00:00 **Just going to get started. So the way this is going to work is I'm going to have some kind of opening, getting to know you a little bit about your background, questions that I might ask you a bit about collaboration issues, benefits of collaboration. And then towards the end, I'm going to ask you some questions about technology. OK, so just to start off, what kind of research do?**

I'm the director of informatics at a Medical School.

00:25 **OK.**

So my career is remote and collaborative just in general.

OK.

So I handle big data of all types, but mainly sequencing data.

OK.

So typically it is for biomed.

OK.

So name your disease. So we have a family with familial disease. We sequenced mom, dad, kid and find out which genes are broken.

00:56 **OK.**

So the collaborative aspects of my job are I don't do that. I'm not the primary researcher.

OK.

So I work in collaboration with the MDs that have the patients and they give me DNA sequence DNA and then I analyze that DNA and tell them the answer.

OK/

So by definition my work is collaborative

OK, great.

01:26 **And so and you've mentioned the goal of your work is to find those, I guess they are snips, are they? Or whatever differences are there causing disease? OK, so again, you kind of mentioned this at the general, in general, the role that you're playing is that you're doing the analysis portion while working with others, doctors, whosever projects.**

Over one hundred PIs a year.

Over one hundred PIs a year. Oh, my goodness.

01:57 Yes, OK, it's nuts.

OK, so in general, on average, how many people are on a given project that you're working on?

That's a good question. Anywhere from two or three. Up to a dozen.

OK.

Really varies.

OK, yeah. And then what about on a

02:27 **any current you could pick, any current research project. How many people are on that?**

OK, so we have a long standing project with dilated cardiomyopathy, which is actually Main PI is the product of the secondary PI. So he came from her lab,

OK.

and they continue to collaborate collectively.

02:59 Those two labs are probably 10 people.

OK? Yeah, OK, so are there any challenges or disadvantages to working on smaller projects where there's only two or three researchers?

Yeah, because it puts more pressure on myself and on my staff.

03:29 **OK, can you elaborate?**

Yeah. So, all right. To have an M.D. who has, who have great ideas and are awesome at getting money, but they don't have the background, they don't have the statistical background to build the experimental design, nor do they can they pipet, that they don't know how to do. So there are aspects that the PI can or cannot do.

04:00 **OK.**

Generally, a PI doesn't have time to do it themselves, so you have postdocs and graduate students and things like that where they are underfunded, they end up doing it themselves and/or making, having to have fewer people do the gamut of the work.

04:26 So they rest on me more than others who had a postdoc or graduate student that I could then work with.

OK.

So it comes down to do I actually have to do the work or am I collaborating with and coordinating, mentoring the student postdoc who's actually going to do it?

Mm hmm. All right.

So I have myself and seven analysts in my lab.

04:57 **OK.**

So obviously I can't work with 100 PI, I can't actually do the work of 100 PIs per year. Right. So it's distributed across. And you know, sometimes the analyst or myself is, you know, an ancillary role where you just do a little work and kick it to them and then they take off and they know what to do with it. Other times I'm part of the experimental design.

05:27 So they come to me with an idea. I help them with how many minds you need to do this study. Sometimes I help them with, you know, bench work as well.

Mm hmm.

And then get to, you know, data, hand me data. I generally analyze the data and hand the data, the results to a postdoc or a graduate student. For them to just run off and do the biology with. Small groups don't have that person to throw it to.

05:58 Thus, I have to be, to do the experimental design, how to help pull it off, analyze it, and then do the post analysis. So basically, I'm in it for the long haul.

OK.

Versus most of the time it's a revolving door, kind of a thing. As I sit in my office and people just go revolving door through my office and I just wear different hats and but sometimes, you know, the smaller the group, the more you have to do.

06:29 **OK, are there any benefits to working in small groups?**

Yes. Fewer cooks in the kitchen.

OK, elaborate on what you mean by that?

The more people you have, the more opinions that you collect and the more just, the bigger the discussions and the less productive they become. And so meetings can spin out of control, out of just everybody has an opinion and nobody's right, nobody's wrong and no one will concede.

