what the result is. So then I go into three sets of different kinds of clinical trials. The first one is what's known as phase one, because we're all very original. So phase one clinical trials is and these are general but safety, if it's not oncology, if it's just for safety, you basically get go to a university, put posters up and say, We want males, age 18 to 25 males, because we don't have babies, we're not gonna be accidentally pregnant. 18 to 25 we haven't got all the comorbidities, comorbidities that rough life might have given you at the age of 30 or 35 so you're still pretty healthy. You're pretty young, and we're gonna use some use you. And this is we're gonna start you off. I've I've shown how much, how how much of the stuff I have to give to rats before I kill or mice before I kill, half of them, and then how much, before I get any side effects, and then I probably put it in dog as well. So whereas, okay, so I go to the FDA, it takes, this will take 1000 MiGs per kilogram.

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Is where I get, you know, safety issues. So I'm going to start at 10 MiGs per kilogram. I want to start one, 100 and that's my safety window. And I believe when I get up to 100 MiGs per kilogram, that's when it's going to be efficacious. Swipe huge safety window that I expect, and we're gonna go do this. So I do a feed and bleed. I bring in a bunch of university students, and you beer money, and we give them the drug. We give them one a day, and then we give them single ex scaling. So 10 milligrams, 30 milligrams per gig, 100 milligrams per gig, 300 milligrams per gig, maybe I get up to 1000 milligrams per kick. I probably don't go past that, because I have no need to go past that. And then I jot down all they had. Okay, that's fine. Then I go back and I do, okay, I'm gonna give you 10 milligrams per kilogram twice a day for three weeks. And so you're finding your safety so that's the so then you get your safety window and sign in mice, rats and dogs. I think I'm going to need to dose this, this and this. So I'm going to do what's called phase two. Phase two is when I do my first sick patients. And now I'm trying to figure out, is there some signal that I'm getting, getting these patients better? So now I'm going to say I need to get some level of drug into the person. I don't know if it's twice a day or one pill a day. So I'm going to do your this group here. I'm going to do you twice a day, 30 kilogram, 30 megs per kilogram, and you're this group here is going to get 100 mega kilogram once a day. And I may move it around a little bit, but this is my face too, so I'm kind of still seeing how it works. I'll do maybe 100 patients or something like that. You know, depends on what drug I'm doing. But let's say it's 100 patients. I'll get my data, and I go, Oh, you know what it was looks like. It was actually probably twice a day, but I didn't need to go out as long so it's twice a day for two weeks, or something like that. Okay, that's it. So now I'm doing my phase three trial. Now this is the high school. Write down everything at the beginning. I am going to do 1000 sick patients who have this disease between this age and that age, and I write out exactly what the patient is going to look like, and this is going to be my cohort, and the FDA is going to say, That's too narrow. You have to broaden out the population for all the kind of sickness. Because my My desire is to make sure it works. So I'll say these patients exactly work, and the FDA will say, Yeah, but the world is really made up of these people. So broaden it out for the Health Canada. So you get there, and that's actually a good thing, because you want this to be as broad as population as possible. And you might, and you do your experiment, and you come, this is going to be my endpoint. And with all the endpoint and all the data, and it gets checked and double checked and triple checked, you go to the AfD, hey, go to healthcare, AFD, with your dataset, and you say, This is why I did. And they say, perfect. You are now going to give you permission to prescribe this drug. So that last piece is can be hundreds of millions of dollars, depending on what this how long it takes to follow people, etc, but by the time you get to phase three, you have a pretty good chance of knowing what's going to happen phase two, you have by the time you get into phase two, you have a good idea what's going to happen. You may we had this conversation before. We're not mice. We've done all these experiments on mice, rats and dogs, or whatever the case may be, but we're not mice and rats and dogs. And so the question becomes, what is the risk before you get into humans, and once you're into humans, these programs get people can feel they can start to match. So how do I fund myself? I have to find go back and as early as possible if I have a lead that matches a target. Profile. And I have a bunch of clinicians who say, if you get this, and this looks like it's all good, this will be a good program, that this is something that the world needs, this meets a major medical need, then that's that's probably financial. You'll get less value than you think. You'll get significantly you think, Oh, this is a billion dollar company. Well, actually, I'm going to say it's worth 20 million now, right now, because we're going to be putting in another $400 million before we get to the market. So even if it's a billion dollar company, if the math is tough before that phase, before you're actually, you know, have a lead, and you're just optimizing your lead or have a hit, it's quite hard to raise pure equity, but there are a lot of grant programs, and they're companies like us, because we're a not for profit company, and we are looking for those kinds of things where we can take a risk that a VC might not take. And we can work with other foundations and other groups to try and raise that capital to get what's, you know, ubiquitously known as the valley of death, because you have, you know, you have a good hit, but you have to get from the hit to an optimized lead that matches a target product profile of something people want, and that valley of death takes up a lot of experiments, but there are grants. There are early stage support companies like my like ourselves. We have, we've worked with a group called the Canadian medical isotope ecosystem, which gives out small grants of half a million dollars to try and fund these experiments. And that work can get done. And so you want to get through grants, non VC funders, generally speaking, to that that stage where you can get to that lead, optim optimized lead that is more fundable, white PCs, obviously, the further you go down the line, the more people are interested in funding it. You can also partner with other pharmaceuts and partner with other biotechs, large biotechs who are interested in the same space, who are more comfortable with that level of risk, who may want to do a collaboration where they take over part of the experiments, where they say, Okay, well, you know, as we do the lead optimization, you do these, and we'll do these, these, these hits, and because we like that, and we get first rights of this and that that's Ways to Get, get this, these things before, I

