Supplemental Material

CBE—Life Sciences Education

Bolger *et al*.

Appendix A – Interview Protocol for AIM-Bio Units

Water Transport and Bacteria Growth Interviews FALL 2018

1. **We are interested in understanding how you learned during this unit. Here is the final model that was in your lab report. Can you walk me through it?**
    a. If student seems unclear on how to start: "Can you tell me how this explains [the phenomenon of the lab]?"
    b. Follow up questions for clarifying their model: "Can you explain what you are showing with this [arrow/dot/blob]?

2. **In comparing your first model to your final model, what changes did you make?**

3. **What led you to make those changes?**
    a. If student focuses on the logic/data of why the model had to change, then ask, "Great! Could you also tell me a bit about what happened in lab and what made you think to change the model? [aka. Get their "story/perspective" on doing the science]
    b. If student focuses on the story of changing their model, then ask, "Great! Can you tell me **how** you used data to revise your model?

4. **Some students were surprised by some of the results from the laboratory. Did you see what you expected or were you surprised by any of your results or any of the other teams' results?**
    a. If the student speaks generally or doesn't mention any surprise results, ask about whether there were any results that didn't support their hypothesis.
    b. Follow up (if applicable): Can you tell me about how you reacted when you didn't see what you predicted? (follow up with "what did you do?" if they only talk about emotion).
    c. If student has not addressed any confusing results (as in results that they didn't understand, not just that didn't agree with their predictions): **Were any of the results strange or confusing at any point?** (Follow up with "what did you do?" if they do not already elaborate)

5. **How would you compare this lab to the previous one?** (*only asked in Bacteria Growth interview)

Yeast /Exit Interview FALL 2018

1. **We are interested in understanding how you learned during this unit. Here is the model of yeast mating that your group made. Can you walk me through it?**
    a. If student seems unclear on how to start: "Can you tell me how this explains [the phenomenon of the lab]?"
    b. Follow up questions for clarifying their model: "Can you explain wht you are showing with this [arrow/dot/blob]?"

2. **Can you tell us about how you made this model?**
    a. What data provided the evidence for your model?
    b. Can you talk about the process of working with your group to decide what to put in your model?

3. **Were there moments in the unit in which you remember being really curious or confused about what was going on with the yeast? Please describe.**
    a. How did you use the models?

4. **How would you compare this yeast unit to the previous ones during the semester?**

Part 2. Exit Questions about experience in the lab. (Note: Only questions 1-4 were systemically included in case-study analysis.)

Next, I would like to ask you a few questions about your experience in the lab over the whole semester.

1. **Looking back at the semester, what stands out to you about this lab course?**

2. **What do you think you learned in this lab?**

3. **You created and drew models throughout the semester. What do you think the purpose of models were in this lab?**
    a. How did you use the models?

4. **How do scientists use models?**
    a. Is this similar/different to how you used models in the lab?

5. **One thing you did this semester was to design your own experiments. What do you think is important to consider when designing experiments?**

6. **What do you think is challenging when designing experiments?**
    a. *Can you think of a time when that happened?*

7. **Scientist must come up with their own hypotheses, models, and experiments. Do you feel like your confidence with any of these skills has changed over the course of the semester?**
    a. *Why*?
    b. *Any turning points that stand out?*

8. **Thinking of the models and experiments you created during semester, is there one that you personally feel proud of?**
    a. *(If they hesitate) This could be anything you did this semester.*

Appendix B – Interview Transcripts for Sofia

Key:
Bold and underlined – interview questions
Green – Referring to "I"
Red – Referring to "we"
[Purple] – Referring to quotations listed in the manuscript.

Water Transport Interview:

I: **Would you go to your final model that you made. And if you wouldn't mind walking me through your final model. Your final explanations and ideas.**

S: Yeah, okay, so um, in the lab we learned that with the addition of the 28kda protein that it actually allows more water into the oocyte which ended up having the oocyte bursting which you wouldn't see with a normal um, normal oocyte in a hypotonic solution. So, we know somehow the protein was affecting um, the phospholipid bilayer to allow more water in.

I: Cool.

S: So, what I illustrated was is we know that the um,

I: And if you want to use this since its already graded, you can mark it up all you want (her model).

S: Oh yeah, yeah, no problem. So, as we know the phospholipid um, heads are actually hydrophilic so water loving, and the tails are hydrophobic. So, we already know that um, water is allowed usually so in the hypotonic solution you saw a little bit of um, hypotonic, it was a little bit of increase within the width, but it wasn't anything like super noticeable. It just increased by a little bit.

I: Okay

S: Hypotonic, hypertonic, it really didn't do anything and isotonic which is right. So, with the hypotonic which usually just allowed what I illustrated was about roughly um, just two models for the sake of that. Um, but with the 28kda protein I illustrated that there is actually four H2O molecules actually going from the protein. Attaching itself to the bilayer. Yeah

I: For sure

S: Yeah

S: Um, what else

I: And that was specific to more water going through, there was nothing else that you think or thought you might have evidence for

S: Yeah, I think that was it. From what we gathered from the lab and what we did the reading. This was the only thing that allowed me to come to this conclusion. **[Quote U]**

I: Totally. **So, if you were to actually compare it to your first model, um, what do you notice that are really the big changes in your illustrations of your model specifically.**

S: The biggest changes I think where I added the phospholipid bilayer before we just had roughly like a plasma membrane and the H2O going through it back and forth freely. So, with the phospholipid bilayer, um, it actually illustrated that there actually is an exchange going on with the hydrophobic and hydrophilic heads and the H2O.

I: Really good. So, and I know you mentioned this already, as to why you made the changes that you did. **Um, is there anything from the actual experiments that you did that also helped you add or change anything within your model at all? Not just the presentation of the 28kd.**

S: Yeah, so um, when we actually so, we, I put both of my models in here. So, with the um, what is it called...erythrocytes

I: Uh ha

S: The blood cells, so what our team predicted before was that it would just swell. They wouldn't actually burst but with the information that we saw in the lab, when we added it into a hypotonic solution they actually, we didn't see anything. We were like what's going on? [laugh] We were like oh my gosh. But it actually turned out that there was like left over like bits of the erythrocytes that ended up bursting from the water being allowed back into the layer. So, we had to go back and do all that. And also, with the hypertonic solution it actually didn't shrivel up like you would think, pruney. Instead, it became pinched as the water was being pulled away from it. **[Quote V]**

I: Right

S: Kind of one end like yeah

I: Cool

S: Yeah, so how that effected my model um, so clearly, I had to illustrate the phospholipid bilayer again. [laugh]

I: Yeah definitely

S: Yeah, and then I had to actually reassess why actually this is bursting. Why is there so much water being allowed into here?

