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Landing University Research Opportunities 101*

Roy J. Zhao [1,2,3] Akira Yoshiyama,[4,3] and Rayan Ramadan[5,3]

[1] *Kavli Institute for Cosmological Physics, The University of Chicago, 5640 S Ellis Ave., Chicago, IL 60637, USA*
[2] *Department of Physics, The University of Chicago, 5720 S Ellis Ave., Chicago, IL 60637, USA*
[3] *Meadowridge School, 12224 240th St., Maple Ridge, BC V4R 1N1, Canada*
[4] *Department of Electrical & Computer Engineering, University of Waterloo, 200 University Ave. W., Waterloo, ON N2L 3G1, Canada*
[5] *Faculty of Applied Science & Engineering, University of Toronto, 35 St. George St., Toronto, ON M5S 1A4, Canada*

ABSTRACT

Greetings, my friends! If you are reading this, you are on your way to finding research opportunities at your universities. Landing a research op and contacting all those professors can feel daunting, but I hope this guide can help!

I should note that this guide was written when I worked closely with Meadowridge School (my high school, and my beloved utopia I get to call home), so there are many internal jokes and references; however, I can assure you that the advice for finding research is universal :)

In this document, I *tried* to provide a comprehensive guide on how to look for possible undergraduate ops, contact professors, what to be careful about, and everything in between! **If you have any additional questions or hope to have your old friend weigh in on anything, all of you know that my email (rzhaolx@uchicago.edu) and every dm possible are open for your questions, concerns, cries, and outrages for all eternity :)** Stay in touch and hit me with questions - I will be delighted to help. This guide was made in several streams of consciousness, so it is uncomfortably informal and might sound like me nagging you...who knows, maybe I am :/

Many thanks to my amazing friends Akira Yoshiyama (agyoshiy@uwaterloo.ca) and Rayan Ramadan (rayan.ramadan@mail.utoronto.ca), whose feedback improved and validated the applicability of this guide in CS and Engineering, and who have also generously agreed to correspond to any inquiry from mdr about university experiences. With the presented informality, I listed them as co-authors for their invaluable addition, which is ranked by *procrastination level*. There is a short bio in Appendix A (clickable) for each of us, in case you wonder what we do :)

Okay, now deep breaths. Here we go!

Keywords: Finding research (251) — is rough (1736) — but you're gonna (1868) — get one! (804)

NOTE BEFORE ANYTHING

I will start this guide with a seemingly irrelevant rant after learning some unfortunate comments on undergrad researchers from a reputable program in a major public university in Canada...Research is hard and scary, yes. You will take a LOT of time to learn even just the basics of your project, yes. Even worse, a lot of these times you will have ideas or attempts that are simply not working out after months. Those are all true statements. However, remember

Corresponding author: Roy J. Zhao
rzhaolx@uchicago.edu

* Please feel free to distribute to any Meadowridge School affiliated personnel or alumni. I'm open to distributing it to your peers in other institutions, but please let me know first! I also welcome any feedback you may have on improving this document.
None of us is officially affiliated with Meadowridge anymore, so the affiliation listed is just for old-times sake :)

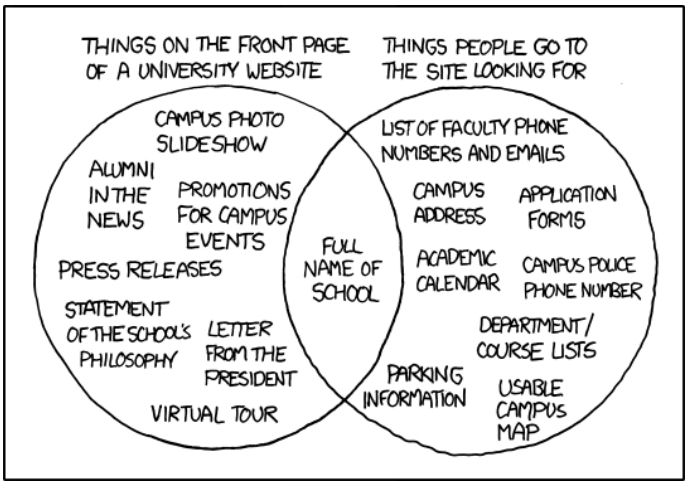

Figure 1. These uni websites...

