

GOLDWATER SCHOLAR COMMUNITY

A RESOURCE GUIDE TO

STEM RESEARCH

Prepared in 2021 by
The Diversity and Inclusion Committee

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INTRODUCTION

HELLO FUTURE SCIENTISTS, TECHNOLOGISTS, ENGINEERS, OR MATHEMATICIANS!

Often undergraduate students interested in STEM (science, technology, engineering, and mathematics) fields do not know how to start engaging in research. They have never been taught about the steps they need to take to secure the resources, mentors, and opportunities that are helpful in the pursuit of a career in STEM. We hope that the roadmap to a STEM career contained in this document will help aspiring researchers such as yourself. Our goal is to ensure that you have the information you need, as an undergraduate student, to navigate through the dynamic world of research.

This document was created by members of the Diversity and Inclusion Committee of the Goldwater Scholar Community. We are dedicated to promoting diversity and inclusion in STEM fields. If you have any questions or comments, please reach out to us at council.gsc@gmail.com.

DISCLAIMER

Although this document is presented as a timeline with a set series of steps for each year, we recognize that this is an idealized situation. Many, or even most, students will pursue a nonlinear path to research or begin this journey later than their first year of college. All research careers are uniquely shaped by a person's background, field, and scientific interests.

That said, we believe that the advice in this document will be useful to you at any stage of your undergraduate career and at any level of engagement in research, whether or not you are following the idealized timeline we have set out here. Also, unexpected opportunities for research experiences may come up at any time. We encourage you to remain open and receptive to opportunities to engage in research that may not be in your original plan. Keep in mind that your career may include a non-academic science or engineering focus in organizations that include startup businesses, large corporations, government agencies, and non-profit organizations. Engagement in research will help prepare you for a diverse set of career opportunities.

TESTIMONIALS

To demonstrate that the path we lay out in this document is not the only road to success in STEM, we have collected the following statements from Goldwater Scholars who have taken nontraditional paths to exceptional academic achievement.

MEGAN MITCHEM, 2019 GOLDWATER SCHOLAR

"I started my journey in higher education nearly 10 years later than many of my peers. Initially, my plan was to get a two-year degree in nursing at my local community college. That plan changed after taking my first laboratory course. Little did I know, research is highly addictive! I switched my major to biology, which shifted my timeline quite a bit. I went from wanting an associate degree to pursuing a doctoral degree seemingly overnight. I studied through the summers so that I could carry a slightly lighter course load during the spring and fall semesters. I scheduled my classes in a way that maximized the amount of time that I could spend with my son, while also making time for research. As a first-generation student, finding mentors to help me through the process was paramount to my success. Your path does not have to be traditional, linear, or expected. It just has to be yours."

JUSTICE ROBINSON, 2020 GOLDWATER SCHOLAR

"My timeline differed from the timeline outlined in this document by being six years delayed. I attempted to go to college right out of high school and wasn't able to. My interest in a research career actually came from the experiences I had during that six-year gap. Once I started, utilizing the Honors programs commitment to research experience and networking with the professors helped guide me to more opportunities and relieved any anxiety that my gap years were a negative thing."

TESTIMONIALS CONTINUED...

STACY OKADA, 2016 GOLDWATER SCHOLAR

"I began my 2-year degree (which took me 3 years to finish) at 37 years old, with a 3.5 year old unruly toddler and a 10 week old baby. I had no idea what I was doing. I'd been out of college for over 20 years, and had forgotten my most basic algebra.

*By my second semester, I felt ready to go part-time. I met an extraordinary mentor and one of his most valuable lessons was this: **It's better to finish well than to finish fast.***

After I graduated MassBay, I began my studies at UMassBoston, with a plan to go full time for 3 years and graduate. The first 2 years adhered nicely to my well-structured plan. But at 42 years old, I took a year off to have our third child. I went back and finished, graduating in May of 2020 with a Biochemistry degree, after having to go fully remote during spring break due to COVID-19, having to study for and take my final exams online.

I took the next few weeks to support my girls through their remote learning, I took a one-week vacation, and for 3 weeks I applied for jobs, fielded interviews, and made the cuts. In the end, I got offers from 100% of the places that I applied for. Fresh out of college. At my age. With entirely too many children. In a pandemic!

***Don't. Ever. Stop. That's it. That's the only rule of success. Stay the course. You can do this.** If you've enrolled, then you're already doing this! One foot in front of the other, baby steps, repeated steps if need be, it Does. Not. Matter. Just stay the course, and you will get there! The obstacles don't matter, they'll only make you stronger. Thank them as you stomp right over them."*

The authors of this document are grateful for our own mentors and campus representatives, who contributed significantly to our pursuit of research careers with their knowledge and experience:

Jeff Thibert, Frank Connolly (University of Notre Dame)

Corey Efron (The Ohio State University)

Nick Alward-Saxon, Xiaojian Zhao (University of California, Santa Barbara)

Virginia Fuillerat (Miami Dade College)

Scott Palmer (University of California, Davis)

Theon Gruber-Ford (Howard University)

Kate Dallinger, Jeremy Wilmer (Wellesley College)

First and foremost, use your campus resources

Before we get into the details of how to succeed in STEM research, we want to highlight that you should take advantage of useful resources on your own campus, including career services specialists, academic advisors, and fellowship advisors. Their job is to help you succeed in college, secure valuable experiences, and prepare you for your career. This document is meant to complement, rather than replace, the resources provided by the professionals on your campus. For students whose universities do not offer strong professional guidance in STEM, we hope that this document will teach you how to find research opportunities on your campus as well as those available nationally through sponsored programs at other institutions.

What is research and why is it important?

Research is defined as the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings (Hampshire College, 2020). The primary purposes of research include furthering our understanding of the world, helping people in scientific and nonscientific settings make informed decisions, advancing the state of technology, and improving the quality of life.

Below we have included an outline of how undergraduates who are interested in pursuing research as a profession can make the most out of their time in college. Note that this outline represents research engagement under ideal conditions, including starting early in your first year, the availability to commit substantial time to research in all years, and the availability of multiple research opportunities on your campus. These are therefore just general suggestions; there are no hard-and-fast rules to follow! There are many paths to a career in research, and many successful researchers follow a nonlinear route. Your trajectory should be tailored to your own background, experience, time commitments, family obligations, and interests. It is never too late to start research!

FIRST YEAR

Your first year is a great time to start thinking about conducting research with faculty members on campus and to begin participating in clubs, organizations, and programs that support undergraduate research. This is also the time to start thinking about a career, and to what extent you want research to be part of that career. A quick note: When we use the term “lab” throughout this document, we mean any research group you could be working with. The term does not refer solely to working within a lab setting. Also, we recognize that research on campus may not be possible at a teaching college. In this case, you may need to find a way to pursue research off campus during the summer, perhaps through an REU, or Research Experience for Undergraduates. Most REU applications are due in February or March, so exploring summer research experiences needs to happen early, during the fall semester.

1. Academics first

- **Give yourself time to adjust to your campus and the rigors of college coursework.** If you can get a head start on research in your first year, fantastic! If you need time to become acclimated, however, make sure that you do not spend time on research at the expense of your learning and grades.
- **Research experience will NOT make up for poor grades** when applying to graduate or professional schools. You will need good grades to be a competitive applicant. That being said, there are graduate programs that evaluate applicants more holistically, which may allow research experience to compensate somewhat for average grades.
- **Research takes time!** Know that students often spend 10-15 hours per week working on a research project. Before committing to a project make certain that you have enough time in your schedule to take it on. Your research mentors will be committing their time to your training, and your research group will be depending upon you. You will be expected to do your share of the work.
- **Some more general tips** for getting involved in research can be found on the Cornell Undergraduate Research First Steps [website](#).

