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**SPEAKERS**:

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[Music Intro]
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[AL] This is Arielle Lomness and you're listening to Frequencies, a podcast from the Library at UBC Okanagan.

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[AL] Hi there, I'm here with Richard Federley, the Research Support Specialist with the Office of Research Services at UBC Okanagan. Welcome!

[RF] Thank you very much Arielle, it's a pleasure to be here today.

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[AL] Can you start off by telling us a little bit more about your various roles that you've had here at UBC Okanagan?

[RF] Ya, absolutely. So when I started out at UBC I was initially an Instructor for first-year Chem. So teaching ah, you know a very large group of students, kind of at a diverse area or range of chemistry skills, which is a really fun class to teach because we kind of get to cover everything from thermodynamics, kinetics, some different reactions, little bit of organic chemistry. So, we kind of get to play with a little bit of everything, which makes it a really fun course to teach. And then the following year I was teaching aqueous environmental chemistry and atmospheric environmental chemistry. So these are third year courses intended for students in environmental sciences and chemistry as well.

[AL] Great, and now what about your current role here?

[RF] So now I've moved into the Office of Research Services as a Research Support Specialist for the natural sciences and engineering. So I help out with faculty with applying for grants, trying to find funding for works with industry partners, and really trying to help build up the research programs.

[AL] In the context of your previous role as an Instructor in Chemistry here at UBC Okanagan, can you talk to us about your approach to engaging students in science?

[RF] So in terms of engaging students in science, you know science is just really exciting. Science is fun and I really think it should be. It touches every aspect of our lives from you know driving in our cars to using our cell phones. So understanding something about it and learning about how uh science can kind of interplays with our everyday day to day lives I think is something very important and it's something that's not too difficult to try and sell students on. It's just fun and cool stuff to do.

[AL] So you sometimes use specific tools in the classroom to show students the interactive nature of science. Can you tell us more about this?

[RF] [laughter] Ya so you know that's a great kinda follow up question for this because in classrooms I tend to use a lot of analogies and kind of metaphors and like to tell stories things like driving in the car. So tell the student put them in an environment that is familiar to them and we just start talking about it. Uh maybe discussing brushing their teeth in the morning and how the bristles on the toothbrush are made of nylon and then start thinking about what's sorts of things are going to make that nylon break down. So all these kind of everyday experiences we have, getting up in the morning, brushing our teeth, driving to school, uh... flipping through the pages in your book, talk about how all this material comes to be and uh just try to understand something about it. So I tend to use a lot of these sorts of tools and uh techniques I would say in the classroom.

[AL] Do you find that the students feel that it really resonates with them more to learn about those topics?

[RF] I find kind of through the years I've found that the examples that I gave that were kind of everyday experiences, that the students tended to test better on those concepts. And I think that comes to a sort of reinforcement so if we discuss uh break down of nylon for instance and we do it in the context of something like a toothbrush well it's very hard not to think about that then every morning when they brush their teeth. Right so it has that kind of reinforcing uh ability, I guess. And um those those concepts that we tie to kind of our everyday experiences I think the students also find them more interesting. Because it's something that's tangible something that they can see and they can see how the science is truly affecting what they're doing in their day to day life, which is very important.

[AL] So what facets are particularly important in terms of students gaining literacy?

[RF] For students to truly have a lifelong learning and be able to use the information that they've learned, you know twenty, thirty years down the road, I think it's important for them to understand conceptually how something works. Rather than just kind of, you know, memorizing names, you know, for a bunch of different things. So take uh, take clouds for instance. So you know, you can go and memorize and learn all the different names of all the different shapes of clouds and try to categorize them that way and that is an important thing to learn so that we can have discussions around different types of clouds and so forth, but that would only be one very small kind of aspect of understanding how a cloud forms and how it works. And we've all sat around and looked at clouds and picked out ones that looked like animals and so forth. Um but you know, ten years from now if you forget the names of the different kinds of clouds, oh that's a cumulus cloud or a [inaudible], you forget these names, um, you're kind of lost with that information then. And it's very easy to forget a name I find. But if students understand how a process actually occurs, how a cloud actually forms, if we think about how the air is changing and we discuss different thermodynamic properties of it and um, they can actually picture what's happening. We're doing a few things - One, we're getting them to understand a process on how something occurs. We're getting them to visualize something that might be impossible to see. So if a student walks out the door and they understand a process for how a cloud forms and how it's this, this thermally uh, essentially heated portion of air that's rising and expanding and water eventually condensates and forms a cloud, if they can picture this process, they can walk out the door and see a cloud and they can see how the air is moving around them, they can picture these thermals rising, they can picture air sinking around it and they see something that was invisible and something that they couldn't see in the first place. And once you picture that process it's very difficult to forget that. Right, once you truly understand the mechanism. So even if they forget all of the terms, they forget the names, the cumulus or adiabatic expansion or any of these terms, they're still going to be able to picture this process of the air circulating and moving and they can see that when they look at the cloud. Um, so the names are very important in terms of scientific discussions and being able to have a well thought out conversation with someone. Especially when we're discussing subtleties and differences between different concepts, but in terms of lifelong literacy understanding how something actually works I think is a very, very important skill.

