

SCUE Presents

# The Roadmap to Research



Dear Penn Undergraduates,

You've all heard it before during admissions tours. Penn is a "world-class research university." In 2012, it occurred to us on the Student Committee on Undergraduate Education (SCUE) that Penn has so many institutions and resources for research--yet as an undergrad it's difficult to navigate the system if you actually want to find research. Where do you even start?

So, SCUE set out to fix the information gap.

It's our pleasure to introduce you to the Roadmap to Research.

The Roadmap to Research is a guide to all things research at Penn. Produced with the aid of CURF and many professors, the Roadmap provides the most comprehensive walkthrough available for starting or enhancing your research career. Also included are vignettes from student who've found success in their research careers.

Like any roadmap, use it like the title implies: you'll need it if you're lost, but you might also discover the road less traveled. And be sure to check back at [scue.org/roadmaptoresearch](http://scue.org/roadmaptoresearch) for semesterly updates to the document!

Enjoy,

Arjun Gupta  
Project Chair

Mary Peyton Sanford  
Project Chair



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INTRODUCTION

# About the Roadmap

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**So you're interested in research but don't  
know how to get started? Great!  
You've come to the right place.**

The University of Pennsylvania is a research institution, which means that a large portion of our resources is allocated to research in myriad forms. Research is the lifeblood of Penn, but that means more than simply producing knowledge. Research is a superior means to learning and is part of the toolkit for promoting social good. Penn has the infrastructure to help you do research on any topic that interests you. SCUE's *Roadmap to Research* serves as a handbook for those questions that arise about research during your four years and beyond. Even if you are already involved in research, you might find valuable information in the *Roadmap* to help you enhance your research experience and pursue other interests. This document is written for students by students. Use the Roadmap as its title implies: you'll need it if you're lost, but you might also discover the roads less traveled. As this Roadmap will show you, there are a million different paths you can take to getting involved in research, and there is no "right" one. Research is about process. While some projects culminate in a final product, the value lies in the experience itself. Here, we will introduce you to the idea of research, what it can do for you, and how to get started. The Roadmap will also offer you snapshots of student experiences in the "vignettes" section. Read on and keep an open mind.



# Q&A

## What is the Roadmap to Research?

Here's how this document works: We have separate fields of research based on academic disciplines. Flip to the section that interests you, or browse them all! You might surprise yourself and find an opportunity you didn't know existed. In addition to field-specific resources, each of the sections contain vignettes: snapshots of student research to give you a better idea of what it's really like. For more general questions about research and ways to get started, keep reading. The next section covers the general know-how for getting started in research regardless of your field of interest.

## What exactly is "research"?

Of course, research in different fields is different in terms of methods, day-to-day work, and end goals. But here is the general idea: assessing the status quo, creating a new way of thinking, testing this idea, applying this idea in the real world, and sharing the results.

## Why do research?

Research allows you to work at the cutting edge of a field or combination of fields. Students often come away from a research experience with a deeper understanding of the material learned in class, as well as real-world problem solving skills. In the big picture, research is critical to advancing a field. Research can help take you to the next level, whether that is in higher education or work. Conducting research as an undergraduate is one of the best ways to solidify your understanding of coursework and develop skills for your work after Penn.



## **Do I need prior experience to begin research at Penn?**

No. Most students begin research without any experience. Since most students have not conducted research prior to coming to Penn, professors are mostly looking for potential and a willingness to learn. Particular research positions, however, may require background experience. Just be sure to do your homework on the position before approaching your professor.

## **When should I get involved in research?**

If you want research to be a large component of your time at Penn, the earlier you get started, the better. It is important, however, to scope out your research interests and potential professors you would like to work with. The summer after freshman year can be a great time to getting acclimated to research.

## **How much does coursework matter in terms of preparing for a research position?**

A lot of research is learning on the job and finding specific pieces of information or methods as you need them. Very few research positions have a strict course work requirement. That being said, since you will typically take four to five Course Units (CUs) as a Penn student, you should figure out how you can use courses to improve your research abilities. Of course, foundational courses are generally useful. As you finish degree and sector/foundation requirements, don't be afraid to explore challenging upper level courses. Often, these courses have a research component and can serve as a stepping stone to a larger research experience. Just keep in mind when looking for a research position that professors are considering you as an investment. Be prepared for them to ask for your transcript and have a resume or Curriculum Vitae (CV) on hand when you are applying for research positions.

