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**Santa Ono:** You're listening to CITR 101.9 broadcasting from UBC's Point Grey Campus located on the Traditional Unceded Coast Salish Territory of the. Hulkamania speaking Musqueam people.

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**Santa:** Broadcasting from the University of British Columbia the home of a giant snowball fight. This is *Blue & Goldcast*.

**Female Speaker 1:** It's so funny. I love it, yes.

[music]

**Santa:** I'm Santa Ono, the president and vice-chancellor of UBC. On this season of the *Blue & Goldcast*, I'll be speaking with the people who are helping to shape UBC's next century. Here at UBC, we're doing our best to adapt to COVID-19. In addition to washing hands and staying home, adapting has meant wearing a face mask to minimize virus transmission.

In classrooms or on public transit, face masks are now mandatory in most indoor spaces. They have been a visual cue for COVID-19. Some masks have a hazardous downside. Single-use face masks like the blue surgical masks that you see everywhere contain microplastics, which end up in our aquatic ecosystems.

As these microplastics enter our food chains, they cause chronic health problems for humans. UBC professors Johan Foster and Orlando Rojas have been working to change this. Johan Foster is a chemical and biological engineering associate professor in the Faculty of Applied Science, as well as NSERC Canfor Industrial Research chair.

Orlando Rojas is a chemical and biological engineering professor. He's also the scientific director, Bioproducts Institute, and a faculty member with UBC's Faculty of Forestry, the Faculty of applied science, and the Faculty of Science. He is also the Canada Excellence Research Chair.

Johan and Orlando have been working with a multidisciplinary team of researchers and scientists to design what may be the world's first fully compostable and biodegradable medical mask, the CanMask. Easy to produce, and made from BC wood fibers, Johan and Orlando say the concept behind the CanMask is as important as the mask itself.

Welcome, Orlando and Johan to our show.

Many of the face masks people wear to protect themselves and others during COVID-19 are single-use synthetic masks. When did you realize the scale and potential impact of the plastic waste being created by these masks?

**Orlando Rojas:** Well, that was very early on as we joined UBC. Both Johan and myself are new to UBC, very proud to be here. Yes, COVID got us by surprise in our daily works that we were having in brainstorming ideas for research, we realized that there were a lot of waste on the streets. It was obvious that there was an environmental issue here and we decided to tackle that.

**Santa:** Tell me about that CanMask prototypes that you've created. A lot of people have heard about it, but imagine that you're talking to somebody who doesn't know about it already, what local materials are they made from?

**Johan Foster:** We really wanted to make a biodegradable facemask or compostable facemask. We really started from something similar to paper, just pulp that would normally be put into paper, but we reform it into something that's breathable, so you can breathe through it, but it will also remove those water droplets that transmit COVID-19 from person to person.

**Orlando:** To add to the resources that we have around BC is very well-known for the forest products industry. We have to remember Canada has a very large area of forest land, it's about 35%. If we can sustainably use the bioresource that is available to us locally, that's really a big win as far as solving an issue but also tackling many other needs, for instance by the communities and the industry that are local around our campus and in British Columbia. There is a major, major benefit to the industry.

I want to remind the idea here is not the CanMask, is not the mask, is a possibility to expand this concepts to other materials that we use every day that are in need to be replaced, for instance, with sustainable renewable materials, leading to a more sustainable future, the so-called, the circular bio-economy. This is what we want to set at this point.

**Santa:** I wanted to ask you, why is it so important that the masks you design be both inexpensive and easy to produce?

**Johan:** For most of these applications, where we're utilizing bioproduct to replace, say, single-use plastics or other kind of traditionally-used materials. A lot of the time people don't want to pay more; sometimes they're willing to pay a premium, but in an ideal case, they don't want to pay more, and they want that product to work as good, if not better than the existing product.

what we wanted to do with our BC, or Canada-based bioproducts is shorten the supply chain, so in the future, in the unfortunate case that this continues on, or in the next pandemic, we can control how and when we get those resources to make our PPE. Then, also, make it using BC and Canadian talent, and then use it here locally also.

