Episode 50: Dr. Chris Goldfinger

**KL:** Katie Linder

**CG:** Chris Goldfinger

**KL:** You’re listening to *Research in Action*: episode fifty.

[intro music]

# Segment 1:

**KL:** Welcome to *Research in Action*, a weekly podcast where you can hear about topics and issues related to research in higher education from experts across a range of disciplines. I’m your host, Dr. Katie Linder, director of research at Oregon State University Ecampus.

On this episode, I am joined by Dr. Chris Goldfinger, Professor of Geology and Geophysics at Oregon State University. Chris’s research interests include subduction earthquakes; mechanics of oblique subduction, accretion and erosion of active margins; seafloor imaging, mapping, and visualization techniques; and seafloor drilling technology. His current work focuses on the investigation of the earthquake potential global subduction zones, including Sumatra, Japan and particularly the Cascadia subduction zone. Chris has been widely quoted by the media for his research, perhaps most noticeably in a 2015 *New Yorker* article called “The Really Big One” about the potential fallout of a massive Cascadia earthquake.

Thanks so much for joining me on the show today, Chris.

**CG:** Thank you Katie, it’s good to be here.

**KL:** So listeners may be familiar with your Cascadia research, but for those that maybe aren’t, can you briefly explain a little bit about that research?

**CG:** Sure, what I do is mostly called paleoseismology, which is the study of past earthquakes. And so what I’m mostly trying to do is build long records of past earthquakes and subduction zones, Cascadia, other places, mostly because what we, what we know about them from modern day instruments is too limited in time. What we’re after is a long history of these bigger earthquakes, which is used for just understanding the basic plate tectonics, but also understanding the hazard, because as the world has grown, we’ve built a lot of large cities on subduction zones. And with the hazard almost completely unknown, we need these long records to sort of access how, what the situation is for cities in Cascadia, Sumatra, even San Francisco.

**KL:** So when you’re doing this research, I’m curious, cause you mentioned there are other zones you’re looking at. How much travel are you doing, and what does this entail? Do you know when you go around and looking at the histories of these earthquakes, how are you kind of collecting that data? What does it look like?

**CG:** So I, when I, there are a lot of ways you can collect earthquake data. Most people in the world do it on shore by digging trenches across faults and physically looking at the fault ruptures, like for the San Andreas Fault in California you can do that, and other faults around the world. I mostly work on subduction zones, which are submerged under water, so you can’t really do that. You can’t, unless you have a submarine you can’t drive up to the faults. So what we collect is indirect evidence of earthquakes in the form of submarine landslides. So we go out in a big ship and collect core samples from the surface, and then try to relate those to earthquakes, or maybe other processes that could cause the same kind of evidence, and try to sort out earthquakes from climate and storms and all that. If you can do that, then we get basically a submarine record of past earthquakes in a subduction zone. So we work mostly on ships.

**KL:** Well this is fascinating, the places our research takes us. Many of our listeners don’t go on ships to conduct research, and so being able to go on location like that must be pretty interesting. When you go out on these ships, are you there with other scientists as well, who are there for maybe different purposes, and you’re all sharing a ship to kind of get the data you need, or are you with a team that’s really focused on the subduction research?

**CG:** Usually it’s more of a focused thing, because to do these types of things, you need a large ship, you need a lot of people, and you need to pretty much focus on one thing at a time. In other places, with other modes of doing science, sometimes people wind up with a shared kind of a trip, but usually that doesn’t work very well. Multitasking is, in this case, sort of a way to do a bunch of things badly. You really need to focus on one thing. And so we’ll typically go out on a 300-ish-foot ship with about 60 or 70 people all doing the same thing, so it’s a sort of a factory experience. We’re at sea for five to six weeks, taking course [?] 24 hours a day until it’s done.

**KL:** So, one of the things that I think—you know, your research sounds like it could get very complex very quickly, and I’m wondering if you can kind of drill down (no pun intended [both laugh], for lack of better phrasing) to talk a little bit about what are the central research questions that you’re really focusing on, and how have those shifted over time. I mean, have you found out certain information that’s influenced the research you’re working on now?

**CG:** Mm-hmm. Yeah, that’s a good question. In the big picture context of all this, plate tectonics, the all-encompassing model for how the earth works, is only less than 50 years old, so we’re still learning some very, very basic things about the Earth, and I wouldn’t say it’s very sophisticated. So in the simplest sense, we’d like to know, in a subduction zone like Cascadia or Sumatra [?], how often do we have big earthquakes like Sumatra’s 2004 earthquake or Tohoku [?], Japan’s 2011 earthquake. When both of those happened, neither of those areas had any idea that an earthquake that size was even possible in those areas, so every time we have a magnitude-9 earthquake around the world, it’s a surprise of some kind—

KL: Mm-hmm. Which seems kind of shocking to me, that we would, in this current day, not be able to tell that that kind of thing is coming.

