# Module 8: Getting Started with Research

BMES Cell Team

Winter 2021

# Outline

- Benefits of Joining a Research Lab
- Terms and Lab Positions
- Finding the right lab
- Emailing the PI
- Resume Tips
- The “Interview”
- Advertisement for Open Lab Positions
- Live Tour of the Cardiovascular Engineering Research Laboratory
- Q&A Session with Undergraduates from Various Labs

# Benefits of Joining a Research Lab

- Opportunity to perform hands-on research
    - Learn useful skills outside of classes
    - Discover whether you want to do research long term
- Looks good on a resume
    - Especially if you are lucky enough to be an author on a published paper
- Get to know the PI better for a potential letter of recommendation
- Get research units that count as class credits

# Terms

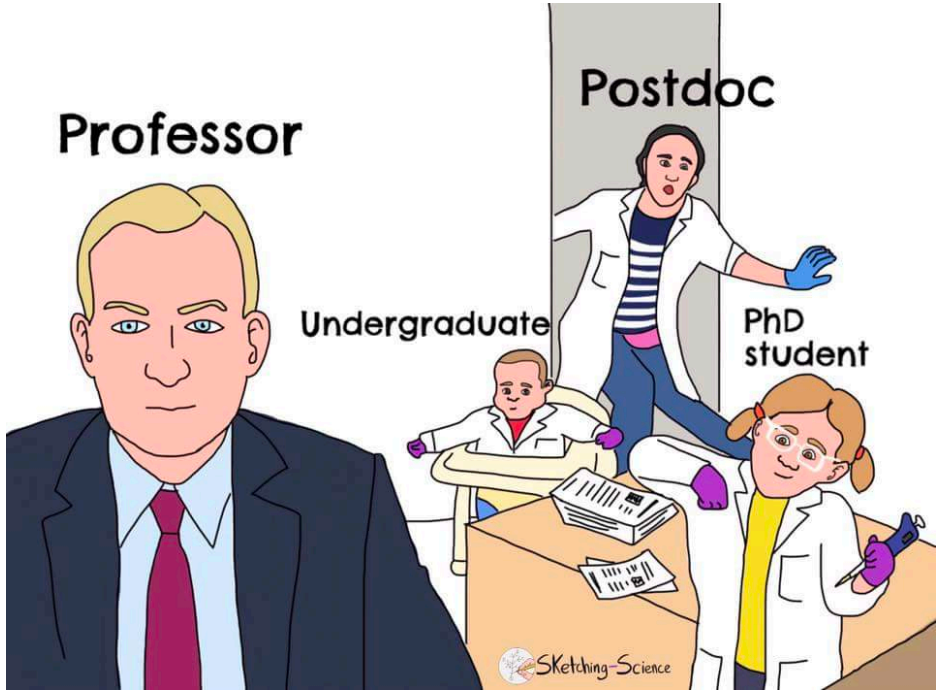
- **Wet-lab:** Research in topics similar to what we have been doing this year. Involves chemical and biological experiments.

# Terms

- **Dry-lab:** Research that focuses on programming, electronics, and simulations.

# Lab Positions

- **PI/Professor:** The person in charge of the lab.
- **Postdoc:** A person who recently earned a PhD but is doing additional research to gain experience.
- **Graduate Student:** A student who is working towards a Masters or PhD degree. They take classes on the side as well.



# Lab Positions

- As an undergraduate, you are likely to spend a lot of time training before you can do anything interesting

- Take initiative! After you undergo basic training, ask someone in your lab if you could assist them with their project.
    - Once you feel comfortable enough, you can even write your own abstracts and create protocols for your own experiments.

# What to Expect

- Time commitment varies by lab. Ask the current members of the lab for more information.
    - Usually 10 – 20 hours per week and additional summer work
- When you first start, you will likely be shadowing other students. The longer you are in a lab, the more independence you will have.
- You will probably work under a post-doc or graduate student
- Weekly lab meetings to hear about what the rest of the lab is doing

# Finding the Right Lab

- Go to https://samueli.ucla.edu/search-faculty/#be for faculty profiles
    - Most professors will have labs, but *lecturers*, *affiliate professors*, and *adjunct professors* generally do not
- Professors listed under **Chair**, **Vice Chairs**, and **Core Faculty** have labs that are heavily bioengineering-based
- If you are interested in *interdisciplinary* research that blends bioengineering with other fields (medicine, electrical engineering, etc.), then look for professors under **Joint Faculty**