07:03 And, you know, the bigger the project, the worse that gets. Actually, the smaller the project, you know, the smaller the discussions become, it becomes <redacted> what do you want to do versus, hey, what all do we want to do ? And so, yeah, small is a problem. Huge is a problem.

Mm hmm.

A nice round figure would be PI, graduate student, postdoc,

07:33 myself, maybe a technician, so you have four to a half a dozen people, because each one will have their own jobs to do. And so, the work gets divvied out amongst more people without gaining so many people who aren't doing much.

OK, OK. Going to discuss some of the disadvantages associated with the larger projects. Are there any additional issues or challenges?

08:02 I do have one project that is, has become an unwieldy thing simply because it's actually, so the first example I gave is a PI and his previous mentor that work well together.

Mm hmm.

I have a different group that is from the trauma department.

OK.

There are

08:30 at least six distinct PIs that work together as a conglomerate group.

Mm hmm.

Everything from statistician's to MDs, trauma surgeons.

Mm hmm.

And once you get past someone who's in charge--so you can have one person in charge and a bunch of people under them, then order is maintained.

09:01 But when you have a lot of equals, it becomes very, very unwieldy, very fast because you think everybody has an opinion. Get a bunch MDs in the room. They all have very large egos and very large opinions. And it just gets it gets unwieldy very fast. That project in total is probably a couple of dozen people.

09:28 OK, and in total, most of which I've never met, simply because they're just right there in there in the labs doing their thing. And I just interact with the multitudes of PIs and postdocs. And so, yeah, there's a degree of, from not enough to just right to too many to Oh my God, just let me out the door.

09:59 **Are there any benefits to working on the larger projects?**

Oh yeah. Money. Generally larger projects are more well funded, more people, because it takes more money to have more people. And so there it's less of an issue of penny pinching. It's just get it done. I don't care how.

10:24 So it becomes more, as the budgets get constrained, there's more discussions on what to do and what not to do and why versus just do it

Mm hmm.

kind of thing. So on the far end, you've got tons of money. You can do whatever you want. As long as it's a good idea and you pass committee, just go do it to if there's so, you have new P.I.

10:54 assistant professor comes in and gets a starter package and have a quarter million dollars. So I have a quarter million dollars to get my next grant is essentially what that's for. And so it's very, very slow. And the first, it's a free for all because you've got a quarter million dollars. It's tons. Starts eating it up pretty quick and then they get penny pinching and get really tight and will not do proper controls because they cost too much money.

11:30 And so the experimental design flaws simply because we have to conserve funds so the projects get smaller, tighter, harder to defend. So on the far end, when you have no money and so, you know, there's the startup package and then there's when I've blown that startup package, I have to go to the to the dean for rich funding, blah, blah, blah, like it's really bad.

12:00 **So how does that affect the outcome of those projects?**

It can be detrimental. Um, I have a study right now for which I spent a lot of money but didn't do it well.

Mm hmm.

And she's probably spent fifty to one hundred thousand dollars on sequencing and has nothing to show for it simply because proper controls aren't done.

12:26 And to be honest, there really aren't any proper controls, so I can't blame her for being a little tight, but she was doing a whole mouse genome's for B cell lymphomas. And so, B, cell lymphomas are just weird blood cells that do all kinds of wacky things. So there really isn't a good control. But she should have done something.

12:52 **OK.**

So sometimes they have more money than they have educational background to-they get the foray into projects for which they don't have an educational background to stop themselves.

OK, so kind of moving slightly different track here, what percentage of your projects roughly have involved at least one collaborator who is at another institution?

A bunch.

A bunch.

13:21 This being one of those institutions.

Right, right. Right. Would you put this somewhere like a bunch means like 80 or 90 percent or a bunch is like 50, 60 or

Well, no. Yeah, OK, let me qualify.

Yeah.

Of the hundred PIs per year, most are on my institution simply because that's where the money is.

Right.

On this institution alone

13:50 I work with one, two, three, four, five, at least a half a dozen people every year.

OK.

So actually, and then in addition to this one, I have collaborations from Texas to Louisiana, Mississippi. I collaborate with, you know, at least half a dozen or more universities per year.

14:19 **OK, so would you say that like over half of your collaborations are just within your own institution?**

Yes.

OK, like, would you say them more than three quarters are just in your own institution?