**CG:** That’s right. Well, we know how now, but we’re just now learning how. We haven’t known this for 50 years or 100 years or 200 years, and so a lot of times when I give public talks, I show a picture of Neil Armstrong on the moon and say, “When he was walking on the moon, plate tectonics was five years old.”

**KL:** Wow.

**CG:** So that’s how far behind geology really is, and so it’s hard to explain that to people. You know, when you see Sheldon on The Big Bang Theory, and he’s always joking about how geology isn’t a real science, he’s partly right. [both laugh] So we’re really in a place where we’re just learning these big things and making lots of big mistakes as well. But that’s not good we’re making big mistakes in a field where it’s directly applicable to society, and we don’t want to make big mistakes, but we’re starting to catch up, and we’re starting to learn how to do this stuff. So now we can go to Cascadia or Sumatra in Japan and start to develop pretty reliable records, so at least if we haven’t answered all the scientific questions about how it all works, at least we can get the basic answer of how big, and how many, how often, that sort of thing, so that the society side can take that information and plan accordingly. So that’s sort of the goal: to do both things, but really in a society comes, probably, ahead of the basic science, in my mind.

**KL:** So, that actually leads into my next question, which is, it seems like this research would really connect you with the public in a really significant way, and you had mentioned kind of giving a public talk about it. I’m wondering if you can speak a little bit to that. What has that been like to be a researcher that is finding out information that is incredibly applicable to a large range of people, both in the science community and just laypeople who may need to know this information.

**CG:** Yeah. Originally, when I started out as a graduate student, that wound up attracting me somewhat. My major professor was Bob Yates. He was a world-famous earthquake geologist, and he’d started out his career working for an oil company and gradually moved toward more and more societally-relevant things, as it—I guess to him, it seemed like studying rocks that were millions of years old was, he called it, “fault pathology.” It was like being a medical examiner or something. And so he got more interested, and it got me more interested in studying things that were actually happening today and were actually relevant to people today, rather than being completely academic about it. And so that attracted me. I like to do science, but I also like to see it used for something. In this case, we have a lot of major cities around the world essentially sitting on ticking time bombs, and most people have no clue that this is true or what to do about it or just how big of a bomb it is. So it’s kind of a compelling case to just keep going down that track, and that’s sort of what I build my career on, what I like doing.

K**L:** To what degree is the kind of research and the findings that you have—are they kind of directly related to advice that you might give to people based on what they should do for earthquake preparedness, or are you several steps removed from that, and there are other folk who are working at that more directive layer about how can we prepare and what can we do?

**CG:** Yeah, yeah. That’s a good question. Actually the chain is really short, as it turns out. So the people that do what I do, the information that’s developed, the first place it goes is—well, generally—to the public. It gets into the press, and people hear about this thing, but it also goes directly into building codes, and they’re on sort of a six-year cycle, so they and the USGS (who build the national seismic hazard maps) are on a six-year cycle. So every six years, they pull in every new bit of stuff they can and try to evaluate it and update the hazard maps and the building codes accordingly. So it’s a pretty short chain, actually. And we also work with state and national emergency management people and FEMA and things like that, to help them develop realistic scenarios for their high-level planning and even just the day-to-day sorts of things that people do to prepare for an earthquake: you know, have some water stored, and strap down your water heater, and that sort of thing. This kind of a gap of information—people hear these things, and they wind up in the newspaper or something, and it’s hard for the average person to go directly to “Okay, what should I do? What should I be thinking about?” And so public talks and things help kind of bridge that gap, and so I kind of enjoy helping to bridge the gap a bit, because they’re not going to read the scientific papers, generally, and usually the newspaper version is distorted in some way, it doesn’t quite do the trick. So there is a gap there, and most of us who work in this field are helping to try to bridge that gap and work with the media a lot, or public talks and that sort of thing, to help fill that gap.

**KL:** Well, we’re going to hear a little bit more about that later. We’re going to take a brief break. When we come back, we’ll hear more from Chris about his work with the media. Back in a moment.