# Finding the Right Lab

- Visit the lab's website and look up publications and articles written by members of the lab to gauge your interest

- If you are planning on going to graduate school or medical school, the *quality* of research is very important

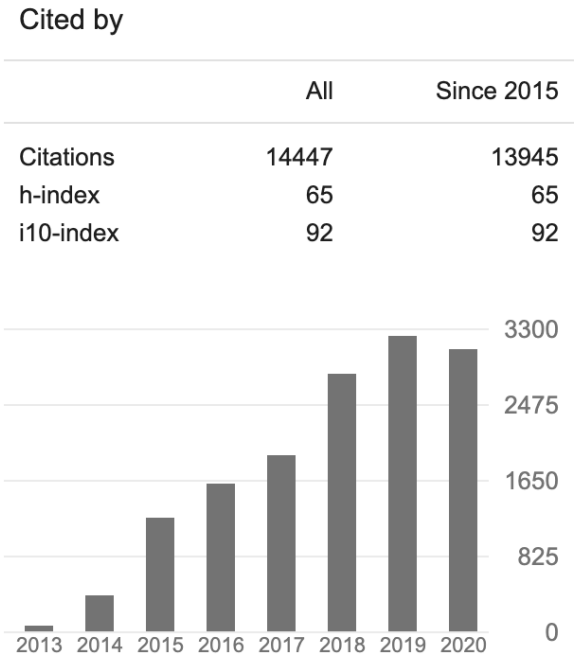
    - One metric of research quality is the h-index, which takes into account the frequency of publications (quantity) and number of citations (quality)

    - You can find a professor's h-index by looking up their name on Google Scholars

# Finding the Right Lab

- A good h-index for graduate or medical school would typically be >20 **but** *please do not use this as the only factor for your decision in joining a lab* since it is not always accurate.

- Valid reasons professors may have a low h-index:
  - They are a new PI
  - Their research topic is very specific, and may not receive a lot of citations




- The best thing you could do is to look at their past publications and see how often undergraduates are listed as a coauthor in a published paper

# Finding the Right Lab

- Every Spring Quarter, BMES hosts a research fair where you could network with current lab members and ask questions
    - This is uncertain this year due to a virtual setting

- Apply for the Biomedical Research Minor
    - They will place you in a lab based on your interests

# Finding the Right Lab

- Make sure you start by looking for professors whose research you are *actually* interested in
    - If you're unsure, you can even reach out to a graduate student or postdoctoral researcher and ask to shadow them for a day
    - You don't want to end up committing to a lab whose research you don't like

- Be true to yourself!

# Emailing the PI

- Make it clear the you have researched their lab and understand what their research is about
- Relate it to your own interests to explain why you want to join their lab
- Talk about what you can gain from working in their lab, and discuss your future plans

**NOTE:** It is OK if you don't have research experience. Since you are an undergrad, professors don't expect you to have a whole lot of experience. What matters most is your *sincere interest* in their field, and your *willingness to learn and grow*.

# Emailing the PI

Dear Dr. Seidlits,

My name is [redacted] and I am a first year bioengineering student at UCLA. I am writing to express interest in doing undergraduate research in your laboratory beginning in the winter quarter.

Your research of central nervous system injury and regenerative therapy for such injuries using bioengineered microenvironments fascinates me. As a matter of fact, I hope to specialize in the neurological application of bioengineering myself, so this research opportunity would provide me with tremendous exposure to a field that I am passionate about. I know that I would learn a lot under your guidance, especially given your expertise in the subject. I also have an extraordinary academic record throughout both high school and my first quarter of college, as seen in my attached CV, and am willing to put in much time and effort to help the research project succeed.

I would be so grateful if you were to consider me and give me a chance to meet with you to discuss my interest in your research further. I am available during the winter quarter on Mondays, Tuesdays, Thursdays, and Fridays between 3 pm and 6 pm for an interview. Of course, I understand if you are not currently looking for any undergraduate student researchers, so I will gladly reapply for either this position or a position in another research project you may do in the future. Thank you for your time and I look forward to hearing back from you.