I: Nice.

S: So, yeah.

I: Definitely. That's awesome. Cool. I definitely like that fact that you were talking about the hypertonic piece. I think that is really cool that you made those observations because I think that's a very easy thing to overlook.

S: Yeah, because it's not anything like spectacular.

I: So, and you didn't say this specifically, but I would like you to think about, um, some students were pretty surprised by the frog egg not changing in the environments.

S: Yeah.

I**: Um, so where you surprised by that? And how did you react to that result?**

S: Actually, my group ran out of time, so we only got to see the frog egg in the um, 400 NaCl solution, so the hypertonic and it really didn't change in the hypertonic. Like we only got two minutes to see it. But it didn't change. Some groups which we borrowed from in their data in the benchling, actually viewed some change, it wasn't anything spectacular, but it was slight change, like less than like, the meter things on the ruler.

I: Right.

S: Like it was less than that. But um, basically in the hypotonic, its present in this solution in like a natural setting so I didn't think it would change there.

I: Okay

S: yeah. and the isotonic, that's the concentration inside the cell so I didn't think it would change in the isotonic either. Um, hypertonic, I did think it would actually shrink but it did not.

I: Right,

S: So, um,

I: Back to the drawing boards, right?

S: Yeah, it was back to the drawing boards. So, I actually thought that-- that was really surprising considering how much protection an egg has versus a regular erythrocyte.

I: Right

S: Yeah so, I don't know. I didn't look into it that much, but maybe there's an outer coating or something

I: Okay, I like that, that's fun.

S: Yeah, something that's different that sets it apart from the erythrocyte that it would have more protection

I: Cool.

S: In hypotonic and hypertonic solutions.

I: Super. More experiments.

S: Yeah.

I: Cool. I like that.

Bacteria Growth Interview

I: **Here is the final model in your lab report. Can you walk me through it?**

S: Okay, so my thought process when making the model was that from the data we collected, we found that there was acid breaker present um, when we did the acid breaker test. So, we completely scraped our first model of the protein hypothesis and instead went with the um A bacteria actually releases a protein into the um, CA solution which actually ends up breaking the CA so the bonds of CA which then the CA stays broken in solution which makes it hospitable for E to survive in.

I: Okay, awesome. So, in comparing-- so you mentioned this a little bit, but in comparing your first model to your final model. **What changes did you make?**

S: Literally we like overhauled the entire thing. So, the first model, our first model dealt with that um the bacteria were exchanging proteins and that was what made E able to survive in the solution without A.

I: Okay.

S: So, upon, because actually we did two hypotheses, um we found that E that has already been exposed to the A still dies when in the CA solution so there wasn't the exchange of proteins in the solution. So, instead we went with the CA hypothesis which stated that CA was being broken making it a hospitable environment for E. So, between the models, the first model was protein being exchanged between the um actual bacterium and the second model deals with, A exchanging a protein with the surrounding solution which makes it, which makes E survive in the solution.

I**: And what lead you to make those changes?**

S: What led us to make the changes actually dealt with what we collected during this experiment. So um, in our experiment we tested, okay, our results. In our experiment we tested 2 hypotheses. The first one had to deal with the proteins being exchanged between the 2 bacteriums. The second hypothesis had to heal with um seeing if A actually broke the CA and whether or not E survived in it afterwards. So, the new um, model came from our findings which proved the protein hypothesis was wrong since when we actually incubated E in the solution that has already been exposed to E that has previously been exposed to A and then putting E in the solution, it still died, there was dead bacteria that we viewed underneath the microscope but um, upon doing the acid breaker test we found that there wasn't acid breaker and then we were like, okay, we are getting somewhere with this. And then we exposed A to the, took A out of the solution and then incubated E in the solution to which we found E did ended up growing. **[Quote O]**

I: Okay, um **so after you saw those results like what like what did you think. Like what was the story behind getting those changes, making that new model? So, you had your different results so what did you think? What did you do to make the new one?**

S: So, we knew it was something to do to deal with the CA, not necessarily the proteins themselves that were being affected since that was ruled out from our protein hypothesis, so instead we settled to the CA was definitely the main um, indicated in our model and we also obtained this from other groups when we did the whole sharing group thing. **[Quote O, continued & Quote W]**

I: Okay.

S: And um, most of the groups did a procedure, I'm sorry, did a procedure, I think it looked at they took CA out of the solution is what they did so there, it was more than half the groups did that, there was only one group who did a similar um, product to ours and their results backed up ours. While the other groups took out the CA and yeast still died even without CA they hypothesized that CA was what was killing E but instead I guess the solution itself was killing E. So um, from that our results of CA breaking and E surviving in the broken CA supported their, what they couldn't conclude. **[Quote W]**

I: Okay.

S: Yeah, so that's what they got form that.

I: Awesome thank you for sharing. **Um so some students were surprised by some of the results from the lab did you see what you expected or were you surprised by any of the results or any of the other teams' results?**

S: Um, not really. I wasn't really surprised. The CA breaker test um I was kind of surprised with that but not the protein test because our pre-lab reading had to deal with how certain proteins could have been exchanged. I was like wow this is wrong. So going into the test we found out that this would be wrong beforehand, and the protein hypothesis was wrong. The CA breaker test was down to our last hypothesis, we weren't really surprised that it worked but more of um ca actually did breakdown. That was more like wow, its actually glowing under the UV light and that was like crazy.

I: **Um, and you said that you found that out from the reading but how did you react when you I guess it's not that you didn't see it in the experiment but even it wasn't what you predicted?**

S: Um, so it wasn't what we predicted, um we did have two fall back hypotheses so we were just like, okay [laugh] But um so we basically split it between our two groups since it was a group project between two teams. So, the two teams, we both worked on different hypothesis and then we came together at the end. So, um one team worked on the protein hypothesis while we personally worked on the CA breaker a hypothesis. Ah, I can't really talk on the protein hypothesis until we came together, and I was like, wow, that didn't work, like that's crazy you know. We're like what's gonna work [laugh].