[music]

# Segment 2:

**KL:** So, Chris, unbeknownst to me, I became aware of you through an article. I didn’t know you, and then I ended up coming here to Oregon State and learning that you worked here, but when I was living in Boston right before I moved out here, I very distinctly remember, on a Saturday morning, lying in bed reading a New Yorker article called “The really big one,” and my jaw kind of dropping about this Cascadia earthquake that could happen. And this was an article that went kind of viral. People were talking about it. There was a follow-up article to it. We will link to it in the show notes for anyone who hasn’t heard about it. But I wanted to just start by asking you, this article was when *I* really became aware of this issue, and I think it was the same for a lot of people, and I think it was an article that really brought a lot of people to your doorstep in terms of media attention. But talk a little bit about—you’ve been doing this work for quite some time. I’m sure this wasn’t the first time you’ve talked about this issue.

**CG:** Yeah, that’s right. Well, over the years, I and lots of other people—there are probably maybe two dozen that are working on the same problem in Cascadia—we have all participated in a series of documentaries. There are probably seven or either of them, Discovery Channel, Discovery Canada, NOVA, National Geographic, and my thought a year ago was that this was pretty much out there, everybody had seen it already, and I didn’t really expect anything of the New Yorker article at all. There was no really new information in that article that hadn’t been seen before, so I really wasn’t expecting anything to happen in particular, and to be honest I’m sort of West-Coast centric, so the New Yorker is prominent on my horizon, typically. And I really didn’t realize how influential they were.

**KL:** Mm-hmm.

**CG:** The only time I’d normally New Yorkers is in a stack in the dentist’s office—

**KL:** Uh-huh. Uh-huh.

**CG:** —with Manhattan-centric cartoons that I didn’t get. So I really didn’t think much of it, and Kathryn Schulz came out and spent a day here and spent time with some of the other Cascadia denizens and picked up the story, and she’s a very bright young woman, and she slurped up all this information pretty well. She’s not an Earth scientist, but she’d always told me she wanted to be a geologist, and so she was kind of fascinated by the whole thing, and absorbed all this information. You know, I spent a whole day with her just explaining plate tectonics and earthquakes in Cascadia and all that, and she absorbed it pretty quickly. And then almost a year went by before the article actually came out.

**KL:** Oh, interesting!

**CG:** She was a freelancer when she actually did the work and then was a staff writer when it came out, for The New Yorker. And I was in a meeting in Switzerland or something when this thing came out, and I didn’t think that much of it, and then things just went crazy for—I’m still not sure why, but anyway they did. And maybe it’s just that social media is the way things go viral, and that’s when I found out, and we all found out, to our surprise, that most of the country and even most of our local inhabitance had no idea about this. We thought that this was a done deal.

**KL:** Yeah! So, for people who maybe have not read the article—we’re kind of talking around it—what is kind of the basic premise of this article that she wrote?

**CG:** Well, its just describes what is to us a pretty well-known scenario of Cascadia generating a magnitude-9 earthquake and what would happen in that scenario. And so this, for us, is relatively routine. These are really big earthquakes. They’re similar to the one in Japan in 2011 and Sumatra in 2004, and the main thing about Cascadia is that we have essentially no level of preparation for this sort of thing. Japan is very well prepared and actually did quite well in their earthquake. But our situation is we’ve built all our major cities (you know, Vancouver, Seattle, Portland, Victoria) on Cascadia, not having any idea that this problem existed. And so we’re actually closer to Indonesia, who had large cities like Banda Aceh built on top of the Sunda subduction zone without really much inkling of what was going to happen. And so we’ve got a large and growing population and industry, and all these things, and most people just hadn’t heard that we were on top of this time bomb and that we had a relatively high probability in the next, say, 50 to100 years. The last one we had was about 316 years ago, in the year 1700. The Native Americans were here, and they have legends built around this story, and they actually were well aware of it before the geologists figured this out [**KL:** “Hmm.”], starting in about 1985 or so.

**KL:** Mm-hmm.

**CG:** So we immigrants [laughs] are now just learning this story, and so the article basically just outlined what one of these earthquakes would be like, what would happen in general, and then there was a follow-up describing it in more detail. And it was very, very well written. It was factually accurate, but written as a writer would write it, as a, you know—

**KL:** Yeah.

**CG:** —not as a scientist.

**KL:** Well, and I think it scared the heck out of a lot of people, in terms of just what could happen and what the capacity could be for destruction with a quake like that.