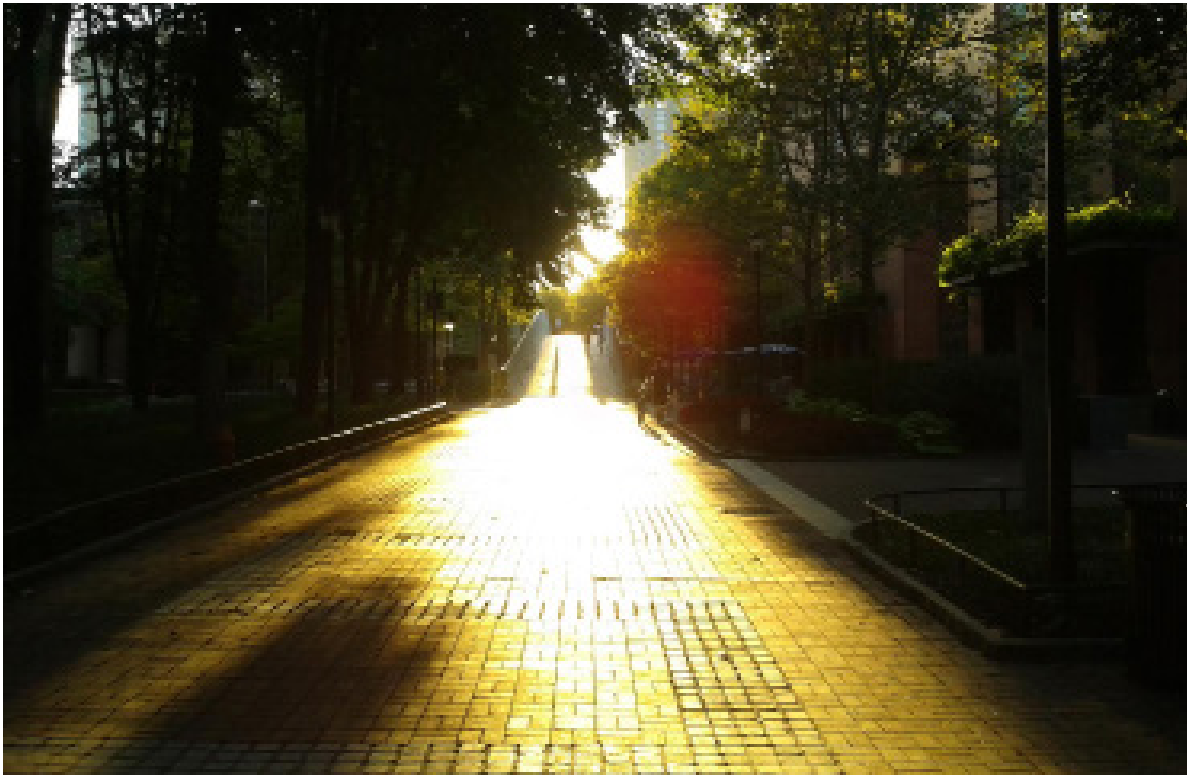


## Can I do multiple kinds of research?

As long as there are no explicit conflicts of interests, yes. Taking on multiple research projects is very challenging, and you should seek the guidance of older Penn students and faculty advisors. If you are starting research for the first time, then it may be best to start research in one field and get comfortable before branching out. Many research projects may involve working across different fields and skill sets, so you will get a breadth of experience in just one project.

## What do I get for doing research?

Research shows you what real life in that field will be like and makes it possible to pursue graduate training in that field. Through research, you gain the necessary skills to work in the field and it is possible to secure letters of recommendation from people who know you in a relevant setting. Some students receive academic credit for their work and might even be paid, but in the long run these benefits are small compared to the experience.



## RAMP UP TO RESEARCH

Whether you're in the College, Wharton, Engineering or the Nursing, read this section first. Research requires students to take an active role in shaping their own experiences. There are tremendous resources that exist for students at Penn who are interested in doing research. Seek them out and take advantage of them!

Here is a list of suggestions, irrespective of your school, on how to take initiative and find a research position at Penn.

### Choose Your Approach

1

#### By Topic of Interest

Decide on your research interest. Your research focus should be more specific than a general interest in a department—but that is a good place to start. For example, a well-developed research interest is not simply, “psychology.” Psychology encompasses a breadth of research areas. Instead, you should narrow it down to “childhood development” or “animal and behavioral psychology.” Having a specific research interest in mind will make it easier for advisors and professors to help you find a suitable research position later.

2

#### By Seeking a Good Environment

You might not know what you want to study. The choices seem infinite. So, deciding on a topic right out of the gate may be premature, and it might be a better idea to find a good environment to get you started. Or, you may have your heart set on a topic, but find that research institutions that focus on that topic don't foster environments where undergrads can thrive. So early in your career, it may be wise to think less about picking the perfect research topic and more about finding the right environment in which you can learn a lot and gain the necessary skills. How do you find out where the right environments are?

#### ***Tap into Your Network By Speaking to Upperclassmen, Peer Advisors and Faculty Advisors***

Take advantage of experienced researchers around you. They will often have helpful advice and connections to professors. In particular, discuss your research interests with your faculty advisors. Research involvement varies, but many of these people have valuable advice. They will also be able to comment on professors who you are thinking of working with and let you know if they think it would be a good fit.