this: ALL of the people you see, including the grad students, postdocs, and your profs themselves, went through this unfortunate stage where they knew literally nothing about what they do. DO NOT ever feel bad because you need time to learn something that you haven't had a chance to! Research is a long and hard process because you are really trying to study the universe itself, it is not supposed to be easy. **Don't let anyone tell you that you're a liability to the lab - a big part of what profs and labs do is they are supposed to teach and prepare you. If they are not, they failed their job - it's that simple.** If they decide to take on you, they are supposed to mentor you rather than make toxic comments against you. In my own experiences, I have taken half a year to work through a tutorial on galaxy formation, messed up *very* expensive supercomputer resources, and had to restart a simulation (which takes days to run) steps away from submission. Even experienced researchers are nothing close to perfection themselves, and no one should expect you to be when you have just started; and as they have been through these things, they are in absolutely no position to call you a liability. To drive the point home, these opportunities belong to you! Take your time to adjust and learn, ask questions as you are entitled to, and you will become much better really soon!

WHERE DO I START?

Now here's the actual starting point after my rant: I *reasonably* expect all of our universities and departments to have websites, though see Figure 1. Start there! On the departmental websites, there is usually either a "research," "people," or "faculty" button. (e.g. UCLA Biochem, UW Physics, UofT Cell & Systems Bio ← any blue fonts are clickable links in this guide :) The department should provide a succinct summary of its ongoing research. Some departments do a great job of categorizing everyone under subfields (e.g. protein-folding is a subfield of structural biology), but some merely list the people and their research.

Now, we should be able to find each prof's individual directory, and some of them will take us to their lab websites. For example, here is a sample directory page of Andrea Young, a professor at UCSB (https://www.physics.ucsb.edu/people/andrea-young). There, we can usually find their Google Scholar page and their group/lab websites. Make sure to check out both! I especially recommend skimming through some of their recent or most famous papers to get a feel for their research. If these are not available on the department website, keep in mind you can always google "Roy Zhao Google Scholar" :) Also, Google Scholar isn't the most up-to-date search engine for papers. Different fields have different go-to search engines (e.g. NASA ADS for astronomy, PubMed for medical research, various open-access arXiv pre-print services: arXiv, arXiv for CS, BioRxiv, ChemRxiv, ResearchGate, etc.) See Figure 2! The arXiv services are especially useful if you are being charged to read a paper, say on Nature. If that happens, search the paper title in one of the many arXivs! Chances are they are already open-access there. Note that your university account will give the most optimal use of these resources!

If you find yourself totally lost when reading their papers, you should be! Being involved in cutting-

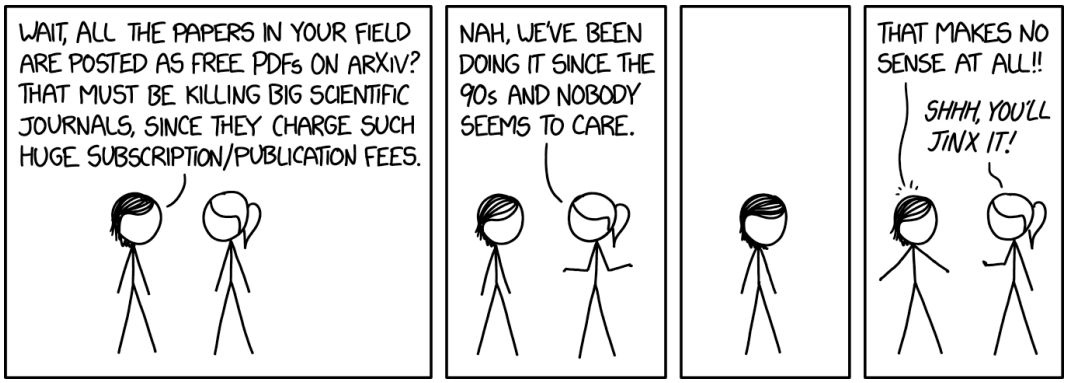

Figure 2. arXivs are amazing!

edge research takes quite a learning curve, and no one can start with full force on day one. Take some time to ask other people (us? :) or Google terms you don't get, check the overview on their websites, and if you still don't totally get it, it is perfectly natural. Once you step into the field, things will gradually get easier. We all have to start somewhere. Being lost means you are learning!

One more thing to check on their webpage is the "people" section. Many professors will specify if they are recruiting people and, if they are, their requirements! (e.g. what courses you should take or what skills you should have) They also occasionally list their lab roster in the "people" section, so take a look and see if there are undergrads in there. If yes, then it's a good sign. If not, keep in mind that most of these websites are outdated or don't even include undergrads, so still reach out and ask!