Yes.

That's where I'm kind of going. It's sort of like, you know. Yeah, like almost like this sometimes, always, never, type grouping here.

Exactly.

OK, great. So in those situations where you're working with collaborators that at other institutions why did you choose to work with them?

14:47 Oh, that's a great question. Mainly because they needed assistance and I could do it. All right. Others. Yeah, actually that's almost always the case. So I, as in other computer science people, are good at helping people who can't do it themselves.

Mm hmm.

So once you become a bioinformatics person, you've become exceedingly handy and people will come find you, because they can't do it themselves.

15:21 **OK.**

So that is primarily the reason, you know, there's <retracted>. Those guys just don't have anything. Here, you have, at least had, a dysfunctional genomics system.

Mm hmm.

Actually still do. And the informaticians were either ineffective or left or are currently deluged with others.

15:51 So it's a supply and demand issue. If you do not have the supply and you have the demand, people will go other, will have to go other places, by necessity.

OK.

And so then they seek out people like myself

OK.

from other places.

So typically you're the you're the one who's being sought out because of your expertise?

Yep.

Right., just out of curiosity, has there been a project where you were seeking out others for or is it just more than one way?

16:22 I have plenty of work to do.

Yeah. No, I'm interviewing people who are in slightly different situations.

Yeah. So I'm in the extreme of the other way.

Right. And you're not the first person that I have spoken to who is who is in that, where everybody's looking for them because they're experts. Sometimes people go both ways. Sometimes it going the other way. So that's kind of why I'm asking the asking this question.

Yeah, because you have the other side of myself is the people who don't have that and they're seeking out someone.

Right.

16:51 I just happen to be the first person they contact.

Right. OK, so, um, are there any challenges or disadvantages to working in, working on projects where your collaborators are distributed?

Well, yeah, I mean, it's just a matter of getting everybody together.

Parking.

And parking. It's more of the herding cats. How many PI meetings have you had?

17:22 So where are you in your degree?

So I'm yes. I'm just I'm doing a kind of a combined master's, and I just got my masters, so I'm just starting to get sucked into those larger meetings.

OK, herding cats is just difficult at best, of trying to find a time when you can get everyone in the same room, the same thing, whether you're a graduate student with a committee or, you know, it's a project oriented meeting is the same thing, is trying to get people in the room or even on Skype or just getting five minutes together.

17:59 The more people you have, the worse it gets. That's why you only have four or five committee members.

Does like location, like whether or not your collaborators are co-located or distributed affect the frequency at which you meet?

Yes. Well, yes or no.

Yes or no.

With the advent of Skype, it's trivial to get together when five minutes are possible.

18:31 **OK.**

Distance becomes less of an issue because we Skype with people from Italy.

OK.

And so it's just a matter of finding time. So, face to face meetings are easier local.

Mm hmm.

But. You know, I see the <redacted> lab more.

Mm hmm.

Just simply because they meet more and I meet them here more because I'm here more.

19:01 **OK.**

And so face to face meetings are more local. But I'd say if you're going to be remote, you have to accept that you're going to have to electronically get together at times.

OK.

Yeah, so that's helped.

Kind of on a similar track, do you think that the size of the group has any impact on how frequently you have meetings?

19:31 Hmm. I guess I don't have an opinion on that.

That's fine.

Um, probably, probably not. So it's probably not correlated.

OK.

In my sense, I have some big, huge meetings that are done every week and I have small meetings that are done every week and have the opposite of big meetings,

19:57 never, we never meet. So, yeah, it just in my mind, it doesn't seem correlated.

OK. So kind of went on a tangent there. But getting moving back, are there any benefits to working on projects where your collaborators are distributed?

I mean, and distributed in

as in not

space

distributed in space, not

geography

geography, yes

OK.

20:29 Actually, to be honest, I don't see. All right, there's no particular benefit to them being remote, there's not necessarily a detriment either.

OK.

I think it's more beneficial for them to be closer just because of ease.

Mm hmm.

But,

20:55 I think it can function easily, either direction.

OK.

Locally, it's probably a bit easier simply because you don't have you know, you already have a time issue. Adding a space issue is just an additional. And I'm not sure of. I think I pleasantly avoided that.