I: **And were any of the results strange or confusing at any point in the process?**

S: Um, the one results where they did the protein hypothesis and then looked at the bacteria underneath the um, microscope. So, when we first did our initial results before reforming models, so when we were just looking at it like, um, we saw species E in the CA solution and there was basically no E in the solution is what we viewed. So, there was nothing on the screen. There is no living bacteria there is no dead bacteria. While we when they did the protein hypothesis, you, they ended up seeing dead bacteria that I think it stained black. I was like this is weird. Like, like I, it was just confusing like comparing it. Like we already had what we were supposed to look for based on the previous lab and so finding this was like, it wasn't living bacteria because it didn't stain pink, but it was still bacteria. So, it was still present, but you could view it this time caught me off guard. Like, what is this?

I: [laugh] Okay. Um, and when it caught you off guard how did you kind of maneuver that? What did you--

S: I just kind of went with it since none of the other groups, because I was like oh, maybe I can use another groups' pictures from benchling but no. Since everybody's experiments were pretty much unique and the other group who did a hypothesis like ours didn't take pictures of it, underneath the microscopes. I was like, okay.

I: [laugh]

S: So, I just kind of had to work with it and like okay even though it is weird, I was like, whatever [laugh]

I: [laugh] Okay. **Um, how would you compare this lab to the previous one?**

S: Um, the previous one was, I feel like more...straight forward. I feel like there is more...since everybody just kind of did a streamed lined experiment with their models, everybody's models' kind of lined up in the end. We all kind of knew what we were looking for. While with this, you had different teams going off on like, oh I'm going to find if CA is what's killing it, I'm going to see if the proteins are, there were so many different variables with different teams, it made it hard to compare results at the end. Because, you were looking at, everybody was looking at what they thought was right even though we had different models... **[Quote H]**

I: And I'm curious you said that it was more, fewer variables.

S: Uh ha

I: Do you think that, like are you saying that is a good thing or a bad thing?

S: It makes for a more interesting experiment if there is more variables and everybody is doing whatever they want but, um, when it comes together with data collection and actually bringing this all together, that's the hard part. Like that's what like throws everybody under the bus. I was like oh my gosh, what do we do? [laugh] **[Quote H, continued]**

I: Okay, thank you for sharing.

Yeast Interview:

I: **Here is a model of yeast mating, can you walk me through it?**

S: Okay so, first we did the fus1 and the beta-gal, illustrated, okay

I: Uh ha

S: Then we found that the alpha cells actually synthesize overall than A cells, wait these are the alpha these are the A. Okay, then the entire thing we had like, okay. Okay so we had the one procedure with the fluorescent light, and we couldn't test our hypothesis because the other team took all the time, so we ended up doing their hypothesis. So, I'm kind of like, bad on their hypothesis.

I: No worries.

S: So, their hypothesis was whether alpha cells um, shmoo and so the um, alpha cells were um, tagged with GFP, so green fluorescence protein and we viewed underneath the microscope whether or not they shmooed.

I: Uh ha

S: They shmooed.

I: Gotcha.

S: So, that's what I illustrated.

I: Gotcha, so, up here you have A+ and alpha and then are they shmooing and then the fluorescence said, yes, the alpha are shmooing. Up here you have A and A, and you say shmooing and I am curious...I'm just curious about that?

S: Okay, so my lab partner drew this but--

I: It's all good, I'm just curious, just let me know.

S: Cause we changed this one, I'm pretty sure it's supposed to be an alpha too, because she erased that one. But we do know that A+ and A shmoo from the fus1.

I: So, that A+ and the A shmoo as well?

S: Yeah, yeah. We know.

I: And A+ and alpha shmoo?

S: We were like do they shmoo? do the alpha shmoo? And we were like yeah, they shmoo.

I: Gotcha, and was this in the first day you saw the A+ and the A shmooing?

S: Yes, this was the first lab, so day 1.

I: Gotcha. and they were put together and they were shmooing?

S: Yes

I: Gotcha, okay cool. Just wanted to be on the same page as you. Sometimes, I'm not. [laugh] Cool. Awesome. Can you--you already did this a little because you were talking about the experiment you did. **So, can you tell me about how you made the model? So, what evidence did you put into your model? Did you use any, and I'm curious did you use any evidence from the group data that helped with your model as much, or mostly your own?**

S: It was basically just our own because there was only, so with the group models, that they had, other groups, like it was two teams on one experiment.

I: Uh ha

S: So, we were going to do that with our team. But we didn't get to test ours. [laugh]

I: Yeah [laugh].

S: So, we were just going off of one data set and um, based on what they were looking at, they weren't looking at shmoo, like for example, they were looking at other different aspects that would um, either occur after or occur before, which weren't really related to whether we were just looking at alpha cells individually, not with A's. Not with anything else. We were just going to see if they shmooed together in order to create a product.

I: Uh ha, gotcha. So, your model is focusing on your hypothesis versus just like, in general how is this working which a lot of the other groups were doing.

S: Uh ha

I: **Okay, gotcha, cool. If you were to think of some of the other groups, would you change any parts of your model?**

S: Hmmmm [laugh].

I: I know you might not remember it also, that's okay but--

S: I don't remember any of the other groups but--

I: I'm just curious.

S: Um, I think it was not the 'incrumbs' (group name), that's who we worked with. Um, I think that--

I: I think all the data is still up there.

S: Wow [laugh].

I: Just to make it even easier [laugh].

S: There was one group that kind of was like, I was like wow, that's strange but, yeah... Um...

I: you know, just trying to remember things.

S: I'm trying to remember which group it was...okay I think it was the plate growth plate thing and the analysis of them.

I: Okay, uh ha

S: Because they found, I think one, okay both of them are like separate but like one doesn't grow without lysine, one doesn't grow without something,

I: The met

S: yeah, met yay. I was like, that's super weird because like I don't know.

I: Just confused?

S: Yeah, it was what? This entire lab. This was a rough lab [laugh].

I: That's okay, you know they're not all as easy as others, right. Cool, awesome. Um, I am also curious for your model, can you tell me a little bit about the process of working your group of what to decide to put in you model. Did you, you guys like disagree about which directions your model should go or were you all on the same page or how did that process go?

S: Yeah, this was a bad model. Usually, I draw the models but when we like disagree, I don't draw the models. ([laugh]

I: [laugh]

S: So, we were l really like, wow, I need to slow down. So, I didn't really know where to start and our group didn't know where to start so we were like what are we doing? **[Quote X]**

I: Yeah.