Apart from searching the websites, talking to people in your department is also a great way of familiarizing yourself with the available opportunities. Those included but are not limited to your instructors, TAs, and upper-class friends who are working in labs already. They will be able to give you the most environment-specific pointers (e.g. they likely know who's taking students and who's not, who will be easier to work with, or who has a good track record of working with undergrads). **Many departments also offer weekly seminars or colloquia normally targetted to grad students and faculty, but I especially recommend crashing these!** Many of the colloquium speakers will be from your own department, which gives you a chance to ask them questions face-to-face after the talk (alert: there is also often free food for these things :). These colloquia and conferences will also complement your understanding of the cutting-edge foci of your field. If your university happens to be hosting conferences (Canadian Undergraduate Mathematics Conference, Canadian Association of Physicists, etc.), crash these as well for exposure and opportunities! Many of the weekend conferences should also be cheap to attend.

Make sure to check many many people, so you know the range of options you have, then pick your favourite! For most of us, remember that your department is NOT the only destination. If you are one of the bio majors, check out other places like Biochem, Bioengineering, Immunology, Physiology, Molecular Cell & Developmental Biology (MCDB), etc. If you are in CS or physics, look through various opportunities in engineering departments (electrical, chemical, mechanical, or even civil) or physical chemistry! Chances are your background will be a good fit in multiple departments, and you can find an even broader set of research by looking broadly. e.g. For engineering in particular, it is easier to get software/computer hardware/CS types of research in the biomedical field with BME profs than it is with actual ECE profs, likely due to differences in funding and lab space and overall ease of incorporation of students into the lab. So if you are interested in that particular type, cast an especially wide net. It is still a very valuable experience.

Many universities also have student organizations or other official resources that aim to help you get research. However, people's experiences diverge. My experience says that although these can occasionally provide some institution- or department-specific advice and really rarely broadcast available opportunities, they are usually not too helpful. However, for some other programs (say Rayan's), there may be first-year funding sources and even "matching" with

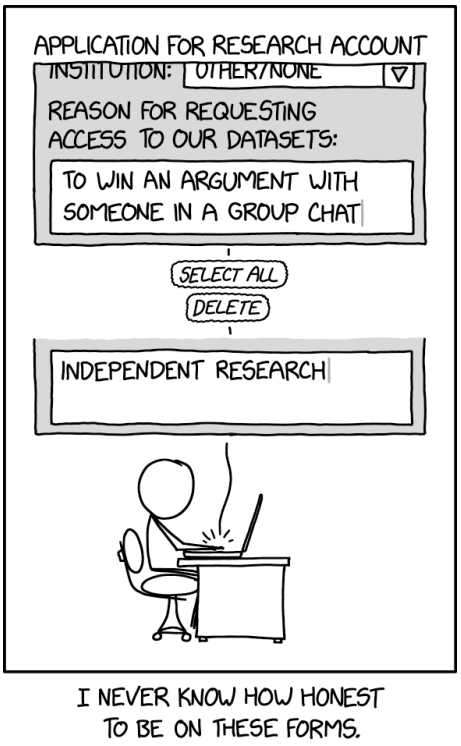

Figure 3. Is this you?

profs. Keep your eyes open to see how helpful they are!

I also personally recommend signing yourself up for different mailing lists in different departments. For example, if you're in biochem, signing onto the mailing lists of bioengineering or biophysics may be a great idea. These mailing lists are often advisors' go-to places when an opportunity (fellowship, scholarship, lectures, and internships) is brought to them. Being on more departments' email lists will likely expose you to a greater set of possibilities. Reach out to a department's advisor to sign yourself up!

Now that we know what's available in your school or department, write down your favourite groups and the professors' email addresses! Let's draft an email to let them know how awesome you all are.

THINGS TO CONSIDER BEFORE GOING FOR THE PROFS

Okay, hold up your keyboard for just a second! Before going to the next section, which gives you ideas on how to make these contacts, do keep a few things in consideration:

- First and foremost, do you like doing the research you find? (i.e. is Figure 3 you?) If not, keep in mind switching is always an option. Profs understand you are young and flexible, so they understand if you choose to leave for other opportunities or interns. The subfields you choose will weigh more in the later stages of your undergrad, especially if academia is your choice.