Sincerely,
[redacted]

# Emailing the PI

Hello Dr. Hsiai,

I am a first year Bioengineering student at UCLA, and I wanted to ask you if there are any opportunities available for **undergraduate students** in the Cardiovascular Engineering Research Laboratory. I found out about your lab when we met at *Discover Engineering 2018*, but I decided to wait a year to get accustomed to the university before I begin looking for research opportunities.

Although I only have some introductory research experience, I am very interested in learning more about how bioengineering blends in with medicine. In particular, I want to pursue an interdisciplinary career that allows me to integrate technology into medical branches like cardiology. By applying to your lab, I hope to network with graduate students and explore topics like vascular repair and computational fluid dynamics. Moreover, I am looking forward to gaining an experience that will add to my existing knowledge and reinforce my passion in this field.

I am available this summer for training, and I hope to commit as much time as my schedule permits. For your reference, I have attached my CV. Thank you very much for your time, and I look forward to hearing from you.

**Justin Chen**
University of California, Los Angeles '22
Bioengineering B.S.
Phone: (408) 679-0488
Email: jcheno21@g.ucla.edu

# Emailing the PI

- In your email to the PI, make sure to attach a *curriculum vitae* or *resume*
- A **curriculum vitae (CV)** is a comprehensive list of everything you have done, usually multiple pages long
    - Geared towards academia and research-based positions
- A **resume** is a one-page summary of your experiences, tailored to the position you are applying for
    - Geared towards industry-based positions
- For the purpose of undergraduate research, it doesn't matter whether you attach a CV or resume

# Emailing the PI

- Things to include in your CV or resume:
    - **Education (schools, GPA, etc)**
        - Only include your high school if you are a freshman
    - **Any science or lab experience you have *in college***
        - This can include Cell Team, or any lab classes you've taken
    - **Experiences that show you are responsible and can work with others (clubs, organizations, jobs, etc.)**
    - **Qualifications and Skills**
        - Include specific skills you have gained from Cell Team
        - You should note that you have went through these skills *virtually* due to the pandemic. They will understand.

# Resume Tips

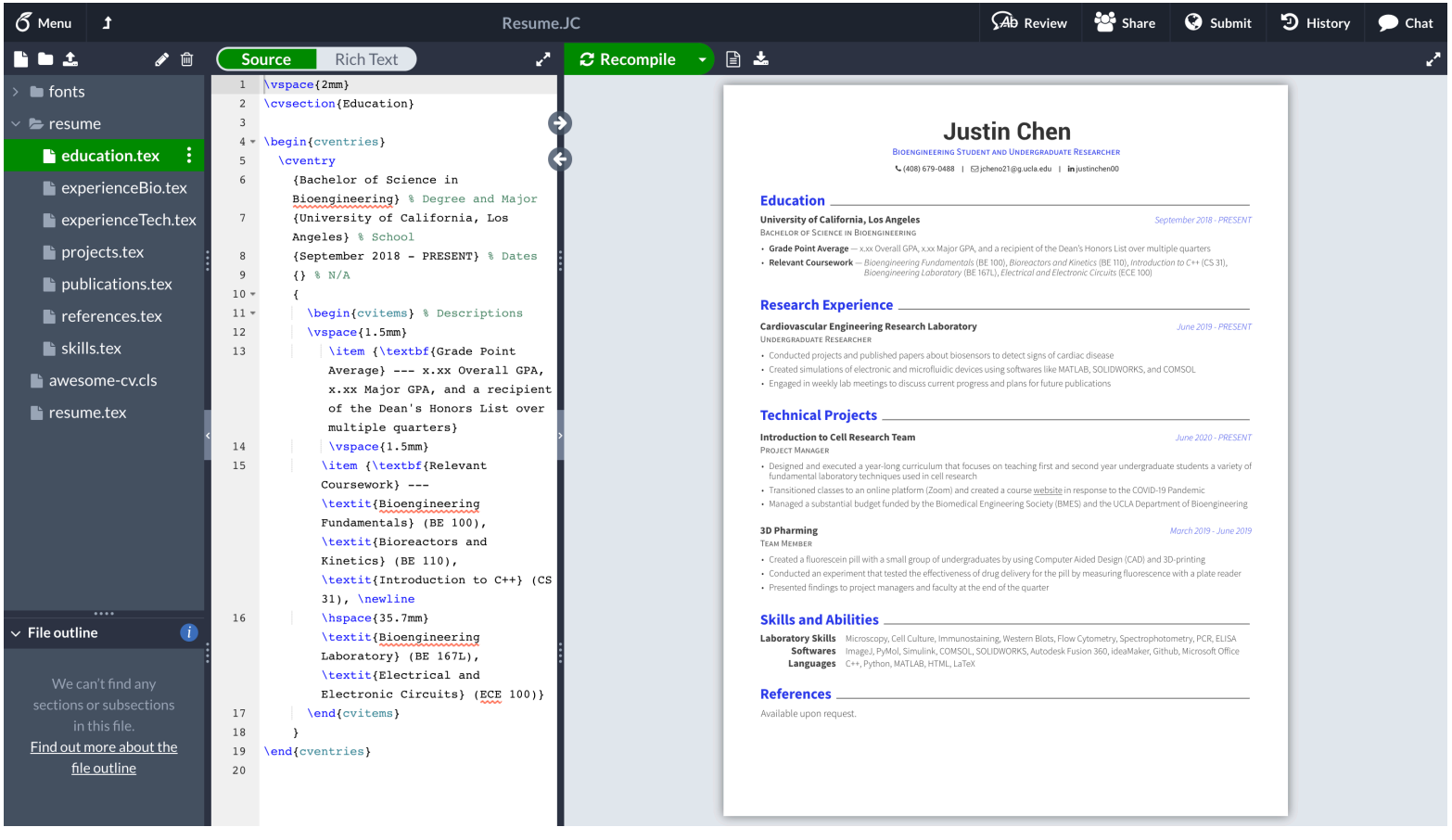
- Start your resume with your most relevant experiences (recent and science-related), and work your way down
- Start each bullet point with the most important action verb
    - Instead of “worked with graduate students to conduct a project on x-ray crystallography”
    - You should say “conducted a project on x-ray crystallography with graduate students”
- Of course, make sure everything is meaningful and concise