## RAMP UP TO RESEARCH

### ***Don't Have a Network? Make One.***

- Going to UPenn.edu is a great place to start. The slide show on the home page often has pictures showcasing the fascinating research going on around campus. Click on the “about this photo feature” and use the information from the caption to find the professor’s website (all Penn faculty are required to have one through the University, and many also have personal sites). From there, find the names of the undergrads who work in that lab. Send them emails asking how and where they got started in the lab, as well as questions about the lab environment and the work itself.
- Penn gives out dozens of awards for undergraduate research every year. Look up the winners, find them on PennDirectory, and send them emails about their work. Many will be happy to point you in the right direction.
- Penn-specific research publications highlight work done in labs as well as professor and student accomplishments. Look into Penn’s Scholarly Commons and student-run publications.
- Look at graduate school websites to find research positions. These sites are broken down based on research topics and list all of the professors doing research in each area. This is also great practice if you are looking to apply to graduate school.
- The Work-Study Database is a great resource to find research projects. It can help work-study students get research positions professors are encouraged to hire these students.

### 3

### **Through CURF**

The Center for Undergraduate Research Fellowships (CURF) is dedicated to connecting undergrads with research positions. CURF offers a variety of resources, including free “research consultations” and a research directory where professors post listings of projects that require undergraduate help. Check them out at [upenn.edu/curf/research](http://upenn.edu/curf/research).



## 4

**Through Coursework**

Consider courses that cultivate your interest in a field. This will help you hone your topic of interest and also confirm what you enjoy studying. Use these classes as opportunities to build relationships with your professors. Even if you do not end up researching in their particular subfield, they are generally happy to put you in contact with other professors. It is usually easier to build these relationships in smaller classes, so take some seminars early in your college career. If that is not an option, put in the effort to get to know your lecture professors through office hours and other relevant events on campus.

**Getting Started**

## 1

**How to Send an Email**

A “cold-email” is an email sent to someone with whom you have little or no preexisting contact. When sending emails to professors or other students, here are some things to keep in mind.

- Spend some time researching the work professors in your field of interest have done. You can often find papers that they have written online, and can get a good sense of their work by reading through abstracts and summaries. This exercise will also help you write detailed emails to professors focusing on their personal research.
- If asking for a specific position, you should start sending out emails roughly 6 months ahead of the date you would like to start. These things take time, so think ahead.
- Address professors as “Dr.” or “Professor” where applicable. This can be found on the professor’s web page.
- Individualize your emails. Discuss the interests that you have in common with the professor’s research. Overgeneralizing indicates a lack of interest, and no professor wants to receive a form letter.
- As an undergrad, do not say that you are seeking paid employment. It sounds presumptuous, and paid positions are more difficult to find. If there is any indication that you are in it for the money, a professor is less likely to respond.
- Double-check the spelling of the professor’s name and proofread the email. This step is crucial when you are making a first impression.

## 2

**Know Whether Your Field Requires a CV or a Resume**

As a rule of thumb, the Life and Physical Sciences prefer a Curriculum Vitae (CV) while Humanities, Social Sciences and Wharton prefer a resume. If you are unsure of what should go into these documents, make an appointment with Career Services. They can help you write and edit resumes and CVs, as well as advise you on which document to use for a specific field.



## 3

**Skills Developed Through Research**

Demonstrating basic research skills can help you secure a position, but this is often not necessary. Research is a learning experience in itself and many professors do not expect you to have prior knowledge. Think about your current strengths and where you have the most room for growth.

**Critical Reading:** Critical reading skills amount to more than an ability to read and comprehend. Students grow more comfortable with the style and jargon of scholarly literature and apply what they learn to their own work.

**Writing:** Writing requires a student to master the technical language of a discipline. A student must be able to present his or her findings, often synthesizing large amounts of information in a single paper or argument. This helps students develop practical writing skills. Most careers require some writing and students who are able to communicate clearly will have an advantage when looking for jobs. word will have an advantage when the time comes to look for jobs.

**Verbal Communication:** Communication skills describe an ability to convey ideas. Research can involve test groups, interviews, and discussions, all of which require clarity. Moreover, frequent interactions with the research community will challenge students to effectively convey their findings.

**Developing an Argument:** Researchers challenge their own hypotheses through data analysis and critical thinking. This process requires attention to detail that helps students sound arguments worthy of presentation and, in some cases, publication. These steps could include:

- Testing hypotheses with experiments.
- Defending arguments
- Using peer and professor feedback to develop projects
- Writing articles that present and support results

**The bottom line is, research can only enhance your Penn experience.  
Read on for discipline-specific information!**



FIELD OF RESEARCH

# SOCIAL SCIENCES



"I could not conduct my own study without my experiences as a research assistant...I not only have gained skills that will be essential in any job or field, but I have learned about myself, my interests, and what motivates me (perhaps more so than from my coursework)."