- Would this person be a good letter writer? Having reference letters from big names will definitely be a plus for grad school or industry positions, but only if this big name knows you! **An emotionless letter from big names is less beneficial than a really strong one from an assistant professor, or people who are a little less famous.**

- Is academia gonna be your next immediate choice? (e.g. are you gonna take an M.D., Ph.D., Master's, or even combined M.D./Ph.D. in the field?) If so, it is a good point to consider your professors' connection and reputation in the field! However, do understand that many times there likely won't be a choice...but keeping this

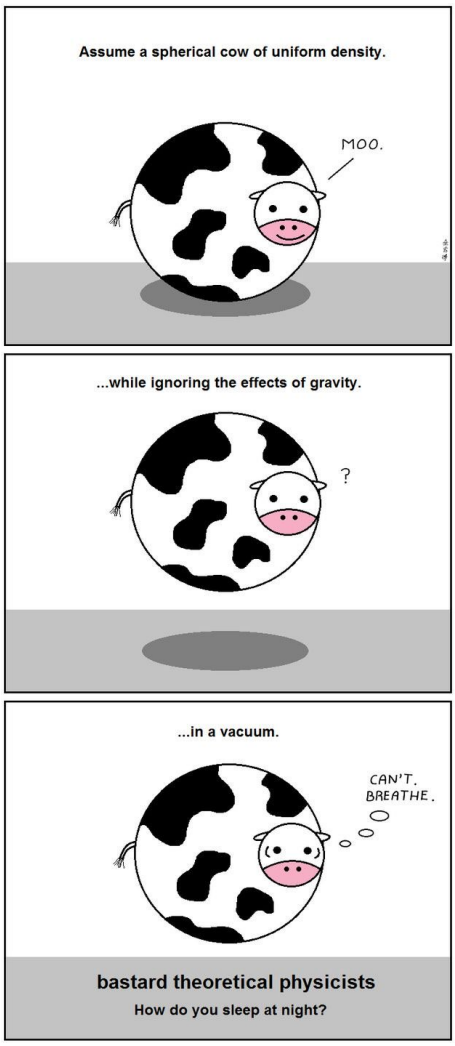

Figure 4. Warning for theory people...yes I did astro theory too:)

in mind will not hurt. This also applies to the earlier comment about doing research in a different department. If you intend to apply for a biochem Ph.D. but have a research letter from biomedical engineering, that definitely does not look sus, but your prof might be recognized less in a different field and has less connection. All of these might sound convoluted, so just to drive the point home: **consider your prof's connection and reputation in the field you are going to stay in the future!** If you are heading to industry, this is still a worthy consideration: does your prof have connections in the industry? If you are on the fence about this one, feel free to get me on board! **I would personally always weigh your research interest more than the profs' reputation**, but it is up to you to balance your internal idealism and utilitarianism.

- Would you work with a grad student/postdoc or the prof? If it's a mix, how's the time split? This could be a big factor. Most large experimental groups have this kind of hierarchy where you work with grad students and postdocs, but your professor will only interact meaningfully with them. It is worth considering if you really want to work in this environment, though many won't give you a choice...In this case, it is common for the grad student/postdoc to give significant input to your letter. In some cases, the grad students/postdocs will even write your letter, and the professor will merely take that letter and submit it :/ On the contrary, most theory groups (which means they do math, modelling, or computer simulations) are typically smaller, and you will likely have close interaction with profs, though note these groups are also typically smaller so there's less need for undergrads sometimes. There's also one more trouble when doing theory work...see Figure 4. Doing heavy

math-involved theory is also a little harder. Keep in mind doing work in a lab and doing theory is different, and I would recommend weighing your liking more!

- Would it be too much to do with all of your classes? What is expected from you time-wise? Keep in mind you will have to split your time between research and classes. GPA is also crucial to many of your future applications/awards/resume items. However, working less than 2-3 hours a week for a group is kinda not taken seriously...
- Would it be possible, or is it likely that you can co-author or even lead a paper/present at a conference? Having undergrads publish papers/lead conference talks is rare but not impossible. These papers/talks will also look great on your CV, especially if an academic Master's, M.D., Ph.D. is your chosen path, though it is also heavily weighted if you apply for industry jobs. Completing a paper means you can take on hard projects by yourself for a substantial amount of time. These skills are valued anywhere you go.
- Would you mind if you're unpaid? Many of these opportunities will be voluntary, especially during the academic year. You can always choose to apply for an extra fellowship in your school or nationally. Two of the most famous fellowships are The NSERC URSA fellowship and Undergraduate Research Awards (URAs) at different institutions. Most of it will go towards the materials needed for experiments, but could also be used to fund yourself. Experimental groups typically have more funding than theory groups, so you're more likely to be paid. Note that many summer positions are paid. Many universities also have a collection of possible scholarship/fellowship you can apply embedded in their websites. (e.g. the UBC page and the UofT page)

One more thing to think about: speaking from experience, the longer we have been in our groups, the more "productive" we will become (i.e. more outcomes, stronger letters, or even conferences and papers). However, we will also need 2 or 3 reference letters for virtually any Master's, M.D., or Ph.D. application, though industry positions differ in their requirements. I recommend having at least 2 research letters out of 3 total on our application. So, there is a delicate balance to whether to switch labs or do intern during summer.