**Santa:** Now, one of the things that we're discussing with the Government of Canada and the provincial government is how to invest in the ecosystem so that when there is a future threat, whether it's another pandemic or climate change, that we are more self-sufficient as a nation. That's one of the reasons that your work is so important.

Here's the question. if we think about building back a more resilient Canada, and you know the needs that we have to deal with this kind of pandemic, beyond the innovation that you are involved in, are there other parts of the scaling-up process that we together with government, both provincial and federal, should pay attention to and invest in so that we can scale up more quickly if there's a further pandemic?

**Orlando:** Maybe I can initiate the answer to that question is super important. In the university, our mission is to develop the science. We reach to the point of prototyping the masks. One thing that we need to realize is that that process actually took very short time. People think universities are very slow in the operation, but actually, when you put resources together, it can go very fast.

That's what we did with a team of students that volunteered their time. In three months, we develop a prototype. Now, going from the prototype to the manufacturing, that's a big gap.

In the university, we're not really equipped to do this. I think this is where the government and also I should say, the private industry can really play a very important role. After this prototyping effort came out, I think we reached maybe, or actually, we were reached by many, many companies interested in this type of development. From that process, I think we identified a few. I think now we're entering that process, where there are very large possibilities for us to expand the production and make this a reality.

This is a process and it's part of our mission in the university, get the sciences started, and then to partner with the companies and in this case producers to make this in such a way that it creates really a big impact and bring value to these ideas and these scientific discoveries.

**Johan:** I'll follow up on that a bit. I think the other ways that the federal government or even consumers can help push and pull this is adoption. The federal government has talked a lot about replacement of single-use plastics, so you can think of every single one of these masks because there's single-use plastic. Yes, people might, use them for months, but we'd probably caution against that. In the simplest sense, this is just a single-use plastic.

If we think about this going forward, yes, we want to make every single one of these things recyclable, or reusable, or compostable to be able to alleviate that stress on trash but also, unfortunately, they do get thrown on the ground. If they do, well, these things are just going to decompose rather than get washed into the oceans or into the rivers and start

problems with microplastics or animals eating this. It alleviates a bunch to that problem. There's push from the federal government that can happen and then there's pull from consumers that want to be able to use an environmentally-friendly product.

**Santa: [unintelligible 00:10:14]** UBC we have very entrepreneurial students probably in your classes, in your laboratories. Is there an opportunity for faculty members, or students, or alumni to create new companies that will enable this industry to grow in our province?

**Orlando:** Personally, as a professor, this is one of the tasks that I have thought for myself, I want to create impact. We have a lot of scientific papers, publication. This is really great, but at some point what you want to do is to create impact. What I dream is to have students around me that create their own future in the way of start-ups, companies.

I think UBC is really the right place. We have an amazing group of faculty. We have been discussing with them many of these ideas. The students are volunteering their time. I think they are better trained than all of us are a little bit older in terms of the business possibilities.

I think this can be an example. If we do it right, it can be an example that we can show around so that other students, younger generation follow the same ideas that others are attempting to do.

**Santa:** There's no reason why we can't do it. If you think about the other very important things that are happening in terms of dealing with COVID-19, if you look at the Pfizer-BioNTech vaccine or even Moderna, they're only possible because of research that came out of UBC at a Pieter Cullis' Lab. As you know, in that case, the multiple companies have spun out of UBC that are critical to our humanities success in dealing with this pandemic.

In those cases, nanoparticles were created that make it possible for the messenger RNA or mRNA to be stable and to be delivered into the cell so that the spike protein or its variants can be expressed and that immunity can be passively provided by this nucleic acid. That is only possible because of UBC technology.

The other major frontline therapy that's being used around the world from UBC is the platform which is the basis of this spinoff company AbCellera, which is one of the most effective ways of managing individuals who have been infected with COVID-19.

Then, most recently, this past week, the federal government has invested in Precision Nano, which is yet another spinoff from UBC. I hope that you will really do this. You can see that there are many platforms and support mechanisms at UBC to help you and your students actually spinoff these technologies and create jobs for British Colombians.

