




# Research Experience for Pre-Health and Medical Students

A guide for SNMA & MAPS students



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# **Research Experience for Pre-Health and Medical Students**

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### **WHY DO RESEARCH?**

While having research experience is not required to get into medical school or residency programs, most medical school and residency applicants have some sort of research experience that they can talk about in their application and during their interviews. Being able to clearly communicate your research project to the admissions committee is probably the most important aspect of your research experience for medical school or residency.

I am writing this guide to pass on things I've learned from my own research experiences to pre-health and medical students who come from underrepresented minority backgrounds. While the information I present here might be common knowledge to some, I believe this information still has value for students who might not have had access to friends or family in academic science or medicine growing up. This would be the case for many students who come from underrepresented backgrounds. Of course, the information shared here can be used by anyone, but I do ask all who used this guide to consider the importance of and work towards improving inclusion and diversity in medicine.

### **TYPES OF RESEARCH USUALLY DONE BY APPLICANTS**

Applicants pursue all different types of research. These research experiences can be in any field or discipline. There are three different types of medicine adjacent research you can get involved in.

Basic science research -----> Translational Research -----> Clinical Research

#### Basic science research

Basic science research is in the STEM (science, technology, engineering and mathematics) fields. Basic science research in life sciences like biology or chemistry is mostly done in a laboratory setting. A lab is headed by a Principal Investigator (PI), who can be a professor at a university or a research institution with funding that allows them to pursue research projects. At your colleges and universities, the PIs are your professors.

Because all my past research experience has been in basic science research, this guide will mainly focus on how to get research experience in basic science. Keep in mind that some parts of this guide might not apply if you choose a clinical research project or research in humanities/arts. However, most information provided here will be applicable for different types of research.

#### Translational Research

Translational research is like basic science research in many ways. Translational research is taking knowledge of basic biological, chemical and physical processes discovered in basic science research and applying it to create new medical therapies, procedures or tests that can potentially be used to improve human health. Translational research usually occurs in a laboratory setting as well. The difference between translational and basic science research is

more in definition. You can approach finding and working in translational research the same way as you would in basic research.

### Clinical research

Clinical research is somewhat different from the first two. Clinical research involves projects seeking to answer questions about safety, effectiveness and outcomes of medical practices, procedures and treatments. The findings from these studies are the drivers of modern medical decisions and evidence-based medicine. The PIs of clinical research will mostly be MDs and you probably won't be working in a laboratory setting. You might be in a clinic setting if you are involved in clinical trials and interacting with patients. You can also approach finding clinical research experience described in the guide here.

### **WHAT TO GET OUT OF YOUR RESEARCH**

When you are doing research, it would be very nice if you can get your name on a publication, present a poster or give an oral presentation. These are evidence that you significantly contributed to research and have seriously participated in research. In your application, there are places for you to list your publications/poster/oral presentations. We will talk more about this later.

In my own opinion, the most important thing to get out of your research experience is learning how to effectively communicate your research to others. You will need to not only write a concise and clear description of your research experience in your application, you will also need to fluently talk about your research projects during interviews. We will also talk more about this later.

### **FINDING THAT INITIAL RESEARCH OPPORTUNITY**

There are different ways to find your first research opportunity in college. It really doesn't matter how you find your first research experience; all that matter is that you have one. You can find these approaches online. Here I will just elaborate on each a little more.

❖ Your school's dedicated undergraduate research website  
Most schools will have a webpage and resources dedicated to undergraduate research. There is a wealth of research related information that is consolidated for you by your school. Definitely take advantage of your school resources because it is specific for your school. For example, at University of Iowa, we have the Iowa Center for Research by Undergraduates office [www.uiowa.edu/icru](http://www.uiowa.edu/icru) This website contains a database of professors who are willing to serve as research mentors. Offices and websites like these are great resources for not only finding a mentor but also other research opportunities like research symposiums and fellowships.