2. Think about career paths that interest you

- **Talk to professors, lecturers, and graduate students** to determine if you are interested in a research-oriented career path. Professors can provide you with valuable insights into the life of an academic researcher, and graduate students who are interested in conducting research for industry or the government may have insights into other career paths.
- **Go to career services and advising centers** at your school to learn about different career paths and to what extent they incorporate research. Learning about career possibilities early on will allow you to plan ahead and seek out relevant experiences in the next four years.
- **Professional societies generally have a wealth of resources** that help students understand career opportunities in their respective disciplines. Visit the website of the professional society in your field of interest and you may even want to consider joining the professional society once you are further along in the field of study. These societies will often have student memberships at a deeply discounted rate. If you do not know what professional societies exist in your disciplinary area, ask a faculty member in your department. See [our list of Professional societies for minorities](#).
- **Join a student club in your discipline** as early in your undergraduate program as possible. This will provide you with access to a wealth of information and introduce you to upper-level undergraduates who will be able to provide you with useful information about your department, especially in terms of its faculty and courses.
- **Use your school's alumni network** to get in contact with people who are further along in their career. Your school's career services center can often help with this, and you can always ask your current connections whether they know people in the fields in which you are interested. Networking is key to your career considerations not only to learn more about different career paths, but you may also uncover some helpful job or internship opportunities.

3. How to identify and secure a research position

- **Identify faculty with whom you're interested in working** by visiting the faculty sections of departmental websites related to the fields that interest you. Each faculty member should have a webpage with a short biography and a list of research interests, as well as contact information and a CV. The webpage may also have information about open seminars and other media (e.g., interviews, press coverage) discussing their work. If the faculty member's webpage does not provide you with as much information as you need, but you think you may be interested in the research they are doing, feel free to use search engines, such as Google Scholar, to find and read some of their publications.
- **Cold email faculty members!** Cold emails are emails you send someone with whom you have no prior association. This may sound intimidating, especially as a first-year student, but here are some tips that will help you stand out.
 - **Visit the faculty member's website**, and read through some of their publications. Reading a scientific paper can be challenging, but [here is a link](#) from the journal *Science* and [a link](#) from a researcher at the University of Waterloo on how to approach it.
 - **Be formal and professional**, use an appropriate salutation, such as "Dear," and the faculty member's correct title (most likely either Dr. or Professor).
 - **Give a one or two sentence introduction** of yourself.
 - **Then explain how your research interests align** with the faculty member's work as specifically as you can. It's even better if you are able to cite particular examples of their work that interest you.
 - **If you have an up-to-date CV/résumé, attach it to the email** so that the faculty member can briefly review your experience and qualifications. If you do not have a CV/résumé, this is a good time to develop one (in fact, all college students should have one; your school's career services center likely has resources to help you develop a CV). See [our section on CV/résumés](#).

NOTE:

You may start out washing glassware or doing low-level repetitive tasks. That's okay as long as there is an opportunity for growth and development of your research skills and experiences.

- **Express your interest in a research position in their lab**, and ask for an appointment to meet with them. There are usually two types of positions available, and if you are only interested in a (rare) paid position, be sure to say so:
 - ***Paid research assistant***: receive monetary compensation in addition to the valuable experience
 - ***Non-paid research assistant***: no monetary compensation but obtains valuable experience and/or course credit
- **Thank them for their time**, and conclude with a formal sign-off, such as “Sincerely.”
- **Overall, be concise**. Faculty members are busy people and often do not have time to read meandering emails.
- **If the faculty member’s administrative assistant’s email** is on their lab website, carbon copy (cc) them on the email! They often can push the faculty to reply if they may have missed your email. Follow-up, ideally with the administrative assistant if there is one, if you do not receive a reply from the faculty member within one week.
- **Do not take it personally** if they do not respond or are unable to offer you a research position. You have to be persistent and willing to contact multiple faculty members in order to have a successful search.
- **Below is a cold email template that you can use:**

Dear Professor (___),

My name is (___), and I am currently a (1st/2nd/3rd/4th) year student studying (major/s) at (school). I am interested in exploring the opportunity to participate as an undergraduate research assistant in the (lab/group name). I have attached my (CV/résumé) for your consideration.

(Talk a bit about yourself, what you're interested in, your past experiences, and how these experiences qualify you to work in a research setting. Limit this section to just a few sentences.)

The (lab/group) stood out to me because (be specific as to why you want to work with this group, and how the group's research aligns with your own interests and/or career goals. Limit this section to just a few sentences.)

Thank you for your time and consideration. I would appreciate the opportunity to meet with you to discuss your research and to explore the possibility of becoming a part of your research team. I would be happy to set up a (video call/meeting) with you at your convenience to discuss this further.

Sincerely,

(Your signature)



- **Following up on the initial email to faculty:**

- Always return their emails promptly and professionally.
- Do not be discouraged if they do not respond immediately or at all. You can send a gentle follow-up email after one to two weeks just in case your email got lost in the faculty member's inbox. When you do so, reply to your initial email, and, if you'd like, use this template:

Dear Professor (),

I just wanted to check in with you to make sure this email made it to your inbox. I would appreciate the opportunity to talk with you about your research and to discuss the possibility of me joining your research group.

Thank you!

Sincerely,

(Your Signature)



- **Go to office hours** and ask faculty about their research interests. Professors and graduate students enjoy talking about their research, so connect with them and show up during their office hours (when pandemic restrictions allow). Bring a couple of questions, ones that aren't answered on their web pages, and make sure that you express how your own research interests align with theirs.
- **Come prepared for your meeting!**
 - **Prepare an agenda** with questions and topics that you want to discuss, though make sure the answer's aren't on the faculty member's webpage.
 - **Be prepared to answer questions.**

QUESTIONS TO ASK:	QUESTIONS TO ANSWER:
<ul style="list-style-type: none"> • Do you involve undergraduates in your research program, and do you have any openings at this time? • Do undergraduates in your lab conduct their own projects or do they become part of a team? • How many undergraduates work with you? • Are there graduate students or postdocs working in your group? 	<ul style="list-style-type: none"> • Why do you want to join this lab? • What classes or past experiences have prepared you for working in this lab? • What kind of projects would you be interested in? What kinds of skills are you interested in gaining? • What are your career goals, and how does research at this lab align with your career goals? • What does your availability look like?

- At the end of the meeting, ask if they have any more questions for you. Then thank them for their time, and assure them that you will send an email if any follow-up questions come up.

4. Securing research off campus

- **Conducting research off campus** is valuable for students who are unable to find a research opportunity on campus or who may want to experience a field of research that is not offered at their home institution. You are most likely to be able to do this during summer breaks.
- **Submit applications for summer research opportunities**, which are generally due between January and March. [Refer to our section below under summer after first year for more details.](#)

5. What is a curriculum vitae (CV) and résumé?

- **Both CVs and résumés** include your name, contact information, education, related experience, skills, and significant accomplishments.
- **A résumé** is strictly limited to one (or two pages), and should highlight only the most important details about you. Sending a résumé often suffices when you are just starting to build your research record and do not have over two pages of information for a CV. Just because you have not done research previously, this does not mean that you do not have information that would be important to include on a résumé for a research position.
- **Be creative** in thinking about how your past experiences may help prepare you for research. For example:
 - What coursework have you taken in high school or college that provides you with relevant analytical background or hands-on experience?
 - Have you worked a job that shows your ability to be responsible, proactive, dedicated, passionate, a problem solver, a valuable team player, etc.?
 - Have you participated in any training that could be relevant to the kinds of research positions that interest you?



- **A Curriculum Vitae or CV** incorporates information not typically seen on a résumé, such as a more detailed description of research projects, community service, leadership activities, publications, conference presentations, grants, scholarships, and honors and awards. The CV is more geared toward research position applications and is typically appropriate after your first substantial research experience.
- **Helpful resources:** While we hope these links are helpful, we want to reiterate the importance of taking advantage of your school's career services office, writing center, and campus advisors for additional guidance!
 - [Undergraduate career manual](#) (UCSB 2020)
 - [CV/résumé tips](#) (MIT Communication Lab)
 - [CV/résumé Distinctions](#) (UC Davis)

6. Get involved with campus clubs and organizations

Join clubs that you are passionate about, especially those that align with your research interests. This is a significant way to build new skills, network, and explore different career paths. However, just as we said at the beginning, be careful about not overextending yourself. You should not join so many extracurricular activities that you either dilute your ability to contribute meaningfully and deeply to the ones you join or negatively impact your academics.