Many institutions also broadcast summer paid opportunities or internships, in which you will go to a different institution to work with a different group/company over the summer. Again, it's a delicate balance to keep. Are you going to work with your summer group after switching, or are you planning to come back to your academic-year group? **The default is that if you get into a lab, you "automatically subscribe" to the group until you graduate, unless you tell your professor you are switching.** If you like doing work in your current group, ask if your profs have funding to support you over the summer! If not, at least ask for credits (many institutions have research classes, in which the "instructor" will be your prof, but you just do research and it's not an additional class. Profs almost give all A's for these except for some...)! It is also possible to simultaneously work in two groups. However, would you have the time to do a meaningful amount of work in both groups with heavy course loads? Are you sacrificing one group's work or even your GPA? Just some things to think about...

These are terrifying choices! When in doubt, check Figure 5 for enlightenment maybe? :)

HOW DO I CONTACT THE PROFS?

With a list of groups you are interested in working in and the professors' email addresses, let's talk about how to get ourselves in!

In most cases, people get their positions by cold emailing professors because professors are notoriously hard to find and usually busy. However, if the interested professor is conveniently teaching you or is teaching some other classes currently, I strongly encourage talking to them after class face-to-face or during office hours. Even if you do not get an opportunity, the connection will be there. If this prof is teaching other classes, use your course selection software strategically so you know when and where they have classes.

Talking in person not only gets you an answer faster (email takes way longer!) but also gives you a feeling of how this person might be. Keep in mind you will likely ask this person for a letter or referral down the road, and in any event, you will be working with this person (or their graduate students or postdocs) or for an

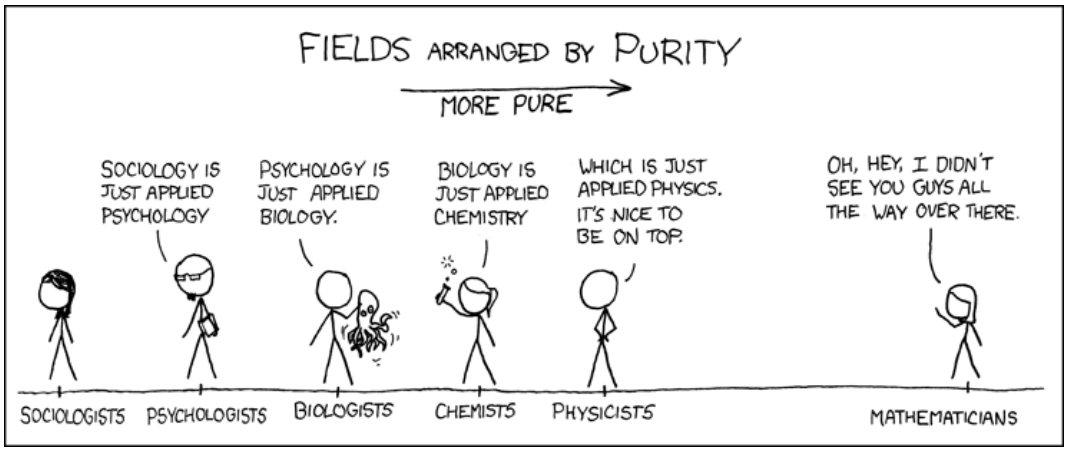

Figure 5. The field metrics for real...ignore that dumb mathematician! Math is not that amazing.

extensive amount of time, so if this prof sounds like a jerk, ditch sooner than later :) Another good way is to see if you can talk to anyone who's currently working in this group; they can also likely give you information on the availability of the professor and group as a whole. Ask your TAs what groups they are in and see if they have friends in your fav group!

