

Interviewer: Okay. Alright. So yeah, so it's been three to four months since the workshop back in March when you were in the R workshop.

Researcher: Yeah.

Interviewer: So, what did you think of it? First of all were you able to attend both days?

Researcher: I was able to attend both days. I thought it was really good. So, I have no experience with R, had no experience with R at all. So, it was all brand, brand new. I think for a first introduction it was good. It did feel, in certain bits, a little bit fast paced just because I didn't know at all what to expect. And so on certain parts it would be like "Okay, this is fine to follow" and then you'd get a little bit lost and then it'd be like "Ahh" you know. So, a little bit panic, but they did take enough breaks and have enough time to stop.

Researcher: And then if you had questions you could ask specifics. So yeah, I thought it was a really good first introduction to a lot of these different things. The lead teacher, you could tell that he had taught this type of coursework a lot. But then the postdocs who were teaching the more specific bits about this part of data analysis or "Oh this R can do this particular feature" you could tell hadn't taught as much. And so there was a little bit more, either confusion or like sort of discussing back and forth. And I think that's really good that they have the practice to teach. And so I appreciated that. But sometimes I got a little lost too, cause, you know what I mean? You could tell it was their first time explaining it as well and sort of whenever you're training someone, it's the first time you've done that.

Researcher: And so I could totally appreciate that. But I also was a little bit like "Wait, what's happening?" And a few times. But it was really good. And I mean the course was like \$25 or something. Like it was huge value earned for very, you know what I mean? So, I thought that that was really great. I did feel like by the end of the two days I was a little bit overwhelmed and I definitely felt like I don't feel comfortable diving into my own data just based on the information gained from these two days. But it did kind of enable me to: one feel like I could understand a little bit more what the more informatics people in my lab are doing day to day and then they talk about stuff and I'm like "Oh, I know those words" like you sort of get to know the techniques that they're using a little bit more and the different software and stuff.

Researcher: And you feel like "Okay, I kind of understand on a more basic level what they're doing fundamentally day to day." And then it made me want to learn more. So, I am taking now ... UC Davis puts on an informatics workshop. It's specifically for single cell RNA, which is what I want to use. And so it's a combination of like learning R studio, which was taught in the library course. In addition to how do you practically analyze your single cell RNA sequencing data? Cause they're like a combined, both the programming aspect as well as the kind of experimental and then analysis aspect. And so that made me want to sign up for that. And that's another like three day intensive thing that's at the beginning of July. And

if you have your own RNA sequencing data, which I do, they want to help start facilitating you analyzing your own data.

Researcher: So, I feel a little bit like I haven't changed my workflow all that much yet. And the intent is that over the long term I will, and I do feel like before it just all felt like very much a black box and now I at least kind of feel like I know what I need to learn. Have the more definition of those things. And so I felt like it was immensely, immensely useful. Even if, at some parts, maybe it was a little bit too high level or a little bit confusing. Regardless, I felt like it was a good first introduction.

Interviewer: Great. Yeah, was there anything that we could have done to make it a better learning experience for you?

Researcher: I'm trying to think. I probably should have written all this down right after the fact. But no, I don't know. I mean I think everyone is there kind of with different types of data in mind. And so I think for the bigger picture it was actually very, very useful. It would be kind of nice ... But I don't know if this is really the role of these particular courses to do. If there's like an entry level one and then a "Once you've done it once" then like a slightly more advanced level. Because I felt like this course tried to do a lot really fast, which was good and ambitious and again helped me understand the definitions of all these different things. But I don't think I understood all that they were trying to get across. And so it might be nice to have a slightly more simplified version of that and then a more intensive practical "Let's practice together" kind of a course.

Researcher: Like two different ones. But again, I don't know if that's in the library and stuff, you know what I mean? But it was, yeah.

Interviewer: Nice.

Researcher: Yeah.

Interviewer: That's good to hear though. That's good to hear how structuring it-

Researcher: Yeah, I was. I don't know. I've definitely recommended it to other people and so I know that someone in my lab took the one that was here just a month or two ago.

