**You're an Evolutionary Genomicist you are comparing genome sequences from multiple organisms. Forces that create, maintain, and destroy diversity I have one additional questions in regards to what you do and that is; what is the potential impact of your work?**

Depends on the specific project and where we are working. One of the big themes in the lab right now is the interactions between multiple different genomes that exist in side the eukaryotic cell, specifically mitochondria and nuclear genomes. And that has a lot of important human health relevance because a lot of diseases probably have a genetic basis that lies either in the mitochondria or in an interaction between mitochondrial genes and nuclear genes. We have done some pitching on that front for saying that we need to understand this for the basis of human disease. We do a lot of our work in plants, which seems weird if you're talking about human disease but there's a good reason why plants are a good purpose, a good system, to study the question because they exhibit lots of variation mitochondria mutation rates so we can actually test some of the ideas that are out there that are attributed to high mitochondria mutation rates and by taking advantage of plants. That is one of our pitches. We've got a project in the lab too that is also on that same theme; interactions with the mitochondria genome and the nucleus but it is being done in the context of genetic rescue which is something related to conservation biology. I've been collaborating with some people in the department on this and basically the idea of genetic rescue is you've got a small population that is threatened with extinction and one of the forces that threatens small populations with extinction are genetic factors, in breeding and some of the problems with accumulation of dilatorous mutations because the population is really small and selection not very efficient in it. So one solution to that is the idea of genetic rescue where you introduce foreign individuals from a different populations that bring with them allelic diversity, genetic diversity, that can accommodate and/or formulate that problem. This has been done with like Florida panthers where they brought in cougars from Texas and stuff like that to rescue the population. One thing that no one has really thought about that is to what extent are their genetic differences if you bring in males versus females so one of the important factors is the interaction between the mitochondria and the nucleus because the females bring in mitochondrial DNA with them and pass that on to their children. And males have mitochondrial DNA but they won't pass that on to a population. So that's a question that's got relevance to conservation biology, that's connected to this theme of research in this lab, so there are areas like that. First and foremost we are evolution biologists and we care about the evolutionary questions."

**What is the average number of researchers on the projects you have worked on and in general?**

I would say roughly in terms of involvement at the level of like who is going to be on the paper when it is published and that level, probably in the vicinity of 4 to 5 is the number of average authors on a paper that I publish. Sometimes there's a larger number of physical bodies that contributed to the project in some way because there might be a technician who is involved but did not have quite as much involvement that they should be published. In some cases you might expand that number to more of like the 8 to 10 range.

**What would be the general rules be of you and the people you are collaborating with?**

Usually most of my work involves a combination of working with organisms collected from natural populations. I do a lot of work with like classic model systems. So people are often involved in paining samples like going out into the field and collecting things sometimes work I've done sometimes work others have done and that can certainly be a part of the collaboration. Then there is often a wet lab component where actually, say extracting DNA, doing the molecular biology to analyze

the DNA samples things like that. And there is a big computational component where especially with bigger data sets DNA sequencing data sets analyzing those and you know so data analysis computational work so I would say there is those three areas in which people tend to work in those collaborations I have been involved in

**And where do you generally fit in here?**

At this point in my career my most common one is the last, the computational and data analysis. Sometimes I also, certainly done a lot of the first two. More as a graduate student as a post doc than I do now. Almost never have there been cases where I just did the first two and didn't do the data analysis. I can only think of one main project where I generated a lot of the sequence data and was an author on a paper but someone else was the lead author on that and they drove a lot of the analysis of the project. Almost always part three, the third that I mentioned and often the other two in conjunction with the third. –

**How many researchers are on your current project?**

So of course, the current project, is highly plural right? Is there any in particular?

**I have to ask this question because in our process of looking at themes and issues it's not enough just to get general guestimate because guestimates tend to be wrong or not deliberately wrong, but we call bias. It is tough to have people generalize. So when I ask about a specific it provides me with a better more accurate.. So just pick any of them.**

I guess that is my question, is there any criteria in which you want me to pick

**But I still ask about the general because I'm trying to look at the big picture. If I ask you about your most current research project and there are only three people on it, that's not representative, right?**

Is there any criteria in which you want me to pick

**How about your largest current**

In terms of number of people? What is the question?