*Pros:* Professors and mentors listed here are likely experienced mentors who have successfully mentored undergraduate students in the past.

*Cons:* You might have more competition from other students who might be interested in the same professors/mentors. Your school might not have similar resources.

❖ Browsing professors on departmental pages

Looking at faculty profiles on department websites is a common way for students to find research positions. This method lets you compile a large list of potential professors to contact. Most department websites feature a brief description of the faculty's research interests and their contact information. This is a convenient way to see if the professor's area of research is interesting to you. Sometimes the department pages list professor's publications as well. You can look at the dates of their publications to determine if they are actively doing research. If they have recent publications, that is an indication that the lab is still actively doing research. On the other hand, if the professor's last publication was 5 years ago, it might mean that this professor is just teaching classes and not running a lab anymore. Another way to find their recent publications is to search their name in Pubmed. Either way, you can compile a list of professors you are interested in and prepare to contact them.

I suggest contacting professors one by one instead sending out multiple emails. This way you won't be overwhelmed with meetings and having to decide between which professor/lab to choose. Contact the professor you are most interested in first. You might meet them and see that it's a great fit for you and you join their lab. Or, they might not respond, can't take you, or you meet and you don't like them. Then you contact the next professor on your list until you find a lab that fits. This way, you avoid being overwhelmed with meetings, needing to make a choice between labs and having to tell a professor you're not interested anymore. While the PI mostly likely won't care, it might be still awkward if you see that professor all the time. Because you only need to find one lab to join, you don't need to spread a wide net in the beginning.

*Pros:* Easiest and most convenient way to initiate contact with professors, especially if you are shy and intimidated by talking to professors. This method also allows you to find a lot of potential mentors.

*Cons:* It can be hard to know which professors might be actively working on research just through their department biography.

#### ❖ Talking to professors

The professors that teach your courses can be great resources for you to find your first research experience. An example scenario: you go up to the professor after lecture and ask a question about what was presented. When they finish answering your question, you promptly follow up with "I really find this topic/field fascinating and want to get more involved in research in this field, would it be possible to meet with you sometime to talk about ways to get involved in research?" What most likely will happen is that the professor will say sure and to email him/her about this to remind them. This approach is nice because it gives the professor a face to put your name to when you email them. In the case that the professor refuses for some reason, be gracious and thank them for their time.

*Pros:* Talking to a professor leaves them a favorable impression of you as an interested student. This is helpful because the professor is more likely to remember you, take you as a student in their lab or evaluate you favorably in class. If you do well in this class, you can ask the professor for letter of recommendation.

*Cons:* This professor might not have space, might not be doing research or might not work in a field you are interested in. However, this is still a good opportunity for this professor to recommend you some other professors who might be taking students.

❖ Teaching assistants and upperclassmen

If you are a little scared of talking to a professor outright, you can learn about research opportunities from your TAs who are either graduate students or upperclassmen. TAs and upperclassmen are easier to talk to and less intimidating. Generally, you will get a lot of good advice and wisdom from upperclassmen. For example, your TA might tell you that Professor Gonzalez is super chill and her students love her. Or an upperclassman might tell you that Professor Martinez doesn't check his emails often because he travels a lot, so you should probably expect to email this professor multiple times before he replies. They can also give you a good idea of what it's like to work in different labs and help you decide which lab might fit your personality.

*Pros:* Good way to learn about the personalities of professors and lab culture.

*Cons:* You still need to initiate contact with the professor. Teaching assistants and upperclassmen might be biased against a particular professor.

❖ Your school's student employment page

If your school doesn't have a dedicated listing of research mentors, your school might have a student employment website where you can perhaps find a lab looking to hire a student researcher. This is how I found my undergraduate research position. These postings are good because they specify who they are looking for. It will tell you if they want students with experience or students with any experience level can apply. The posting will often also tell you the types of experiments you might be involved in and what kind of responsibilities you will have. However, keep in mind that you are NOT looking for a position where you just wash lab dishes and not doing actual research.