Interviewer: Yeah.

Researcher: He really enjoyed it too. And now we're all gonna take this other more structured course that's looking specifically at the things that we want to do with the data itself. Yeah.

Interviewer: Great. That's great to hear. So, you've already kind of started talking about this a little bit, but I just wanted to revisit your work flow here.

Researcher: Yes.

Interviewer: So, first of all, just to kind of re-summarize what I wrote down or what I took from this. It sounds like you ... So, you have imaging data. Well we have some tissue data.

Researcher: Yeah. I think these are like sort of the samples that we start from. These are our sources and we're interested in human [body part] development. And so the different processes that we use to analyze things or you know, assess what's actually going on in the developing human [body part]. And so a lot of what I do is microscopy. And I'm fairly familiar with this part of the workflow and fixing and the antibody staining and using, kind of immunofluorescence to look at microscopes and then processing those images, both using Photoshop and Illustrator to put figures together, but also using things like Amaris or Fiji or ImageJ to do quantifications. So, those are more like cell counts or intensity or those types of things. And then you kind of go into making figures or putting them together, a lot of like time in Excel and Prism, those types of things and kind of putting those together.

Researcher: And then the other side of the lab is really interested in understanding transcriptomicly what's happening in the cells. Kind of a more fine molecular detail. And so we do a lot of single cell RNA sequencing and so I do all the whatever culture system we're using and then all of the prep of the samples and stuff and then they go into the 10X machine, really they go off to the sequencer and when the sequencer sequencing data comes back, like handed off to somebody else, they process it. And then once I come back together then output is "Okay, put these figures together put them in paper." And so this is still, I think very similar as far as like working in collaboration with people. And I ultimately think it will be mostly like in collaboration with others, but I would like to have a little bit more independence about some of this.

Researcher: And I think the thing that felt like it was missing before, which I don't think I've fully grasped, but when I'm working with another person and they're doing the informatics analysis and they're sort of describing what they've done and then it comes out and it's like, "Oh this is very different." But this isn't different at all. I sort of felt like I just had to trust them, and not that I don't trust them, but as a scientist I always want to be able to know that what they're doing is rigorous, really understand the methodology that they're using. And then, especially if it's like our combined study, if I'm then reporting those results to others, I want to make sure that I really believe them. And so this has provided the tools for me to at least understand more of what what she's doing and from a like actual data processing approach generally understand.

Interviewer: I think I remember you saying that one of the people that was doing that or the person that was doing this was maybe leaving the lab. Is that still the case?

Researcher: Yeah. I mean, yes. So, she's going out on the job market this year. So, it'll be like within the next year that she'll be gone. And it's not that there's not other

people in the lab that I could work with that have these skills too, but yeah. I mean she's particularly fantastic. So, it's sort of one of those things where I'm like, "Oh, I'm sad that she's leaving" but I would like to be able to, when she does leave, take more of that aspect of, especially my own independent projects, on myself. And then I think moving forward too thinking about how I want to have my own lab in a few years and being able to at least guide students even if I don't know this ... Like as much detail as maybe an informatician would. At least I can tell people like the student, you know what I mean?

Researcher: People that I'm mentoring, like the approaches that they should be taking and generally things to understand and try and they don't want to be completely kind of illiterate to those processes. Yeah.

Interviewer: Yeah, definitely. So, looking at this workflow right now, is there anything that's different now that you've changed in terms of the tools or the processes or what you do versus somebody else?

Researcher: I don't think quite yet. I think it's one of those things where ... This actually helped me to kind of like outline where specifically it is that I wanted to change or to grow. But I think this is still kind of in progress. So, I now feel like I have at least more working knowledge of this. But yeah.

Interviewer: So, that was my next question is there future changes that you plan on making?

Researcher: Yes.

Interviewer: You can write in green or circle in green.

Researcher: So yeah. Knowing exactly how to align my sequencing data and then using R as a tool to characterize the cell types that we're interested in and looking at changes across different groups.

Interviewer: And you think that you'll be doing that or that you'll be working more closely with it?