7. Support networks for underserved and underrepresented students

- **Find your community!** Many schools have multicultural centers, transfer student centers, Black, Indigenous, Latinx, first-generation student centers, and other minority-serving groups and associations that can be very useful for finding a community and support structure at your school. Get on their email listservs, as they may have information about research, job, and internship opportunities specifically for these student groups. See [our list of Professional societies for minorities](#) below.

- **Seek campus grants and scholarships** that are available to all students, but also look for those targeted towards underserved and underrepresented students. Many universities have undergraduate research programs that pair you with faculty and graduate student mentors, funded by the federal government or private foundations. See [our list of Funding programs for participating institutions](#).
- **Seek external grants and scholarships.** Look into organizations that fund underserved and underrepresented students conducting research. See [our list of External grants and scholarships for underserved and underrepresented students](#).

8. Find at least one mentor, and develop a strong relationship with them

Mentors may be faculty members or graduate students in your research group, but they can also be individuals outside of this environment who add to your development as a researcher. Keep in mind that your applications for scholarships like the Goldwater and for graduate and professional schools will typically require you to ask at least 3 individuals to write letters on your behalf, so cultivating relationships with multiple mentors can be important.

These two papers from [Yale](#) and the [NIH](#) offer important insights on what to look for in a potential mentor. Once you've identified a mentor, here is some advice about how you can best work with them to advance in your career as a researcher.

- **Developing a relationship** with an academic mentor can help to guide you through the beginning of your research career.
 - **Faculty mentors** can effectively help you develop your research questions and interests, and they are a vital resource for connecting you with other researchers. While they may often not have time to edit your fellowship and graduate school essays, they can advise you on larger efforts, like project proposals and graduate school decisions. Faculty mentors are great sources of career advice, and they can serve as important advocates for you as you progress in your career.

- **Graduate student and postdoctoral fellow/scholar mentors** can provide you with additional support and help you understand how to successfully execute the next stage of your research career. It is usually appropriate to request that they review your application essays, to ask them about the PI's mentoring style, and to get college, graduate school, and career advice from them. If your school does not have graduate students, faculty members will be more focused on undergraduates and can provide these services.
- **Be prepared when you have meetings with mentors.** Come to each meeting prepared with an agenda and questions you may have. Remember that faculty are busy and your mentor's time is valuable. See [this section](#) for tips on how to reach out to faculty, and [this section](#) for how to stay connected.
- **Always take notes** to refer back to meeting details afterward.
- **Write a thank you email after meetings with mentors**, especially for meetings that are not regularly scheduled, or if it is your first meeting with your mentor. This leaves a good impression, which is key to a strong mentor-mentee relationship. You can use the following email template:

Dear Professor (),

Thank you for taking the time to meet with me last week. I really enjoyed our discussion about your research, and I'm looking forward to future conversations.

(If there was any specific discussion of follow-up during the meeting it is good to put it in writing here. Be specific about anything the mentor offered to do and similarly about what your responsibilities are. Be as concise as possible).

Sincerely,

(Your Signature)



- **Develop a relationship with mentors beyond just academics and research.** Get to know the graduate students, postdoctoral scholars, and faculty mentors on your research team. Some mentors will wait for you to initiate discussions about activities outside of research as they wish to respect your privacy. Keep your mentors updated by visiting during office hours and checking in at least once a month. Mentors will be able to produce stronger letters of recommendation and offer more targeted advice if they get to know you better as a whole person, not just as a researcher.

- **Know that your time is valuable too!** If a mentor seems distant, not invested, uncomfortable, or unable to provide the help you need with your career goals, do not be afraid to search for a new mentor or perhaps for an additional mentor. [This column](#) from *Science* can give you more ideas of alternative sources of mentorship. Still, be polite and honest in having the conversation with your original mentor about wanting to work with someone else. While you may not spend as much time with them in the future, they may still serve as a valuable connection or reference! Always try to leave a relationship with a former mentor on amicable terms.
- **Know your college's policies associated with harassment,** such as [these guidelines](#) from Ventura College. These policies will not only help you build good relationships with your research colleagues but also help you build positive relationships within your campus community. California also has an online [Sexual Harassment Prevention Training](#) and [here are harassment complaint forms](#) from the US Department of Education.

SUMMER AFTER FIRST YEAR

Summer is a time to engage in an independent research project on- or off-campus! Some summer programs may require you to have previous research experience before participating. Therefore, engaging in research on or off campus after your first year is a great way to make yourself more competitive for future summers! You will need to think about summer research during the fall semester or in the early spring, as most opportunities for summer research have application deadlines from January to March.

A summer of full-time research is the perfect way to learn about which fields of research interest you most and to meet new people who are at different stages in their research journeys. If you cannot do research the summer after your first year, consider finding a paid internship in industry or taking classes. Taking a class during the summer may free up time to do research during a subsequent academic term. Also, if you established a relationship with a research mentor during your first year but cannot continue in the lab over the summer, consider asking to work remotely with them: reading background literature over the summer or developing an experimental design for research that you might carry out when you join or rejoin the lab in the fall.

1. What is a summer research experience?

- A **summer research experience** is a summer program that gives undergraduates a chance to participate in an in-depth paid research experience. These experiences are usually 8-10 weeks in length, and they can take place at your home university, another university, a government research center like a national laboratory, or in industry. Programs like these will typically teach you the necessary skills over the course of the summer, so do not be particularly concerned whether you have the skillset to work on a project going into the program. At the end of the experience, you will typically have the opportunity to present your research to other members of your research cohort and faculty.

PAID SUMMER RESEARCH

Undergraduates usually receive a stipend for these kinds of experiences, and room and board are covered by the program.

*A **stipend** is a fixed amount of money designed to fund a student's living expenses and sometimes other fees. It is comparable to a scholarship. It is not a loan.*



- These experiences are typically funded by government agencies such as the National Science Foundation (NSF), but they can also be funded by individual schools and scholarship foundations (i.e. Amgen, DAAD RISE, etc.).
- Specific examples of these kinds of programs include:
 - [Research Experiences for Undergraduates \(REU\) Sites](#), funded by the National Science Foundation, provide the opportunity to do research as part of a group of ten or so undergraduates, drawn from around the U.S., at a host institution. An REU Site may be domestic or international.
 - [Science Undergraduate Laboratory Intern \(SULI\)](#), a program funded by the Department of Energy, provides research opportunities at one of 17 DOE National Laboratories.
 - See [our list of Summer research opportunities](#) for a more comprehensive list.
- **The benefits of summer research** include gaining relevant research skills, networking within your field of interest, and gaining experience working in a different lab.
 - Do not feel discouraged if you are not able to complete a project in its entirety by the end of the summer period. Your summer project could be the beginning of a longer-term project, either at the same lab during the academic year if it is close to your campus or at a related lab near or at your school. In any event, you will have learned important skills that you will take into your next research project.
- **To make the most of a summer research experience, you should:**
 - **Get to know all the members of your research team**, including fellow undergraduates, graduate students, postdoctoral scholars, and faculty members.
 - When appropriate, **communicate a desire to take on additional tasks** or independent projects.
 - **Be prepared to work hard.**
 - **Attend social activities**, both STEM and non-STEM related.
 - **Attend research seminars** at the host institution.
 - Do not be afraid to ask questions if you want to learn more about a subject that interests you.
 - If you like a presentation or want to learn more, take note of the presenter's contact information and follow up.
 - **Do not be afraid to try something that you are unfamiliar with!** A summer research experience is the perfect time to learn something new and expand your skill set.