**Number of collaborators, number of researcher, or number of people on the project. It can be rough**

7 I think will be

**Is there any difference, in say, roles in this project versus the other one?**

No, I was definitely involved in the data analysis. Which is what I'm often in. I was involved in some of the original wet lab sequence generation and this had a pretty small component in terms of a paining samples. So I had some role in that but it was actually really little work in general.

**How many, percentage wise, have involved at least one collaborator at another institution?**

A pretty good fraction. More than 50%.

**Why did you choose to work with these people?**

I have got a whole slew of publications for example that were all built around sequencing mitochondrial genomes that came out of my dissertation work as a graduate student at <redacted> and that's something that was not something people did in the lab I was trained in or nor did anyone at the university.

**"Why not "**

It had not been the topic of focus or skill that was needed. There were reasons why my research was connected to that lab but that was a new direction. And that was unrelated to something they had done previously and so I initially tried to go along a little bit and read the literature, like here is the method and you try to recreate them and that's always harder if you're just going by a paper and I wasn't having a lot of success. I ended up connecting with one of the more prominent and more experienced people in/with that particular technique and actually traveled to <redacted>n university, I was in the University of <redacted> and <redacted> University was where this researches lab was. And I actually went there basically to be shown the ropes on how to do that sequencing and what not. That established a collaboration then with all of the work that came out of the project which was multiple papers involved. Both that PI as well as the post doc that was in his lab. So certainly reasons like that where someone else has the skills, or the technique, or the ability that you do not have and their better at doing those things. Similarly like southern blots is another technique that is used a lot kind of, you know a technical one that is good to have experience and to know what you are getting, they are just slow and sort of a pain. A couple of other papers I have, have involved those. I was not the one to do them, I already had a little bit of a collaboration going with someone because she asked me to send them seeds and stuff like that and she was working on that technique. And then it came up, you know what? This project we are working on right here we could really make it a lot better if we included some southern blots. Hey, you already have the seeds and you know how to do this, and you are going it in your lab. And it established a collaboration right there. I had a couple of papers come out along those lines. So that's common. Getting materials and seeds is also common. Theirs people that are collaborators on things because they just sent us either extracted DNA samples or seeds. They sent us stuff they already had but they had put in a lot of work into getting that stuff.

**And that was stuff you were requesting from them?**

Yup. And it's gone above that I'm not sure if I have ever been an author on something, you know, sent them seeds. But I have definitely had people on papers who have provided materials to me, and that was their role in collaboration.

**So in this first case where you had search out and find an expert, how did you find this person/select that person and actually contact them?**

In that case it wasn't a co-call, they actually came to the University of <redacted> to give a seminar. I was meeting with them and discussing what I was working on and the project and the problems I was looking into and they made the offer and hey you know, if you would like to come out to the lab, we would host you. I emailed them three times afterwards and they didn't respond for a while, I pestered

them enough and then they followed through with the offer. In that case they kind of serendipitously came to me. There are other times where it is more of an active search process. I have a graduate student in the lab right now who is drumming up ideas for her project and her dissertation and the way she headed, we haven't actually done this yet. She is doing some more thinking on her own first but the way she is headed, there is a good chance that we are going to need someone who knows how to transform tobacco plastids. we need someone to know how to do this technique we already have a couple people in mind, you know, this is the person who is working with this gene and this method and you know..

**Are they people that you know, or people of people you know, know?**

So the reason this name sort of came while I was at a conference recently I was discussing it with a colleague there and he basically said you should talk to him and him and one of them some who I know from literature you know, the other ones name was completely foreign to me. I think that the information was both they are working on this type of stuff, it might not be published it yet, but they are working on methods like this. Also their personalities, they are really nice people and open type things. That is also something you don't get from the literature either. Basically making recommendations about people that would be good to contact.