-Meggie McCarthy-Alfano  
SAS '14 on conducting medical  
anthropology research



SOCIAL SCIENCES

## WHY DO SOCIAL SCIENCES RESEARCH

The social sciences are unique because they explore the cross over between quantitative and qualitative analysis. Students are challenged to observe patterns in the world and explain them by synthesizing concrete data. Student researchers regularly find themselves conducting interviews, working with numbers, analyzing data, and reading scholarly articles. Like research in most fields, research in the social sciences is an organic process. You will move back and forth between collecting information and analyzing it throughout your research experience. Given the myriad fields housed within the social sciences, research experience in this department can be as varied as the individual pursuing it would like.



## GETTING STARTED

**1**

### **Choose a Topic of Interest**

Reflect on what interests you the most within the social sciences. Try to be as specific as possible in your search, as it will help you find the lab of best fit for you.

**2**

### **Coursework**

Taking courses within your areas of interest will help you find a suitable research topic and develop useful skills in the process. Use these classes as opportunities to build relationships with your professors. Even if you do not end up researching in their particular area of interest, professors will normally be happy to put you in contact with other professors. Get to know your professors through office hours and other events on campus.





## GETTING STARTED

3

### **Speak to Upperclassmen, Peer Advisors and Faculty Advisors**

Take advantage of those around you who have experience with research. In particular, discuss your research interests with your faculty advisors, who have connections and a good understanding of research in a specific field.

4

### **Emails**

Sending emails to the professors who you are interested in working with is usually the first step in the research process. For more information on how to send an email, see [Ramp Up to Research](#) in the Introduction.

5

### **Research-based Classes**

Research based classes provide students with an opportunity to hone their research skills as part of the academic curriculum. Capstone seminars teach the process of how to do research, and are valuable for students who wish to conduct their own research project or write a senior thesis. Speak to your advisor and look at your major's course offerings to better learn how you can incorporate research opportunities in your course schedule.

6

### **Honors Senior Thesis**

The thesis is a capstone experience in many departments, encouraging students to conduct their own research and write extensive papers. Before starting a senior thesis, a student must find a faculty advisor who has done work in a related field.

7

### **Independent Study**

In general, independent study projects require students to take a great deal of initiative. Students are expected to select a clear topic, choose a professor as their mentor, and get a department advisor's approval. The independent study generally results in a deliverable final product, which could be a paper, data analysis, or other type of final project. For those students who already have research positions, independent studies are a good way to get course credit for their work.





## Research Components:

**1. Reviewing Literature:** Reviewing literature helps you build a body of knowledge in the subject in which you work. Depending on your field, reviewing literature may be your main responsibility when you first get started.

**2. Fieldwork:** Research in many disciplines within the social sciences, such as Urban Studies and Anthropology, requires research at the site of interest. Depending on the research topic, this type of research may involve interacting with the local community or even traveling to a different country. Fieldwork can be subdivided into observational research and participatory research. Observational research deals with recording subject behavior and interaction as a third party, while participatory research allows the researcher to engage with the subject matter. Often, the research gleaned from fieldwork is qualitative. Surveys, interviews, and general observations are commonly conducted on site. Fieldwork follows prior study.

**3. Analyzing Information:** There are several ways in which researchers can analyze that data they collect in the field. After collecting qualitative data, social scientists must analyze it to understand what it reveals about the population of interest. A statistics course will equip you with the basic skills required to complete the necessary computations in an analysis.

**4. Interpreting Data:** Not all fields require a strong background in coding, but most recommend that students have at least rudimentary knowledge of the processes. Learning how to code is not as daunting as it seems and most undergraduates do so with either the help of a professor or a simple online class. The two types of coding that exist are Quantitative Data Coding and Qualitative Data Coding. The nature of your project will determine what kind of data analysis is necessary. A basic computer science class like CIS 110 is useful for learning these skills. The extent to which different fields require coding or statistical knowledge varies greatly. Moreover, if you wind up working with professors who rely on coding and statistics, they will help you develop the basic knowledge you need to be successful.



## ON-CAMPUS RESOURCES

1

### Grants

Students who want to work independently can apply for grants to fund their research. See CURF or individual departments for more information. The application process varies greatly depending on the specific grant. Most applications require a specific research proposal and oftentimes letters of recommendation as well. A Google search about non-Penn affiliated student research grants in your field of interest is another avenue to pursue.

2

### People to Contact

- **Teaching Assistants:** Teaching Assistants can help you connect with your professor and, because they are involved in research themselves, they can give you an inside look at what research entails.
- **Grant winners:** You can normally find the names of students who have won grants, a summary of their research projects, and their e-mail addresses online. Consider contacting grant winners, especially if you are interested in pursuing independent research.
- **CURF Research Peer Advisors:** CURF Research Peer Advisors are undergraduate students who have been successful in research and are willing to help students delve deeper into the research opportunities at Penn. You can read bios and find the contact information for them at <http://www.upenn.edu/curf/research/research-peer-advisors/current-research-peer-advisors>.