Researcher: I think, yeah. So, I think, I don't know if I'll be doing all of it, but at least more together. Really I was handing everything off to her. She'd do everything on her computer and then I'd only see figures weeks later. And so this would actually be like handling the data myself, doing some in R, if I can't, or am having issues like helping her, helping me kind of troubleshoot those things. Or even if she eventually does do some of the analysis I'll know what she's done specifically.

Interviewer: Right.

Researcher: Those types of things. And then future, future longterm down the road, really knowing how these things work so that I can at least guide students in the right

direction. So, this is my plan. And yeah, I would like to totally master R and really like be the programming wizard, you know what I mean? Those are my aspirations. I don't know if that's really totally feasible, but I am planning to use it. I have R on my computer now that I can, you know what I mean? Like those types of things. So, that's definitely, I think something that's gonna happen in the next few months. And I have single cell data that I'm gonna use that I'm going to take to this course. And if in two weeks that I'm hoping that they can start to help, you know what I mean? Start me off on the right track. And then I'm ... My plan is to analyze it myself. So, yeah. So, in the next coming months, but that will be the goal there.

Interviewer: That's great.

Researcher: Yeah.

Interviewer: Any other kind of areas?

Researcher: Yeah, I mean I think just knowing how to ... Because this is a lot of like with other people as well, knowing how to actually make these types of plots, plotting the data in different ways, having the ability to manipulate and kind of look at the data from different angles rather than just being kind of handed whatever type of already predefined analysis and then going from there. So, doing things like that myself. Then maybe not only knowing how to put my own data on a repository, but also being able to have the tools to take other people's data that's publicly available and look at it. Using these same tools. So, data mining for other things of interest. Other questions that we're already interested in.

Interviewer: Yeah.

Researcher: So, those are the main things. Yeah.

Interviewer: And so we've talked a little bit about R, what about GitHub. That was part of the workshop.

Researcher: Yeah.

Interviewer: Is there anything that ... Is that something you think you'll use at all?

Researcher: Yeah, I mean I think so. I think I still am a little bit ... It still feels a little bit like nebulous to me as far as what the ... Because I do know my lab has a GitHub, you know what I mean? A set account or site or whatever it is. So, that you can share data and do work together. As far as the process of how to use Git and GitHub, I felt very confused by. So, I don't feel like I could do that independently yet. But yes, that is also part of it as well. But I think, yeah ... I feel like ... I don't know, like open resource sharing is very important. But I think the main goal for me is really to just learn how to practically use some of these tools and not that

I wouldn't want to share them with others or share my code or whatever. I don't feel like I'm going to be a huge contributor on that side. Very likely.

Researcher: Maybe I will, maybe once I get into it I'll really like it. But I still feel like the bigger picture is sort of the science and I just want to have the tools to ask some of these questions.

Interviewer: Yeah.

Researcher: So yeah, so I would probably use it some, but I don't know, probably just not at this time.

Interviewer: Yeah. And what about running kind of commands in Unix or using the Unix shell?

Researcher: I felt really uncomfortable doing it. I've never done that at all before. So, I know that that's a big part of it. And what you have to use it. Especially because so much of this data is huge and you have to use the server until you just have to use the shell. But I don't know, I found it both kind of nebulous and also scary. They were like, "Don't ever type this or you could just delete the whole thing."

Interviewer: Right.

Researcher: There were these things like there are no take backs. And it's very good information to know because you don't want to do that. But also scared me from wanting to try these things by myself. So, like as far as how do you know what these different commands are? Like they wrote a bunch of them down and I have now a document that has a lot of those things that I could do. But I felt like, "Okay, I sort of have these pieces now, but I don't know how to replicate them in a way that would be usable." Like I still don't have the whole picture in my mind. Like it's like a piece here a piece there.

Researcher: Okay, can do this one thing. But I don't know all of the data processing that I want to do. What order I would do them in. So, does that make sense?

Interviewer: Yeah.