**How often would you say that knowledge of somebody's personality has an impact on whether or not you choose to collaborate with them? Even if it is co-calling or meeting with someone you have never met before. Or someone you are consistently working with.**

I think it definitely matters quite a bit, whether or not you initiate a collaboration but then also whether or not you take it, there are sometimes where you have a collaboration and say sure that will work, but not necessarily want to repeat or pursue indefinitely. Then there are other ones where you say this is great, you have a skill, we have a skill they work well together and we can get a lot more productivity out of this. –

**Can you give me some examples or specifics as to why some of those collaborations you chose not to work with? You said maybe the project went well, but**

I think their some where their isn't a natural connection or next step where the synergy still will exist and it's like okay, we came together and got something done you had the ability to do this wet lab technique and we had the right data set where we wanted to analyze that but we don't have another data set like that and we don't have a need to do that wet lab technique again. We don't need to do any more northern blots and so there is not a lot of reason to keep going. Whereas some projects we did that once it works and we can do that 8 other times on 8 different projects and it works continuously. The southern bolt technique I mentioned, you know, there are two separate papers where we basically did that twice. So it was like we need a southern blotter in here, you guys already have the materials to do, we sent them to you, you know how to do this. Great, we will plug that in, that will be a figure in the paper, and you are a coauthor on it. We do that exact same thing again two years later for the same set and I'm like okay, you know this study there is a hole in it, we would like to do the southern blot and that worked. So that is definitely one of the biggest ones. Do you need to repeat the combination of skill sets? –

**And you mentioned the project where you needed the expertise, of someone who knows how to do the southern blot. You were working with someone you already knew, how often are you working with you have worked with someone in the past versus not**

Very commonly, theirs a relationship that is already there so that's. The <redacted> group is not the southern group. That you know became a long project. I went out there first to learn how to do the wet lab technique of sequencing the mitochondrial genome. but then I went back to learn how to analysis the data because they of course had expertise and you know as an off shoot of the project we started sequencing chloroplast genomes another part and you know, so they have done that, so we collaborated on that. So the all the pieces there weren't exactly the same thing I just described where we are doing the same thing again. And it won't be the same exact role but because we are entering into the scientific area. They also had entered into that same scientific area and hit the natural branch points and had the diversity of skills. And sense it was all new to me but I was actually more learning those techniques for myself. They were good mentors and trainers and collaborators on that front. And the relationship was already there. I wasn't like they were the only people in the world. There are a lot of other people I could have called. But I knew them and I had a good relationship with them, I knew they were responsive and I respected their ability as scientists.

**It seems as those in these situations that every time you are collaborating, they are playing a very vital role. So what are the disadvantages or problems that are associated in distributed projects?**

Certainly one of the biggest ones is engagement. Getting them to provide, put their role into the project on the time frame that you want. Sometimes someone is like yeah I can do that for you and then you send them the necessary materials or whatever and months go by and it just hasn't happened and you know they have other stuff going on. You can't set the time table and the priorities if someone else is doing a key piece of the project. –

**What do you do in those situations?**

It depends on the specific project, but nothing more than gentle prodding with email, like what's going on. That is pretty much is what happens. I'm sure there are some cases. And then there are like the bypass route and that come in more in publications and in writing phase because you have the same problem where you write something up and you send it to your collaborators to comment or provide feedback on. So some collaborators are less responsive in terms of like getting comments back on a manuscript that you want to submit. Sometimes I go to the opt-out model where I send them A manuscript and instead of being like okay let me know what your comments are and feedback I will send the manuscript and say I am going to submit this on Friday unless I hear something other from you or have other input. Instead of them sign off on something and actively do them, I make them actively stop the process type of thing. That is when the science is already done and you are just looking for feedback or approval to submit a manuscript type of thing. If it is like an essential step in the project, then you either have to figure out a way to do it or just wait. I don't think of a lot of examples where I have dropped somebody or went to someone else or done it myself, at least not the big things.