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[AL] So moving a little bit more outside of the classroom, in the context of your current role at the university with the Office of Research Services, how do you see some of these same concepts of science literacy that you've engaged with in the classroom playing out with a different group of people?

[RF] So in terms of science literacy you know, science... part of it is understanding what goes on around us, right. We just have those fundamental questions, why is this thing the way it is and why does it behave the way it does and we want to understand that but then, and again I would argue that knowing that and knowing how something works enriches that environment, but then we want to be able to take that information and build upon it. Say well wait a minute, ok I know that this one thing behaves the way it does um, and I know that we have this other object or other case that's very similar. I wonder if it also behaves like this? And that now isn't a scientific conclusion in a sense, we wouldn't want to make that false assumption that oh this other thing does behave the same way, it's now turned into a hypothesis. And it's something that we can test. And the researchers here at UBC Okanagan are doing wonderful research and that's really what they're pushing towards, their trying to say um ok we know a lot about our area of expertise, can we apply it in this way. And they're really pushing the knowledge growth in science and taking that to their own literacy that they have in their expertise and just helping expand our knowledge.

[AL] Do you see them approaching it from interdisciplinary perspectives?

[RF] Ah yes, so a lot of the really exciting research happens at these kind of cross discipline borders. So ah if you think of things like uh… biology and technology. So there's a lot of technology that's developed um that really comes from biomimicry. Or um someone, some engineers seeing something in nature and saying hey wait you know, how does that work the way it does and then them realizing that hey, we can apply this to something new. So very kind of classic case of this was the discovery of something like Velcro. So for Velcro an engineer had actually noticed that these little kind of burrs that we all had experiences in walking, with walking in the bushes around here where they stick to your clothing and stick to everything else. So as the story goes it stuck to his dog and then he actually took one of these burrs off, picked it off and then went and looked at it under the microscope and saw the structure of this and it looks like kind like the letter J, each one of these little hooks and he realized that hey this is something that kind stick quite well and can be peeled off and stick again and so forth and he developed it then into a technology. So seeing this kind of uh… that cross discipline, the ability to think of engineering concepts and how something functions in biology led to the development of something really cool. And we see this in a lot of different areas. Uh, using the structure of like a humpback whales fins, if you look at them the leading edge on it, that part that kinda cuts through the water, is not perfectly smooth necessarily like an airplane wing but it has a bunch of ridges on it, so some novel concepts are to design things like wind turbine blades that have that kind of rough leading edge so that they'll have more efficiency. So anywhere we see these kind of cross discipline, doesn't have to be between biology and engineering, it can be between health and biochemistry research for instance, um anytime we have this multidisciplinary approach it allows us to kind of take maybe two concepts that might seem unrelated, put them together and you know come up with something that's really cool, new and unique. And a lot of the researchers here are doing research exactly like this.

[11:22]

[AL] So grant writing is a very specific style of communication and it's going to a very specific audience. Do you find that there are certain ways to portray concepts that you see that you work through with the researchers?

[RF] So in terms of applying for a grant, there's usually a funding agency or restrictions that they have in place and they are usually, the grants are also evaluated in a very structured way. So trying to take everyone's individual writing styles and uh, match them up with the funding agency's requirements, uh can sometimes be tricky and quite fun to do. So a lot of these researchers have really wonderful ways of discussing their research. They'll find ways to explain concepts in their proposals uh in ways that you know I never could have possibly dreamed of. And a lot of times they'll come up with ways of explaining things that I find as being very elegant. And uh I could see those skills definitely translating into their teaching and how they would interact with students and it's very clear that they spend a lot of time thinking about these concepts. It is after all their research and their baby so to speak. So it's, it's...it's interesting. I find it very fun to read their proposals and see how they approach these problems. Um and how they're able to align again those kind of funding agency requirements with the research that they're proposing and putting forward.