3

### Online Resources

Check out department websites! There, you can find current opportunities that will connect you to someone in the department that you can research with, research centers, and a list of professors. Some department websites, such as Psychology, also have pages that include detailed descriptions of research in subfields of the department.





## ON-CAMPUS RESOURCES

4

### Workshops

Each semester, Weigle Information Commons holds workshops on specific software programs, such as STATA, that you might need for research.

5

### Research Events

Many organizations and departments host events throughout the semester to introduce students to research, often called “symposiums” or “colloquia”. One example is the CURF Research Fair, held at the start of every semester. These events are a great way to learn a bit about research opportunities and to start networking with professors. They also often have free food! Keep an eye out for emails from CURF and department chairs for these great opportunities. Make sure to sign up for the CURF Listserv as well as the Listservs for any department in which you are interested in doing research.

## TAKEAWAYS

- Analyzing a combination of qualitative and quantitative data: This analysis is somewhat unique to research in the social sciences because most analyses include hybrid forms of data collection in their research endeavors.
- Developing new methods of research and designing experiments: Typically social scientists have a significant amount of freedom in framing their research and designing procedures. This is an opportunity for students to think critically and develop a plan to address a problem.
- Become a part of a vibrant community: As you get more involved in research, you will have increasing opportunities to meet professors who are leaders in their fields and talk to students who are very passionate about their research.
- Network with Faculty: Many of the faculty members you could research with are at the top of their fields. If you find a professor who has worked in an area that interests you it is a good opportunity to get advice on your future. Penn professors are also well connected to other leaders in their fields and can often put you in contact with their colleagues when it comes time for you to look for a job.



FIELD OF RESEARCH

# NATURAL SCIENCES



"My research has been a great way for me to learn how to creatively come up with new ideas and contribute to the field. It has given me an opportunity to individually take charge of my learning and apply many abstract concepts from my classes to problems in the real world."

-Hannes Leipold, SAS '16  
on a research in materials  
science



## NATURAL SCIENCES

*Research in the life sciences not only examines life systems, but also extends what we know about the logic of life systems to engineering applications. The process of this research involves both discovering biological phenomena and creating new tools that enable research. Research in the physical sciences develops the methods of examining nature and describes fundamental phenomena. Founded in physics and math, this research provides the foundations for applications across engineering and other sciences. The process of getting started and actually doing physical science research is similar to that in life science research, though the day-to-day experience of the work is markedly different. Please read the Life Science section first; keep an eye out for general procedures and tips. This section begins with information generally useful for research in any natural science field, discusses the lab structure, and then splits into "life sciences" and "physical sciences".*

## WHY DO NATURAL SCIENCES RESEARCH

Natural sciences research deals with cutting edge technology and spurs major advances in a wide range of fields. Beyond that it is especially empowering to build autonomy with your own project, and eventually contribute your knowledge to a close community of scientists. Natural scientists make up a very dynamic network that will also provide connections and mentorship. One of the most important aspects of a positive research experience is choosing the right fit for you (see our tips on how to choose a lab below).



## GETTING STARTED

### 1

#### Reading the Literature

The “Science Times” in the *New York Times* is a good place to start. You should also read the shorter articles in journals like *Science* and *Nature*. You may not understand every detail, but the point is to get a feel for the different kinds of research. There are also Penn-specific research publications that highlight work done in labs at Penn by both students and professors. Look into Penn’s Scholarly Commons and student-run publications for examples of work from your peers. If you want more specific information about given field, check out texts about research methods and the history of different subfields.

### 2

#### Going to Talks

There are talks every day at Penn by either our own or visiting professors. Search department websites to see a calendar of events. Learning about and attending these events will enrich your research. Then, later on in your research career, attending conferences becomes valuable. Conferences are held by major scientific organizations such as the American Chemical Society and the Biophysics Society. You can attend conferences to learn about recent research and communicate with professors and graduate students. The conferences typically consist of poster sessions where graduate students present specific topics, short talks given by professors, and hour-long sessions that provide the big picture of a professor’s approach to a problem.