No, no,

Talked around that one.

it's fine.

21:20 **So, I mean, in addition to having, not having to, it being easier to schedule things, you know, not having to worry about a space issue, are there any other benefits to working in working on projects where all your collaborators are at the same institution as you?**

In mine? Not really, because I don't have a lab. I don't have a lab. But it's not like I'm tied to the bench.

21:50 I can take my computer and go to Zimbabwe and work just as easy. Actually, I've worked in Mexico City as easily as I've worked here. So my job isn't whether they're down the hall or a thousand miles away, my job is basically the same.

OK.

So I don't find it a detriment or a benefit.

OK.

Once the results have been derived, sometimes easier to work, work them through because I have a large education to impart to them.

22:26 So that's easier at times. I mean basically I am just as, things are just as good, remote as close, sometimes it's actually better if they're not near you so they can't knock on your door.

OK.

So that's a different aspect, I work with so many people, with so many demands that having them not near is sometimes easier.

22:57 **OK.**

So they can't knock on my door.

OK.

That's definitely an aspect of it.

Absolutely. OK, so kind of a slightly different track. Roughly what percentage of your projects involve collaborators who are in different fields?

I'm going to be extreme and say one hundred percent,

Right.

but simply because collaborative science, OK, so it used to be that a PI would come up with an idea,

23:36 construct the design, get it funded, get it done, get it analyzed and write the paper. So one guy, one project. Doesn't happen anymore. The projects are getting too big, too collaborative. So you need, you know, the PI with the big idea and the money. You need bit scientists, you need analytics, you need statisticians.

24:06 So collaborative science is here to stay and it's only getting stronger. So the days of single PI are ones, It's just not happening anymore. Actually, that's why I have a job, is because they can no longer fund their science alone.

OK.

So it's kind of, it's not <retracted> who helps, who guarantees their funds

24:36 but basically if you put an informatician on, doesn't have to be <retracted> can basically anyone, then you have a much higher chance of success, simply because it's collaborative and because what will happen is the reviewers will read the grant and they'll go, you're an M.D., you can't do this, and it's gone. So they will reject it. So cooperativeness actually equates to success now.

25:09 And so almost everyone has multiple disciplines coming together. Yeah.

Right. So then when you're saying sucess you mean both with receiving grants and getting and also getting it funded and also the project outcome?

Yes, absolutely.

Great. So are there any disadvantages or challenges associated with working with collaborators who have a different field or background than you?

25:39 Oh, like I said, it adds to the overall success because, you know, multiple heads are better than one. On my side, I get to learn from them and they learn from me. So that's the benefit of my job is I don't necessarily understand what the next person who sits in front of my desk, I don't necessarily know what they're doing and what they've done and what they know.

26:09 But that's the benefit is I get to play in their sandbox and I get to learn from them.

Right.

And so that's that's my payoff, is learning is, you know, additional learning over and above what I've already gathered, so that it is beneficial to do basically all.

Right. Are there any challenges?

Are there any challenges? Yes, there's lots and lots and lots of challenges because the more people you, with different disciplines, the less they know about any of it.

26:40 So if you have, the bigger the pie, the smaller the wedge. Right. And so less any one person knows about any of the rest of it.

OK.

So the more collaborative and the more dissected it becomes, the harder it is to get past the education hurdles. Me trying to explain and taking genomic reeds and mapping them to the genome.

27:10 That's an a fairly large algorithmic feat.

Right.

Sometimes, though, I can just wave my hands and go, OK, just things just map just similarity. Other people will demand that I explain it. And so, it gets it's whether or not the PI is, or the person who does not have the education is trusting and appreciative of those who have a different opinion and different educations.

27:44 So again, it's mob science and that if you've got people who are rowing the boat all in the same direction, then everything is good. Everybody agrees and everybody understands that they don't know everything. But when you have someone who doesn't know and doesn't know that they don't know and won't take it on faith that you know what you're talking about, it becomes headbutting time.

28:16 Absolutely. And that all of the above happens from complete cooperation to complete chaos.

Have you ever had a project fail because of collaboration issues?

Yes.

OK, what was the why, what happened, not naming names like what happened and what was the overall the ultimate outcome of that project?