# Resume Tips

- There are many templates online you can use, or you can design your own
    - However, if you choose to use an online template, make sure you modify it so that it looks original
- Most people create their resumes on **Microsoft Word**, **Google Docs**, or **LaTeX**
- There are many free online softwares, such as **Overleaf**, that allow you to edit .tex files


# Resume Tips

## LaTeX Interface



# Example Resume

## Justin Chen

Bioengineering Student and Undergraduate Researcher

(408) 679-0488 | jcheno21@g.ucla.edu | justinchen00

## Education

**University of California, Los Angeles** *September 2018 - PRESENT*

Bachelor of Science in Bioengineering

- **Grade Point Average** — x.xx Overall GPA, x.xx Major GPA, and a recipient of the Dean's Honors List over multiple quarters
- **Relevant Coursework** — *Bioengineering Fundamentals* (BE 100), *Bioreactors and Kinetics* (BE 110), *Introduction to C++* (CS 31), *Bioengineering Laboratory* (BE 167L), *Electrical and Electronic Circuits* (ECE 100)

## Research Experience

**Cardiovascular Engineering Research Laboratory** *June 2019 - PRESENT*

Undergraduate Researcher

- Conducted projects and published papers about biosensors to detect signs of cardiac disease
- Created simulations of electronic and microfluidic devices using softwares like MATLAB, SOLIDWORKS, and COMSOL
- Engaged in weekly lab meetings to discuss current progress and plans for future publications

## Technical Projects

**Introduction to Cell Research Team** *June 2020 - PRESENT*

Project Manager

- Designed and executed a year-long curriculum that focuses on teaching first and second year undergraduate students a variety of fundamental laboratory techniques used in cell research
- Transitioned classes to an online platform (Zoom) and created a course website in response to the COVID-19 Pandemic
- Managed a substantial budget funded by the Biomedical Engineering Society (BMES) and the UCLA Department of Bioengineering

**3D Pharming** *March 2019 - June 2019*

Team Member

- Created a fluorescein pill with a small group of undergraduates by using Computer Aided Design (CAD) and 3D-printing
- Conducted an experiment that tested the effectiveness of drug delivery for the pill by measuring fluorescence with a plate reader
- Presented findings to project managers and faculty at the end of the quarter

## Skills and Abilities

**Laboratory Skills** Microscopy, Cell Culture, Immunostaining, Western Blots, Flow Cytometry, Spectrophotometry, PCR, ELISA
**Softwares** ImageJ, PyMol, Simulink, COMSOL, SOLIDWORKS, Autodesk Fusion 360, ideaMaker, Github, Microsoft Office
**Languages** C++, Python, MATLAB, HTML, LaTeX

## References

Available upon request.