Researcher: And so I sort of like, "Okay, I'm going to pause from this." And then I've had lots of other papers and things that I've been needing to do this spring and once I am kind of done with some of these other projects, I'm gonna dive back in and this is going to be my goal. And so actually later this summer, next month it's gonna be a big push.

Interviewer: Good. Well that sounds great. Is there anything else that you've kind of changed overall about your workflow or other kinds of changes that you're looking at going forward?

- Researcher: I mean there's always things about even just the way that the culturing of the cells that I'm using or the types of manipulations that I'm doing kind of up at the experimental end are always changing.
- Interviewer: Right.
- Researcher: Things like that. But a lot of the equipment that we have available to us to do these different things is very static. It's not that it doesn't ever change. We got a new calcium imaging microscope. And so that's a physiological ... like a way to look at physiological data and changes that I haven't looked at before. So, there's different things that I could ... But it's still like microscopy, you know what I mean? From like a big picture standpoint. So yeah. I mean I was trying to engage some new techniques up at the front here and then doing different things to B samples to understand the details of the biology. But overall I think it's very much experimental manipulation, technique to analyze, you know what I mean? To assess that data or capture it I guess and then analyze, put it together and try and understand it, write it up.
- Researcher: I think actually the general flow is quite similar.
- Interviewer: Okay. Yeah. So, one thing we're trying to figure out is you take this workshop and you've mentioned it's only two days, it's kind of a dump of information. And we're trying to think if there are things that kind of motivate people after the workshop to keep going. If there's like interventions that the library can do or just in general things that kind of contribute to success afterwards. Is there anything that you think particularly kind of helped you or motivated you to kind of look more into R, or work more on these?
- Researcher: I mean, everyone that was ... All of the course teachers were really encouraging and it was very helpful that ... I feel I was ... Yeah, the postdocs all did a really great job. I feel like I was being hard on their teaching. And what was really encouraging about them was saying like, "Oh, I didn't have any experience with this before I started my postdoc."
- Interviewer: Right.
- Researcher: Or you know, I've only been doing this for x number of years. I was like, Oh phew. Okay. I'm not too old to learn this. So, that was really good. And I think them having practical examples of the way that they've incorporated it into their research and what they've used these programs for, I think was helpful. So, not only these things that my lab specifically does but what other people actually use the tools for too. As far as what else to do to keep going ... I mean I don't think you can ever teach ... Eventually like a degree's worth of information in two days or even in five days or whatever. So, I think it would be nice to maybe have, what I was saying earlier, a very intro course. It's a little bit more basic. And then more of a hands on, you just come in and practice, maybe type of course would be useful.

Researcher: I don't know. Or ... I'm trying to think what else would be ... Because at the end of it I didn't feel like any of it was not helpful. I thought it was all very relevant information. It's just a lot. It was a lot of information.

Interviewer: Right.

Researcher: Honestly after the two days I was just like, "Okay now think about that for a bit" because it was like overwhelming. And my husband's a programmer so I would like try to talk to him about it and he'd be like, "Oh blah blah" and he would just launch into it. And I was like, "Okay, I can't. I can't talk about this, it's too much". So yeah. I don't know. It has made me want to continue, but I was like, I definitely need a break, let that kind of like sink in and then go back to it. So yeah.

Interviewer: Yeah, that sounds like you're going back for more.

Researcher: Yeah.

Interviewer: It didn't scare you off.

Researcher: No, not at all. But yeah, I don't know what the kind of scope of what the library programs would offer.

Interviewer: Or I mean just anything that, whether it was support from people in your lab or like anything that has kind of motivated you or kept you going or made you wanna enroll in that class.

Researcher: Yeah, I think it's like wanting to know ... I think it's both support from people in the lab. Seeing postdocs and graduate students who either have learned this and are really good or are actively learning it right now and working toward these goals. Made me be like, "Oh, I would really like to have that skill." I think that was really vital.

Researcher: And then, just the type of data that we are collecting. And I mean it's getting more common, but I think it's relatively unique skill for molecular biologists to have programming experience and to know how to work with more sequencing data. So, I think that will also make me look more appealing on the job market later. So, those types of things. So, it's like both a mix of really wanting to understand the science myself and then also feeling like these will be tools that will be helpful for job prospects as well.