28:43 I've had PIs who were exceedingly demanding and didn't understand that people like myself didn't work for

OK.

We work with you, not for you.

OK.

When you don't get that distinction, things go bad really fast because there are demands that are put on you as if you're an employee of that person and then those expectations aren't met, spirals out of control.

29:17 Essentially the there are people who whom you can work with and people whom you can't work with. And I haven't found all that many. I found a couple of people whom I have simply chosen to walk away from simply because it just wasn't worth the time and the effort to make it work.

OK.

And that's pretty strong since that's my job.

Right.

29:45 But there are people whom it will, just won't allow the collaboration to, or actually they don't see it as a collaboration. They see it as a hierarchy. And you just can't, there are times when you can't deal with that. You just have to walk away, agree to disagree and walk away. Yes.

OK.

Dissolve.

Yeah. What would you say is the biggest impact on the outcome of the project?

30:13 **Would it be the size of the group and their location, general geographical location like co-located or should it or the individual disciplines or backgrounds?**

Single word: respect.

OK.

So if it's all of this is collaborative, all of this takes people of different skill sets.

30:42 It's about the respect. It's not the size. It's not it's not how small it is, how big it is. It's how respectful all of them are to each other and the greater group. If you have a thousand people and they all respect the view of the other, it'll go smoothly. If you have two people who can't decide on what day it is, it's going to be a fight the whole way. So it's about mutual respect, not necessarily the size you're doing.

31:11 **OK, so I'm going to be moving on to this last portion of the interview. This is kind of gonna start off a little bit different. So you've mentioned a few things as we've been talking that, tasks that seem to involve collaborating with others, such as building your experiment design, doing analysis, sharing data, and sometimes even doing the post analysis.**

31:36 **Is there are there any other major tasks that you do that involve working with others, peers or people in your own lab?**

All right, besides the getting it done part, that's basically been getting it done, part, a pretty big part of my work is education.

OK.

And not so much that I teach a class.

32:06 It's that the graduate student comes to me and I mentor them. So it's more of a mentor education than a classroom education.

OK.

That's I'd say 20 to 50 percent of my job is mentoring. And it's not just graduate students, postdocs, it's PIs, its older PIs.

32:34 So, yeah, it's just getting them up to speed to where I can actually talk to them.

OK.

On a one to one basis.

OK.

There's a vocabulary level that you just have to learn.

How do you usually do that?

Tediously slow. And so I start from ground zero

OK.

and just build them up.

33:01 **OK, let me rephrase. Are you meeting with people one on one or?**

Yes.

OK. Do you ever email, Skype, phone calls?

Generally, this is a one on one face to face thing because it's difficult. So what I do didn't exist five years ago, right. So it and a lot of the concepts are foreign to biologists anyway.

33:34 So a lot of what we do is in computer science aspect, but it's the application to a biological question. So there's aspects of like even once a server, what's a head node? You know, what's parallel, distributed computing? And so for them to understand what I'm what I do for them, you have to sit down and I need to see their blank face.

OK.

34:01 So a lot of times I'll just start talking and or I'll ask them questions of do you understand the next gen sequencing? Do you understand Illumina sequencer? And so I quiz them and then figure out from their blank face where I need to start.

OK.

And then generally it's just treating me like an idiot and start from the beginning.

OK.

And it can take hours. I mean we, I do this in one to two hour sessions until I see their brain starting to hurt.

34:31 And then I, then I go, OK. And so it's yeah. I find it's much easier face to face because there is more of that eye contact, of I can see that you're getting it

OK.

versus a blank telephone or even Skype. You just don't, you can't necessarily know they get it unless you can see it.

34:56 **OK, what about with your other meetings throughout the whole the whole process of these meetings, how do you conduct those?**

I generally either call a one on one in my office to discuss those things, or they call me to a lab meeting where we have a grand discussion.

OK.

Generally it's a one on one in my office.

35:26 **OK, so face to face?**

Face to face.

Have you, do you ever, what about when you're working with collaborators who are not nearby?

I will typically go to them

OK.

because the face to face is that important.

OK.

Because they really in my job, because, for instance, I have people on what's the <retracted> campus where the sheep are.