If this prof is hard to find or if emailing is simply easier, then cold email it is! I think an example may help the most. I sent the following email to my advisor, Steve Furlanetto, back in my third year:

> Hi Prof. Furlanetto,
>
> This is Roy, a junior physics major at UCLA. I would just like to get in touch early and express my interest in working in your group in semi-analytic modelling of 21-cm cosmology.
>
> My ongoing research in Prof. Joan-Emma Shea's group involves computational modelling of protein folding. Therefore, I am very familiar with operating on Linux/supercomputer systems and simulations in molecular dynamics. Hopefully, these can be useful if you have available projects! Course-wise, I have completed all core courses except 110B with a UD GPA of 3.94 and am currently taking 221A. I have attached my transcript and CV below for your reference.
>
> My first research opportunity was in cosmological spectroscopy with Prof. Phil Lubin, but I never had a chance to do it due to the pandemic. I look forward to hearing from you!
>
> Cheers,
> Roy
>
> (Attached my CV and transcript)

So this is the general format I will go with! A couple of points to be made:

- Attach your selfie - like this in Figure 6. (Ok don't actually do this...just to be clear)
- If you can confirm that these people are professors (look at their titles on their personal websites), then address them using Prof. rather than Dr. The Prof. title is somewhat more prestigious. I'd also recommend having this remain the case even if this person emails you back with their first name in the signature, unless explicitly asked.
- Science and engineering people like **simple, clear, and direct** sentences and emails, so avoid having too many subordinate clauses, flowery adjectives, or long paragraphs! Three sentences in one email paragraph is sometimes plenty.

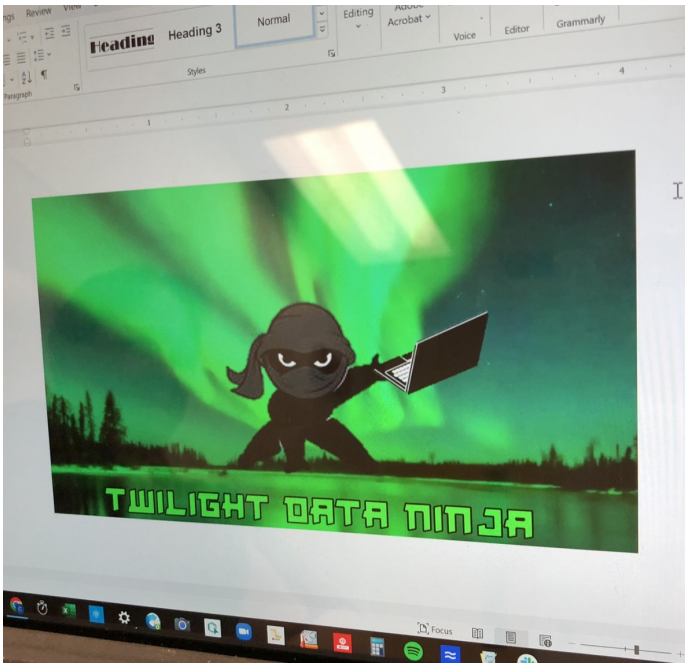

Figure 6. Twilight Data Ninja! If you want to show this to Ms. Mohoruk, she will get it :)

- I'd also recommend keeping the introduction to your past experiences short and to the point in the email and referring to your CV in the last sentence. (if you need some help putting together a CV, let me know! Maybe I will draft the second in this series to be CV-making... :)
- That said, **also attach a CV!** If you are just starting up, don't stress about making everything perfect. An outline of your capabilities (coding, specific experimental techniques: spectroscopy, chromatography for your IAs and stuff :) and past research experience (your EE and IA count) is great!
- **Attach your transcript!** If your GPA is great (i.e. greater than 3.5), highlight that in your email! Professors care about your major GPA much more than your general GPA (the one that includes your English and other non-STEM courses) so I recommend running a conversion by yourself for STEM classes only. However, this is not to say a $\lesssim 3.5$ GPA is not great. Let's just not allow that single number to shield you from these opportunities.
- Always check your caps! e.g. capitalize "Engineering Science" as a program, or any acronyms that you may use.
- highlight a few relevant courses that you took or your capabilities! If you are working in Lifesci, then list your bio/chem/physics classes. If you know how to write Python, R, or even C, include them, as they will be a huge plus, as well as any previous research you have done (again EE and IA count - include them even if they are not immediately relevant! Some of us used our EE and IA as hooks for finding research and it worked!) That said, keep these short and concise! The details should be reserved for your CV only.
- I will also suggest **adding one quick sentence outlining what you are most interested in regarding this person's research**. Be specific! Please don't just say "I'm interested in your research in astrophysics." That just sounds like you don't even wanna try. Something like "I'm interested in working with you on developing computational techniques for simulation of proteins" is much better. Asking a question from reading their work is also a great choice. Keep in mind that people don't expect you to be experts in their field; if that's really so, you should take that tenure, not them :) **Just having a vague idea about the research you want to pursue is not only okay, but thoroughly natural.**
- If you have past and/or possible connections with these profs (e.g. if you worked with their students, their colleagues, even their advisor, etc), make them the first thing after your name, and as always, make them short and concise. **Having too much info in the email can hurt you more than having less!** Actually interested people will go for your CV upon reading your email intro. You won't miss them.