S: So, we had to get help and we were like, what are we even doing? So, we asked the TA, and she was like, well you should do this, and we were like wow, we should do that. **[Quote X, continued]**

I: (laugh)

S: So, we basically copied, what's it called, the 'incredibles' (group name), we were like, incredibles what are you guys doing?

I: Uh ha

S: Because it's their hypothesis. So, what we did overall was we just illustrated day 1 and then we illustrated day 3 that was literally, we shouldn't even call this a model, it's just--it's just…**[Quote Y]**

I: --data

S: Yeah, it basically is. Like it's not explaining a phenomenon like, we aren't explaining how they shmoo, we're just explaining, oh we saw them shmoo. **[Quote Y, continued]**

I: Gotcha

S: That's, really hard.

I: Which it probably came from the fact that you guys had a hard deciding what to do--

S: Yeah

I: --right with all the information.

S: Yeah, um, but we disagreed mainly on what actually to present. Because I was like oh, we should also, um, put in the actual protein of the GFP, to illustrate that in there to at least show some sort of like the procedure that was going one before we found these results and they were like 'no, that's dumb' and I was like okay. [laugh] **[Quote J]**

I: [laugh]

S: So, we didn't do that. **[Quote J, continued]**

I: Yeah.

S: Yeah, I'll probably like redo it on my own time. **[Quote J, continued]**

I: That's okay you know. That's what the lab report is for, right? Awesome, I'm just curious. **Um, cool, so were, this is very similar to the last question I asked but were there moments in the unit in which you remember being really curious or confused what was going on with the yeast?**

S: Yeah, the entire unit.

I: [laugh]

S: Like it really was, I was like I don't know why but this unit was just like over my head. Um...

I: So, it was mostly being confused then versus curious? [laugh]

S: Yeah. I don't know why, but I was just so confused this unit. Um, I think the shmoo and also um, what's the other one called, oh, the zygotes cause um, well we were looking at some of them and some of them just looked the same and they were like, oh, they're shmooing, and I was like, that literally looks like the picture of the zygote we looked at.

I: Gotcha

S: And nobody really clarified that, and I was like...okay, like…

I: So, distinguishing them made it more confusing?

S: Yeah, and then like we had some pictures on our slide that looks like zygotes and they're like no, this is shmooing and I was like, nobody is saying anything, and I was like, okay. [laugh]

I: [laugh]

S: This is shmooing I guess. But like I don't know but telling them apart was really confusing and then actually then understanding what was going on with the other groups' data because we just had a simplistic, it was literally like the easiest one, we just throw them under our microscope and look at them. Like we had no work involved so what they were doing so like more advanced stuff and I was like wow, I don't even know what's going on because, because we were literally doing like, nothing.

I: Yeah, gotcha.

S: Yeah.

I: Cool, was there points where you felt curious or mostly just confused?

S: Um, I was curious once I um, saw the plate growth analysis. I was like wow, I wish we would have done that. Because--

I: Yeah

S: --the results they got was like crazy and I was like, wow, it turns out that like some of them breeding, they didn't need to create it, they didn't have to be in the area where it was like a necessity, instead they could just carry it themselves, that was crazy.

I: Yeah, yeah cool. Awesome. **Um, how would you compare this yeast unit to previous ones?**

S: Yeah, this one was bad.

I: [laugh]

S: Um, this unit, I don't feel like it was harder but, I don't know. I had a better hold on the other units.

I: Gotcha.

S: It's just that his unit I feel like it was so simplistic that if you didn't pay attention then you would be like, what's going on? And the fact that um, usually what the units do is that we're all like, on the same page, on the same page, and then we just kind of branch off, but in the end, all of our results come together in order to regroup together. With this one, I think it was more everybody was branching off at the beginning and then we're not really coming back to the same conclusions that we found it on.

I: Gotcha.

S: Yeah, so, how everybody had a different procedure so some groups, like with the plate analysis, they found, wow, they can breed together and make their own thing. We found from the light that they shmoo. Those basically aren't related in any way.

I: Gotcha.

S: Like so, with the previous units, you had like a cohesive ending while this unit it was just kind of left there.

I: Gotcha. So, it felt like it didn't come together for you.

S: Yeah

I: Gotcha. Cool, um, perfect so, now I'm going to transition to the second part. So, this is going to being focusing on your experience in the lab over the whole semester.

S: Okay

I: So, not just the yeast unit, so, now we're broadening out. **So, looking back at your semester, what stands out to you about this lab course?**

S: Um, this lab course, I was talking to my friends who are taking another lab course that is exactly like this lab course MCB, like the other ones.

I: The normal 181

S: Yeah, the normal one and compared to that, like our setup was way different. We were doing labs in like a different, what's it called, um, order and stuff like that. But, um, she seemed less satisfied with her lab for some reason. I think more because it was a straight to the point, oh, a lab. It felt like a lab. Well, with this lab, I know that Dr. Hester tried, like her hardest to be like this isn't a lab like the write ups. These aren't lab reports. [laugh]

I: [laugh]

S: It's like okay. Like um, it was more like a research group is what it felt like instead of um, just being in a regular lab doing experiments and going home. Instead, like at the end of the day, everybody came together and was like, what are you presenting, what are you presenting, what are you presenting. Yeah, so I feel like this was more like a lab group. **[Quote S]**

I: Yeah, definitely. Cool, that makes sense to me. **Um, what do you think you learned in this lab?**

S: Wow [laugh].

I: [laugh]

S: Um, I feel like I learned more than my lecture actually. Yeah, yeah, um especially from the write ups. Especially from the write ups. The write ups were really well for organizing your thoughts in the end.

I: Gotcha.

S: Um, what did I actually learn though. Um, do I like list them all off [laugh].

I: Yeah, tell me some things that you learned.

S: So, from the first lab, what was the first lab?

I: The first lab was the black box, and then it went into water transport, so if you remember we looked at the plant cells and

S: And they take up the saline and all that. I remember that.

I: Just like in general, what did you learn?

S: What I learned was...this is like a hard question. Okay. Um…

I: You can think for a minute, it's all good. No pressure.

S: Overall, I learned that it is better to work with people who share their results. Yeah. **[Quote T]**

I: So, yeah, so being in a collaborative space is more productive?

S: Yes, being in a collaborative space is more productive than just single groups, yeah. **[Quote T, continued]**

I: Gotcha.

S: Yeah.

I: So not even with just within your own, but you're saying like across the whole class.