35:57 So they're doing reproductive physiology. So they know a lot about what they're doing, but they have no idea what I do and what I can do for them and

OK.

and it's easier for me to come to them because there's generally more of them than there is of me, so I find it easier for me to just go to them generally, especially if it's remote and if it's locally remote.

36:26 I will just drive the hour to come here simply because it's that much more productive.

OK.

And if it weren't that productive, I certainly wouldn't drive by I-25, if they were not productive.

So more productive compared to what?

Trying to explain mapping algorithms on the phone. Not from zero. It's just too complex.

36:52 Most of the time I need a whiteboard because, and that's actually the greater thing, is people are visual. And if I say I need to take reads a map into the genome, OK, that's a lot more abstract than me drawing a chromosome on the board and saying it goes right here. And so I end up drawing figures, whether it be on a whiteboard or just on a piece of paper.

37:18 And so trying to give them more visual, not dumbed down, but more simplified things for them to key in on until we can get farther along in the discussions.

OK, what about meeting with people who are within your lab?

OK, so we have weekly meetings. Actually, my office is open for them

37:41 if they have a particular issue which does happen or we have great discussions on I have this to do, there isn't an algorithm to do it. Thus we need to make it. Hmm. How do we where do we start? How do we do it? So we have a consortium of minds to put together to tackle a problem.

38:05 **OK, so you've mentioned earlier that sometimes you referenced using Skype for having conversations with people where in your process of getting things done or educating, do you Skype?**

Generally, it's for experimental design, not education, so it's disseminating of information, whether incoming and outgoing.

38:35 **OK.**

I haven't tried doing any type of educational thing through Skype simply because it's just, I would imagine I could, it just be more painful.

OK, so how when doing building experimental design, what technology do you--we've mentioned Skype—what technology or methods you use to accomplish that task be it meeting in person or on the phone or Skype or WebEx or what not?

39:11 All of the above.

All of the above?

Yeah. WebEx, Skype. I guess it depends on how much the visual image is important.

OK.

So the difference between Skype and WebEx is simply you can share a desktop kind of a thing. And so if I need to show them a complex figure or something like that, then you can do that most of the time.

39:37 I still want to do it in face to face simply because there are things, like you're writing down things and as I say things, same thing as you know, you can do that on the phone but sometimes it's just I find it easier face to face. Maybe I'm old school. I don't know. But even so, the back and forth I find easier face to face look even remotely.

40:08 **Even remotely. OK, if you can't. If you can't. Absolutely. You want to do a face to face. But you can't, what is your next better tool then?**

Yeah. Then absolutely. So that people in Italy are the greatest example of it's difficult to get them here or me there, so we must do it electronically. So that means just you have to .

So what do you use?

Generally Skype.

Generally Skype.

Yeah.

Have you ever had any issues with using Skype for accomplishing this task?

40:39 **No. Great.**

I mean, other than, you know, bandwidth issues skipping and things like that, sure. That be about the only thing. I mean, when you when you're at that point, you just you have to make it work. So there's no limitation because you have to make it work.

OK.

And so you get over the issues of people's voices, skipping those kinds of things.

41:08 And you just you just learn to to power through and ask people to repeat those kinds of things.

OK.

So obviously if we had better bandwidth, then certainly things would be easier, but not huge limitations.

OK, do you ever use the phone for this?

Oh yes.

OK, when do you use the phone over using Skype or?

I guess it depends on the longevity of the question that needs to be asked.

41:42 **OK.**

Phones are generally quick question.

OK, why?

I don't know. It's just pick up the phone. I just got a quick question because Skype is more of a planned procedure.

OK.

And you have to have make sure your computers are set to do it. Everybody's got a phone.

Hmm.

And so it's just a quick, easy. Skype becomes a little more of a planned procedure than an impromptu thing.

42:16 **Are there some collaborators you're more likely to do that impromptu phone call question than others?**

Yeah, there's one that I refused his phone calls.

Oh, why is that?

He's French. And it's just it's tedious to talk to him on the phone because he speaks English well. But he stutters in a French dialect. It's just painful.

42:46 **Oh, my goodness.**

It's like so I there are people I mean, even Skype. He, any verbal, there are some people who don't do well verbally at all. So this guy I would prefer him to write an email because he writes fluent.