- **Keep a journal of your summer experience** or consider other methods of documenting your intellectual contributions, struggles, and descriptions of what you enjoyed about your time in the lab. This is a useful reference for future scholarship and graduate school applications.
- **Keep in touch with your lab members** and research advisor once the experience ends, as they will serve as important mentors, advisors, and recommenders for you in the future. See [this section](#) on tips to stay connected.

2. Tips on securing your first summer research position

- **Start early.** Most applications are due in the late winter/early spring.
 - See [our list of Summer research opportunities](#) at the end of this document. Some of the opportunities listed below are specifically designed for underserved and underrepresented students.
- **Reach out to professors** on campus to see if they have research opportunities for undergraduates in their laboratories, or, if not, if they know of colleagues who might offer research opportunities for undergraduates.
 - Check department webpages and bulletin boards for listings of research opportunities.
 - Ask if the professor will have funding for you or if you will need to acquire your own funding.
 - If you are eligible for Work-Study, look into whether or not your university and research advisor can set up a payment agreement. For example, your university work/study program might cover 75% of your support and the advisor might cover the remaining 25%. In addition, if your school has an office of undergraduate research, visit this center and inquire about potential research funding for your project of interest.
 - After emailing, if you have not heard back, and you have sent a reminder email, consider checking in with a faculty member during office hours in order to express your interest in working with them.

3. How do I ask for and obtain strong letters of recommendation (LOR)?

- **Think about who you want to ask for an LOR and why.** If you took a class with a professor but had minimal interactions with them outside of class, it will be difficult for them to provide you with a detailed, personalized LOR. As you take courses with various faculty members, use this as a reason to connect with them during their office hours and cultivate a relationship with these potential LOR writers (and mentors).
- **Asking for an LOR early** is always better! You should ask a professor for an LOR 6-8 weeks before the due date of your summer research experience application.

ASK FOR A **STRONG** LETTER OF REC



Don't just ask a professor for a LOR, as if they can write a *strong* LOR for you. Some letter writers may not have the time, inclination, or ability to provide you with a detailed, personalized LOR. Therefore, make sure to ask the professor if they can provide you with a strong LOR. If they say no, they are actually doing you a favor. ***A bad LOR can sink an application.***

- **Ideally, your LOR writer should know you well in a way that aligns with the criteria of the opportunity.** The writer should have numerous specific experiences with you upon which they can draw to make their letter effective. These experiences can come from interactions in a lab or in class, or from conversations during office hours that demonstrate that your interest and dedication exceeds that of the average student.
- **Meet in person with your recommender** to ask for the letter if possible. However, during this time of social distancing it is more than appropriate to meet with them on a video call. Be as polite as possible in this conversation, and be sure to make the details of the program and the LOR due date very clear. Be sure to thank them as the conversation concludes, whether or not they've agreed to write the letter.
- **Write an email to a professor** if you are unable to meet in person or would like to follow up after your meeting. You can use the email template we have included below.



Dear Professor (___),

I hope you are doing well. My name is (___) and I took (class) with you (list semester and year). I thoroughly enjoyed your class.

I am in the process of applying to (summer research experiences for undergraduates or specific names of programs), and I was wondering if you would be able to write me a strong letter of recommendation. (Include a sentence about why you have decided to ask them to write a letter in particular). The due date for the letter is (day, date). I have attached my CV and a draft of my personal statement for the (program name) to this email. If you agree to write the letter, I will follow-up with a packet that will provide you with more details about the award and my work to assist with the writing.

Please let me know if you have any questions or concerns. I would be more than happy to meet with you and discuss this further.

Sincerely,

(Your Signature)

- In your email asking for an LOR, **be sure to include the due date of the letter and state that**, if they agree to write the letter, you will follow-up with additional information about yourself and the award, and answer any questions they may have.
- Common items letter writers ask for are as follows:
 - A curriculum vitae (CV)/résumé
 - The personal statement or statement of purpose that you will be submitting for your program of interest
 - A short statement of why you're interested in the program and a bulleted list of why you think you are a strong applicant
 - Drafts of your application (You can follow-up a little later with these; you don't want the drafts to be too rough)
 - Answers to their own pointed questions.
 - See [Information Packet](#) on the Goldwater website for a guideline of what to give your LOR writer.
- **Send reminder emails** to your professors a month before, and then again a week before (and again days before if necessary) the LOR submission deadline. Professors are busy and will appreciate a friendly reminder!
- **Don't be afraid to ask.** Your letter writers have been in your situation and know you need their help. Just make sure that you give them enough time before the deadline to write an outstanding letter. Also, you can ask them to submit LORs to multiple programs. Once they have one letter prepared for you, it is relatively easy for them to tailor that letter for other applications.

- Look at the [Goldwater Letter-Writing Guidance page](#) to see how your recommender will be approaching this. This understanding will make the process easier for both of you.

4. Stay connected with the people you meet on your summer experiences

- **Maintaining relationships with your summer advisors** will make it easier to ask for future letters of recommendation.
- **Keeping up with the other students in your program** as you return to your home schools is an important first step in establishing your academic network.
- **Here are some tips** for staying in touch with the people you meet during your research experience:
 - Ask to continue participating in laboratory meetings virtually.
 - Send holiday greetings, special occasion emails, and periodic updates.
 - Mentors and other lab members will appreciate hearing from you on holidays, if you (or they) have published a new paper, or if you have an exciting life update to share.
 - This also gives you a chance to check in on the status of your project and keep in touch with the lab.
 - Make a [LinkedIn](#) account
 - When using LinkedIn you can add your past and present work and research experience, including awards and publications.
 - Use a professional photo as your profile photo, and keep your entire profile regularly updated.
 - Use LinkedIn to keep up to date with the professional milestones happening in the lives of the people you met over the summer. You can comment on their updates to show your support and strengthen your network.
 - Follow your research group on **Science Twitter!**

SCIENCE TWITTER



Science Twitter is a general term given to all of the scientists, researchers, and science enthusiasts on Twitter **who tweet about science, research, or important news impacting the world of research.**

- If you follow enough of these people, your Twitter feed will start to have a strong science focus. This may mean that you want to create a professional Science Twitter account that is separate from your personal Twitter account.
- Labs on Science Twitter post news about **recent papers** they have published, **job opportunities**, and ask for help surrounding scientific problems from their colleagues. This can help you stay up to date with the rapidly changing science world.
- Look for both Lab accounts and individual accounts from lab members.

5. If you do not have a summer research project, consider taking classes

- **This is a great alternative** to a summer research experience if you do not secure a summer research position OR if you find that taking classes is more beneficial for your career plan.
- The potential benefits to taking summer classes are as follows:
 - **Easing your workload for the following semester**, possibly freeing up time for research during the academic year.
 - **Learning more about a different area that interests you** if you are considering a minor or want general exposure to a different topic.

6. Look for a non-academic industry internship or job

- **Industries, such as startups and private companies,** also offer research-focused summer experiences. These experiences are different from those in academia in that they are typically more applied and geared towards the goals of the industry. These training opportunities can help you develop skills that will prepare you to be successful for a broad range of both academic and non-academic career paths.
- **A potential downside to industrial research** is that you may not be able to share the research you did during the summer publicly. Although presenting your research is important, if your internship does not allow this, ask your industry mentor to write a strong LOR for you that highlights the skills and type of work you did over the summer.
- **More about working in industry vs. academia** can be found [in this article](#) from Northeastern University.

SECOND YEAR

Second year is a good time to familiarize yourself with research communication, especially through poster presentations and oral presentations primarily at conferences, and written publications primarily in journals. This is also a time to expand your network in your field by attending research conferences on the campus, regional, and national levels and engaging with others in your field via LinkedIn and Science Twitter. See what Science Twitter is from [this section](#) above.