**What about the benefits?**

Basically expand the scope of the science you can do. People have limited techniques. I have limited abilities, there are something I know how to do and a bunch of things I font. A lot of the collaborations

have addressed scientific questions that I would have otherwise not have been able to do with my skill set. That's the big one. –

**What about when working on collaborated projects. Where everybody is in the same location. What would you say any of the disadvantage or problems would be with that?**

Certainly easier in terms of coordination. The only drawback I could see is that you are drawing from a more limited pool of expertise. You are not necessarily going to the best people in the world who know how to do it. You are going to the best local expert. _

**Can you elaborate on the benefits?**

If something is confusing or weird or you need special instructions you can walk down the hall and talk to people. So a good example of this is I feel like is genomic facilities. So more and more the actual DNA sequencing that gets done is centralized at major genomic facilities where samples get sent in and they do the preparation and things like that. <REDACTED> don't really have one of those facilities. They have one or two sequencer scatter around campus but they don't really have core genomic facility. So for most of our sequencing we send it out to other facilities and that has certainly limited the amount of input and sort of instructing I can provide the amount of customization I can have on the project. I can contrast that to when I was doing my post doc at <redacted> where they had their own facility. So when I submitted my samples I literally walked my samples over there and it I wanted something done I could go over there and talk to the person who was doing it. Not being limited to email communication I feel like goes a long way. Demonstrating wet lab techniques in the lab and talking through them.

**What percentage of your project involve collaborators who are in very different fields? When I say very different I mean outside of biology**

Not many. A pretty limited list I did this one thing where I had a very small part on it. But with <redacted> lab group in computer science. But even that they are bioinformaticians. But they are already thinking about that. There have been some economic projects, there was a paper I published last year where there was a bigger genomic project. It was sequencing an entire eukaryotic genome, there was a big facility involved. But some of the people including the coauthors who were really computer scientists most of them are biologists they are just a mixture of field ecologists versus microbiologists and computational genomicist. –

**In the couple of projects you mentioned where there was a couple of collaborators or you were the collaborator in the different field. Were there any disadvantages or difficulties?**

In both of those it is kind of tough to answer that question in the, I was very disconnected, in that second one that I mentioned where there was a larger genome facility with two computer scientists. I never directly interacted with them. In fact I didn't even know their name until I put their name on the paper at the end. It was more of that leader in the group, the PI in that group, that was the go between. He was a biologist. He was a genomicist who got more into computation data analysis. He was my only point of interaction. –

**So he was your point of interaction, but did you ever need to pass information to them or was it kind of separate?**

Not really, so the reason, what was going on here was something called in insect 5000 genome project where essentially this group had a large amount of funding they were sequencing a lot of inset genomes, so you put in a proposal that says okay, my inset that this is mine to sequence and if picked yours then you would send them DNA and they would sequence it and send you back the genome. In that case what a lot of people behind the scenes were doing, they were just setting up the bioinformatics architecture and stuff like that. They are doing this a dozens of times over and they are doing it in a kind of pipe line fashion and spit out the output. But it was very much a pipe line and one size fits all thing. And they were getting authorship on papers because it was a big contribution in making the project work. but it was basically not something where our input would have been something they were willing to change the entire pipe line for one insect species compared to the many others they were looking at. In that case there wasn't much.

And in the case with the interaction with <redacted>'s lab, basically my role in that project was I came up with the idea and <redacted> were at like a day care with our kinds and she was talking about her machine learning stuff and how she had a student were their was going to be a project but it fell through. Wow there was this paper that recently came out about a binding thing. It wasn't a machine learning project because there wasn't enough of biology out there to apply those techniques. That was my main role but after that I was mainly just the person that did the sanity check on the biology type stuff. This is our idea and this is the analysis type stuff. <redacted>  would ask me basic questions about biology and stuff like that. My role in that project was extremely minimal. There wasn't much of a difficulty or a benefit of the collaboration because it was such a loose collaboration in a sense. –

**You kind of touched on this in the other project, the real benefit of having these computer scientist there was they essentially made the project work, the technical aspects. So with the rest of your projects, pretty must all of your collaborators are biologists or biology related. What would you say are any disadvantages or advantages to that sort of group?**

We speak the same language, which is an advantage. It tends to be where were communicate fairly easily. There were too many where I really felt where I was so ignorant to what they were working on that I couldn't understand. The communication is easier. The disadvantage I guess would be the mirror statement of what I said what the advantage of collaboration was to begin with where it expands the scientific questions you can ask. Because I'm working in a more limited domain of biology, that also limits the scientific questions that I'm addressing where they require breaking new boundaries in statistic, computer science, or physics. We wouldn't have the ability to do that with the current collaborators. –