## GETTING STARTED

### 3

#### Lab Structure and Dynamic

Understanding the structure of the scientific laboratory will help you understand your role and who to go to with problems and questions. While this is a typical model, not all labs are structured this way:

- **PI:** The lab is headed by a “principal investigator” (PI), typically an assistant or tenured professor. The PI creates “big ideas” that guide the lab, runs the business of the group, and promotes the group’s research. The PI is responsible for controlling the quality and direction of the research and communicating results to the rest of the scientific community. Of course, all members of the lab are responsible for research integrity and have the opportunity to present their own research. When seeking a research position, you will most likely get in touch with the PI. After joining a lab, your PI discuss with you plans for your project and what you would like to get out of your research experience.
- **Post-Doctoral Students:** Post-docs have their PhDs and are seeking very specific training. A post-doc will typically work in a lab for a couple of years and then become a professor. Post-docs can be great mentors, but may not be present for the entirety of your lab experience. In any case, you should take advantage of their knowledge, experience, and accessibility.
- **Graduate Students:** The graduate students are simultaneously under the training and mentorship of the PI and responsible for leading projects. Graduate students meet with the PI to plan out a project, and they then carry out much of the experimental procedure. In fact, graduate students will likely serve as your primary mentors because you will initially be assigned to a project under their leadership. Most undergraduates come in with little or no prior experience. In this case, your graduate student works very closely with you for the first few months to help develop your lab skills. You should not hesitate to ask a lot of questions and fail often and early; your graduate student was in your shoes not too long ago and will probably be happy to help you along.





## NATURAL SCIENCES

- **Undergraduate Students:** Other undergrads may work in your lab. Older undergraduates are probably the most relatable, since they are further along in their research. Grad students may be unfamiliar with the Penn undergraduate experience, in which case other undergrads in your lab may be a good source of advice.

### 4

#### Choosing a Lab

Visit department web pages and the Perelman School of Medicine site to find PIs and their lab pages. Each lab has a statement of goals, a list of personnel, and a list of publications. Make a short list of labs that interest you. Read on for more information about what to look for in a lab.

- Meet with a faculty advisor in the sciences. While it may be helpful to research within your major, do not feel limited. If research opportunities in other departments interest you, seek out an advisor in that field to discuss your interests and lab selections.
- Set up meetings with PIs from labs that interest you, and feel free to meet with several. See if your advisors or professors can put you in touch with the PIs, but if they cannot, don't be afraid to cold-email (for more information on how to send an email, see [Ramp Up to Research](#) in the Introduction). In your meeting, the PI typically goes over your resume and statement of research interest. You should ask about the kind of work that you might be able to do, work expectations, schedule flexibility, and whether you will be paired with a graduate student.





## What Do I Look for in a Lab?

**1. Prior Experience with Undergraduates:** Look on the lab website for previous undergraduates who have worked in their lab. Too few or none means that the lab may not be equipped to train you. This is not at all a universal rule; some labs may just be new. Grad students are oftentimes your day-to-day mentors and, ultimately, your partners in research. See if they have worked with undergrads before.

**2. Lab's Age and PI's Experience:** Against conventional wisdom, it may not be best to work for the "big name" in a field since very large and developed labs may not take the time to train you. On the other hand, very small and new labs may not have the manpower or foundation to give an undergrad a good experience. Take both of these into consideration as you look. Your advisor is a good person to talk to about the reputation of the lab.

**3. Scope of skills:** More important than a specific problem is the breadth and depth of skills you will learn in a lab. As an undergrad, don't worry about curing cancer; instead, develop skills and understand the world of research.

**4. Topic:** Of course, you should consider what specific problems interest you, but don't let this be your only factor. Typically, the PI will have a few projects that he or she may see as a good fit for your skill set and interests, as well as the needs of the lab.



## NATURAL SCIENCES



**5. Independent Study:** A good option to get course credit for your research is independent study. This is a little different depending on the field and department. Once you have a position in a lab and a defined project, it is possible to sign up for independent study. This course is not a lecture-exam model but rather requires a proposal and a final results-based report on your independent research. Here, “independent research” means work that a student carries out himself or herself – the overall project idea can be derivative of your lab’s projects. There is an expectation that you will conduct at least “10 hours” worth of research per week for this credit. Different principal investigators (PIs) will have different expectations and different methods of assessing your work. Typically, PIs are outcome oriented and are more interested in setting research goals to accomplish as opposed to time forms to fill out. In a single semester, few PIs will expect you to finish a project or even a “significant” part of your project, especially if you have just started research. A successful first independent study for a semester will assess different strategies for carrying out the project; explaining why things failed is a crucial part of the larger process. Examples of course numbers include:

Life Sciences: BIOL399, BCHE299, BIBB399

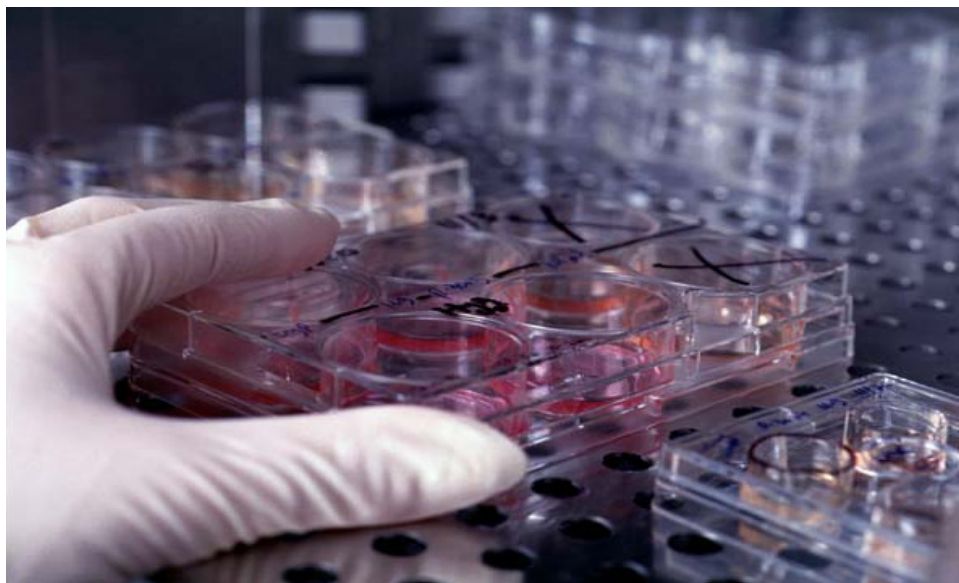
Physical Sciences: PHYS299, CHEM299, Honors Program in Mathematics

**6. Switching Labs:** If you later think that another lab may be better suited for you, don’t hesitate to talk to your PI and advisors about working in another lab. Some students proactively choose to switch labs to gain new skills.





## LIFE SCIENCES



## GETTING STARTED

### 1

#### Subfields of Research

The subfields of life science research are distinguished by their methods of approaching similar problems. This section provides an overview of several major subfields of the life sciences and the big picture questions that they try and answer. Understanding the kind of research that a particular lab does is the first step in shaping your research experience. Consider both the process and aim of your research. The following courses are common requirements for students in the life sciences. We stress that this is not an exhaustive list, you should explore all available course options, and you should meet with an advisor if you have serious questions about course selection.

- **Biophysics (including Mathematical/Computational Biology):** How can we represent biological phenomena in physical and mathematical models? Are there general principles governing these models? A student's research in biophysics usually involves using physics, math, and computer science to take on old problems from a new point of view. For example, you may study the function of a protein not through genetics but mechanistic studies.



## GETTING STARTED

- **Chemical Biology/Organic Chemistry:** How can we mimic nature's production of molecules? Can we build tools to probe the way life systems work? Chemical biology is concerned with the engineering of biological systems for the purpose of studying living systems and creating new functions. Organic chemistry provides the tools to build molecules and modify living systems in chemical biology applications. You can also conduct research in chemistry aimed at improving the field itself as opposed to solving a life science problem, but this work, especially in organic chemistry, often requires some background experience.
- **Molecular and Structural Biology (including Genetics):** How do we define and elucidate biological phenomena? How does a specific biological pathway work? This subfield ties together almost all of the life sciences and is a very accessible and popular option for undergraduate research.
- **Cell and Tissue Biology:** How do molecular actions give rise to a developing embryo? A thinking brain? This subfield draws on the framework of molecular and structural biology but focuses on a specific biological phenomenon. Neuroscience and developmental biology attract the most research interest.
- **Environmental science:** What frameworks do we use to connect molecular science to study life systems on the largest scales? How do we delineate specific phenomena like heavy metal contamination? Research can involve field work such as assessing pollution and urban development in Philadelphia.
- **Clinical research:** How do we translate basic science into therapeutics? As an undergraduate, you probably will not work directly with patients. Rather, you will develop a method to assess and target disease or materials for others to use in the clinic. For example, undergraduates have profiled drug mechanisms and engineered better stents for use in heart surgery.



## GETTING STARTED

### 2

#### Classes

There are many courses that typically serve as good foundations for life science research, but most research positions do not have course prerequisites. One exception is organic chemistry, where students are typically expected to complete Chem241, 242, and 245 before conducting serious bench work. PIs do look for some general background knowledge, and a solid transcript is beneficial when seeking a lab position. Later, taking upper level courses allows you to focus in on cutting edge work in specific subfields.

## TAKEAWAYS

- Getting Course Credit for Your Work: Independent study awards credit to students for a certain number of hours in the lab and deliverables deemed sufficient by your PI and the head of the undergraduate department.
- Presenting and Publishing Your Work: Presenting a poster is the most accessible and popular form of delivering your research to a broad audience. Typically, an undergraduate who has made some progress on a larger project will present a poster on the project and cite the other contributors. You don't need to finish a project to present a poster. Look for poster events in departments within Penn, through CURF, and at local professional conferences. You typically must submit an abstract and follow printing guidelines specified by the event. Once a group makes more progress on a project, the members may submit their work to a professional journal. Many undergraduates who do extensive research often do not publish a paper. Typically, undergraduates spend most of their time at Penn learning skills. The PI decides when the results of a project are sufficient for submission to a journal, and the co-authors. If you are not getting the results you would like, don't be discouraged. Focus on what you can control: do good work, keep track of all experiments in a notebook, and present your research at group meetings.