*Pros:* You know for sure that a specific lab is actively doing research and looking to mentor students. They might specify the type of projects and experiments you will be involved in.

*Cons:* The lab in the job posting might not be in an area of research interesting to you. Other students can also apply.

❖ Family connections

Having family/friend connections to get you started in a research position is not something that will be available to a lot of students. If you do have someone who can help you, you should absolutely use this help! This option is the easiest one to take advantage of if you have it. However, if you don't, other methods can also help you get your foot in the door and accumulate experience.

*Pros:* Easy way to get your foot in the door and get some research experience.

*Cons:* not everyone have this option.

## **CONTACTING PROFESSORS**

Here I will provide example emails for you to use as templates. Depending on your level of experience, you might write your emails to the professors differently. These examples are here for you to customize to however you see fit. The reason I am providing these examples is because I never knew how to start these kinds of emails and was googling example emails other people have written. The general format of these emails can be organized in the following way:

1. Brief introduction of who you are and why you are emailing
2. A little bit of information about yourself, your academic or previous research experience
3. Why you are interested in this professor's research
4. Asking if they would meet with you
5. Attach a CV/resume if you have one

For students with some previous research experience:

*Dear Dr. Okoye,*

*Hello, my name is Weiren Liu. I am currently a freshman here at University of Iowa. I am interested in pursuing research during college. I came across your research biography on the biology department website and wanted to ask if you would consider taking me as a research mentee in your lab.*

*A little about me: I worked as a research assistant in Dr. Gonzalez's biochemistry lab the summer between my junior and senior year in high school. During my time in Dr. Gonzalez's lab, I worked on a protein characterization project where I studied the interactions between the protein ferritin and gold nanoparticles. I used biochemical techniques to characterize protein nanoparticle conjugates. Additionally, I learned various molecular biology techniques while in Dr. Gonzalez's lab including DNA cloning techniques such as designing vectors, bacterial transformation, DNA purification, PCR and agarose gel electrophoresis.*

*I read your biography and was fascinated by your work studying the mechanism of HIV transmission. Browsing through your past publications on pubmed, I see that your lab utilizes some techniques I am familiar with and some that are new to me. I would love the opportunity to not only contribute to your lab but also learn new skills.*

*If possible, I would love to meet with you and see if you would consider taking me on as a research mentee in your lab.*

*Thank you so much for your time!  
Weiren Liu*

If you don't have any previous research experience but have taken introductory science courses that has a lab portion, you can talk about that. For example, Biology 101 often have a lab section that will teach you some molecular biology techniques. You can mention this to let the professor know you have some background.

*Dear Dr. Kirk,*

*Hello, my name is Weiren Liu. I am Pre-med sophomore here at University of Iowa majoring in neuroscience. I am particularly interested in neuroscience research. Becca Smith, my TA for Introduction to Neurobiology, recommended you to me and told me that you might be looking for a student. Therefore, I am emailing to see if you would consider meeting with me to talk about the possibility of me working for you as an undergraduate researcher.*



*Last semester, I earned A grades in both Biology 101 and Chemistry 101 and their respective lab portions. I learned basic laboratory skills and molecular biology techniques in these courses. I am also currently excelling in my Introduction to Neurobiology course. I believe my performance in these courses provided me with a solid foundation to start participating in research. The more I learn about your work on the neural development of zebrafish, the more fascinated I am with this field. It would be a great privilege for me to get the chance to work with you in your lab.*

*I would love to meet if you are available. Please let me know.*

*Thank you so much for your time!*

*Weiren Liu*

If you have anything about yourself that you think might make you a more attractive student, you should mention it. Did you do well in your science classes in high school? Got 5s on your AP sciences tests? Did you win awards at science fairs? If you don't have any of that stuff, it's also totally fine. Here I provide a simple email that you can send to professors.