**Can you give me a general list of tasks that you do in your research that involve another researcher where either when you are going the task or discussing the task. Or you know, somebody else is consulting you after doing something.**

Certainly writing, writing a paper that results from all of this research is a big one. So we do quite a bit of that. Analyzing data, sharing the data back and forth and analyzing it, interpreter is often kind of a multi-party affair would be a big one sometimes training are some examples of those with the collaborating ones I mentioned. Where someone was being a part of it but they were also training me. That involved multiple people. Of course that is what being a professor and working in a lab is about. Either training of like either wet lab or analysis techniques. Then I guess you know, the physical sharing of materials. You know Seeds DNA samples or that kind of stuff

**Starting with writing papers when you're working with people. What tools do you use to accomplish this?**

Oh yeah, the ever painful exchanges with word. Not too much emailing drafts of papers back and forth. You know you write this section and I will integrate it. Usually whoever is the driver is the integrator. So <redacted>, one of my students who is writing us a draft of her dissertation project, is the primary author on it so she is going through that process but you know there is another piece that another student did, so we messaged him and told him to write us the methods section. And the data she was analyzing was generated by a post doc so he wrote up that section of the page, but she is sort of keeping the master copy. So as people send them in, she puts them in. So if she sends something to me and I tear it up with track changes and she incorporates them into her copy. –

**Are these individual conversations between her and you or are they in a group**

Mostly they are paralyzed interactions going back and forth with individuals. With this particular group of individuals, there are a couple of times where I am like okay we just need to get together. Out of all of these people I just listed there are two graduate rotation students and one post doc who just got together here in a room here on campus. –

**When is it more beneficial to sit in a room to talk versus email and vice versa?**

Usually when the topic is complicated enough I would say involves multiple people, and it involves multiple back and forth, right? It's not just question, answer. It's like question, and what is the answer to that. So we need to make some decisions. You are matching the email thread in your head and it's just going to be way too complicated. –

**What about when you are working on a paper with people who aren't able to physically be there. How do you manage that discussion?**

Usually it is by email, that's the main thing and just CCing multiple people and you know, conversations going back and forth and sometimes getting unwieldy.

**What do you mean by unwieldy?**

Sometimes a multi way conversation inherently like linear form of email. People commenting back and people writing email simultaneously. You get multiple emails coming back at the same time and didn't read it because they were writing it at the same time. Too much information on similar topics coming in at once with people responding to one question, but forgetting to respond to the other part. –

**What do you do when that is happening?**

It depends, basically I feel like I usually leave that up to whoever is in charge. if that is me, I usually, if there are things I think are important I try to follow up and say okay this was missed or you guys are saying two different things. If I am not the one in charge and I don't think it's that important I ignore it. If I do think it's important I try to be the thorn in people's side and say hey I think this is important

**Do you ever try to use any other form of communication methods?**

The <redacted> project that I mentioned was quite a big project. Our component of it that resulted was specific to my project but there was a component of all these different projects, which shared some common foundation. For that we did weekly conference calls. Which were not set up by me. I just got the AT&T access code and called in at 9 in the morning where I called in. those were like 30 people on the conference call. –

**How did that work out?**

It was fine, there were little bits that were sometimes important to me that I had to share but I would usually sit there with my phone on mute, doing something else waiting for my ears to perk up for something that was like what's going on with this. So it was probably a fair amount of wasted of time. The fraction of the call that was important to the average individual, the call was quite small. –