S: Yeah, across the whole class. Because nobody was really alienated from other groups over here. We were all kind of like, hey what's up, but we didn't know their names. [laugh]

I: [laugh]

I: **Um, okay so in this class you created and drew models throughout the semester, what do you think the purpose of the models were in this lab?**

S: Okay, so the purpose of models, I feel like illustrate, what we can't really not, correctly, but effectively explain on paper. So, with models you are able to visualize what you're seeing and that's like, paper. Like picture. Okay. So, um, what we would write, of course you can describe it but actually seeing the process and how they interlock telling to how they actually work together is a really different thing. You can describe one thing, but you can see another.

I: Uh ha

S: So, um the models are an aid if not something in their own right. You could probably give a model and be like here and if it's a well-illustrated model, if it's a well processed model then somebody would be able to understand what's going on without words.

I: Uh ha

S: Yeah.

I: Definitely. Cool, awesome**. Um, how did you use the models in this class?**

S: Um, the models were more of like a guiding tool for me, especially during the write ups. So, the models were basically were like a trail for my thoughts like during what's going on especially when explaining, I always went to the models to actually look at what was happening instead of just trusting myself and that type of idea ([laugh].

I: Yeah, definitely. **Cool, so, now how do you scientists use models?**

S: Umm

I: Or how do you think scientists use models?

S: How do I think scientist use models, um, I think, going back to my first point that yeah, they use it as like an aid more of to illustrate um, their findings.

I: Uh ha

S: I feel like. So, how we used it to explain a phenomenon I guess some scientists do use it to explain a phenomenon and some use it as an aid in their respective right to actually explain further what's going on within their experimental results.

I: Uh ha

S: Yeah.

I: Yeah, definitely, **do you think um, this is similar or different to how you used models?**

S: Oh, it's similar.

I: Similar.

S: Yeah.

I: Gotcha, cool.

Appendix C – Interview Transcripts for Joan

Key:
Bold and underlined – interview questions
[Purple] – Referring to quotations listed in the manuscript.

Water Transport Interview:

I: Ha did it. Okay this is student F7. [laughs] Cool so, we'll get started. We don't need these yet. I try to be organized but [laughs]. Okay so we're interested in understanding how you learned during this unit. So, this was last week and the last couple weeks where you did Water Transport. Here is your lab report and then if you don't mind pointing out your final model to me. I think it's hopefully towards the end [giggles]. Awesome! **Cool so um do you mind walking me through your final model?**

S: Okay. So, [laughs] we essentially just changed our initial model to include the protein and what the cell looks like with or without the protein. So, with the protein it sort of allows like the transport of water across the membrane, so, the cell will change shape or like kind of explode how it did in the blood cells. And then without the protein there's no way for the water to go in and out of the cell, through the cell membrane so like the plasma membrane, so there's no change.

I: Gotcha. Do you mind just telling me a little bit more about the protein and how it works in these like three scenarios that you have drawn?

S: Like what do you mean? Apart from it--

I: So--

S: Like it's in the plasma membrane--

I: Gotcha.

S: So, it--wait—so, usually the plasma membrane is mostly hydrophobic like in between the layers so the water wouldn't react with that, like they don't want to be around water. So, the water is not going to go through the plasma membrane without the proteins because they sort of make like an opening for the water to go through.

I: Gotcha okay cool, just want to make sure you understood that.

S: Okay [laughs]

I: No no, there's no wrong answers; I'm just curious! [laughs] Cool. So, you talked a little bit about your first model to your final model**. Do you mind talking me through like the specific changes and maybe talking about like what data led you to make these changes?**

S: Yeah so, the, I think the biggest change was the addition of the protein. So, we sort of like if you look

at this model and this model it's like essentially telling the same story like if you look at it here and like here. But there's no--

I: So, looking at the different --

S: Yeah

I: --hypertonic hypotonic, that jazz

S: Yes, so like you can see like up here the chloroplast in the plant cells like they're the ones that were affected and so like if you look at that like the general idea's the same, but this was missing like that explanation of like well why is it the way it is.

I: Gotcha

S: And then same with like the frog eggs, the--

I: Yeah, the oocytes [laughs]

S: Yeah, the oocytes. Like those ones you sort of like we had to add an explanation in back to like why they didn't do anything, why it was just the same or the other way around.

I: Gotcha

S: So, it was like the big major like difference, and I guess just more like a descriptive picture cause we actually like drew the plasma membrane like in this picture

I: [laughs] Yeah, versus the circle. I feel ya [laughs]

S: Yeah, the circle that like didn't even change shape cause it sort of doesn't illustrate that like the whole, I guess for like the blood cells, the whole cell was changing shape versus which I--we kind of showed up here, which is no change in shape but like the plant cell and the oocyte.

I: Gotcha so what actually, cause in the plant cell you still see this phenomenon happening so if it's not--

S: Yeah

I: --the cell wall what's going on?

S: Like what do you mean if plants is--if it's not the cell wall?

I: So, your--you said that the cell wall in the plants and the plants like--

S: Like what's changing? Like the cell walls like a rigid cell wall, like it's not gonna change shape, but inside of the cell that's what's going to like let more water in like move the chloroplasts around which is what we tried to show up here.

I: Gotcha okay.

S: Like when there's less water, they're sort of like clumping together and when there's more water they seem really spread out.

I: And what is this clumping? Like what--what are the little dots representing?

S: Chloroplasts.

I: Oh, okay gotcha.

S: Like clumping together.

I: No, I just wanted to be clear.

S: Yes.

I: Yeah cool, awesome. And so, I'm curious—so, you said that this obviously just adds a mechanism to it. **So, what data or was there anything that led you to come up with this mechanism?**

S: Yeah, was this, this one. What we were given in class. **[Quote AA]**

I: Oh okay cool so the worksheet in class.

S: Yeah the worksheet in class. **[Quote AA, continued]**

I: And how did that give you the mechanism?

S: Well we could see like with the protein and then without the protein, it sure showed like how the volume was changing like if the water coming in and out so it was like well, that sort of leads the conclusion of like with the protein water can go in, without the protein it can't. **[Quote AA, continued]**

I: Gotcha, okay cool. Awesome. Cool so.

S: It might have helped if I had reviewed this before I came in. I just couldn't [laughs]

I: [laughs] No no, you're all good.

S: Oh, I forgot. I just waltzed in and I don't even remember doing this.