# Example Resume

## ANYA BEKHTEL

**UCLA Bioengineering student graduating April 2021**
**Seeking a technical role where I can help enhance the quality and accessibility of preventative healthcare systems for American patients.**


abekhtel@gmail.com (209) 981 0863 www.linkedin.com/in/anya-bekhtel
Los Angeles, California


## WORK EXPERIENCE

### Caregiver
**In Home Support Services**
July 2020 - December 2020 | Stockton, California
- Assisting my grandparents perform self-care tasks and attain necessities.

### CMC & Preclinical Intern
**Karuna Therapeutics**
July 2019 - September 2019 | Boston, Massachusetts
- Interpreted pharmacokinetic and toxicity data for formulations of Karuna's leading drug candidate (KarXT) and presented major findings to C-suite.

### Optech
**JCPenney Optical**
June 2018 - August 2018 | Stockton, California
- Communicated optical information to customers and repaired broken frames.

## TECHNICAL PROJECTS

### Bacterial Bioreactor for Polystyrene Degradation
**UCLA Bioengineering Senior Design Capstone Project**
October 2020 - present | Los Angeles, California
- Collaborating with Plastic2Food to construct a small-scale bioreactor that can support the polystyrene-degrading bacteria Pseudomonas Putida.

### Technical Projects: EKG Build, Robotic Design, Cell Team
**Biomedical Engineering Society (BMES)**
October 2017 - present | Los Angeles, California

Electrocardiogram (EKG) Build Team - Member (2017-2018)
- Learned basic breadboarding and Arduino coding by constructing an Arduino-based Electrocardiogram Circuit and designing 3D Printed system housing.

Robotic Hand Design Team - Electronics Co-Lead (2018-2019)
- Collaboratively coded and designed an Arduino-based flex-sensor glove for controlling the flexion and extension of Pinky, the 3D printed robotic hand.

Cell Team - Project Manager (2020-2021)
- Teaching essential wet lab techniques to first year bioengineers through weekly presentations, guided journal clubs, and simulated experiments.

### HHMI Undergraduate Student Researcher
**Ozcan Research Group**
October 2019 - December 2020 | Los Angeles, California
- Re-designing 3D printed antimicrobial susceptibility testing (AST) device that allows for faster, accurate determination of bacterial resistance to antibiotics.

References and additional project details can be provided upon request.

## EDUCATION

### B.S. Bioengineering (X.X GPA)
**University of California Los Angeles (UCLA)**
September 2017 – April 2021
- Major GPA - X.X
- Dean's Honor List (2017, 2019, 2020)
- ALD/PES Honors Society

## COURSEWORK

- General and Organic Chemistry
- Biochemistry: Central Metabolic Pathway
- Anatomy and Physiology for Bioengineers
- Introduction to Statistical Methods
- Biomedical Measurements and Transducers
- Biocompatibility & the FDA Approval Process
- Biomaterials: Novel Hydrocephalus Shunt
- Dynamic Biosystem Modeling and Simulation

## STRENGTHS & SKILLS

Technical Writing | Technical Projects | Client Communication | Chemistry | Excel | MATLAB | Simulink | 3D Printing | CAD | Cell Culture | Viability Assays | Microsoft Suite

## LANGUAGES

**English** ●●●●●
**Spanish** ●○○○○
**Russian** ●●●○○

## VOLUNTEER WORK

### Delivery Coordinator
**MaskUpLA Nonprofit**
September 2020 - present

### Freshmen and Transfer Mentor
**SWE, BMES, and MentorSEAS**
September 2018 - present

### Pediatric Literacy, Clinic Assistant
**Simms/Mann Venice Family Clinic**
October 2017 - March 2020
- VFC volunteer work halted due to COVID-19

# More Resume Tips

- The format of your resume is subjective and dependent on the reader, but there are some universal rules:
  - Use a neutral and readable font
  - Keep it as concise as possible, but >1 page is OK if you have a lot of experience

- Pictures of yourself may be OK with some readers, especially if you are applying for positions that involve graphic design

