**Santa:** It's been about a year since COVID-19 changed everything from the ways we learn, teach, and interact on campus and online. One thing that hasn't changed is the drive UBC students and faculty have to find solutions for real-world issues, including protecting each other from the COVID-19 virus. Kevin Golovin is an assistant professor at the School of Engineering at UBC Okanagan. When the virus hit, he quickly found a new application for his research, anti-fouling and anti-fogging face shields. Professor Golovin, welcome to *Blue and Goldcast*. Kevin, what were you working on in your lab before the pandemic began?

**Kevin Golovin:** My lab was working on a number of different coding technology. We like to develop things that will repel any type of hazardous solid, liquid, or gas.

**Santa:** What were the applications for that kind of functionality? Was it for things in the public domain or secret things for the defense?

**Kevin:** The application really was quite broad depending on what the technology was. We do a range of products, or not products but projects related to, for example, textile modification. That's with partners like Lululemon or Arc'teryx. Then we go all the way down to DND-related projects on modifying textiles as well but a little bit more secretive. Then we also have projects related to the repellency of solids like ice and that would be for airplanes or wind turbines. It's a wide range of topics.

**Santa:** Of all those different projects that you work on from garments to plane wings, to perhaps glasses or things like that, which is your favorite project?

**Kevin:** I've always leaned towards ice. The technology is called icephobic coatings. It's a material that repels ice. It just seemed like a really cool, no pun intended, idea in that you could take something that, as Canadians, is a very practical problem that happens every day, maybe less so in Vancouver than here in Kelowna. You could make a material that solves that for everyone.

**Santa:** It really is pretty impressive, the range of projects and applications your research is touching upon. Congratulations for that.

**Kevin:** Thank you.

**Santa:** How long have you been working in this field?

**Kevin:** It's probably approaching eight years or so now. I started this way back during my master's degree and have never given up on it because the problems aren't solved yet.

**Santa:** Certainly, you're making progress, right?

**Kevin:** Oh, yes. We think we're getting closer and closer. As we talk to more and more companies, it seems like we're one step away from actually solving at least some of the problems.

**Santa:** That's fantastic. Tell me about how quickly you pivoted, because you work on a number of different projects, to the new application we're going to talk about it right now with respect to the pandemic.

**Kevin:** Well, as soon as COVID came about, it was clear that repelling hazardous liquids also included things that could transmit the virus. That allowed us to start thinking about different coatings that could repel droplets of sneeze and cough and things of that nature. It was really just re-envisioning the type of liquids that some of our coatings could repel.

**Santa:** This is really not my area of expertise, but can you just help the listener understand? The virus that causes COVID 19, I think is SARS-Cov-2, is transmitted from person to person through droplets of moisture when you exhale, or your cough, or your sneeze. Are you effectively blocking that virus getting to someone nearby by blocking the liquid?

**Kevin:** It's not necessarily a blocking. You think of blocking as a shielding mechanism but once you've blocked something, you also don't want that to sit around and wait for the person to then accidentally touch whatever their blocking would be. There's the additional challenge of removing the liquid after it's been successfully blocked. Our coatings are really dealing with how to get rid of the liquid once it's been blocked from the person.

**Santa:** That's interesting. These face shields that you're working on are referred to as anti-fouling, anti-fogging face shields, and I understand they're already in use in Kelowna. This pandemic is less than a year old here in North America. How did you make such rapid progress from your research to something that's actually already in use?

**Kevin:** We had worked closely even before the pandemic started with a local industry partner here named PRE Labs. They originally, before the pandemic, were a body armor and survivability products producer. They worked with DND, we worked with DND, and that's how we met. They quickly pivoted to making PPE for the pandemic which included face shields and face masks. We already had a project with them on coatings and so, we both pivoted together to start working on face shields. We have a separate project now on face masks, on the comfort of face masks, but not with the coating technology.