I: [laughs] It's all good, no no. You didn't need to prepare. Cool. So, you talked a little bit about what led you to make those changes. Was there anything specifically in the lab that like happened? I think you kinda talked about the oocytes. How did that like make you need like a mechanism compared to your first one?

S: Well cause like we couldn't see anything happening.

I: [laughs]

S: Like there was like no changes and it was sort of like I thought we were expecting changes like from sort of like lecture like that sort of like theoretical take on it or like well, "things should be different, like there should be something happening" and so. It was sort of like how do we explain things not happening.

I: Gotcha so [laughs] it sounds like you guys were surprised of like--

S: A little bit [laughs] we were kinda like

I: [laughs] "What, what's happening?"

S: [laughs] "Yeah like what, like are we supposed to know something that we don't?"

I: **Yeah. So, what did you guys do as a group just like in like real time in lab? Like when things didn't work out, what happened next?**

S: I mean, we sort of just like accepted that--

I: [laughs]

S: --like something was happening, you know we're going to be like, we trusted our process. We were like "we did it" like it was consistent, so something's happening and we were--we were like-- I think we briefly talked about like the fact that it's maybe like since it's like the cell but its' also like an egg, we were like maybe it's maybe like a different sort of plasma membrane like type. I mean I guess it kind of was like without the protein, so like that's what we were talking about, like maybe it just like doesn't let water in or like it--something like that.

I: Yeah, so as a group did you guys immediately start to be like "Oh my god my--our model doesn't work!" and like try to leave that in that terms or just like "The experiment isn't doing what we expect" kind of thing?

S: Yeah, sort of that. Like not really like our model was wrong more just like there's a case now that we have to add. That's what we thought like "We're not wrong". And then when we did the blood cells, we were like “okay see we're not wrong". **[Quote BB]**

[Both laugh]

S: Like, it exploded so things are happening.

I: Yeah yeah, Totally. Cool, awesome!

Bacteria Growth Interview:

I: **If you would go to your final model of your lab and could you walk me through your model.**

S: I could try. So--

I: If you need to doodle.

S: So, basically, we were showing the difference between like what how species A behaved in the presence of acid. So, when there was acid there, we sort of made like predictions that like maybe like making some sort of nutrient or like making energy like breaking the bonds or breaking it down something because we did see that in the acid breaker test it did glow.

I: For sure.

S: And like with that regardless of which medium it was, like species A and E would both survive if A was present with the acid and then if species A was present but with no acid then if it was in the AATC which has like nutrients and everything, then E would survive and A would survive but if A was there but there was no acid like in medium 2 which had like nothing, except salt, then it didn't survive.

I: Okay, so what did that tell you I guess about the acid?

S: Um, I mean, what do you mean?

l: So, in this one over here that you just mentioned with no nutrients and no acid it didn't survive over here. You mentioned that in medium 2 with no nutrients and the acid--

S: Yeah, so whatever happened between species A and the acid was sort of like giving species E, cause we were sort of looking at species E specifically cause we didn't' see a time when species A was not growing.

I: Okay.

S: So, we wanted to specifically look at species E.

I: For sure, that makes sense.

S: Yeah, so like in all of these experiments it kind of was just species E because species A was always growing with or without the acid.

I: Cool, awesome. So, in comparing your first model

S: This one?

I: uh ha, to your final model,

S: uh ha

I: **What are some changes that your group made?**

S: So, we definitively, so in our first model we thought that our reasoning behind basically the same phenomenon was that A was somehow like protecting E.

I: Oh, nice.

S: Like because we saw that the only time that E didn't grow was when A wasn't there, so we were like maybe like A is, I don't know, like putting itself around E or something sort of like in that formation.

I: Oh, that is actually really cool.

S: Like maybe that's why it has some sort of protection happening.

I: Cool

S: So that was definitely different

I: Okay, so you guys kept with that idea or...

S: Because we saw that like if A even, if there was A and no acid like A didn't grow, there was no growth in medium two with no acid.

I: Got it.

S: So, we were like well, obviously like A isn't protecting anything because A didn't survive.

I: Okay I like that reasoning, okay. Cool, so, you already mentioned what lead you to make those changes. **So, some students were surprised right, by some of the results and the tests that were conducted in the lab, um, where you specifically surprised about any of the results, um, or any of the other teams' results when you did your sharing of what happened?**

S: I mean no, so like the contradictory things the results were like this test.

I: What test is that?

S: that was when species E was cultured in ATCC with acid. So, in our test we no growth, that's just like A. So that's what we got so I was skeptical of that because we did that test 3 times and like kind of saw bacteria the second time.

I: Sure.

S: But didn't get a picture of it and couldn't find it again.

I: Oh no.

S: so, then we did it two more times and just saw ink blots, that made us think that we were gram staining wrong

I: Right.

S: Like something was happening to other teams which their names are probably in here somewhere, but I can't remember them off the top of my head.

I: Okay.

S: They did see growth, that same kind of what we used in our model.

I: Okay.

S: So, I wasn't necessarily like surprised but, that was something I wasn't expecting, I was expecting growth and when I saw...you feel it, moving on.

I: Comparing this lab to the previous one--

S: Uh ha

I: --what are some of your thoughts?

S: Like do I like this one or do I like the other one, or like...

I: Was it easier or harder, did you like it did you not like it, anything about it, how would you compare the two?

S: The first one was way more straight forward about--I could see the end goal that I was supposed to be getting to I mean like in terms of biological knowledge I was supposed to understand it, that's what I mean, not like the experimental end goal. **[Quote CC]**

I: Sure.

S: Like I understood the overall topic like this I was sort of, like I feel like I didn't get like a biological understanding of something. **[Quote CC, continued]**

I: Sure.

S: Because it felt like there was like no direction we were supposed to go in and like everybody went in different directions which is like fine but then when I was like trying to talk to them about, like other groups about their experiment like they kind of didn't pertain to my experiment. **[Quote CC, continued]**

I: Okay.

S: And even though they did like maybe a similar test, it wasn't the exact same test, so, I was kind of like I don't know how to like make conclusions on everybody else's stuff because it had nothing to do with mine. **[Quote CC, continued]**

I: Okay.

S: And then like at the end I was still, like I tried to make in, like tried to make some conclusions about like the peptide something, whatever that, however it's said, peptide glycan

I: peptidoglycan?

S: There you go, that word.

I: That word.