1:02:32

think we just had a short course on how you develop a new pharmaceutical, and it's very tough, and maybe a short course, but it's a long journey, and I think people would have the insight from what you've said, that there's a lot of pitfalls the valley of death, because in developing new cancer drugs, I'm my understanding is about only about one out of 10 ever succeeds, and maybe that's even a high ratio. And then there's a lot of expense along the way of doing the Phase 123, particularly phase three, where you're involving a lot of patients. And increasingly, these studies need to be done in many sites, involving lot of patients, sometimes from different countries around the world. It's It's not simple, and it partially explains why the prices of these new products are expensive. You have to recover all your R D costs, and then you hope to make some money so that you can reinvest to make the next investments in R and D for other products that will follow along.

1:03:37

If I can just add one more thing to that. So actually two things. One, the One in 10. It always depends. Whenever someone says that to me, it's like, well, from starting from when, from when, I would say is one in 10 at best, once you're even in human trials, yes, you know, forget when you're all the way back here, it's, if you did the math, you probably wouldn't start. That's, that's, that's the one thing. The other thing is, yeah, this, look, there's huge promise from radio pharmaceuticals and radio therapies, but it is expensive. The isotopes themselves, just for one dose, can be 1000s of dollars just for one dosage, just that, that portion of the radio isotope that you're attaching, depending on which one it is, how scarce it is can be, thou can be 1000s of dollars. So then you get the idea. Well, then there's all the other manufacturing, there's the delivery. It's, this is not cheap medicine. However, it does have the potential to be another order of magnitude jump in our, you know, tools of treatment for oncology. I mean, you have immunotherapy, which has changed that section of the world. You have, you know, I mean, you have, and this could be another of the same order of magnitude as we. Happening with immunotherapy. I

1:05:01

think there's huge promise here. I think it's a very exciting area, and I think it's particularly exciting of a lot of it's happening in our backyard here in Hamilton, and through McMaster University and in collaborations with other Canadian institutions. And that your center is one that's sort of supporting, encouraging, helping to fund,

1:05:22

we're helping down at that early stage. That's where we're trying to, you know, those, those people who are in the clinical trials, they don't need us. There's others who who are prepared to fund that, yeah, and they do it well, yeah, and they know what they're doing. You know, we're playing in that earlier stage where we're, trying to do lead optimization and that kind of work. That's where we look around the landscape and go, Where can we what's missing that we can fit in, right? You know, we have advantages where we are a not for profit. We do have grants. We do have access to grants. We also know foundations like to work with other not for profits. So we can work with them because, you know, their members don't want to feel like they're, you know, helping Pfizer, though, you know, not trying to slam Pfizer by any shape or form, but, but, but, you know they, they, but if they know they're helping early stage research with a not for profit that's trying to recycle money back in it's an easier story, and it's, it's one we believe it.

1:06:18

Well, I definitely excited by what you're doing. And I'm also very impressed at the both the excitement you exude when you talk about this, because you're obviously very, very engaged in it, and by your, I would say, almost transformation from finance guy to biologist, interesting merger of ideas and learnings and so on. I think it's been really interesting to hear from you how this center has made such an impact already, and I anticipate more impacts to come in the future. And I just really want to thank you for this podcast today.

1:06:52

Well, thank you very much for letting me join you. Thank you very much again for the work that you guys do. It's really important, and anything we can do to educate people in this, you know, very scary path that they'll have to go forward on is helpful and so that they can learn. So hopefully I was able to add a couple bricks to that whole pathway. Who will,

1:07:13

oh, yeah, it's been excellent. Really, really appreciate it on this has been a different podcast in some respects, but I think a very valuable one for our listeners to hear what's going on in this area, and I think it's a developing area, they're going to hear much more about. So once again, thank you.

1:07:27

Thank you very much.

1:07:31

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