*Dear Dr. Ferentz,*

*Hello, this is Weiren Liu. Thank you so much for taking the time to talk to me and answering my questions after lecture today! As I mentioned during our talk, I am looking for research opportunities to broaden my knowledge in biology. I am following up to see when you would be available to meet with me.*

*I am free on Tuesdays, Thursdays and Fridays in the afternoon. Would you be free during one of those days?*

*Thank you so much!*

*Weiren Liu*

## **MEETING YOUR PROFESSOR FOR THE FIRST TIME**

When you and your professor agreed on a time to meet, you will go to their office to discuss their research and what you might work on in the lab. Be prepared to talk about yourself a little bit and why you are interested in their research. Usually, professors love to talk about their research and will talk at length about it.

Things to keep in mind and to discuss during your meeting:

- ❖ All the research projects that the lab is conducting. These are the projects that you might be working on. While the professor is talking about these projects, try to gauge which project will be worthwhile for you.
- ❖ As a student researcher, the ideal situation will be one that you join a project that is ongoing and developed. These will be projects with experimental methods already established and people in the lab are already experienced with the techniques used in this



project. This means that the experiments used to answer the research project question has been decided and that the best way to perform these experiments has been decided. What you will be doing in the lab is performing experiments to get data that can be used for publication. Working on ongoing and established projects increase your chance of making concrete contributions and getting your name on a paper. It is usually not a good idea to begin your research experience with a project that is just starting because that involves a lot of troubleshooting and figuring things out. The professor will most likely not even let you in these projects. But just in case you are aware.

- ❖ Establish what you want to get out of your experience and communicate that clearly. Express clearly that you want to conduct research, conduct experiments and make contribution to a publication.
- ❖ Also ask what kind of expectations the professor have of their undergraduate or medical students and their mentorship style. This will give you an idea whether your personality and working style is a good fit with this lab and this mentor.
- ❖ If you have a chance to talk to the lab members when you meet the professor, do it. This is a great opportunity to get to know culture of the lab, gauge how the lab interacts with each other and how they view the PI.
- ❖ In my opinion, whether you find a particular project/professor interesting does not matter too much when doing research for medical school or residency. For example, there is a professor working in an area that you just have some minor interest in but nothing that really excites you. However, this professor is an amazing mentor who is incredibly supportive of his student researchers. This professor's lab work on many projects and publishes regularly. Furthermore, many of his past student researchers have gotten published in this lab and got great letters of recommendations from this professor. Absolutely choose this professor even though you might not find what they are researching very interesting! These are qualities of a mentor that will better help you get the most out of your research experience, write a good recommendation letter and get you into medical school or residency.

## **STARTING RESEARCH**

Once you joined a lab, here are some things you should keep in mind and some things you can expect.

- ❖ Depending on the size of the lab, you will most likely not work directly with your PI. Instead you will probably work with and be mentored by a post-doctoral scholar or a graduate student. This will be the person teaching you about the project and showing you how to perform experiments. Make a good effort to work well with the person who will be mentoring you in lab. Your lab mentor might be updating your PI on your progress. Eventually when you need a letter of recommendation, your PI will be relying on the feedback he/she gets from the person you are working with. Therefore, it is very important you get along with your lab mentor.
- ❖ Clearly communicate your schedule with your mentor so your mentor and others in the lab know when to expect you to come into lab. Depending on the personality of your mentor, they may pay a lot of attention to your progress or they might not care. Regardless, you should establish your schedule with the PI so people know when to expect you in lab.

- ❖ When you start in lab, you will probably be given publications and papers to read for background information. These papers can be dense and hard to understand. However, it is important that you try your best and ask your lab mentor any questions that you have. When reading these papers, think about the topics being discussed and connect what is being discussed back to what you have learned in class. If you've never read a paper before and don't know how, you can ask your lab mentor for help. Reading background information will help you better understand the basis of your experiments and how experiments will answer questions posed by your project.
- ❖ When you start performing experiments, you will first observe your lab mentor performing the experiments. Observe the methods and techniques used carefully and take notes when your lab mentor mention a tip or a trick that is not specified in the written protocol. Ask questions if anything is unclear. Next, you will perform a control experiment yourself under the supervision of your lab mentor. Your lab mentor will be observing your techniques and advising you accordingly. With control experiments, you need to get an expected result. If the experiment you performed showed the expected result, that means your techniques are good and can be trusted to perform the experiment unsupervised. If you are not getting expected result in control experiments, your lab mentor and you will try to find where things went wrong. Once you get reproducible results, your lab mentor will let you start performing experiments on your own.