**Santa:** You work on both anti-fouling and anti-fogging. Is it the same mechanism that contributes to both anti-fouling and anti-fogging?

**Kevin:** No, it's actually the opposite. The reason fogging occurs is because you have little droplets that sit on the inside of your glasses, your face shield, and those scatter light. What you really want is to spread those out into a nice flat film so that they don't scatter light, and you can see through them but on the other side of the face shield on the outside where the actual COVID-19 potentially containing droplets are occurring, you want those droplets to be removed. You don't want them to spread out. It's actually an exact opposite technology.

**Santa:** Oh, I see. I see. These are two different technologies that can be--?

**Kevin:** Yes. The anti-fogging is on the inside close to the person, the anti-fouling is on the outside.

**Santa:** Oh, that's fascinating. I'm now understanding this technology. Thanks for explaining that to me.

**Kevin:** Yes, of course.

**Santa:** Have you run into people wearing the face shields that you've produced in the community?

**Kevin:** I was at the dentist the other day and the hygienist was wearing one of the face shield that say PRE Labs on the piece of foam that houses the face shield. I could see that it was one of the ones we had made.

**Santa:** I wear glasses, as you can see. When I wear a face mask, often, they fog. Can you sell something so that you can take glasses like mine and make them anti-fog?

**Kevin:** Oh, yes. Anti-Fogging is actually not a new technology. Divers have had the anti-fogging goggles for when they're diving for 10s, 20s years. It's more of a large-scale application to a face shield that we were investigating.

**Santa:** I can actually go to Canadian Tire or somewhere, London Drugs, and buy some anti-fogging?

**Kevin:** Oh, yes. It's actually a fairly easy DIY. If you take a toothpaste and rub it into your glasses, that actually makes it anti-fogging.

**Santa:** Toothpaste, but it might not be able to see very well.

**Kevin:** A very thin layer of toothpaste.

**Santa:** Thin layer? I get it. I get it. All right. Well, how did it feel to actually walk into your dentist and to see something you'd worked on your dentist's face?

**Kevin:** Oh, that was one of the most fulfilling things. I was telling the hygienist that I might've helped create the thing she was wearing. She was super excited about that as well because they never realized the innovations that potentially are coming out of the university.

**Santa:** That's wonderful. Now, what's it been like for you and your students to see this out in the real world? Have they seen it like you have with your hygienist?

**Kevin:** I'm not actually sure if they've seen that anywhere, but I know just being able to work on something that's actually helping people just for their mental health and staying positive during these times, it's been super helpful for the students to know that they're actually contributing towards the solution.

**Santa:** I can imagine. Tell me about how you interact with the students in your team. You've talked about the fact- you've educated me because I don't know anything about the field, that I can actually go into a store and get something, and I can even use toothpaste to make my glasses anti-fogging. Certainly, what you're working on is very sophisticated and continuously improving on a baseline of knowledge. When you talk to students in your team, how does it actually work? I guess you get together regularly. Does each student have a particular role to play, or do they solve the problem together? Do they ideate on their own, how does it work?

**Kevin:** The way I like to run my lab is that each student has their own core project that they're working on, but everyone's building up the same set of fundamentals that they are becoming experts in coatings, and how you modify a surface to have some cool engineering property. We used to meet in person regularly, and now we meet remotely regularly, and we all discuss our various challenges and topics that we're working on. As a team, we are stronger together, so no one person necessarily has the answer to all of our challenges that we're working on. Usually, someone in the group has expertise, and we use that combined knowledge to solve the problem.

**Santa:** Now, often, industrial corporate labs will say that they like to work with universities, because they will sometimes give a problem to their internal R&D team, and give the same problem to a university-based group that sometimes has not only graduate students, but sometimes has undergraduates. They actually tell me that sometimes, they get more innovative solutions from the university because you have students that look at problems from completely new ways, from, say, a corporate scientist who might have been there for decades and maybe 40 or 50 years old, that they really benefit from what they call, naive intelligence or innovation of the youngest members of the team. Do you find that in your lab?