S: Like I kind of like tried to make like predictions about that and sort of how that was. I mean that's how you do gram staining so maybe because we are seeing different. I don't know, I just feel like I couldn't make like a biological, this is what we are supposed to be learning. For the other one I was like, okay now I understand plasma membranes.

I: Got it.

S: And this one I mean, like I guess I understand how these hypothetical species that I don't know what they are, react in these mediums that I also kind of vaguely don't know what they are.

I: For sure.

S: Yeah.

I: Can you elaborate on the peptidoglycan, I'm actually interested in that because it is not in your model.

S: No, it's not, I kind of drew a sort of model at the end that I don't like

I: Oh, nice.

S: I like did it and then I was like I don't know. I guess I could like talk through it.

I: Yeah. It’s not for a grade

S: Well again--

I: It’s a great idea, I would love to hear it.

S: But it was like somewhat thinking, so like in this, which one was it, it's a little hard now that it's not in color. Um, this one I think, it was this one. These were gram negative even though it was A and so I was like, why would they be gram negative if its A?

I: Interesting.

Yeast Interview:

I: **So, the first question. We are interested in understanding how you learned during this unit this unit being the yeast lab. Here is your model upside down. So, here is the model of yeast mating that your group made. Can you walk me through it please?**

S: So, this side is sort of, like the, if like what we think is there isn't there. And this is like what we think the normal process is. So, we think that there's two signaling proteins specifically in the A cell, the A strain, that secretes some sort of signal into like the medium wherever it is that then causes both of the cells to start shmooing and then like mating. And then if they don't have the signaling proteins, either of them, it doesn't happen no shmooing no mating. **[Quote M]**

I: Okay. So here you have, a triangle and a square. What is this signify?

S: That they're different.

I: Okay.

S: That's all.

I: And those? It says signaling protein. So, this is just the signals that are initially released.

S: These are the signals.

I: These are the signals.

S: These are like the proteins.

I: Right, those are the- releasing signals that are initially released.

S: Yes, okay.

I: And they're still in here. What are they doing down here?

S: Nothing.

I: Okay.

S: They're there.

I: But they're still in-

S: Yes.

I: Okay. They're still expressed.

S: Yes.

I: Okay. **Can you tell me about how you made this model?**

S: Like what evidence I used?

I: Yeah. **What data provided the evidence for the model and kind of just the process of working with your group to decide how to create it.**

S: Dang that's not my class's that was what's very helpful. They're all up there. That's not my class. Well, we used our data initially which was the plate growth meeting assay and basically saw that without the mutants either one or two it's like the triangle or the square. There was no mating. And then there was another group that, I can't remember which group it was or what they did but they their conclusion was that shmooing leads to mating. I think it was the counting ones. So, their conclusion was that like if they're shmooing them like there will eventually be mating like that's the precursor to mating. So, then that's how we jumped to the conclusion, like made the conclusion of like okay then because we saw mating or didn't see mating then like there isn't any shmooing. You know what I'm saying? Like that's how we created that bridge of like mating and shmooing and then the ideas of like it, the signals being released into the medium it was from the group. I want to say that did the beta gal assay and they used the condition medium, and they found that if there was in the A condition medium like there was still shmooing. So, that's how we knew that it's secreting something that like both of them are reacting to. **[Quote N]**

I: Okay

S: That's the conclusions we drew.

I: And you said that it's secreting something that both of them are reacting to. I don't see that specifically in this model. How do you think that kind of happens or if it is in in this model and I

S: Well, I guess it's not like directly like this one is coming over here and like. But that was our thought process behind like this arrow. Saying like these are here now and then like.

I: So, they just released into the medium and then they don't like. Cause right now you said that--

S: Yeah, like okay

I: [inaudible] interacts with the other, so the alpha and A cells somehow after its secreted into the medium by the A cells. So, how do you think that occurs?

S: Some receptor over here is like feeling for those, and then with it, when that happens it's like oh time to shmoo. And then potentially, I mean I guess there could be like either when these are expressed and like things are happening and it's secreting that whatever the signal is that could be when the A cells start shmooing or even they could have like their own receptors that are like then--

I: I mean you said when these are expressed you talked about the signaling proteins.

S: Yes

I: Okay. So, when it's not the mutants--

S: Where my finger is pointing where this cannot pick up, yes that's--

I: Exactly.

S: That's what I meant. Where my finger is pointing.

I: **So, were there moments in this unit in which you remember being really curious or confused about what was going on with the yeast?**

S: Not confused. I mean I guess it wasn't even my project that kind of made me curious but the project. I think it was the beta guy, when they had the condition medium like that really sort of like my group like all of us were like what. Like we like because our test didn't do that. So, we were just like "oh that's like super cool" that like, oh. That's like really what initially sparked our model was like oh okay. So, there doesn't even have to be A cells in order for the Alpha cells to do anything. So. Yes. Because that's where the coolness came in towards the end and it wasn't even ours. **[Quote EE]**

I: Ok. Thank you. So. **How would you compare this yeast unit to the previous ones that you saw during the semester?**

S: I feel like I liked it more than all the other ones. Yeah. Yeah, like I feel like-- I feel like I genuinely learned more from all the other groups and I think that's where it was like cool. Whereas like in all of the other labs like sometimes I didn't learn new things because like we were doing too similar of like experiments and it was sort of like okay. **[Quote DD]**

I: In the portion where you would compare?

S: Yeah, that's again that's what I mean. So, I guess, like there wasn't really a difference to me with like the actual experiments because like they all seem generally like the same. Like steps taken and sort of just like okay we're going to start with like an initial model we're going to like do some experiments that everybody did the same ones and then we're gonna like choose your own and like that sort of like that is all pretty much the same. So, like whatever I don't have a preference, but it was sort of like this one at the end I felt like I genuinely learned from everybody else's that they were so different.

I: And you liked that?

S: Yeah, I liked it because we realized that we were making assumptions where we shouldn't have been. But like other groups conclusions then let us make those assumptions. Which was like a cool sort of. It was also sort of like oh wait you can't just assume because we were like yes shmooing means mating. But it's like, okay like does it? And then the other group was like yes it does and you're like oh okay. Yes, it does. Now we can say yes. So, it was cool. **[Quote DD, continued]**

I: Okay. So. Next, I'm gonna ask you a few questions about your experience in the lab over the whole semester and not specifically about the yeast lab.

S: Okay. I hope I don't have to remember all the labs because I don't.

