The following document includes quotes from a panel of Teaching Assistants (TAs) hosted during Biology TA Orientation. Panelists were all former TAs in the Biology department, with a broad range of experiences.

TA1 - a graduate TA for an upper-level Biology course
TA2 - a graduate TA for an introductory-level Biology course
TA3 - a graduate TA for an introductory-level Biology course
TA4 - an undergraduate TA for an upper-level Biology course
Host - Instructor of TA training

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TA1: My first time TAing, a challenge I had was actually a disruptive student who would talk over people, wouldn't raise his hand, and would monopolize recitation. So I had to implement some strategies to allow other people to speak up as well, and make sure that other people were able to engage with the material. I often had to say “let's hear from someone who hasn't spoken yet today” or things like that, that would allow people to get more comfortable raising their hands when the other person was already talking a lot.

Prioritizing material for recitation

TA3: I think one challenge that comes up in Introductory Biology sometimes is, depending on your section, you're probably going to have these recitation handouts.The recitation handouts will have practice problems on them, or ways for thinking about the lecture, and sometimes they take quite a long time to go over. And sometimes you'll find that if the students were struggling in the lecture they don't actually have the background yet to even go through those problems, so you can be hitting your head against the wall trying to get them to answer these questions that they are not really sure how to answer. So I would often just ask students before recitation “How do we feel about this lecture?” “Do we want to do the problems, or do we want to just go through the lecture again?” or “Which problems do you think are going to be most helpful?” So I think not tying yourself to the recitation handouts, being able to be a little bit more creative, and recognizing that a lot of students haven't taken biology since middle school, so they really, really needed somebody to go over the lecture with them again.

Host: Yes, that's a super important point about flexibility. You all as scientists are used to this with your experiments - needing to be flexible - but it's also true in teaching you'll find that different students have different needs and just communicating with them to find that out is really important.

Managing time in class

TA4: Towards the beginning I struggled with time management and figuring out how much to plan, because it seemed like I could go over so much in terms of content review and also practice problems. I always came up with a ton of practice problems ahead of time...In my first recitation I only got through 60% of what I wanted to, but then I got a sense of how much I could actually fit into one recitation. So then in future estimations I sort of used that first experience as a model to figure out how to break it down into the amount of content review and amount of problems, and different types of problems - both quick “correct your misconceptions” problems and then deeper “think critically about the material and apply it” problems.

One thing that I thought was helpful was to have some material or problems that I would make optional for myself, depending on how the timing was going. I would keep track during recitation. So if we were halfway through the time and only a quarter of the way through my presentation I would maybe go through just one example of a type of problem and give the handout to the students, so they could complete the rest of them on their own. It was about being patient with

myself with the first recitation, and then using that learning experience to be flexible in subsequent recitations.

Host: I love this message you have of quality over quantity. You're teaching them how to solve these problems on their own, and so, as long as you give them the tools that they need, that's all you're meant to do. You don't need to cover everything.

Working with students of varying interest and experience in Biology
TA2: The biggest challenge with introductory biology when I taught it was the large diversity in the set of people who were taking it: from incoming freshmen to seniors majoring in engineering or the humanities. That is something that every TA individually had to reckon with given the unique composition of their own sections. One solution that I converged to was just continuously telling them about things that I was working on, even if they were only tangentially related to the topics being covered in that day's recitation. Additionally, I would try to share the perspectives that had led to my appreciation of a nuanced concept in biology, or to even simply share newer developments that are exciting in biology... I believe these practices help motivate students from diverse backgrounds to learn the fundamentals/basics that are taught in an introductory level course.

Host: Yes absolutely. When you're dealing with a broader audience, finding ways to connect to them and help them to see the relevance of the materials is really important.

Working in a course with multiple instructors
TA1: Sometimes the professors were not always on the same page, and didn't always communicate to myself and the other TA(s) exactly which expectations were needed for the first half of the semester versus the second half of the semester. So just really clarifying that in your pre-semester meeting would be something that I would recommend doing because we often had to go back and do things that we didn't know we had to do in the different sections.

Connecting with students

Finding out who is in your classroom
TA4: Since I had a smaller recitation, on the first day I actually set aside 10 to 15 minutes for introductions. So not only did I introduce myself, I had everyone go around and introduce themselves, including a fun fact and also if they work in a lab or what their research experiences are like. That both gave me a better understanding of where the students were coming from and what material I should emphasize more or less, and also just made recitation seem more like a community.

TA1: I would also say that one thing that I found was really important early on, was to make sure you learn people's names and how they say them because it's just important... it shows that you're interested in their well-being because you care about how they present and you are respecting that as well.

TA3: I sent out a Google form asking students about their background in biology...I was so intimidated, my first day of teaching because I was like “Oh my god, MIT - they're all engineers, they're all mathematicians” and I walked in there and asked “Do you all know what DNA is?” and everyone just shook their heads. So it's really important to know where they're coming from. [In the Google form] I asked them how to pronounce their names (phonetically written out), their pronouns, if they had any learning things that I should know about. Some students confided to me about things like ADHD and things that were helpful and not helpful for them when you're doing a recitation.

Promoting group work
TA4: I built in some group work, especially in the earlier recitations, so students could get to know each other. I think overall that just built a really good rapport both with me and the students and just within the recitation in general.