**Kevin:** Oh, I do, definitely. One of the interesting parts, coatings is a strange field in that no one gets a degree in coatings. You can find mechanical engineers or chemical engineers, but no one has it, no one's a coating engineer. We draw in lots of expertise from various different fields. We have petroleum engineers, mechanical engineers, aerospace, and that allows us to have lots of these different knowledge bases, attacking problems in different ways. Again, we also have undergrads through postdocs that think about the problems quite differently.

**Santa:** You do accept undergraduates into your lab?

**Kevin:** Oh, definitely, yes. Some of our most promising technologies were created, or at least ideated, originally from undergraduates.

**Santa:** You probably don't have enough spaces in your lab for all the students that want to work in your lab. What do you look for when you're interviewing an undergraduate who's never worked in a lab before? Do you look at grades, do you look at how they answer questions? How do you pick the diamonds from the rough?

**Kevin:** The biggest quality that intrigues me the most is curiosity. I think when students are naturally curious about problems, that leads to the most interesting solutions. Obviously, I'm not looking for someone that already has the expertise at my lab, because what could they add, but students that are naturally curious, always tend to bring in the coolest, newest ideas.

**Santa:** When someone sent you an e-mail, says, "I want to meet with you and talk to you about a possible position in your laboratory," and they're brand new, they graduated from high school, they're on campus for the first term, and you get 10 of these emails, how do you determine who's curious? What kinds of questions do you ask when you talk to them?

**Kevin:** A lot of times, the students will be clever enough to look at my website and say, "Hey, I liked the interesting work that you're doing. I've seen the videos," so on and so forth. I try and use whatever they've picked up on and ask them, "What's the next step? How would you do this project one step further?" and see if they can add onto what's already been done. Sometimes it's great ideas that they might never work and maybe they're terrible for some other reason, but the curiosity comes out of questions like that.

**Santa:** Now, when you're actually in a meeting, and you're talking to somebody, and you ask them that question, you give them a background of what's known, and you ask the question, "Where would you go from here?" You're going to have different kinds of people, those that will reply very quickly, and those that might say, "Well, let me think about it." They might come back to you a day after, with even more brilliant, more well-formulated idea. Who do you pick, the one who can think quickly and give you a pretty cool, innovative answer, or the person who might be more shy, but then a day later comes back and just blows you off your feet with how innovative they are?

**Kevin:** Well, most of this is done by e-mail, so I think all the students have a bit of time to think about the problem. Some will obviously e-mail back right away and say they're super interested, some might take a few days, but at least in those interactions, a lot of times, they have the time to think through and therefore, there's no bias to someone that happens to be quick on their feet.

**Santa:** Well, that's fantastic. I think a lot of people who are interviewing people for their research teams will really benefit from what you just said about how you actually identify people who are curious, and are able to synthesize information and come up with brand new ways of approaching the problem. Now, you also focus on how to make the processes that you're inventing or developing more eco-friendly. Tell me a little bit more about that.

**Kevin:** One of the ways I got into the textile industry and modifying fabrics is because there's a type of chemical called perfluorocarbon. You can think of the stuff that's on your nonstick frying pans, and those happen to be toxic. It's actually been known that they've been toxic for 30, 40 years, and it's been pushed to the side. There's a big push now, finally, to get rid of all those technologies from the world, really.

There's currently nothing that has the same advantageous properties of repelling all these liquids, like oils and low-surface tension liquids is the term. My lab's been at least attempting to pioneer alternate technologies that have the same liquid-repellent properties but don't utilize these toxic chemicals.

**Santa:** It's toxic because it comes off of the utensil or the cooking pan, or is it toxic because when they're making those pots and pans that they're not careful with what they throw away?