I: No, it's not specific details about-

S: Oh, good. I was like oh no-

I: It's more general. **So, looking back at the semester what stands out to you about this lab course?**

S: Like in relation to what? Like anything? Like, just what?

I: Yeah, however you take that question.

S: I guess when I like to think about this lab, the only word that comes to mind is like model. Like that's all we've been doing which is true. I feel like it's an interesting take on like a biology lab because like I had them in high school and everything. So, this is my first one at a university but in high school we had labs like we didn't really talk about models but it's sort of like. I think it's a really good way to actually be thinking about the science and not just like chugging through an experiment because that's easy when you're given the instructions and you're given what you're curious about because of course like hey there's this thing called shmooing be curious about it and it's like okay sure like I can do that. So, it was like interesting to me, it was an interesting approach to, like approach it as a model and be like how are you going to explain it with our experiment, like we're gonna tell you what to be curious about but, like we're not going to tell you how you're going to explain this phenomenon you're seeing. **[Quote Z]**

I: And you've said you haven't taken another biology lab in college. Have you taken other labs, or this is this your first lab at all?

S: Yeah, I've taken lots of labs.

I: Okay. And in comparison, to those what do you think stands out about this one?

S: I mean they're all very different. So, like I'm not sure in relationship to like. I don't know. I mean all the labs I've taken are like hands on labs that we're doing things. So, I know that some other people like the other classes that are doing this like the other 181 labs they're doing less like hands on things, so I guess that. But all my lab are pretty much, I don't know.

I: They're wet labs?

S: Yeah, like I… they're fine. Like they're all fine. Labs are great. I love labs.

I: Okay. **What do you think you learned in this lab?**

S: Like, what am I going to remember after this lab? I guess, probably like the process of drawing conclusions based on what you see. Like that's probably what I'm going to remember from this. Like next year people are probably gonna ask me did you take that lab and I probably go and say yeah sure. They're going to be like can you help me with this. I'm like, "No I don't remember anything else", but I'm going to remember like I'm not going to remember specifics, I feel like I'm gonna remember like drawing models. Looking back at your model like two weeks later I'm going what in the world was I thinking. What is this? And then like explaining that in you're like lab report. That's probably what I'll remember. Cause I feel like I did that in every lab report. I was like clearly from my original model I knew nothing. As we can see. Exhibit A.

I: So, you created and drew models throughout the semester.

S: I did.

I: As you have mentioned.

S: I did.

I: **What do you think the purpose of the models were in this lab? And like how did you use those models?**

S: I feel like models. I feel like it was a way for us to like work as we would in a real lab. Because I also did an internship at a lab here. So, like I feel like, I vaguely remember it was a while ago, but like I vaguely remember and like that's kind of like the process like you look at something or like you read about something and you're like okay that's like pretty cool. And then you like run some experiments just to like see it, If you did it. And then you like go to your P.I. and you're like this is what I want to do and this is how I'm going to do it so, can I do it? And then when they say yes you just kind of like do it until you get results so it's like or like you can draw a model essentially. I don't think it's as simple as that, but I think this is like a really good way to show us what it would be like to do research for real on something that you can't just like find on the Internet. I'm sure I could go like read about this. **[Quote R]**

I: **And within the lab how did you think you used the models? How did you use the models?**

S: Like what do you mean? Like, use them…

I: Like were, like what purpose did they serve to you in the lab?

S: Like before or after? Like what do you mean? Like I drew them on the first day and then how do they help me like the next time or like I drew my final one like this and then like how does that help me later? All of it? Like what do you mean? Lots of ways I could answer this question.

I: Not like long term

S: I was like do you want me to frame this, like what is this? Okay.

I: **How did you use the modeling process and models themselves in the lab and with the coursework that you had to complete?**

S: I mean, I guess by the end by this last project I feel like my group and I spent a lot of time like we were really conscious of the models that we were eventually going to have to draw. So, I feel like we thought like instead of waiting until the end of the experiment to like sit down and draw the model we were like planning the model as we were going like makes us like since we knew it was coming, we were like…I feel like that. Like it made us almost like engage a little more in like the experiments we were doing, because we were like we know we have to. Like that's been how we're doing it it's like we have to do it. So, like let's do it now and sort of make it easier for ourselves so I feel like. Definitely this lab that help because we knew it was going to happen. So, we were like preplanning it on like, with the chalk before she even gave us the assignment to do it. We know it's going to happen. So, let's use what we know like in the moment, like what we're curious about in the moment to because it's hard remember that later when you're trying to write it. So, maybe like in the moment that's how we use it other than like using it for my lab report. **[Quote F]**

I: Okay. That makes sense. **How do scientists use models**? I know you mentioned this a little bit today.

S: What have I talked about. I have no idea what.

I: When you were like explaining the research process, but you don't have to mention that again just how do you think scientists use models. And do you think this is similar or different to how it's done in the lab?

S: I mean, yeah. They use it like how I mentioned. Like as a way to explain some phenomenon that they've seen or maybe as a way to sort of explain something more complex than they can actually…What am I trying to say? Like if they're curious about something in like humans. And they're like okay but maybe ethically we can't do the tests we want to do. Let's do it on another organism that's maybe similar like make a model of what we think is happening. And then like maybe we can compare it to that. I feel like that's a really like If the biggest way I could think of like science uses it. Other than explaining like basic things. I feel like science has moved past like explaining yeast Like in this sense and so I feel like it's more like using yeast to explain something else that they can't explain.

I: Okay. And how do you think this

S: Oh, like this lab in relation to this lab?

I: No, how do you think this is similar or different like you did? Which you did I guess

S: Oh, yeah. I mean I guess like we weren't using it to explain. Like, like we're sticking pretty like closely to like yeast. We weren't using this idea for like a different organism that maybe does the same thing or like shows the same. So, I guess that's different

I: than the complexity of it?

S: Yeah, but I feel like that didn't take away from like what we were doing. Because I feel like it's pretty easy at least for me to like to see the connection even though like I wasn't like we weren't necessarily like necessarily doing it. I can still be like okay like I can see how in a regular like research situation in some lab like you might use a model that maybe has already been like I don't know approved by you know journals and stuff. You have to get like certain number of approvals to make it like real science [inaudible] happen and then you're like oh I have this model like everybody accepts it like let's use it. And then maybe like using it towards your idea of like what you think is happening in this other organism like running tests. It like gets different, I guess. But. I shrugged.