**CG:** Yeah, it did do that, and some people in the science community felt that it was little over the top, but I’m not one of them. I’m actually thinking that scaring people a little bit is completely appropriate, considering the situation. Since we’ve learned about this thing, we’re now in sort of a race. We don’t know how much time we have, but we’re in sort of a race to minimize its future effects, and so being a little over-the-top and a little bit frightened about it is probably a good thing, in my mind, and so I think the article did a tremendous amount of good in just raising awareness and informing people who, like you, had never heard of it. A good example of that is in the 2004 Sumatra, I gave an interview on the Wolf Blitzer show on CNN, and just right after that, there was a press conference, and President Bush was talking about how the U.S. was going to send aircraft carriers and send aid to Indonesia, and one of the press pool asked, “President Bush, do we have any problems like that here in America,” and he goes, “Well, no I don’t think so.” [laughs] And I couldn’t believe it, you know.

**KL:** Wow.

**CG:** So we have two big subduction zones here, one in the West Coast and one in Alaska, and the level of knowledge in Washington or in decision-makers’ minds about these things is virtually zero, so getting it out there in a big way was a good thing, did a lot of good.

**KL:** That’s incredible. So, I would imagine that many researchers are not getting calls from CNN and NOVA and various other places where you’ve been able to engage the public in what’s going on with your research, and I’m wondering what advice you might have for researchers who find themselves, all of the sudden, perhaps, in the same way that you weren’t really thinking a lot would come out of this, and then all of a sudden it went viral—and I’m sure that increased the amount of attention that you were receiving from the media—how do you handle that, and what are some strategies that you’ve used to kind of think about how best to share about your research with the media in a way that you think is going to be impactful and effective.

**CG:** To be honest, I don’t prepare all and don’t have any strategies. The only thing I could say, really, is that there’s a big gap between what we normally do from day to day writing scientific papers, and how it’s going to be perceived in the media.

**KL:** Absolutely.

**CG:** And the only thing I can say is advice for scientists, is just learn how to say what you have to say in really simple English, and that’s the key. If you start going off talking about Bayesian uncertainties of this measurement, or whatever, it’s not going to work. A famous quote by Richard Feynmann, you know, the Nobel physicist, he said, “If you can’t explain what you’re doing in plain English, you probably don’t understand it yourself.”

**KL:** Mm-hmm.

**CG:** And really the key. People come to your office and bring cameras and microphones and want to ask about what does this mean. If you can’t explain it to your mom or your dad or your five-year-old, that’s the level you need to be at, and so I would just suggest practicing on your parents or your children or your friends to see if they get it. And the other thing, really, is just have a willingness to work with the media, because if they’re interested in your work and it has societal relevance, they’re the ones that are going to help you get the word out, and a lot of scientists really don’t want to do that, has been my experience. We had a session at the GSA meeting two years ago where we talked about—it was a day-long Cascadia session. We had a science session that was just the latest scientific findings, and then lunch, and then we had a sort of societal relevance session talking about building codes and engineering, and the very last talk, we had a producer from Discovery Canada who was there to talk about how to work with the media. And he was a really speaker, gave a hilarious talk, it was fantastic, and we were in this gigantic meeting hall that probably held 800 people, and there were only 10 people left.

**KL:** Oh my gosh!

**CG:** So the scientists really would rather hear about the latest results in carbonate sedimentology than they would about how to deal with the media should they come your way. So these folks are hard-working folks, they’re just trying to do their job, and the scientists felt like, you know, they’re here to distort what we’re saying or just turn some simple thing into an over-the-top soundbite for the evening news, and that’s really usually not the case. They’re usually trying to get it right, and for them to get it right, we have to figure out how to help them get it right, and that’s what Mark Miller’s message was. But it was disappointing to see that the sort of rank-and-file scientists didn’t really have much interest in just learning a new skill that would help do that.

**KL:** Yeah, that is so interesting.

We’re going to take another brief break. When we come back, we’ll hear from Chris a little bit more about earthquake preparedness. Back in a moment.

[music]

# Segment 3:

**KL:** Chris, one of the things that you talked about was kind of the important partnership between scientists and the media, in terms of sharing research outcomes but also what is the impact of that research on people’s day-to-day lives. And I know after reading this article that we’d previously mentioned in The New Yorker, there was this quote in there, of basically “everything west of I-5 will be toast,” which I think threw people into a little bit of a panic [both laugh], in terms of just what does that mean. And I should mention I live just west of I-5. That’s where my house is. But I think people just weren’t prepared to hear that information and just the drastic nature of it. So I’m wondering if you could speak a little bit to how that panic, you know, it kind of influences how you engage with the public about this information, and also just speaking to that part of the article—is west of I-5 going to be toast?