Interviewer: And in terms of ... So, that's kind of like promotion or things that enabled you. Was there any kind of barriers that you faced or reasons that you weren't kind of able to dig in right away.

Researcher: Yeah, I mean I was like, "Why didn't I do this in college?" I don't know, I definitely had this regret of like, why isn't programming ... I don't know. And I think it will be more so for younger kids moving forward. Right?

Interviewer: Right.

Researcher: And that's good. I'm like, "Okay encouraging the next generation to do that." But despite my regret of the past ... No things that were ... I just felt like I don't understand a lot of what people are talking about in terms of programming. Just visualizing functionally what you're doing, like specifically. And then also how to ... What the order of operations are, what you do first, how you're actually handling the data. The shell thing was like totally crazy to me. All of that stuff. So, it felt like the kind of barrier of knowledge felt too high, you know what I mean?

Researcher: And so that's one of the things that ... Because for years now I've been saying, even at the end of Grad school, I was like, "Oh, I should take a course on this." And I never did.

Interviewer: Yeah.

Researcher: It always feel like there's something else more important to do. So, as far as the immediate science. But I think postdocs are supposed to be for training and I'm like, "This would be a very good thing to take time to invest on for training."

Interviewer: Yeah, for sure.

Researcher: Yeah. So, those are the main things.

Interviewer: Yeah. All right. So, now we're going to come back to this. So, our checklist.

Researcher: Okay.

Interviewer: So, here we're talking about the workflow as it is now. So, with this current workflow, do you use any programming languages like R or Python or the command line?

Researcher: I don't. I will soon.

Interviewer: That's totally fine. This is just one kind of glimpse of things. Have you transformed any step by step workflows into scripts or functions?

Researcher: No, not really.

Interviewer: Do you use version control to manage code?

Researcher: No.

Interviewer: Do use any open source software?

Researcher: No, I don't think so. I don't think I use open source.

Interviewer: Do you share any code publicly?

Researcher: No.

Interviewer: And do you share any computational workflows or protocols publicly?

Researcher: No.

Interviewer: And then the last question then, is ... So, one of the reasons that we teach these classes, obviously, programming is a skill that lots of people need to have. But kind of more big picture we're also hoping that it helps you make your work a little bit more kind of computationally reproducible. So, The idea that someone could take the same data and code and come out the same results.

Researcher: Yeah.

Interviewer: So, I'm wondering just what you think, if participating in this workshop has helped you make your workflow more reproducible?

Researcher: I think ... Well it's sort of a convergence of being a part of the workshop but also the project I've been working on with this collaborator who is doing all the informatics side of things. Because I don't know if it makes any of this part more reproducible. But together we've collected a bunch of Seq data and then also compared to publicly available Seq data in this project that we're working on. And then detailed exactly how we did that. She did that. And then like all of that data is now available to other people to look at as well. And so I think that that part of it, yes, I think in certain ways. But again that's not like totally independent or just because of the course.

Researcher: It's kind of a convergence of different things. But it's ... One made me appreciate that more and two I think that that's really valuable. And one of the goals of the project is really to assess what people are looking at [body part] across different protocols and different scientific groups and basically saying "Are we all talking about the same thing biologically or not?" And that's been a cool project to be a part of. And then also helped me kind of ... It's given me a different measure to validate these things than just stating, you know what I mean? So, generally yes. I think it's helped me give me confidence that there's more scientific reproducibility than it maybe seems like it on the way that people sort of spin on their, do you know what I mean? The way that they write about their data versus what the actual raw data looks like. And so that's been cool. Yeah.

Interviewer: Yeah.

Researcher: I don't know if that answers the question at all.

Interviewer: Yeah. I think that's good to hear that you're kind of thinking of how it applies to bigger projects and the way that you do your work and kinds of projects.

Researcher: That's been helpful.

Interviewer: Very cool. All right, well thanks so much.

Researcher: Yeah, no problem.

Interviewer: Let me turn this off.