### **BEING A GOOD LAB CITIZEN AND LAB ETIQUETTE**

- ❖ Be courteous and respectful to everyone. This is pretty self-explanatory and how you should behave regardless where you are. Be polite and respectful to not only your mentor but also to your co-workers, other students, lab assistants, administrative assistants, and custodians, everyone.
- ❖ Stay on top of your own work. This means when performing experiments, whether measuring out chemicals or running gels, avoid making a mess and clean after yourself promptly. Leave equipment clean after using them and don't leave dishes in the sink for more than a day. You might make some mistakes in the beginning and get reminded by lab members, this is okay. Just remember to not make the same mistake next time.
- ❖ Beware of mistreatment. Being respectful does not mean letting people take advantage of you or step over you either. Remember you are there to learn how to do research and work on your project. Just because you are an undergraduate or medical student in the lab, it does not make you a dishwasher for other people in the lab. Don't let others who don't work directly with you take advantage of you and have you wash their glassware for them or clean up after them. That isn't your job. If someone ask you do something you don't feel comfortable with, refuse. This also doesn't mean you shouldn't take opportunities to help out other people in the lab either.
- ❖ Keep a detailed lab notebook. If you are not familiar on how to keep a lab notebook, ask your lab mentor. In general, it is good practice to take notes and record all experiments you do in lab in your lab notebook. This way not only will you have evidence that you have been productive, lab notebooks are also good for the future when you need to refer to what you did previously. Keeping a detailed lab notebook will save you in the future and I can guarantee it.

- ❖ Keep in regular contact with your PI. This will depend on the size of your lab. If your PI has a big lab, you might not see your PI that much and will mostly just interact with your lab mentor. However, it is still important to let your PI know your progress. You can establish this early in your meeting with your PI and ask him/her how often they expect progress updates and how much they want to know what you are doing. If you are in a smaller lab where you are working closely with your PI or see your PI regularly, then this might not be necessary.
- ❖ Attend lab meetings, seminars and talks as often as you can. Lab meetings are probably the most important to attend. Going to lab meetings is a good way to not only stay updated on what other people in the lab are doing, it is also a good way to show your PI that you are engaged and part of the lab. Additionally, if your PI is giving a talk or seminar, or if someone else in your lab is giving a presentation somewhere, you should make your best effort to attend to show your support. Finally, asking questions during lab meetings and seminars is another good way to demonstrate that you are engaged. It can be intimidating to ask questions as a student so do it if you feel comfortable.