**Were there any benefits to doing a large discussion?**

Yeah, there were, people would chime and know things and there were some redundancy that was avoided and stuff like that. Here is an example where I didn't collaborate with somebody, there is one element of the project that the big overseen coordinator that was like damn you work on this bacteria for that insect and we now have all of these insets you should do the analysis of that one aspect across the really big data sets. Not just on your one inset species, at the time I thought that sounded pretty cool and there was another researcher who was on it and they were there on the phone and perked up and was like we are interested in that too. In fact we already have a graduate student that wants to work on that project. Having a big group of people, lead to not over lapping too much. The main person in charge there was like okay you guys need to work on this together and set it up type of thing. I didn't end up working with him, I had no involvement at all because it very quickly became clear that the personality of that researcher was that they were very possessive of that project. Too, it wasn't going to be a very comfortable person to interact with. That was a collaboration that did not happen because of the personality of the researcher involved and that was the place where I found that out because we had all 30 people on the phone that could chime in, like oh yeah I'm working on that area don't work on it. It was weird, he acted like this complete weird, like totally possessive. One of the more possessive standoff things like ignored emails for a while and was like oh yeah, I forgot about that, did you want that, well we just did it. It was international. But almost as a peace offering he invited me out for a seminar at their university. But you know, it's always fun that was the weirdest one. It was like yeah, come out and visit. So I told my wife I'm not sure if this is going to be fun because this isn't a person who wanted me around. But that wasn't a benefit of having a larger group, you find out topics that perk up people's ears and they either provide useful information or avoid redundancy and work efforts and stuff like that. –

**What about when you are analyzing data with someone else and interpreting data. What tools do you use for that?**

It's kind of a hodgepodge. Just sharing the data is like you know, depends on the data set right –

**I should clarify, I care more about communication in this aspect/ I don't care if you are using whatever**

So you don't care if we use anything like drop box

**No I care about drop box, but I don't care if you are using bow-tie**

Absolutely not

**Do you use drop box**

Some, when I say a hodgepodge of stuff it depends on file size. So email, if it's small enough it's an excel spread sheet and I you know, just send it out CC a bunch of people. When it gets a little bigger you know, but it's small enough to fit in drop box that is definitely a common one that I use. If it gets a little bigger I have like free drop box with a five gig limit, so i quickly run out. I can't share everthing on dropbox you know. so thats a little bit bigger than that but not too unwilldy. <REDACTED> has <redacted> at least the natural sciences, a quick way of dropping on to a website –

**Does that work with people who are, can you share it with data at other universities?**

I just posted, its equivalent of posting it on a website, so yes, using that context there is a public html website and I can set up a folder for <redacted> and you can download things here. So that I use for some stuff and things get really big then it like just set up a server and let them ssh in. And people do the reverse. –

**Again how well does that work with an outside institution**

It works fine with my server because there is no, it's not behind anything that restricts. You don't have vpn. If you got the ip address for my server you can access it from anywhere in the world. So probably not the best for security. But you know, <redacted> people set it up so. We just did the reverse, where I needed to exchange a lot of data and a lot of it was on a server, they set up an account for me on that server and for that I did needed to like ssnp or sscp I needed the port flag or something like that with a specific number. If I were on campus I would not have had to do that, but because that was the pathway and if you were not on campus you did not have a vpn setup for that university –

**So let say you are using email up until you run out of your limit, and then you use drop box until you max out, and then you are using all these things, why don't you use something at the highest level?**

Basically what I just described was more or less inverse order of ease. For me the thing I can don most quickly is zip off an email. –

**Why is it easier?**

I send like 200 emails a day, so I have a lot of practice and a lot of other people do it a lot so they probably, you know the tools are pretty user friendly I guess. I don't use drop box a ton, I find that window if it fits in drop box is someone what narrow, but that seems like an easy tool for me I have got the plug in on my machine, I have a little folder and I stick it in that folder automatically and then I click the share link and it goes. So that is pretty easy. <redacted> is pretty easy but I just dont think of that very often. Sometimes I forget the name of the program. I'm remembering it now but I'm like <redacted>, what's that thing called and them I'm searching for it on my computer –

**Because you don't use it that often**

Yeah I don't use it that often. And sharing the things over the server is a pain in the ass. recently that example in <redacted> they set up the account for me but the person their wasn't a real sis-administrator and they were just a researchers and they like set up the count but they did not set up a default home directory so at that point I was writing stud to them. There was not write privileges for me. So then I had to email those saying they had to set up write privileges. So that went like three emails back and forth with them not know what exactly what they were doing. If it's the reverse and I'm setting up a directory for someone else, I know how to set up a user. But people are used to different things. They try to connect to the server and it doesn't work so they send back a question saying how do I do this or where am I going and that type of stuff. More time consuming