1. Give research presentations

- **Identify the undergraduate research center on your campus, if one exists.** They are likely to have information on opportunities to give **research presentations** and **poster talks** at your institution. Your mentors are likely to have helpful advice about off-campus conferences related to your field.
 - **Oral research presentations** can range from 5-20 minutes depending on the conference, and often involve a slideshow presentation. This is a great way to consolidate and contextualize your research project. Be prepared for a Q&A at the end of your talk.
 - **Researchers often use posters** to present their work in person. A poster is effective particularly in a situation where a researcher does not want to present in front of large audiences. Posters also enable deeper conversations about the research, as you'll tend to engage with an audience one-on-one or in small groups, rather than in the larger setting of an oral presentation.
 - **When making a poster**, be sure it is informative and engaging. Use an appealing layout and color scheme, but don't get overwhelmed with details. This [article](#) gives sound advice on how to design your poster and what should be included. Check out this [how-to guide](#) for printing cheap cloth posters, and this [scientific poster design presentation](#) from Cornell.
- **Grad student and faculty mentors** can provide more specific advice on how to make an effective poster in your particular field.

- **Find a conference that interests you!** Graduate students and professors are a great resource for identifying suitable conferences in your field. See [our list of Minority-focused scientific conferences](#) at the end of this document.
 - Many colleges and universities provide funding assistance to help cover conference fees and travel costs. Investigate different sources for conference funding on your campus (e.g., in your department or from your institution's undergraduate research office).
- **Be sure to plan ahead.** Most conferences require that an abstract summary of the research be submitted weeks to months in advance. The abstract will include yourself and anyone else that made an intellectual contribution to the work as co-authors, and all co-authors must approve of the abstract. Therefore you need to start this process early.

IMPORTANT NOTES

for your research presentation:

1. **Know your audience.** *Gear your presentation to the knowledge level and needs of the audience members.*
2. **Be concise** and tell audience members up front why your research is important.
3. **Convey your excitement and enthusiasm for the project!**
4. **Tell your story** and explain what your role was in the project.
5. **Keep timing in mind.** *Tailor how detailed your presentation can be to the allotted time and your audience.*

- **Practice makes progress!** Always practice your presentation, whether it's an oral presentation or a poster presentation, in front of your lab, a trusted mentor, and/or friends. Practice multiple times. These individuals can help you understand areas of improvement, and the practice will help you to ensure that your presentation is suitable for the target audience and the length fits the timing requirements of the conference.

2. Evaluate your current lab

- **Now is the time** to make sure that you're happy moving forward with the lab you're involved in or whether you should consider switching labs.
- **Deciding whether or not to stay** in the lab you're in or switch to a different lab can be a tough decision. [Here is an article](#) about troubleshooting research labs from Cornell. It is important to make the decision that best benefits your growth as a scientist. Below are a few pros and cons associated with switching labs:

THE PROS IN SWITCHING LABS

1. You get to do different research that better suits your interests and skills.
2. You may be given more independent tasks and project responsibilities that will help grow your skill set.
3. You may like the people and work environment better than your current lab.
4. The research might better align with what you want to do in the future.
5. You will be able to get multiple letters of recommendations, one from your previous research mentor, and another from your research mentor in the new lab.

THE CONS IN SWITCHING LABS

1. You may not develop as strong of a relationship with graduate students and your research mentor as you would if you were to stay in the same lab. This may not be an issue, however, if you stay in contact with your faculty mentor and graduate students after you leave.
2. You are likely to receive a stronger letter of recommendation if you stay with one mentor for multiple years.
3. You could miss out on developing a larger, independent, long-term project. Multi-year projects are more likely to lead to publications, which can be a boon for graduate school and fellowship applications.

3. Apply for merit scholarships and awards

- **Merit awards** are financial awards given to an individual on the basis of academic, athletic, artistic, or leadership accomplishments, regardless of financial need.
- **The benefit of applying** for a merit award includes winning a monetary scholarship, getting recognition for your work, and potentially the opportunity to pursue a program or degree abroad.
- **Campus scholarships** are often specific to one department, discipline, or major, and tend to be based on your accomplishments at your institution.
- **National scholarships (or national fellowships)** are extremely competitive and often, like the Goldwater, require a campus endorsement or nomination to apply. You will need to set up a meeting with your campus scholarship representatives to discuss these opportunities further. These representatives are usually located in an office of national scholarships or fellowships, though most national scholarship websites will have sections that will point you to the representatives for that scholarship on your campus. See our [list of National scholarships for undergraduate students](#).

4. Look for outside research funding

- Ask research mentors or faculty on campus if they are aware of on- or off-campus **grant opportunities** that can support your research. Some schools have their own internal sources of grant funding, typically administered by an office of undergraduate research. In addition, some professional societies award undergraduate research grants.
- **Read grant instructions carefully and keep track of their deadlines!** All grants have their own set of guidelines and important questions that they want answered within the proposal. [This article](#) from Northwestern University provides helpful advice on how to write an effective grant proposal in general.
- **When writing a grant proposal**, there are some basic questions you will likely need to address, depending on the requirements of the particular grant application. These typical topics include:
 - The scientific questions you hope to answer with your research.
 - How your project relates to other work that has been done on the topic.
 - Your plans for experiments and studies to address the question at hand.
 - How your work will affect the larger scientific community.
 - How the money from the grant will be used.
- **Reasons for applying for a grant include:**
 - You have greater control over your project's direction, since you are supplying the funding.
 - You have resources to purchase needed equipment/supplies that may not otherwise be available to you.
 - You gain experience writing proposals, which will come in handy in future applications for grants, fellowships, and graduate/professional school.
 - It is a valuable addition to your CV.
- See [our list of External grants and scholarships for underserved and underrepresented students](#) at the end of this document.

5. Work towards a publication

- **Publishing a research paper** can seem like a long and intimidating process. If you are a part of a lab, ask to be involved in the paper writing process even if will not be listed as an author. This experience helps you gain insight into how a paper is created and what the submission process looks like.
- **Timelines across research disciplines differ.** One of the things you will learn by helping to write a paper is how long it takes to get a paper published in your field. Time to publication varies by discipline.
- **In most fields, the order of the authors listed on a paper is important.** [Here is a link](#) to an article that appeared in *Science* that provides more information about author lists. In some fields, such as mathematics, the authors are always listed in alphabetical order, so these concerns do not apply. Your faculty mentor will be able to clarify how author lists work in your field.

AUTHOR ORDER IN PUBLICATIONS



FIRST AUTHOR:

In most scientific fields, the “first author” on a scientific paper is the member of the lab who ran or had principal responsibility for the project. This is a highly visible and coveted position.

CORRESPONDING AUTHOR:

There is also a “corresponding author,” often the same as the “first author,” who is the person to contact with any questions about the publication.

SECOND (third, fourth, etc) AUTHOR:

The order of authors typically reflects the level of contribution towards the research project, in which the “first author” has the largest responsibility and contribution, then second, third, etc.

LAST AUTHOR:

The last author listed is often the supervisor or thesis advisor overseeing the project, typically a faculty member.

SUMMER AFTER SECOND YEAR

Another academic year completed! However, during the late fall and early winter of your second year, you need to think about what you want to do during the following summer. The summer after second year can be an excellent opportunity to explore different areas of research, revisit a research group from the previous summer, or dive more deeply into work with your current mentor and group!

1. Tips on securing summer research opportunities

- **Apply to summer research experiences on another campus** to gain more experience in a different lab, work on a different project, network with more researchers in your field, and continue to build research skills. Our advice here is largely the same as the advice we give regarding the [summer after first year](#). Also, see [our list of Summer research opportunities](#) at the end of this document.
- **Most programs will require you to submit 2-3 letters of recommendation.** Begin thinking about who you will ask for a letter of recommendation. See [our advice on how to ask for a letter of recommendation](#).
- **Start your search for summer positions early.** Applications for summer research programs are often due in January.

2. Do you want to try a different research discipline?

- If you are interested in venturing into another area of STEM, this is the perfect time to do so. When researching summer research opportunities to apply to, here are some tips to keep in mind:
 - Look at lab websites to learn more about the labs you are interested in joining.
 - Mention reasons for why you are interested in switching disciplines or research areas in the personal statement that will be submitted with your application.
 - Express your interest in particular labs/areas of research by reaching out to the director of summer programs at the respective institution.