### **WORKING IN A LAB, GETTING PUBLICATIONS, POSTERS, ORAL PRESENTATIONS**

- ❖ Getting publications. Getting your name on a paper depends on a combination of factors: how well your project is going, if you produced data that will be used in the publication, and how supportive your PI is. As a student researcher, the most impressive feat would be if you publish a first author paper. This means that you contributed majority of the work to a project both physically and intellectually. Publishing a first author paper usually takes a full time graduate student's years to do. It is not something expected of you as an undergraduate researcher. The time you spend on getting a first author paper will be better spent on maintaining a stellar GPA. There are definitely college students with first author papers that apply to medical schools. These students might have worked on smaller manageable projects, published in smaller journals, or had significant help from other people in the lab. Or the student might not have contributed as much to warrant first author but had a PI who is very supportive and thus credited the student as first author. That last scenario is also ethically questionable. Whatever the case, first author undergrads are not very common and are not expected of pre-meds. Instead, strive for producing quality data of experiments that can be included in a publication. This way you will get your name on a paper which is still very impressive.
- ❖ Research often does not go expected and it is hard to get publishable data as a student. This isn't the end of the world. You will have many opportunities to present posters and oral presentations during your time in college. The first place you can start is presenting in your lab meetings. Once you've started to gather some data that can be presented, ask your PI if you can present in lab meeting. Alternatively, your PI might ask you to present. Either way you will start off with making a presentation for your lab meeting. During the lab meeting, people will listen, ask you questions and give you feedback on your work and presentation. Take their criticism and use them to improve your experiments and presentation. Once you are ready, you can look for opportunities to present a poster at a research symposium. As mentioned in a previous section, most schools will have a website and an office dedicated to undergraduate research. This office/website is where you can find information on research symposiums that are available in your school and

nearby schools as well. A lot of the time, research symposiums are organized by this office.

- ❖ If your school does not have an office dedicated to undergraduate research or does not have organized research symposiums, you can find opportunities to present by asking your mentor and other students. Additionally, you can submit abstract of your research to poster sessions at other/nearby schools. Most school will welcome submissions from students at other institutions especially if you explain that your school does not have such opportunity.
- ❖ Don't be afraid of submitting an abstract for poster presentations to these kind of research symposiums. They want as many people presenting as possible, so your abstract will almost always be accepted, unless it is super terrible.
- ❖ How to make a poster is beyond the scope of this guide. There are many resources online on how to create a good poster presentation. Use those guides to help you create an effective poster/presentation.
- ❖ Absolutely practice giving your presentation to people in your lab so they can help you edit it and give you feedback.
- ❖ Almost all these symposiums will have judges that will judge posters and presentations. They will then give awards at the end. If you win one of these awards, this is definitely something you will be highlighting in your application.
- ❖ If you are able to go to a conference and present your work, this is even better. This would be something decided between your PI and you. There are many travel awards that can be awarded by your school and also by your specific conference. If you are able to present at a conference, apply to these travel awards. Receiving these travel grants is also an achievement that you can highlight in your application.

## **COMMUNICATING YOUR RESEARCH TO MEDICAL SCHOOLS AND RESIDENCY PROGRAMS**

- ❖ Because your ultimate goal is to get into medical school or a residency program, being able to clearly communicate to the admissions committee about your research is probably the most important thing to get out of your research experience. Quickly describing your research to another person is often called the "elevator pitch" where you have 30 seconds to describe your research. I never thought this was hard until I tried to do it. I realized while I understood my research, I wasn't efficient at talking about it. I would start describing my project and stop myself realizing I was using concepts and terms that needed to be defined and explained. This made my whole explanation hard to follow and confusing. Thinking through what you will say and preparing will help a lot with communicating your research.
- ❖ There are 2 places for you to talk about your research in your medical school and residency application, on the written application and during the interview.

### **Writing about research for your application**

- ❖ Written application. You can write about your research in your personal statement and in the activities/experience section of your online application (AMCAS and AACOMAS for MD and DO schools, and ERAS for residency applications) There are character limits in these sections, so you need to be succinct and clear in your descriptions. In the activities

section of your application, you should not only describe your project but also what you got out of it. Here is an example description (my own AMCAS application):

*As an undergraduate researcher in Dr. Ivan Dmochowski's lab, I studied the interaction between gold nanoparticles and ferritin, an iron storage protein. I characterized ferritin-nanoparticle conjugates using a variety of biochemical and biophysical techniques. I also adapted a gel electrophoresis technique to determine the ratio of ferritin subunits to encapsulation of gold nanoparticles of varying sizes. The goal of my project is to generate protein-nanoparticle systems that can be used as biosensors for medical imaging applications. My research experience provided me with the critical knowledge and intellectual capacity to better understand how the research conducted by scientists will eventually lead to medical advancements.*

- ❖ First give an introductory sentence what your project is about.