**Do you ever choose to use a tool or not to use a tool when communicating with a specific person?**

Not really, actually no, so you know sharing stuff over the serve depends on someone knowing what they are doing in a command lab environment right. And this is certainly like in the context of the lab and stuff like that. Theirs like under grades who know you know, don't have any experience in that in which case it is much easier for me to you know to stick the file even if it's too large email, stick the files on the website and send them a link to that to download here. because they have infinite experience with web browsers and stuff then to teach them how to sap or she so certainly theirs that level to where if it's going to go up top retrieving things from the server they are just some people who just don't have that skill set. So I go other routes. So that would be the one main example that I can think of. –

**So when your training or being trained, do you use any software/technology tools?**

Not so much, it depends what the training is the stuff that is at the bench or the wet lab is more just showing or demonstrating –

**You have to be physically there to see it.**

So for things that are more computational, analysis in nature, I personally send notes or instructions to the places that are relevant. I usually keep that simple. My notebook is usually a word file or something like that where I am just pasting what I did in and command lines. I tend to keep it that simple. but one of my grade students who started used one note or something like that, a Microsoft product, but that is how she kept her notebook and you know when we were going through analysis like that she kept her notebook in that format so she could send it to me so I could give her feedback on the analysis that she used. –

**Is there any difficulty switching back and forth from having to use one note with her?**

In that case it worked out fine because it was pretty self-explanatory and I was sort of looking. It worked and she knew the format. So no not particularly in that example.

**I guess the last one, physically sharing materials**

That's just mail usually

**How do you communicate about that?**

There are some that is a little more complicated where you are smuggling across international boundaries –

**I'm not going to tell anybody**

Not literal smuggling. One literal sample from <redacted> this guy had a bunch of DNA samples and didn't want to send them in the mail and has had a bunch lost in the mail at customs, and I find it to bring them across the border with paper work with stuff like that. we coordinate that by my advisor is going to be in Europe so I was like okay we will meet here and you know I will give you the samples and paper work to bring them back, so that was quite the coordination. But all of it was regular communication like that. We're sending you this now. That type of stuff. –

**My last question, if you could create some sort of hypothetical technology that would help you collaborate and do your job, what would it be? What type of features would it have?**

The place where I feel like I waste a lot of time and is inefficient in collaboration is in the writing. track changes exists but, I don't know I almost always find that I end up manually incorporating the edits that people send me but their computer corrupts my note stuff that is inserted into it or I have been working on it too so therefore my version is not the same as theirs because of the time delay, so I don't know what the solution to that but something that allows more efficient simultaneous contribution to the writing of papers because I really feel like I spend a lot of time manually going through comments and taking the ones I want and sticking them into my document. So something that better allows for simultaneous editing. and then there is also collaborating with the more computational people and they send me latex file and I have no idea how the hell to do that and I'm sure there is some type of track changes for that but I do not know what that is for me. –

**Are there any other aspects where you would want more support?**

The sharing of large data sets is another one that is frequently a pain and that is probably more about money maybe than lack of tools. Sharing big data sets, there is club resources where you can buy and give access to everybody, for some reason I am resistant to that –

**Because of money**

Yeah, I'm not sure if it's a rational resistance to that but we spend money in more efficient way than that. I'm like alright I'm not going to pay for more drop box storage and I'm not going to buy alumina where you just store data on the cloud.

**Out of curiosity, can you gestimate where the price would be where you would be comfortable for paying, like as if were 5 dollars?**

This is not a rational economic factor on this –

**I'm not asking you to be rational**

it's just that I haven't done the calculations to think about it, I just have this natural reaction where I don't want to pay for cloud storage space, I don't want to pay apple for iCloud space. Determining the

tipping point is not an easy one. But I would certainly be willing to pay something where I felt there was an integrated long term solution. Whereas I'm like okay this is where you storage solution is and I feel confident that it is doing to be back up that is one thing I worry about all the time. Storing in different placed and different building if there was a way where it was out there that would not let me worry about that crap I would certainly be one to pay for it. –