3. Consider continuing to work with your current group

- If you are interested in the work you have been doing, this is a great option. Potential benefits include:
 - **Developing greater insights** into the work you are doing, and beginning to become an expert on the topic
 - **Securing a greater likelihood of publishing and/or presenting** your work and performing independent projects
 - **Forming closer connections** with lab members and advisors

FIND FUNDING FOR SUMMER RESEARCH



1. **Reach out to your faculty to see if there are existing grants** to support your summer research.
2. **Apply for on-campus summer research grants or programs.** See if your institution is affiliated with scholarships from [our list of Funding programs for participating institutions](#).
3. **Apply for external funding opportunities,** see [our section on looking for outside research funding](#) and [our list of External grants and scholarships for underserved and underrepresented students](#).

THIRD YEAR

Research continues to be important, as well as staying involved with activities on campus or in the surrounding community, keeping in contact with professors, and keeping up with coursework. If applicable to your field (e.g., mechanical engineering, computer science), consider making a portfolio to showcase the research you've conducted. You should think more seriously about your career goals and post-graduation plans, and consider any gaps you need to fill to make yourself more competitive for particular fellowships or graduate programs you wish to apply.

1. Continue your career path planning

- **Planning your career path requires many preparatory tasks**, among which might be standardized tests (MCAT, GRE, LSAT, etc.), letters of recommendation, volunteer work, internships, and research experiences. In some fields you will begin applying for post-baccalaureate activities in the spring of your third year, so make sure to investigate the potential timelines early so that you don't fall behind.
 - See [our section on starting your graduate school and national fellowship applications](#) for more information, [our list of post-baccalaureate programs](#), and [tips for MD/PhD applicants](#).
- **Consider the monetary costs of standardized tests and applications** when looking at future career paths. Ask your faculty mentor, your career services center, and your office of undergraduate research if there are any funds available at your school to cover some or all of these costs. You should also inquire with the institutions to which you will be applying and the organizations that offer standardized tests to see if they have application fee waivers available.
- **Conduct research on schools/companies** that are of interest to you.

2. Have your research interests changed?

- If you enjoy the lab you are working in, then **continue doing good work** there. However, you might feel compelled to switch labs. See our earlier points on this [in this section on evaluating your current lab](#).
- **Additional mentorship during this time will be critical** as you begin to make decisions about your post-graduate plans.
- **This is an opportunity to ask for specific advice about career paths** from the graduate students within your lab and your research advisor.

3. Apply for national scholarships and merit awards

Refer back to [this section](#) above for more information. See the scholarships you can apply for as a third-year student in [our list of national scholarships](#). Some schools require you to start the process of applying for scholarships that are due in the fall of senior year (e.g., Rhodes, Marshall, Fulbright) during the spring of your junior year, so if you're interested in any of these, get in touch with your school's fellowship advisors in your third year.

4. Stay engaged with on-campus and local organizations

- **Build mentorship and leadership skills** by serving as a peer mentor or peer advisor for your department or by tutoring through campus organizations. Your department's director of undergraduate studies will likely have more information about these opportunities.
- Continue to remain engaged in the clubs or organizations with which you are already involved.
 - If you have time, consider taking on a leadership role in one of these groups.
 - Remain an active member of the organization and contribute to the work being done.
 - Do not be afraid to focus your energy on the one or two organizations that are most important to you as the other demands on your time grow.

- **Volunteer work** is another important way to get involved with your local community. This is an experience that can be highly beneficial when applying to graduate/professional schools. It's also a great way to get more familiar with those in need in your community.

5. Consider undertaking an undergraduate research thesis or capstone project

- **A research thesis** is based on an intensive independent research project. It is the culminating work of a student's undergraduate studies and represents their ability to conduct research and write effectively.
- You should **explore the possibility of a research thesis** when you become immersed in a research project that becomes front and center in your undergraduate activities. Because the preparation for a thesis typically extends throughout your third and fourth years, you need to plan ahead to fit it into your curriculum. It is best, therefore, to make the decision to pursue a research thesis as early as possible in your third year.
- **Choose a thesis advisor** who knows you well and with whom you enjoy working. Your advisor should ideally be highly knowledgeable about the subject of your thesis.
- Depending on your undergraduate program, working toward an undergraduate research thesis **may also involve a thesis committee, presentation, and/or defense.**

SUMMER AFTER THIRD YEAR

The summer after your third year is the time to do your most important research, possibly toward your thesis or capstone project. During this time, you should also be preparing applications for national scholarships and graduate school, taking standardized tests, and thinking about career decisions you will need to make soon.

1. Conduct research closely aligned with your graduate school plans

- **Your third year summer is crucial** for you to set yourself on a path to a competitive graduate program. Do work that you enjoy and will most effectively communicate your ability to conduct the kind of research you'd like to do in graduate school. A thesis or capstone project is an excellent way to do this.
- **Find a summer research program** on campus or at a nationally recognized program. See [our advice for securing summer research in the section for summer after first year](#), and we've also compiled a [list of summer research opportunities below](#).

2. Start your graduate school and national fellowship applications

- **Compile a list of 8-10 PhD programs to apply for.** Find schools that allow you to conduct the kind of research you're interested in and provide a culture that will allow you to do that work effectively. Visit the school's website and talk to current students or faculty there to see if the institution could be a home for you. Pay close attention to funding opportunities, faculty research interests, teaching requirements, and connections to other programs and departments.

- **When applying for PhD programs, look for programs that cover tuition and fees and provide a stipend** to cover your living expenses.
 - Check the cost of living in the place where the school is located.
 - Unlike undergraduates and many other graduate and professional students, most PhD students are paid. However, the salaries are usually very small, and you should think carefully about whether you will be okay with that for the next 4-6 years.
- **Find multiple professors you'd be willing to work with** at your chosen PhD program just in case your research interests change. Although your specific research interests may shift after or during your first year of graduate school, getting the “lay of the land” in areas related to your research interests and contacting potential faculty mentors at the graduate school is helpful. Contact the professors you're most interested in working with and see if they are taking graduate students. You might also be able to have a conversation with them about their current research and how your interests align with theirs.
- **Applications are expensive.** Most applications carry a fee of around \$50-\$85. You can apply for application fee waivers for many programs, and more information can be found on the specific program websites. For example, here is the [link](#) to UC Berkeley's graduate school fee waiver instructions.
- **Apply to a variety of schools.** Consider applying to several safety schools that you feel very confident about getting into. Likewise apply to at least 1-2 dream schools that you may not get into (if you don't apply you can't get in!). Your faculty and grad student mentors will be able to guide you toward which schools you should consider safety schools and dream schools.
- **Take the GRE** if you are applying for master's or doctoral degrees in the US.
 - **Think of the GRE as a grown-up SAT.** Most graduate applicants need to take the general GRE test, and for some disciplines you need to also take a GRE subject test. Testing requirements differ for each graduate program, so you will need to gather this information from the websites of the specific programs you're interested in. Many schools are dropping GRE requirements. You may still want to take the exam, however, in case a few of your programs require it.
 - **The GRE Fee Reduction Program** allows individuals with financial need to pay only 50% of the regular test fee. For more information, visit the [GRE website](#).