Figure 7. Some cold hard truths...no just kidding!

- *For CS and CE research positions (math, coding or electronics), mention a side project or two that you did that relate to the prof's research (if you have any). It's usually not that difficult to do side projects related to a prof's work, so if you don't have one then we would recommend doing one or two first and then telling the prof about it when you cold email them. Even if the prof's research is super advanced, you can code something adjacent to their work to show your knowledge of their field and/or your skills in the tools they use in research (programming languages, frameworks, etc.).

- Another way of getting the prof's attention is just to email them with questions about your project / ask for help, and then develop a relationship from there. Profs usually won't say no if you are simply asking a question, or requested to join group meetings. In these meetings, chances are that someone will mention a project that no one has time or interest to do, and these could be yours!

- If you are applying for grants, include your plan with them too! You can email a professor saying, "I'm going to apply to XXX grant", making it more appealing, so email with a plan and a strong idea of what you want to do funding-wise.

The biggest mistake we see with our friends is that they undersell themselves. Don't let the doubts creep in. You are meant to learn on the job. **Sell your ability to acquire skills, not the skills you've acquired.**

I MADE MY CONTACT, WHAT AFTER?

Now it's the waiting period...Professors' responsiveness ranges from 5 minutes to never. If they get back, great! If they don't, feel absolutely free to follow up after 2-3 days. Figure 7 shows you what profs do... **Make sure to send a follow-up in the same email thread so they know they missed you!** Unfortunately, most of the profs you reach out to will likely ignore you. Please don't take it personally - it is not about you! Their group may be full or they can simply be so disorganized that they missed your message multiple times. If nothing comes back after one or two follow-ups, it is time to move on to the next target. This professor doesn't deserve your amazing self :)

I will share anecdotally that it took me around 20 tries to get a good opportunity, even in later years :/ So please don't give up if you are getting these silent rejections. As you take more courses, your CV will look better and better, increasing your chances of getting these ops.

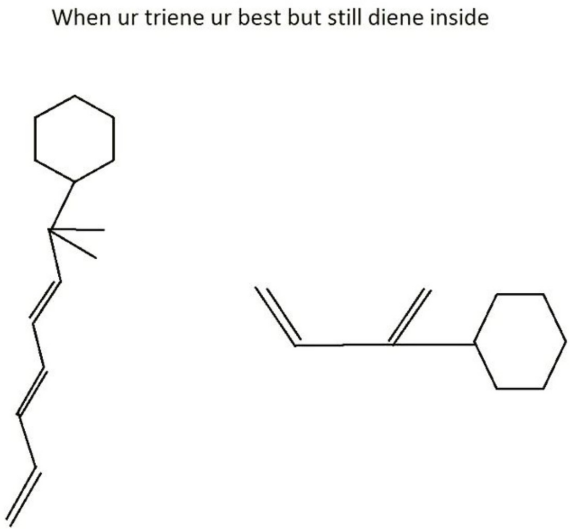

Figure 8. All of us

It is also possible that you will end up having to apply for labs that you are not that excited about. Or, you could have started your project and realized it's not what you think it is. Don't give up - do your projects and learn as much as you can — that's just life! You're learning a new skill anyway, and those skills are NEVER wasted. I once did bio simulations and thought that was completely useless going into astrophysics, but it turned out to be surprisingly handy. Having one research will almost necessarily beget a second, and know that switching labs/groups is always an option!

HOW DO I MAKE A STRONGER CASE?

There are only a few factors generally taken into consideration:

- GPA. Try your best to shoot for a high GPA! Try to shoot for a 3.5+ at any university, though this differs in different schools! Getting 3.5 in UofT is beyond difficult, but at UCLA things are much friendlier.
- Computing skills. If you can, try to take a few coding classes on Python (generally good for anything!), MATLAB (eng heavy), R (for bio ppl), or even Java and C (CS and physics). These will increase your chances!
- Advanced classes. Some universities have strict schedules, so you may have less flexibility, but having more major courses will help.
- if you have previous research, that's always a plus. Don't sweat if you don't. I didn't have one until the later part of my second year :) We (Figure 8) all have to start somewhere.