**CG:** Yeah, that’s.... Well, I live just west of I-5 too [laughs]. So this is a good example of one of those kinds of things when scientists interface with the media that drives some scientists away and just say, “I’m never going to deal with them,” and the better response, I think, is to try to fill the gap of what went wrong. And so, in reality, no, everything west of I-5 is not going to be toast, and I-5 is not a geologic boundary, anyway. She was just trying to relate something that everybody knew where it was. But the quote was actually from the Region X FEMA director, who said, “Our starting assumption,” meaning his agency, “is that everything west of I-5 will be toast,” and that means when the earthquake starts, he’s going to get on the phone and call the cavalry, and he’s going to assume the worst. That’s all he said.

**KL:** Mm-hmm.

**CG:** And people left out those two words [both laugh]. They’re an important two words, because he never said that everything west of I-5 will be toast, and it won’t. But for a magnitude-9 earthquake, a lot of things will happen. In Kathryn’s follow-up, she listed very well some of those things, and we’ll link to that, so people can read them.

**KL:** Yeah, absolutely. We’ll put that in the show notes.

**CG:** And so, she sort of enumerates these things that will probably happen, and then kind of tongue-in-cheek at the end of it, I said well when you read this it sounds kind of toast-like, and it is. But it doesn’t mean that all of them will happen, or that all of them will happen west of I-5, or anything like that, but it’s difficult to underestimate what a magnitude 9 earthquake, or overestimate the effects of a magnitude 9 earthquake. You can do it, I mean I saw on one little-known network, they had a graphic for an upcoming documentary that had a gigantic blue curling wave that was higher than the Space Needle, and I called them up and said, “You can’t put that on television!”

[*laughs*]

It’s just not, you know the tsunami in Seattle will be about a meter at most. So, you can overdo it, but the article in the New Yorker didn’t overdo it, it was quite accurate. And the only things that weren’t quite right is it conflated the probability of earthquakes at the north end of the subduction zone with the south zone and kind of smushed them together in a way that wasn’t really quite appropriate. But it’s a good example of the kinds of things that drive scientists away and say I don’t want to be involved with this anymore, when the better response is to get involved and kind of smooth over the bumps, because the article mostly did a lot of good. Caused some confusion, caused some panic, but a little bit of panic I think in the situation is not a bad thing.

**KL:** It might be warranted a little bit. Well I think one of the things in the follow up too, is really just practical things that people can do. And it sounds like, as you’re working with the public, and thinking about how to share the information you’re learning with all kinds of audiences; I’m sure this is a question you get quite a bit is just: what can we do? If we know it’s coming, we don’t know when, what are the kinds of things we can do. So I am wondering if you can just share – what are some of the top things that you tell people? Especially, you know you read articles online, and you know it’s carry a backpack with you everywhere and keep water in the trunk of your car, all things people just say, I’m not going to do that, I’m not going to be able to do every single thing on these lists for preparedness for emergencies. But what are some things that kind of rise to the surface for you in terms of prioritizing for people what they can do.

**CG:** Oh sure. Some of the simplest things are just having a bit of knowledge of what you can expect. One simple and obvious thing is, the typical wood-frame houses that we mostly live in actually do pretty well in these types of earthquakes. They don’t do necessarily as well in crestal earthquakes, where you have a really nearby fault, like say you’re sitting a block away from the San Andreas and it let’s go. But in subduction zones, the fault and the actual source of the earthquake is underwater and it’s offshore, so you’ve got some distance to begin with. And so what that means, is when it goes, the shaking we feel is relatively light and relatively long period, it feels like you’re on a boat, it’s kind of rolling, as opposed to an explosion kind of thing. So wood frame houses actually do pretty well in those kinds of things. So one thing to know is that your house is probably not going to collapse around your ears in these kinds of earthquakes.