- **Apply for the NSF GRFP.** This is one of the most prestigious fellowships for graduate students in STEM disciplines pursuing research-based master's degrees and doctoral degrees at US institutions. Visit the [NSF GRFP website](#) for more information.
 - **This five-year fellowship** includes three years of financial support including an annual stipend of \$34,000 and a cost of education allowance of \$12,000 to the institution.
 - **Application deadlines typically fall in mid-October**, and the application usually opens in late July/early August.
 - **Applicants can only apply once after enrolled in their graduate studies**, but you can apply as many times as you want prior to being accepted into a graduate program. If you are awarded the fellowship, you will be able to communicate this to the schools to which you've submitted applications, as more graduate programs may accept you since the funding that you'll bring in with the NSF GRFP will allow them to much more easily fund you.
 - **Your preparation for the NSF GRFP application will be very helpful** for compiling materials that you need for other generous graduate school fellowships such as the NDSEG, SMART, DOE CSGF, and others. Pay close attention to the various deadlines for these fellowships to give yourself time to tailor your NSF GRFP materials for these other awards.
- **Apply for other fellowships** that will provide you with additional funding for your doctoral program. Fellowships are short-term opportunities lasting from a few months to several years, and they focus on the professional development of the fellow. They're sponsored by a specific organization seeking to expand leadership in their field. See [our list of Graduate fellowships](#) below.

3. Tips for MD/PhD applicants

- It is important to **understand what a physician-scientist is**.
 - A **physician-scientist** is a person who holds both an MD and a PhD and uses the research they conduct (in a STEM or Social Sciences field) to influence their clinical practice and vice versa.
 - These programs usually take 8-10 years to complete.
- **Look up schools that are MSTP funded.** This means that they are funded by the NIH and will provide you with a stipend in addition to covering your school's tuition cost.
 - Find the full list of schools with the Medical Scientist Training Program (MSTP) funding [here](#).

- **Most MD/PhD programs only require applicants to take the MCAT** as opposed to the GRE. However, this is dependent on the PhD you are pursuing, so be sure to check whether your PhD department requires its applicants to take the GRE.

4. Alternative paths

- **Post-baccalaureate programs** are 1-2 year programs geared toward students who wish to become more competitive for graduate school, medical school, or MD/PhD applications. See our list of post-baccalaureate programs below.
- **Master's programs** can range from 1-3 years, and they can be either course-based (taught) or research-based. [Here is a link](#) with more information on different types of master's programs.
- **Get a degree abroad!** There are many master's and PhD degrees available internationally, and pursuing one of these can facilitate international collaboration in your research area throughout your career. The structure, time frame, and benefits for these programs may differ from those found in the US, so make sure you become familiar with the logistics of each program before you apply.
 - **Ask your mentors** to see if they can connect you with people who studied abroad at programs that interest you. This will give you insight into living abroad and conducting international research, and whether it aligns with your career goals.
 - **Apply for National Scholarships** that support international study, such as the Rhodes Scholarship, the Marshall Scholarship, the Churchill Scholarship, and the Fulbright U.S. Student Program, in order to secure funding for your master's degree, doctoral degrees, or service projects. See the scholarships you can apply for as a fourth year in [our list of National scholarships for graduate students](#).

FOURTH YEAR

You have made it to the final step of your undergraduate career, congratulations!

1. Complete your graduate school and fellowship applications

Continue the application process outlined in [this section](#) above, and be sure to consult with trusted faculty, graduate student mentors, and fellowship advisors at your institution. Applications for fellowships are normally due in September or October, and PhD applications are typically due in December or January.

2. Consider taking a gap year

- **A post-graduate gap year** can be a time for travel, work, research, or other exploration. This is also an excellent time to build your network.
 - **Complete a post-baccalaureate program.** This experience can help enhance your skills and thereby make you more competitive for graduate school. See [our list of Post-baccalaureate programs](#).
 - **Apply for national scholarships** that focus on graduate study can also provide a great opportunity for an academically rigorous gap year. See [our list of National scholarships for graduate students](#) below.
 - **Take a job in industry** for a year. Research-focused jobs can provide an excellent perspective before graduate school, especially if you think you will want an industry position after graduate school.
 - **Take a research assistant job.** A research assistant, or RA, is a researcher employed, often on a temporary contract, by a university, a research institute, or a private organization.
- **Taking a gap year for a national merit award** is something you will have to discuss with your graduate school institution. Each institution has a different policy for delay in enrollment.

3. Relax

Once you've been accepted to graduate school or made other plans, take some extra time to rest and relax. If your post-grad plans involve a lot of work, you'll thank yourself later if you take time to unwind!

This Resource Guide to STEM Research document was created by members of the Diversity and Inclusion Committee of the Goldwater Scholar Community. We are dedicated to promoting diversity and inclusion in STEM fields. If you have any questions or comments, please reach out to us at council.gsc@gmail.com.

Last updated: August 6, 2021

IMPORTANT RESOURCES

Professional societies for minorities

1. [National Society of Black Engineers](#) (NBSE)
2. [Society for Advancement of Chicanos/Hispanics and Native Americans in Science](#) (SACNAS)
3. [American Indian Science and Engineering Society](#) (AISES)
4. [Society of Mexican American Engineers and Scientists - Latinos in Science and Engineering](#) (MAES)
5. [Society of Hispanic Professional Engineers](#) (SHPE)
6. [Society of Asian Scientists and Engineers](#) (SASE)
7. [Association of American Indian Physicians](#) (AAIP)
8. [National Association of Mathematicians](#) (NAM)
9. [Collegiate Science and Technology Entry Program](#) (CSTEP)
10. [National Action Council for Minorities in Engineering](#) (NACME)
11. [Society of Women Engineers](#) (SWE)

External grants and scholarships for underserved and underrepresented students

1. [Jack Kent Cooke Foundation](#)
2. [Woodrow Wilson National Fellowships](#)
3. [American Chemistry Society Scholars Program](#) (ACS)
4. [Sigma Xi Grants-in-aid of Research](#) (GIAR)
5. [The Garden Club of America](#) (GCA)
6. [American Physiology Society](#) (APS)
7. [Environmental Protection Agency Fellowships](#) (EPA)
8. [Ernest F. Hollings Undergrad Scholarship](#) (NOAA)
9. [Evolving Earth Foundation](#)
10. [US Dept of Defense SMART](#) (DOE)
11. [List of External Undergraduate Grants](#) (by the University of Connecticut)

Funding programs for participating institutions

1. [McNair Scholar Program](#) (US Dept of Ed)
2. [Maximizing Access to Research Careers](#) (MARC, NIH)
3. [Louis Stokes Alliances for Minority Participation](#) (LSAMP, NSF)
4. [Historically Black Colleges and Universities-Undergrad Program](#) (HBCU-UP, NSF)
5. [Supporting Advanced Technological Education](#) (ATE, NSF)

Summer research opportunities

1. [Amgen Scholars](#) (AMGEN)
2. [NSF REU Sites by discipline](#) (NSF)
3. [SR-EIP](#) (The Leadership Alliance, 20 institutions)
4. [PATHS-UP](#) (NSF, 4 institutions)
5. [BP-ENDURE](#) (NIH Neuroscience, 10 institutions)
6. [DRI-HBCU](#) (Davidson College)
7. [HBCU/MI](#) (Army Laboratory Initiative)
8. [HBCU-REU](#) (UC Berkeley)
9. [Rosetta Commons REU](#) (NIH)
10. [Research for Medical Education sites by institution](#) (AAMC)
11. [National Nuclear Security Administration MSIPP](#) (DOE)
12. [US Dept of Energy MSIPP](#) (DOE)
13. [US Dept of Energy SULI](#) (DOE)
14. [Grossman Biomedical Sciences](#) (NYU)
15. [Icahn School of Medicine](#) (Mount Sinai)
16. [Life Sciences SURP](#) (University of Minnesota)
17. [Mayo Clinic SURF](#) (Mayo Clinic)
18. [Nakatani RIES in Japan](#) (Rice University)
19. [Summer Internship Program in Biomedical Research](#) (NIH)
20. [ThinkSwiss Scholarship](#) (SERI)
21. [DAAD RISE Germany](#) (DAAD)
22. [UCSD STARS](#) (UC San Diego)
23. [Undergraduate Clinical Scholars Program](#) (UPenn)