# After You Have Contacted the PI

- If the PI responds, great! Do whatever he/she asks of you.
- If you haven't heard back in two weeks, send a follow-up email.
    - I would try to limit myself to two (2) follow-up emails.
- Some PIs may not reply, and some may be looking for more experienced candidates. Don't be discouraged! Just keeping contacting labs and you will find one
    - Some PIs may not be looking for undergrads right now, but may be willing to take you on in a quarter or two

# The “Interview”

- If the PI wants to meet with you, you have probably already gotten into the lab
- The “interview” is more of a conversation to meet you and talk more about the research you will be involved in
- Don’t stress! The “interview” is super casual
- Make sure to ask them questions about their research to show that you are interested

# Other Last Tips

- *Generally*, the best time to apply is Spring Quarter of Freshman year because professors are looking for people to replace the graduating seniors.
    - For this year, Summer Quarter would be a good time to apply too.
- If you are able to be trained over the summer, then that's excellent!
- Most people join a lab between the end of their Freshman year and the end of their Sophomore year

# Lab Advertisements

- We did you guys a solid and emailed various PIs to see if they wanted to advertise any open undergraduate positions ☺
    - Since these PI's responded to our email, we are confident that they will respond to yours as well
- The next few slides will cover their research topics and any requirements they have for joining their lab
- Keep in mind that there are other labs that potentially have open lab positions
    - Either the PIs didn't respond to our email or we didn't email them

# Lab Advertisements

**Meyer Lab**

The Meyer lab integrates data-driven and mechanistic computational approaches with cell biological experiments to study cell behavior.

**When can you start?**
As soon as possible (Spring Quarter)

**Will you be performing remote or in-person work?**
Remote for now; in-person when restrictions are lifted

**Requirements**:
Students must have programming experience and have taken Linear Algebra.

# Lab Advertisements

**Jun Chen Lab**

Wearable Bioelectronics

**When can you start?**
As soon as COVID-19 restrictions lessen up

**Will you be performing remote or in-person work?**
Remote

**Requirements**:
N/A

# Lab Advertisements

**Seidlits Lab**

We use engineering approaches to develop 1) new therapies that promote regeneration of brain and spinal cord tissues and 2) improved preclinical models of brain tumors.

**When can you start?**
As soon as COVID-19 restrictions lessen up

**Will you be performing remote or in-person work?**
In-person

**Requirements**:
N/A

# Lab Advertisements

**Ozcan Lab**

Nano- and Bio-Photonics Laboratory

**When can you start?**
As soon as possible (Spring Quarter)

**Will you be performing remote or in-person work?**
Mostly remote work during Spring Quarter
Limited in-person work starting Summer Quarter

**Requirements**:
N/A

# Other Remarks

**Kamei Lab**

I would wait until you take BE 100. He will advertise open lab positions sometime around Midterm 2.

But if you really want to join as soon as possible, you can email him now. I've seen undergraduates get into his lab as a first year before.

**Requirements:**

Must do research for at least one summer (two summers if you want to go to graduate or medical school)

# Q&A

**Q&A Session**

We have undergraduates from various labs with us today:

**Meyer Lab (1)**
Linnet Chang

**Di Carlo Lab (2)**
Trevor Burnes

**Jun Chen Lab (3)**
Cherise Ching
Darren He

**Yvonne Chen Lab (4)**
Neha Iyer

**Ozcan Lab (Main)**
Anya Bekhtel

**Hsiai Lab (Main)**
Justin Chen

We will take a break and resume at 7:05pm. Until then, you can turn off your video and mic, but please remain on the call.

# Q&A

**Q&A Session - Part I (General Questions in the Main Room)**

Panelists, please answer the following questions:

1. Describe the research interests of your lab?
2. What was your experience like as an undergraduate? (If you are new to your lab, you can talk about your experience working remotely)
3. What is one exciting accomplishment or contribution you have made to your lab? (If you are new, you can describe what you hope to accomplish)
4. General questions from the audience.

# Q&A

**Q&A Session - Part 2 (Breakout Rooms)**

Please find the breakout rooms listed below to have a one-on-one conversation with each panelist. We will keep this open for 15 minutes, unless you guys want to stay longer.

**Meyer Lab (1)**
Linnet Chang

**Di Carlo Lab (2)**
Trevor Burnes

**Jun Chen Lab (3)**
Cherise Ching
Darren He

**Yvonne Chen Lab (4)**
Neha Iyer

**Ozcan Lab (Main)**
Anya Bekhtel

**Hsiai Lab (Main)**
Justin Chen