Putting yourself in their shoes
TA 3: I would sometimes pepper in little stories about when I was an undergrad. You just have to remember what it's like when you used to live in a room with another person, and have to regularly pull all-nighters. I think, just re-putting yourself in those shoes and remembering that's what they're going through and that's how they feel... I think it's a good way to connect with them, just validating that college is really hard.

Normalizing where students are coming from
TA2: I tried to emphasize that assignments and tests are simply an assessment of practice in solving a particular type of question and not always correlative with one’s underlying appreciation of biology or with the knowledge they’ve developed of the subject matter. Knowing how to apply it to a particular question is a different skill set and that's something that can take a while to learn, so struggles in problem-solving shouldn’t detract from the enjoyment of the subject. I think it was important to relate to their trajectories, with particular focus on how it related to my own incremental improvement in problem-solving during undergrad.

Tips and Tools for Teaching

Making recitation student-driven
TA4: I think personally, I really liked making my recitations very student-driven instead of me talking a lot. It was always about everyone participating, and luckily my recitation was like that and people did participate. It's kind of hard when people don't. But I did this by asking lots of what I thought were thought-provoking questions...and leaving time for students to ask questions. Because very often they would be really interesting questions as well, that would deepen everyone's understanding of the material, including my own.

Setting goals for your students
TA2: I think one practical thing to do is, at the beginning of class, outline the types of problems that students should be able to solve by the end of that recitation. So, basically three or four points that should be take-home concepts, so that they know what the barometer for understanding is. This also allows for more questions during the recitations, especially if there's a discrepancy between what they've learned and what they recognize they need to learn. And if they're not confident about solving them by the end of class, then they can be more proactive by coming to office hours or studying accordingly on their own time.

Creating low stakes opportunities for participation
TA3: I find that students really like participating by voting or by polls, and less so by just asking a question, waiting for somebody to respond. Or they also prefer, it seems, to participate when you pose a question and then give them 30 or 40 seconds to answer. And don't let anyone answer until those 30 seconds are up, because then people don't feel like "oh I'm slower". The bio department does a little training on participation techniques and I found those all to be really, really helpful.

Making the material relevant
TA3: I think putting in weird facts is really fun, showing them why you care about biology and why it's interesting. Especially if you're doing Intro Bio, a lot of them are not going to go on to be biologists, and that's okay. But if they can walk away saying "Wow it's really crazy there are six feet of DNA in every cell!" or "Wow I can't believe there's a spider that has a dance that it has to do!" To be able to make fun facts like that, I think keeps people engaged.

Designing your own problems for recitation
TA4: Maybe this is only applicable for a more upper-level class, but I enjoyed designing questions based on real research papers, since that's what the exams were very often like. I think those kinds of questions really helped them grasp concepts and the experimental logic that they would apply on exams.

Grading effectively
TA1: One small, practical suggestion I have is grading online with Gradescope. It was hands down the best thing that ever happened to TAing, in my opinion. I found it was more clear, more unbiased, quicker, and it was just easier to go back and edit. I was more consistent with my grading because I was able to quickly find previous exams that I was like "Maybe I should have graded this a little bit less stringently" or something. So I would recommend it, if you are able to, even if you have to upload the exam yourself, it will save you time in the long run.

Lessons learned

Working as a team with other TAs
TA3: For my teaching team, we liked to work together a lot. We would ask "I'm having kind of a hectic week - does someone have a good idea for how to teach DNA base-pairing?" and then

we would all help each other out and plan recitations more together. And I think that was fun and I wish we'd started it from the very beginning.

TA1: Yeah, I think something we could have done better was working together to make problems and things like that. It really is a lot of time and some weeks you're just going to be too busy and not want to do it, you're not going to give it your best. So I think that if you know that you only have to do it once every two weeks or three weeks, then you'll be able to dedicate more time and feel more proud of what you're doing.

Knowing when to move on

TA2: One thing that I wish I'd done even more of is knowing when and how to skip some of the questions that students ask. I think there's immense merit in constantly asking them questions and gauging what the pulse is, but fielding too many discursive questions during recitation can be distracting... especially given that you only have some 50 odd minutes to get through the material that you want to cover. Knowing where the majority of the students are in their understanding facilitates knowing which questions to prioritize. For the other questions, it might then be best to either point them to an office hour or to write the whole class (or the specific student) an explanatory email afterwards. I think that practice is something that I wasn't doing as much of, but recognize, retrospectively, the merits of doing more frequently.

Taking notes as preparation for teaching

TA3: I noticed after a couple weeks that I was taking notes as though I was a student in the class, which you don't really need to do if you're teaching. So I would start actually planning my recitations during lecture, which I wish I had done from the very beginning because my original notes look like I'm planning on taking the midterm for the class, which I'm not doing.

Designing a problem

TA4: I underestimated the time it would take to create a problem from scratch. So I would just set aside more time, because it takes a lot of thinking and making sure that the questions are not only challenging but also the appropriate level, and actually relate back to what the instructors want to convey and test.

Dealing with questions you don't know the answer to

TA1: Honestly, just say you don't know. You get more trust that way. You can say "From my understanding, I think this is the case, but let me follow up with you after class" or "I'll send an email to the whole class with the answer."

Host: Absolutely...find a way to follow up but don't feel pressure to answer in the moment. It's totally okay not to know, and actually sets a really good example for your students.