Minority-focused scientific conferences

1. [American Indian Science and Engineering Conference](#) (AISES)
2. [Annual Biomedical Research Conference](#) (ABRCMS)
3. [Black is Tech Conference](#)
4. [National Association of Black Geoscientists Conference](#) (NABG)
5. [National Conference of Black Political Scientists Conference](#) (NCOBPS)
6. [National Society of Black Engineers Conference](#) (NSBE)
7. [Society for Advancement of Chicanos/Hispanics & Native Americans in Science Conference](#) (SACNAS)
8. [Society of Hispanic Professional Engineer Conference](#) (SHPE)

NATIONAL SCHOLARSHIPS

UNDERGRADUATE

1. [Astronaut Scholarships](#) are awarded to students in their third and fourth year of college studying science, technology, engineering, or mathematics with the intent to pursue research or advance their field upon completion of their final degree. The Astronaut Scholarship awards more than fifty scholarships valued up to \$15,000 to each selected scholar. Apply as a third or fourth-year. Check with your institution to see if they are able to nominate you for this award.
2. [The Barry Goldwater Scholarship](#) supports developing science, mathematics, and engineering students who demonstrate outstanding academic performance and potential in research. Here you will find useful information, including application tips. Apply as a second or third-year.
3. [The Boren Scholarship](#) provides funding for U.S. undergraduates with an interest in national security careers to study less commonly taught languages abroad in world regions critical to U.S. interests. Apply as a first, second, third, or fourth-year. The Boren scholarship also has a special summer STEM initiative for STEM students. This scholarship does require a commitment of one year of federal government service.
4. [Freeman Awards for Study in Asia \(Freeman-ASIA\)](#) provides scholarships for U.S. undergraduate students with demonstrated financial need to study abroad in East or Southeast Asia. Apply as a first, second, or third-year.

NATIONAL SCHOLARSHIPS

UNDERGRADUATE CONTINUED...

5. **The Ernest F. Hollings Undergraduate Scholarship** includes a two-year academic award of \$9,500 per year, and a 10-week, full-time, paid summer internship opportunity at any NOAA (National Oceanic and Atmospheric Administration) facility nationwide. Scholars also receive funding to present their NOAA research projects at two national scientific conferences. Students must attend a minority serving institution, have and maintain a 3.2 or higher GPA, and have a declared major in a NOAA-mission related discipline. Apply as a second-year if you are in a four-year program, or as a third-year if you are in a five-year program.
6. **The Humanity in Action Fellowship** gives students interested in investigating human rights, democracy, and structural injustice a month of immersive study in one of their host cities in Europe or the US. Fellows produce a community-focused Action Project, and they have the opportunity to join a transatlantic network of over 2,000 fellows. Apply as a first, second, third, or fourth-year, or recent graduate.
7. **The Gilman Scholarship** is an award offered to U.S. undergraduate students who receive Pell Grants to help pay for studying or interning abroad. Gilman Scholars receive up to \$5,000.
8. **The Strauss Scholarship** supports college students (from select California institutions) interested in public service, providing both a stipend to the student and funds to use toward expenses for a public service project. Apply as a second or third-year.
9. **The Truman Scholarship** supports exceptional students in their third year who plan to attend graduate or professional school in preparation for a career in public service, providing funding at both the undergraduate and graduate level and access to the Truman network. Apply as a third-year.
10. **The Udall Scholarship** provides financial support and access to the Udall leadership network to second and third years who are either committed to pursuing an environmentally related career, or who are Native Americans or Alaska Natives interested in fields related to Native health care or tribal public policy. Apply as a second or third-year.

NATIONAL SCHOLARSHIPS

GRADUATE

1. **The Carnegie Endowment's James C. Gaither Junior Fellows Program** provides a substantive work experience in the form of one-year fellowships for uniquely qualified fourth years or recent graduates with a strong academic and career interest in international affairs. Apply as a fourth year or recent graduate.
2. **The Clarendon Scholarship** offers around 130 new, fully-funded scholarships each year to assist outstanding graduate scholars, and also offers the opportunity to join one of the most active, highly international, and multidisciplinary communities at Oxford. Automatically considered when you apply for graduate studies at Oxford.
3. **The Churchill Scholarship** offers outstanding American students the opportunity to pursue graduate studies in engineering, mathematics, or science at Churchill College, University of Cambridge. Apply as a fourth year or recent graduate.
4. **The Fulbright Scholarship** supports up to one year of international funding for recent undergraduates, master's degree recipients, and current graduate students. Apply as a fourth year or recent graduate.
5. **The DAAD Study and Research Award** offers a scholarship for a full master's degree program at a German university or for studies at a German university as a part of a postgraduate or Master's degree program completed in the applicant's home country.
6. **The Gates Cambridge Scholarship** offers full-cost scholarships to outstanding applicants from countries outside the UK to pursue a full-time postgraduate degree in any subject available at the University of Cambridge. Approximately two-thirds of these awards will be offered to PhD students, with approximately 25 awards available in the US round and 55 available in the International round. Apply as a fourth-year or recent graduate.
7. **The Knight-Hennessy Scholars Program** is an opportunity to become part of a unique community of future global leaders pursuing graduate or professional studies at Stanford University. Apply as a fourth-year or recent graduate.

NATIONAL SCHOLARSHIPS

GRADUATE CONTINUED...

8. **The Marshall Scholarship** offers intellectually distinguished young Americans the opportunity to attend graduate school in any discipline in the United Kingdom, while being introduced to the British way of life and British social and academic values. Apply as a fourth-year or recent graduate. The Mitchell Scholarship Program selects exceptional undergraduates for one academic year of postgraduate study in any discipline offered by select institutions of higher learning in Ireland and Northern Ireland. Apply as a fourth-year or recent graduate.
9. One of the most well-known and prestigious scholarships available, **the Rhodes Scholarship** funds two or three years of post-baccalaureate study at Oxford University in England. The Rhodes Scholarship program seeks students who can demonstrate outstanding scholarly achievement, a commitment to others and to the common good, and the potential to be leaders in their chosen field. Apply as a fourth-year or recent graduate.
10. **The Schwarzman Scholars Program** gives the world's best and brightest students the opportunity to develop their leadership skills and professional networks through a one-year master's degree at Schwarzman College, Tsinghua University, in Beijing, China. Apply as a fourth-year or recent graduate.
11. **The Truman Scholarship** supports exceptional students in their third year who plan to attend graduate or professional school in preparation for a career in public service, providing funding at both the undergraduate and graduate level and access to the Truman network. Apply as a third-year.
12. **The Yenching Academy** enrolls students from both China and abroad, to study, live, and learn together at one of China's top universities. The scholarship supports a 12 month residential program for international students, and is aimed at creating a community of enthusiastic, globally oriented young innovators. Apply as a fourth-year or recent graduate.

Graduate fellowships

1. [National Science Foundation Graduate Research Fellowship Program](#) (NSF GRFP)
2. [American Association of University Women](#) (AAUW)
3. [Boren Fellowship for Study Abroad and National Security](#) (Boren)
4. [DAAD USA Graduate Opportunities](#) (DAAD)
5. [Dept of Energy Computational Science Graduate Fellowship](#) (DOE)
6. [Dept of Defense SMART Scholarships](#) (DOD)
7. [Ford Foundation PreDoctoral Fellowship](#) (Ford)
8. [GEM Fellowship Program](#) (GEM)
9. [Global Health Corps](#) (GHCORPS)
10. [Graduate Fellowship for Science Diversity](#) (GFSD)
11. [Hertz Foundation](#) (Hertz)
12. [Hispanic Scholarship Fund](#) (HSF)
13. [Luce Scholars](#) (Henry Luce Foundation)
14. [National Defense Science & Engineering Graduate Fellowship](#) (NDSEG)
15. [National Research Council Research Associateship Programs](#)
16. [Paul & Daisy Soros Fellowship](#) (PD Soros)
17. [Samuel Huntington Public Service Award](#)
18. [Smithsonian Institution Fellowship](#)

Post-baccalaureate programs

1. [List of post-bac programs for health professions](#) (UCSB)
2. [List of post-bac research opportunities](#) (University of Maryland)
3. [NIH PREP Scholars](#) (NIH, post-bacc)