**Orlando:** If I may maybe comment on this. I think the use of the forest resource actually fills those aspects that you are commenting. We're looking into nanomedicines; we're looking into sensors based on cellulosic platforms. There are very interesting developments about using cellulosic materials from trees, from plants in very high-end developments that includes medicine, biochemicals, and biomaterials.

Opportunities are really very large when we combine university know-how with the resources that we have around locally, around our BC area.

**Santa:** We're very, very proud of everything that you're doing and mostly by your vision. We know the quality of investigators that you've put together. We also are confident that the many other researchers in other faculties can also contribute to your vision. We're so happy that you're here. The Canadian government has a plan to achieve zero plastic waste by 2030.

It's pretty ambitious. Do you think that biodegradable products will be able to replace most or all single-use plastic over this 10-year period?

**Johan:** I don't think 100%. I think getting rid of use of all plastics is tough. For certain applications, polyethylene, polypropylene are absolutely fantastic. They're very chemically resistant and they last a long time. Those are the reasons we want to get rid of them. They don't biodegrade. I think we have a huge opportunity to replace a lot of those short-term use plastics.

For example, with the mask, it only needs to last minutes maybe hours because it's only designed to be used for a few hours. Similarly, your grocery bags you use for 12 minutes on the way home or an hour on the way home. You don't need something that's going to last in the environment for 100 years. I think there's huge opportunity there to replace a lot of that plastic waste.

I think combining that with recyclability and reuse will alleviate a lot of that waste that goes into the trash. Using those things combined will reduce the reliance on petroleum-based plastics and allow bioproducts to be used in much greater amounts.

**Santa:** Now, I want to go back to the masks. First and foremost, wearing a face mask is a precaution that people take to prevent airborne transmission of COVID-19 as we've discussed. It's also true that face masks can be pieces of fashion or even political statements. There's slogans on them. How do you factor the imbued social and political meaning of wearing a face mask into your CanMask design?

**Johan:** In general, I think we try to stay out of the political realm. We both think that the use of masks is a fantastic way to help prevent the spread of airborne viruses, but incorporating signs on them or incorporating a fashion statement we think is a fantastic statement about expressing yourself. We also think that wearing a mask can be quite fashionable like the nice black ones that I wear I think complement my skin quite well. In the grand scheme of things, we think that there should be a mask for everybody.

We can print different things on our pulp-based masks and make them accessible for everybody. We think, "Hey, if you want to wear a black one, or a yellow one, or a green one, that's really up to you. If you want to put a Canadian flag on it, that would be great too." In general, we think it is a statement, wearing a mask saying that you not only do care about yourself, but you care about your fellow person.

I think that is a great statement to be able to make.

**Orlando:** I will like to add a little bit about the fashion aspects and the sign. I think this is pretty interesting. The mask is an example of an opportunity where researchers can come together working with different angles. If we think about the mask as an example because there are many more that we can discuss. In the case of the mask, you can think about material scientist working with biologist and chemist all together also with designers and people that look into the social and regulatory aspects.

A beautiful opportunity that speaks to what we want to do in UBC fully cross-disciplinary effort where we have project-oriented ideas so that everybody comes to the table and pitch their ideas. In that same of direction, for instance, involving art design is an amazing opportunity. I can give you many examples within campus and outside campus with universities like Emily Carr where we having discussing about the possibilities also to incorporate art and design. This is just an example.

It's a beautiful, opportunity for us to show what we can do with sustainable materials beyond the masks. It could also for the wearables, for the textiles that we use that pretty much use similar materials and similar technologies that is wood fires. This is now becoming a super-hot topic, the use of wood in the next generation textiles that we use as a substitute for polyester just to give an example. There are many, many more.

**Santa:** Well, I'm so glad that you're working with Emily Carr. I know that CanMasked involved the faculties of Applied Science, Forestry, and Science, but Emily Carr really is a wonderful partner in post-secondary education here in the province. That makes me so happy that you're interacting with them already. Now, you said the most important part of the CanMask initiative is the concept behind it.

What do you mean by the concept?