OK.

He just speaks in pidgin English.

OK.

So it's very painful for him to think through an educated question in an English conversation versus him typing it out.

43:20 He's much better at that.

OK.

But most of the time, not so much. I mean. I'm I would prefer that I'm one who I would rather walk 10 minutes, look in their door and ask them the question, then take 30 seconds and call them on the phone. OK, simply because there's a masking of.

43:50 conceptualization, so I can ask them a question and I'm not sure if they've got if they're answering the correct question versus if I see them and I see that the question on their face is they don't really get the question I'm asking. And I think that answer that they're giving me is for a different question. So sometimes it just gets to the point of I'll just go, OK, and that's just a quirk of mine.

44:20 **OK.**

So it's good.

So you did mention that one case where you would definitely prefer to speak to one of your collaborators via email because of the language barrier. How often do you do you use email for accomplishing this, this task, this building the experimental design?

All the time.

All the time?

Yes.

To do what?

Well, a lot of times it is a time management tool.

OK.

44:49 The fact that you can't get six people in a room,

OK.

you can email them all at once.

Right.

So it's a it's a time basically it's a time saving feature. And it's a point to where you can spend 30 minutes writing an eloquent argument that you may not be able to derive that same argument on the fly while six people are yelling at you.

45:19 And so I find it at times diffusing. And if you have something is exceedingly complex that you need to work through. Sometimes words are, written words, are necessary. Just simply to slow to slow things, slow time down

OK.

and let people have time to read it, soak it in as well as respond, they have their own time to respond.

45:48 **OK.**

And so the issues become so complex that they need to be written simply because people can't wrap around the whole thing in in 30 seconds,

OK.

It's just too complex.

OK. Have you ever had any problems using email

46:13 **for doing this this type of communication?**

Yes, all the time, 100 percent, since I work with so many, that becomes a huge burden and that I will, I've, my phone is sitting here vibrating while I'm talking to you. Every minute that I'm doing something else, someone is wanting something else. And so my email piles up and I may or may not get to it as quickly as people would want me to.

46:44 So it becomes a time sink. If it overruns, then it's not the instant gratification that the other person would want. And same way with me is when I have a quick question, I need answered. I just need to

know which samples are controlling, which samples are treatment. That's all I need. It's a very quick question. It may take three days to answer that email, and I'm stuck.

47:13 So it is it is an issue because of a time lag, I guess.

OK, so when you're, kind of moving from this one, you're sharing data with collaborators or with people within your own lab what tools do you use?

OK, I need you to further qualify that. Note were I'm coming from.

47:44 **So, I mean,**

It's a pretty an open ended question.

It is little bit. I guess. It seemed as though you were kind of going through this, you know, you were doing analysis and then giving it to, say, a postdoc or a graduate student to do post analysis. What are you using to get the data from you to that person? How is that happening?

48:11 All right, so we have verbal and or written communications to design, they go off, they pull off the experiment, they get their DNA, their RNA, whatever they're going to sequence. They send that to the core.

Right. And that's over a traditional snail mail for reverse samples?

Yes. Yeah. Express mail.

Right. All right.

They put it on the machines.

48:37 They sequence it.

Right.

That goes to a server,

OK.

for which I have access. I then transfer that data to my own servers.

Right. Using some sort of FTP, whatever?

Right, FTP, SEP, yeah. I crunch that. Those data files are far, far bigger than normal academics are used to dealing with. So these don't go over e-mail. These can barely be Dropboxed.

49:07 **OK.**

So generally for a bigger file, bigger shared files will use something like Dropbox or I simply make them bring me a three terabyte USB drive and I just download it for them.

OK, all right.

But once I crunched the numbers, the data can generally be, is excel-able. So use Excel spreadsheets or something like that so those can be emailed at some level.

49:40 OK, so the actual project results that someone needs to go play with is the file size is reduced such that OK, now it.

OK, so I mean it seems very clear the distinction you're using. Use Dropbox when you can, when the file, when these pre-going into Excel are small enough, and the rest of time you're putting it on physically on a hard drive.

Right.