[AL] So science literacy is often a play between the conceptual and the factual. Have you seen this emerging through your work with research services as well as in the classroom?

[RF] So we live in a society today where we're constantly bombarded by things, different studies that we see and so forth, and um we also live in a time where trying to decide between factual information and that is you know true real good science versus things that are maybe inferred or hypothesized to maybe occur and this is getting sometimes difficult to do. And I think being literate, not just in terms of science but in terms of varying areas of education um helps us better decide which topic really falls into either of those two categories whether it's factual or conceptual. And really trying to empower students through learning to be able to make that decision on their own without necessarily having to you know go seek the advice of a professor or something along those lines is a very very important skill. So having them develop a long term uh lifelong learning capability I think will go a long ways.

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[AL] Ah how do you see the literacies of other disciplines building on science literacy as a whole?

[RF] So in today's research environment a lot of the really, like we were discussing, a lot of the cool new discoveries end up being at the boundaries between disciplines and I see this kind of progression where it's no longer really adequate to be just focused under one discipline. Just a chemist or just a physicist. Um, you really have to be specialized in kind of a broader range of topics, rather than just very much focused. So if um, if you're an engineer who studies biological systems um, that presents a really unique opportunity to learn something new and ah, I think have some relevant discovery. So it's along the lines of literacy, it's very very important in today's research environment to be literate in a broad range of fields. Um, which I think is just more fun, again. It's pretty cool to learn things just outside your box. Um but again it really kind of sparks that innovation and allows people to see things, see these connections and see these ideas that are really truly new. There's one thing for science literacy that I think is very important and it's um, our ability, again we talked about it a little bit early, but our ability to critically evaluate something. Right, using the knowledge that we have. And not...so it's a little bit of a teeter totter. You have to be able to take the knowledge that we have and apply it in different areas. But at the same time we can't hold on to that knowledge with such a firm grasp that we're inflexible to learning something new. So um, take something like um, Newtonian physics which has been around for two hundred years. So, for two hundred years this was the way we described physics and the world around us. And it did a really phenomenal job at describing almost everything that was known at the time. And it wasn't until something new is discovered that we say, well wait a minute maybe this thing that we've been using for two hundred years isn't necessarily perfect. So the kinda classic example for this is the precession of the planet Mercury around the sun. So if we look at the precession of Mercury, so Mercury has an orbit that's kind of elliptical and the position of this ellipse as time goes by actually changes and if we use Newtonian physics to predict where Mercury is going to be in its orbit it actually turns out it's off by about 43 arc seconds per century so it doesn't predict it perfectly. Um, so you might say well Newtonian physics is wrong or there's must be something else that's accounting for this, this change, this difference or discrepancy between what we observe and what we calculate. And if you held very firmly onto Newtonian physics you would start creating other things to try and account for this discrepancy and this is where the planet Vulcan comes from. So the planet Vulcan was thought to exist somewhere around Mercury which was helping speed up this precession and it accounted for it and we know there's no planet Vulcan that exists around Mercury, it was instead something else that must be accounting for this difference and it wasn't until Einstein came along in 1916 and produced the Theory of Relativity. And the Theory of Relativity showed us that well, because we have something big and heavy like the sun, it's gonna affect the way space is perceived and space and time exist around the area of Mercury because it's very close to the sun and uh it beautifully calculates the actual orbit of Mercury that we see. So again, getting at that kinda main point, if we take our knowledge that we have, these ideas we have, and we hold onto them very, very firmly and very inflexible to accept something new, um that can lead down a path that's not necessarily true. Because remember the goal of science is to try to find what is truly really happening. I mean that's what we want to discover. So having and being literate in science but also being very flexible to accept new ideas or change our line of thinking I think is very important and that's a skill that I think helps again push those frontiers and helps us discover new things.

[AL] Well thank you for joining us today

[RF] Well thank you very much Arielle. It's my pleasure.

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[AL] You have been listening to Frequencies, a podcast from the Library at UBC Okanagan. Your host today was Arielle Lomness. Editing by Karin Haug, Larissa Macklam and Mathew Vis-Dunbar. Music by Trevor Neill. Artwork by Alison Ward. Additional support provided by Michelle Tinling and Sajni Lacey. Thank you for listening.

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