I GOT AN OPPORTUNITY! WHAT NEXT?

Congrats! Now, your professor should have given you information on group meetings, your mentor, and what you will likely be doing! Keep up, ask questions, and you will be good :) Remember it is perfectly natural to feel lost even after joining a group. It is almost the case that you shouldn't understand anything. However, do ask questions, no matter if it is to your grad student mentor, postdocs, or your prof! **You are now working WITH them, not FOR them. You are NOT dumb just because you have never heard of something.** The key is if you are down to learn and ask questions about it. Again, that happened to me and every one of us. As you read more papers, take more classes, and spend more time in the group, you will gradually become an expert in your field. By then, let me know if any of you would like me to co-author a paper!! It has always been my dream to collab with any of you. Please make that a reality one day!

APPENDIX

A. ABOUT US

Here's a little bio section of all of us so you know how we can help!

I am currently a Ph.D. student at the Kavli Institute for Cosmological Physics and the Department of Physics at the University of Chicago, working with Prof. Josh Frieman. My field of research is in astrophysics/cosmology. I am currently working on applying Artificial intelligence techniques to study cosmology. (If you'd like more in-depth info, I am using simulation-based inference to study an astrophysical phenomenon called strong gravitational lensing, which could provide insights into dark matter and ultimately the fate of our universe!)

I got my Bachelor of Arts & Science in Physics and Philosophy from UCLA and worked as a staff scientist for a NASA legacy mission called the Stratospheric Observatory for Infrared Astronomy (SOFIA) during my gap year during the 2023-24 school year. Here, I studied the star formation and magnetic field of the centre of our Milky Way, working with Prof. Mark Morris. Previously, I have worked in theoretical astrophysics regarding the first galaxies in the universe with Prof. Steven Furlanetto (Zhao & Furlanetto 2024), and in running biomaterial/biophysics simulations with Prof. Joan-Emma Shea (Day et al. 2023a,b).

Akira Yoshiyama is doing research in the ECE/CE department at the University of Waterloo with Tahsin Reza, which will eventually culminate into a paper (already??). He has lots of experience with different programming languages, machine learning, and software systems.

Rayan Ramadan is studying Engineering Science at the University of Toronto, and will probably end up in bioengineering-related fields. She'll be doing cutting-edge biosystems research at UBC over the summer! She knows a lot about protein and bio-related aspect of things, as well as the computational tools we use to study these systems.

They both have completed tons of side projects and are involved in tons of extracurriculars in their disciplines. So they will publish more papers than I do down the line. Just know they are also amazing resources for these research things! :)

For those of you who are interested, I will elaborate a bit more about my biophysics research. There, I was responsible for running computational simulations of a library of peptoids, working with Joan-Emma Shea. The overarching goal of these projects is to combine multiple methods (experimental and computational) to efficiently predict the properties of peptoids.

#1: Insights into Conformational Ensembles of Compositionally Identical Disordered Peptidomimetics
#2: A High-Throughput Workflow to Analyze Sequence-Conformation Relationships and Explore Hydrophobic Patterning in Disordered Peptoids. (Day et al. 2023a,b)

I don't think many of you care about astronomy (for reasons in Figure 9), but just for fun...it's Zhao & Furlanetto (2024), published in the *Journal of Cosmology and Astroparticle Physics*. This is my undergraduate project working with Steven Furlanetto. In this paper, I studied stardust behaviour in the first generation of galaxies through semi-analytic theory. We managed to reconcile an observed puzzle and provided physical reasoning for it!

B. AND FINALLY...

The above is all that my old brain could come up with in this particular coordinate in spacetime! Thank you to Akira and Rayan for making numerous additions. Again, if there are other points you are wondering about, or if you'd like me to weigh in on your research choice or drafted email, I would be delighted to help. Just let me (or any of us) know! :)

REFERENCES

Day, E. C., Chittari, S. S., Cunha, K. C., et al. 2023a, chemRXiv e-prints, 10.26434, doi: 10.26434/chemrxiv-2023-b84wl

Day, E. C., Cunha, K. C., Zhao, J., DeStefano, A. J., & Dodds, J. N. 2023b, chemRXiv e-prints, 10.26434, doi: 10.26434/chemrxiv-2023-6z1xd

Figure 9. Yes don't do astrophysics kids

Zhao, J., & Furlanetto, S. R. 2024, arXiv e-prints, arXiv:2401.07893, doi: 10.48550/arXiv.2401.07893