50:09 **Why are you putting it on a hard drive instead of giving them access to the server where the data stored or?**

Because they have no concept of what that would take.

OK.

There's no educational background to be able to access it. They don't know what a terminal window is. So there are concepts that are completely foreign to them that it would take me a lot longer to teach them how to go access to server than for me to download it two or three terabyte drive,

OK.

50:42 And so it's, and they can barely deal with the drive, so it's a matter of educational abilities and time sink on <redacted>'s side of sometimes it's just easier just to hand them a disk and make them go away.

Right. Yes. So you mentioned that you, once you've crushed these then you have, you have your data in Excel files.

51:10 **And then also real quick, why excel over other special type tools, OpenOffice, whatever?**

Because that's the only thing they know. Literally, that's the only thing they know.

Some of these things, like I have to hear you say it, because if you say it comes stronger, then. Yeah. Than if I just, you know,

51:33 I know and to be honest, the people, they don't know that their tools exist, nor can they handle much of what Excel can do anyway. So they're barely competent to. So I disseminate my results as .csv files. Most people do, I have to explain, Microsoft Excel opens them beautifully, but people don't even know that.

52:03 So it's so foreign a concepts to them that that they they're barely competent to do just to handle the data files that I provide them.

OK.

And it's not that they're stupid, it's just out of their wheelhouse. They just have no basis for that knowledge.

Right. OK, so when do you choose to email, why or when do you choose to email files, versus putting them on Dropbox to share?

52:34 It's again, it's a competency issue. It's a lot of people can't even use Dropbox. So we're dealing with now a very different subset of clientele at times. But really, the difference is going to be size.

52:56 I mean, if it's, I mean, we still have a huge deficit in the ability to submit files over the wire, we really don't. It's self-imposed by infrastructure choices. So email can do as big a file as you want. It's the problem is actually getting it done.

Right.

So there is infrastructure problems that necessitate other means just to get it done, which, you know, email, Dropbox server depending on the size.

53:30 **OK.**

Literally.

OK, so just kind of last kind of almost simmering question. If you could create a hypothetical future technology and you don't have to limit to limit to what we think will be able to do in the future, typical black box to make collaborating easier, what would it be? What features would it have? What would it what would it do?

Teleporter.

Mm hmm.

That's the one thing.

54:05 I mean, technology is matching our need for the most part, it's lagging, but it is playing catch up constantly. So we do have we have to rethink the box every once in a while when we jump far ahead of our infrastructure. But to be honest,

54:30 I don't have a current limit and nor do I. I can't envision one because everything that I've needed has been matched, that, by subsequent technologies or just our own ability to engineer it as we need it.

OK, you did mention that you feel that sometimes technology is lagging behind. Can you elaborate a bit on that?

54:59 And basically it's bandwidth.

Bandwidth.

So transferring 100 gig file, that's tedious.

Mm hmm.

I mean, it's no different to me than a three gig. Three meg file.

Mm hmm.

It's the same action. It's just the time that it takes. All right, 100 gig file transfer five years ago was impossible.

55:26 You could not do it over Ethernet. Today you can do it, it's painful, but you can actually do it. Five years, it won't be painful at all. It'll be commonplace. And our emails will take a gig file and not 10 megs.

Mm hmm.

And so we, it's a you build it, they will come kind of a thing.

55:54 So as we build the necessity, the infrastructure must fill it. And there, but there is a time lag simply because it's just not possible. There are times when I want to provide people on this campus access to my server, but the interconnectivity is too slow. So it's just not possible.

56:19 I would love to use the big server on the <redacted> campus. Shoving my, you know, terabytes of data from one campus to the other is still painful.

Mm hmm.

And so we do still have limits. And I get around those limits by sneaker net.

56:38 So if it takes me more time, actually a good example is if I need a file from if I'm at my house and I need a file from my university, depending on its size, I have to make a decision on whether I drive the 45 minutes, take five minutes to download it, or simply I let it run overnight, grab it in the morning, or just not do it because it's going to take, I will be to work tomorrow morning before it would finish and I can spend the five minutes then.

57:15 So it's the lag of data transfer as my as my biggest client right now,

OK.

but we know that people are working on those things. They're just not caught up yet. So there's a pretty big lag on transmission rates.