**Kevin:** It actually comes off of the pots and pans, so it's something that is intentionally put on whatever the product is. The real issue is they do what's called bioaccumulation, so they don't break down. The same reason that they can repel all these different liquids is actually the same reason that they don't break down, they're very inert just in general. Because of that, they take hundreds and hundreds of years to break down. They keep accumulating inside the body, and eventually, they reach a concentration that is toxic.

**Santa:** Then more and more of these pots and pans that are made, the more and more it becomes concentrated in the water because they're inert, right?

**Kevin:** Exactly.

**Santa:** It's really important what you're doing, to try to find an alternative mechanism to repel these things that are--

**Kevin:** Exactly.

**Santa:** Yes, to replace that. That's fantastic. What do you think it is about UBC or UBC Okanagan that has helped you get this technology into the real world so fast, in the case of the masks and shields?

**Kevin:** UBC Okanagan, I always like to tell people is like a startup company. It feels like it's a new entrepreneurial atmosphere here where anyone can really do whatever they want. There's not a lot of traditions in how things have been done for 100 years. Sometimes that is a negative, but a lot of times it's a positive. For example, I'm in the School of Engineering here, we don't have departments. If I want to collaborate with an electrical engineer or civil engineer, they're just my colleagues. We're not even in a different department. That allows everyone to just work together, and push boundaries, and not worry too much about established norm.

**Santa:** Deborah Buszard, who was the former principal and deputy vice-chancellor, used to say that a lot. She often called it a startup, and she said it was pride. I'm hearing the same thing from you. Let me ask you this, as UBCO becomes larger, and it will, and older, do you think it's important for UBC as a university to protect that special environment which is in UBCO?

**Kevin:** Yes, I definitely think that makes UBCO a real gem and it's that kind of collaborative, innovative environment that works closely with industry, and pioneers new things, and isn't afraid to have a small tiny project that ends up maybe going to some startup company and maybe commercializing quickly, I think that's something that's definitely worth protecting and fostering.

**Santa:** I guess the other part of UBCO which is special is that, in comparison to Vancouver with the 56,000 students, that you really get the feeling walking around the campus that faculty and students actually know each other, and the classes are not so large. Do you think that's also something that ought to be protected as we think about the future of the Okanagan campus?

**Kevin:** I definitely think that the students enjoy that. I have undergrads that have worked in my research lab that just came to my door and talk to me and said that they knew that could never happen in Vancouver just because of the size of things. That allows you to interact with the undergrads a lot more closely for sure.

**Santa:** Well, that's wonderful to hear. I'm going to ask the last question. Any word on whether you'll have a face mask that keeps your glasses from fogging up?

**Kevin:** I don't see why not. The anti-fogging face mask is quite a good idea. The technology is there, it's just a question of getting it into the hands of Canadians. I definitely think that's a possibility.

**Santa:** Part of it has to do with the mask itself, the physical construction of it and directing the air that you exhale away from the glasses.

**Kevin:** Exactly.

**Santa:** Another approach might be using chemistry and chemical engineering, right?

**Kevin:** Exactly. You can either modify the face mask or you can just modify your glasses. Either way is a surface-modifying thing. That's what makes me so attracted to coatings, is almost everything has to do with a surface. If you modify the surface, you can affect engineering properties.

**Santa:** I love talking to you. I know that I went in different directions, but it's not every day that I have an opportunity to speak with you. I'm very impressed with-

**Kevin:** Thank you.

**Santa:** -the innovation from you and from your team, and also for the impact that you're having on a very critical issue that we're facing as a society in terms of this pandemic. Congratulations to you and let me know if I can ever be of any help to you.

**Kevin:** Thank you, Santa. Great to talk to you.

[music]

**Santa:** Kevin Golovin is an assistant professor at the School of Engineering at UBC Okanagan. That does it for this month's episode. You can find links to our guests work, as well as previous editions of this show, at blueandgoldcast.com. You can also find us on your favorite podcast app like iTunes or Stitcher. You can tweet at me @ubcprez, that's press with a Z. I'm Santa Ono. Thanks for listening.

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