*As an undergraduate researcher in Dr. Ivan Dmochowski's lab, I studied the interaction between gold nanoparticles and ferritin, an iron storage protein.*

- ❖ Then you can go into more detail on what you did in the lab and what you accomplished

*I characterized ferritin-nanoparticle conjugates using a variety of biochemical and biophysical techniques. I also adapted a gel electrophoresis technique to determine the ratio of ferritin subunits to encapsulation of gold nanoparticles of varying sizes.*

- ❖ Talk about why your project is important and potential applications

*The goal of my project is to generate protein-nanoparticle systems that can be used as biosensors for medical imaging applications.*

- ❖ Finally what you learned from that experience.

*My research experience provided me with the critical knowledge and intellectual capacity to better understand how the research conducted by scientists will eventually lead to medical advancements.*

Of course there are other ways to write a brief description. Write in a way that feels right for you. You can use the examples I provided here to organize your own.

- ❖ In the AMCAS application activities section for medical school applications, you also have option to expand upon on 3 of your “most meaningful” activities. If you choose this option for your research, you can further talk about your research experience. In this section, you can expand upon why research is meaningful to you and its impact on you. You can talk about skills you gained doing research. Maybe designing experiments to test hypothesis helped you learn how to think more logically and critically. Did you have an experiment that was difficult to perform but you found an ingenious solution? Maybe troubleshooting experiments helped you learn how to creatively solve problems. These are some examples of skills that you can talk about in this section.
- ❖ You can also describe some indirect skills you gained from doing research. For example, you can talk about how you became a better public speaker from giving research presentations or how you became a better writer from writing grants/papers. Or you can write about how you learned the importance of collaboration in science and how that helped you better understand teamwork. Finally, if you've done anything special in your research experience, you can also mention that here.

Here is mine from my application.

*Biology and research have always been a significant part of my life since the beginning of my freshman year at Penn. During my time in Dr. Dmochowski's and Dr. Gall's lab, I acquired numerous valuable skills. I gained critical, analytical and reasoning skills from designing, carrying out experiments and analyzing data. Furthermore, I vastly improved my presentation and writing skills through giving presentations, posters and writing grants and research project proposals. Most importantly, my combined research experience provided me with the critical knowledge and intellectual capacity to better understand how the research conducted by scientists eventually lead to medical advancements. With this understanding, I believe I can be a better doctor by being able to discern, evaluate and judge new medical advances and whether these advances would help my patients. I'm also quite proud to have made some small but positive impacts in the labs I have been a part of. In Dr. Dmochowski's lab, I designed the official Dmochowski Group logo and matching T-shirts that showed off lab pride. In Dr. Gall's lab, I came up with a few improvements to lampbrush chromosome preparation. These minor efficiency improvements are now being used in the lab today.*

- ❖ I talked about the skills I gained from doing research which are skills that you will use as a physician. I also talked about other things I did for my lab to demonstrate that not only did I engage with research scientifically but was also invested in the people in my labs. In my opinion, descriptions that are more personal and highlight skills that can help you in medical school or residency are the best descriptions.

#### **Talking about your research during your interviews.**

- ❖ While some medical schools are incorporating Multiple Mini Interviews into their interview process, many schools still conduct traditional interviews where they ask you questions about yourself. If you indicated that you've done research in your application or mention doing research during your interview, you might get asked the question "So tell me about your research" It is imperative that you nail your answer to this question. Because if you stumble on this question during your interview and look like you didn't know what you researched, the interviewer and admissions committee will doubt the sincerity of your research experience. Even though you may understand your research, you still need to be able to effectively communicate it. Therefore, I strongly suggest thinking about your response to this question and rehearse it.
- ❖ Personally, I wrote down my response in the way that I talk and rehearsed that response, so I was ready if this question ever came up.