**Orlando:** The later example that I indicated is the idea of using similar technologies to create materials that go beyond the face mask. The face mask may be a temporary thing that we use. It may go away, it may not, but I think the technology **[unintelligible 00:19:46]**. That technology can be replicated in the production of other materials. An example is wearables, the textiles of the future.

We already are working with a small start-up that is looking into these. The use of fibers with no major modification to create the textiles for the future. This is just as an example, but there are many more in other areas of material development from 3D printing. As we also discussed earlier in the next-generation medicine, nanomedicines, antivirus, and anti-microbials that we can produce from actual the forest, from the forest products.

There are a lot of solutions that we can find in the sustainable utilization of the forest. Beautiful opportunities that go, they CanMask, and these are some of the few examples. Maybe John has in mind other examples, but I think there are plenty.

**Johan:** No, I totally agree with what Orlando said. It is really being able to take that as a core technology. It pushes us to think about; okay, how to make something wearable or how to make it breathable, but then you can extend that beyond to say a house. Can you make a filtration system for a house or can you make coding for a door handle that's anti-microbial or anti-viral?

To working together with people from Applied Sciences, Forestry, the Faculty of Science, and then trying to make it usable. Talking to the social scientists of how do we get this actually used. It's great, it might be a great technology, but if you can't convince people that this is something they should use then that it's useless. We really want to be able to work across disciplines to be able to not only have fundamental science but then have it used in throughout the world, hopefully.

**Santa:** Wonderful. This is the last question. Right now, both prototypes of the CanMask are being tested to ensure that they meet health industry standards. When can we expect to see these masks across campus and beyond?

**Johan:** That's a tough question. We are linked-in with industry and it's about scaling up. We want to scale this up in the right way, we can make prototypes, we can make five masks, 10 masks, but to really make an impact, we need to talk about making thousands or hundreds of thousands of masks. We want to be able to scale that up in the right way in a cost-efficient way.

Then once that scale-up has done, be really able to prove that, yes, they still have to breathability. They still have the filtration efficiency and they still meet all of those standards that people wanted, expect from a high-quality product like this made in Canada, endorsed by us, and made here at UBC. We want to go through all of that to answer your question I guess in a short way, we're not quite sure when these will hit the market, but we're pushing to have that as soon as possible.

**Orlando:** One comment I should maybe make or add is that what we have done so far is quite interesting because the type of performance that we share with these fiber base masks is quite astonishing. We have been looking actually at the filtration efficiency of the material, and it's already competitive to the commercial surgical masks. It only requires one ledger of a porous membrane that we produce with the fibers.

We have very good understanding about the performance of the material, now we need to go to the details about how to process the materials to make these low cost and high throughput. That of course requires partnerships with companies, for instance, that can invest or have the infrastructure to make this a reality.

As far as the performance is quite interesting and we have very good leads about those possibilities. I think this is very promising.

**Santa:** Well, thanks to both of you. As I said, we're very proud of you and we are here to support you in any way. I'm sure that the listener group that listens to these podcasts will be thrilled to hear about your story. Once again, thank you so much for taking time to be with us on *Blue* & *Goldcast*.

**Orlando:** Thank you.

**Johan:** Thank you so much.

**Santa:** Yohan Foster is a chemical and biological engineering associate professor in the Faculty of Applied Science. Orlando Rojas is a chemical and biological engineering professor and the scientific director of the Bioproducts Institute.

You can learn more about the CanMask initiative by visiting the UBC bioproducts initiative website at bpi.ubc.ca.

That does it for this month's episode. You can find links to our guests' work as well as previous edition of the show at blueandgoldcast.com. You can also find us on your favorite podcast app like iTunes or Stitcher. Our email address is blueandgoldcast@ubc.ca and you can tweet me @UBCprez that's prez with a Z. I'm Santa Ono. Thanks for listening.

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**Speaker 2:** You have been listening to **[unintelligible 00:25:12]** Media production.

**Speaker 3: [unintelligible 00:25:14]**

**Speaker 2: [unintelligible 00:25:16]** media.ca.

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