**KL:** That is very good to know.

[*laughs*]

**CG:** Yeah! So that leads to the first thing, it surprised the heck out of me a few years ago to find out that a lot of houses are built on top of their foundations, but not attached to their foundations. Which means that when the earth moves the house is going to go left and the foundation is going to go right, and then it will collapse. So the simplest thing is to simply bolt your house to its foundation, and they have are contractors and even kits at Home Depot where you can do this, and so it’s not expensive, generally, a few hundred dollars typically, unless you’ve have a difficult case. So once you have your house bolted to the foundation, then it can move with the earthquake, and it’ll throw all your dishes on the floor and things like that, but it probably won’t break the house and cause it to collapse or slide down the hill. And then, another really obvious thing is a lot of damage from earthquakes is from houses burning down, because you break the gas line, and you break your gas line to the water heater, the water heater tips over and your house burns down even though it survived the earthquake. And so in 1906 in San Francisco, most of San Francisco burned down, it wasn’t necessarily destroyed by the earthquake. And so, a simple thing there is, again 20 or 30 dollar kits to strap your water heater, they’re usually just for freestanding on the basement floor or something, and you just strap it to the studs and keep it from breaking the gas line, and your house probably won’t burn down. Another thing is, for a couple hundred dollars you can buy an automatic gas shutoff that shuts off the gas at the street, so your entire house’s gas would be shut off. And it’s a simple little mechanical device that goes on your gas line, and has a little ball that rolls and block the gas, so those two things alone, or those three things alone, you’d pretty likely still have your house after the earthquake and still have somewhere to go. And then the second order things are, as you said, storing some food or some water. Maybe in your car, or in some place that will be accessible easily. And then, beyond that the next thing I think about is where you work, you know you spend 8, 10 hours whatever it is, a day there, and most of the buildings that people work in in the Pacific Northwest aren’t as resilient as the wood frame houses that we live in. We have, somewhere between 50-70 percent of the business structures in cities in the Pacific Northwest are unsupported masonry, URN buildings, and they are commonly collapse hazards. So what I tell people to do, since we haven’t been able to retrofit entire cities yet, we’re kind of at square 1, thinking about how to do that and just kind of shocked at how much its going to cost. That is going to get done, but in the meantime, a lot of people work in big tall brick buildings that have no earthquake standards whatsoever, and we presently have no requirements for retrofitting those buildings to earthquake code. New construction yes, but old construction no. So I tell people to look around, look at what kind of building you’re in, in the city you’re in, and see if they have a listing of URN buildings and if you’re one of them, and then think about making some sort of a plan. And the plan might include agitating your supervisor, your boss, the President of the company and informing them, they may not know about it. And so a good example of that is Mercy Corp, they have their headquarters in Portland, and they have a guy, an IT guy who is sort of a prepper, and he was sort of into this stuff and emergency things, and he realized that the building they were in was vulnerable to this kind of stuff. And he started agitating for doing things, and now Mercy Corp has got a pretty good plan, and they put emergency supplies in the bathroom on every floor, and started some training. They realized, from a business perspective, that if their headquarters went down, their global aid mission would go d with it. And more and more companies are beginning to realize that hey, if people can’t come to work, or if we lose a big percentage of our workforce, just business wise, we’re done here, we can’t function. And so Boeing, and Amazon, and Microsoft are all starting to think about these things as well. The business side is harder for an individual to deal with, but really it’s going to take essential ground-up pushing from employees to move these things forward, otherwise they won’t get done. At the coast, the picture is a little bit different, the earthquake is going to be quite a bit stronger, and then you have a tsunami as well. So the houses will still perform well, even under stronger shaking from the coast, but the tsunami is really the big issue out there, and so having an evacuation plan, knowing where the high ground is, knowing how long it takes to get there, and maybe even practicing it with your family once in a while, is the thing to do. And then, again though, being agitating a little bit, and getting involved is good. In the Pacific Northwest, we’re in the midst of, we’re always in the midst of deciding where to build certain things, and the legal requirements for that sort of thing are limited. It means that it’s on everybody to make good decisions about this – individually, and whatever city, county, entity that you live in to be aware of these things, and say, hey maybe we should agitate to not built our next hospital in the tsunami zone. Or, for that matter, OSU to not build their next marine science building in the tsunami zone, you know?

[*laughs*]

**KL:** Yeah. Well I can tell our listeners who are not living on the coast, it’s a little strange to see tsunami warning signs as you get nearer to the ocean. And I too really, that there’s actually been a very well done public service announcement about when you get to the coast, you need to know how to get out of the coast, and you need to know your escape route, and people, even just there for the holiday need to know these things. Chris, your work is so important, I want to take the time to thank you for coming on this show and sharing a little bit about it.

**CG:** Well thanks Katie, for having me on.

**KL:** And thanks also to our listeners for joining us for this episode of Research in Action. I’m Katie Linder, and we will be back next week with another episode.

Show notes with information regarding topics discussed in each episode, as well as the transcript for each episode, can be found at the *Research in Action* website at [ecampus.oregonstate.edu/podcast](http://www.ecampus.oregonstate.edu/podcast).

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