*So during college, I did biochemistry research under Dr. Dmochowski. In the lab, I studied how the protein ferritin, which is an iron storage protein, and how that interacted with gold nanoparticles. From this project, I learned and used a lot of biochemical and biophysical techniques to characterize protein-nanoparticle interactions. And we were able to show that ferritin encapsulated gold nanoparticles in its native conformation. We hope the results from this project can have potential applications in improving current medical imaging techniques and help to develop novel biosensors.*

- ❖ A good response would be one that is succinct and gives the interviewer all the information to have a general idea of what your research project was about. First introduce a broad statement on where your research area is in. You can also provide any necessary background information so that it helps the interviewer better understand what your project is about, especially if your research topic is hard to understand or not well known. I think this might hold true if you did engineering research or any other type of research that your interviewer might not be familiar with. Keep in mind that your interviewer is more likely to be a physician or PhD from life sciences. Therefore, remember your audience and tailor your response accordingly. This way, they are less likely to ask a follow up question to clarify their understanding. For example, my graduate school research topic was more obscure.

*And during graduate school, I studied RNA transcription using lampbrush chromosomes isolated from xenopus oocytes. I'm not sure if you're familiar with lampbrush chromosomes? (Look for their response which will be no and then continue) So xenopus frogs and other amphibians lay eggs that are about 1mm in diameter. These eggs are HUGE compared to human oocytes. And because these oocytes are actually single cells, what we can do is take out the nucleus of these cells and fix the chromosomes on a glass slide! And so the incredible feature of these chromosomes is that they are so big, we can see them under a light microscope! So for my project I used immunostaining, in situ hybridization and different microscopy methods to visualize and study the process of transcription on these giant chromosomes!*

- ❖ It is also a good idea to show excitement and enthusiasm about your research when you are talking to your interviewer. By emphasizing the novel aspect or something really cool about your project, you demonstrate to your interviewer that you are passionate and was invested in your work.
- ❖ Sometimes the interviewer will ask more follow up questions about your research if they are interested. Answer these to the best of your abilities. Remember that this a project you worked on and you are the expert here. You actually know more about it than they do, so be confident in your response. Also remember that interview is timed so they will have other questions to ask. Thus, if you mess up and stumble your answer to research question, you might not get the chance to recover as they need to ask other questions.

### **MISTREATMENT AND BEING IN THE LAB AS A MINORITY**

While mistreatment is not very common in research, it definitely does occur. This is why talking to people in the lab and talking to your peers can help you to better understand who you are getting involved with. Because there is a huge power imbalance between your PI and you the student researcher, there is a potential that you can be exploited. In cases of mistreatment, you as the undergraduate or medical students researcher can be in a difficult situation without a lot of recourse. There are many types of mistreatments. Your labor and time can be exploited. As a student, you are not allowed to work more than 20 hours a week for work study. You might be given too much responsibility than you can handle. You might be continually unfairly blamed for mistakes that you did not make or berated in front of other people. Know that these examples are not acceptable for you as an undergraduate researcher in the lab.

Another topic I want to address is microaggressions. Women, people of color, LGBT, disabled people and others encounter this daily and you can expect to face them in science. To be



completely honest, I do not know of a way to effectively mitigate this problem. Because you the undergraduate or medical student researcher eventually need your PI's recommendation or need your name on a paper, you don't want to rock the boat by confronting people when they make a sexist, racist, homophobic jokes or derogatory comments. You might try to cover your identity by acting more masculine, covering up your accent or changing the way you speak. While these actions do keep us out of uncomfortable situations, they do damage our sense of self, dignity and our ability to conduct good science.

The one suggestion I have when encountering microaggressions in the lab: Keep receipts. If your PI or other people in the lab say anything unacceptable, record it somewhere. Write it down somewhere safe and keep a log of these things like a lab notebook. Write down date, time, the situational context and what was said. These might be useful in the future. If nothing else, doing this also gives you a little bit of reassurance.

Finally, don't be afraid to leave the lab if you experience mistreatment or feel uncomfortable being in the lab as it is not worth damaging your humanity for research experience.

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