## TAKEAWAYS

- Career paths: The skills you develop in life science research are generally useful in defining and approaching problems.
  - PhD: A 4-6 year program for honing your research skills in another lab and taking graduate courses in related fields. PhDs typically do further post-doctoral research to gain a new set of skills before entering research jobs in academia or the private sector.
  - MD: A common route for students interested in direct application of life sciences. Research can help a nascent doctor gain a deeper understanding of material normally just covered in the classroom and stay on top of the most recent findings in biomedical sciences in the future.
  - MD/PhD: A path for those interested in conducting research to build the theoretical knowledge of medicine or to create new diagnostic and therapeutic tools. MD/PhDs typically spend most of their time conducting research rather than practicing in the clinic.
  - Consulting: Generally, analytical skills are useful in synthesizing sets of information for problem solving.
  - Patent law: A non-traditional route that has increasing opportunities given the expanding collaboration between research entities and corporations. A background in science helps when assessing the content and novelty of scientific intellectual property.
  - Policy making and Public Service: Technical issues like environmental policy and healthcare require science to inform policymaking. Often, major issues do not offer a scientific consensus backing one plan of action over another. Experience in research allows one to make sense of the nuances of findings in the literature.



## PHYSICAL SCIENCES

Many undergraduates often find starting research in the physical sciences daunting because this field typically requires higher background knowledge to start doing meaningful work. Fortunately, we have outlined ways to help you get started.

## GETTING STARTED

### 1

#### Subfields of Research

- **Pure and Applied Physics:** What are the general principles of nature? What is the system we use to collect and make sense of observations? Modern physics research has become more subdivided; you will probably investigate specific phenomena or develop methods of observation. Examples include studying electronic properties of molecules and materials, developing optics for imaging, and, of course, general theory which involves mathematical research.
- **Pure and Applied Mathematics:** What are the general principles of numbers and space? What is the interplay of mathematics and empirical studies in physics? While math is distinguished from physical science, we include it here as it most naturally compliments physics. Few undergraduates start in mathematical research, but rather access this subfield through another physical science.
- **Computational Chemistry:** How can we use principles from physical chemistry to model physical processes? How can computation guide experimental research? Computational work involves using software to build a models, set parameters, and run calculations to test a hypothesis.
- **Materials Science:** How can we rationally engineer materials for a purpose? How do we connect atomistic and molecular properties to the macro scale? This subfield currently has directed attention to nanoscience.





## GETTING STARTED

- **Biophysics:** With a better molecular understanding of life, physicists and mathematicians are beginning to take more interest in solving biological problems. Mathematics can provide models for modeling a neural network, for example. Physics can provide a foundation for studying electronic interactions in proteins or a new optical technique for imaging cells. See the Life Sciences for more details.

### 2

#### Classes

Unless otherwise specified, no research position requires prerequisite coursework. Speak with your P.I. and advisor about classes to take that will enhance your knowledge about your research topic.

## TAKEAWAYS

- Course Credit: You can get course credit for your research work in ways similarly discussed in the Life Sciences section. Presenting and publishing your work in the Physical Sciences is also similar to that in the Life Sciences. However, publishing in the physical sciences may be more difficult for an undergraduate because of both the higher threshold for beginning independent research and the more solitary nature of the field. Again, there is no need for a “publish or perish” mindset at the undergraduate level. Make sure to keep track of your research in your group, present posters, and apply for independent study credit.
- Career paths:
  - PhD: The “go-to” post graduate plan. You can pursue a PhD and delve into a subfield of your undergraduate focus or translate a theoretical background (e.g. undergraduate physics) to an applied field (e.g. materials science). Keep in mind that post-doctoral research provides options to hone niche skills.
  - Non-academic careers: The physical sciences themselves can be applied to a variety of engineering careers, though PhD training greatly improves your access to the most interesting work. The analytic skills gained in this field can be applied to less related fields such as finance, consulting, and patent law.
  - MD: Medical imaging and bioengineering have opened medicine for those interested in the physical sciences. Material science and bioengineering can be combined to create new medical devices. The physics behind optics and imaging is required to prove the rigor of a diagnostic test. Your major’s curriculum may not alone satisfy medical school requirements, so double check your course plan.



FIELD OF RESEARCH  
**HUMANITIES**



"But the love of the hunt is what kept me going, the desire to know all I could know, to understand the people who lived before me and what they thought about the country they created for me. If I understood their thoughts, I could better understand the world I interact with every day."

-Alicia DeMaio, SAS '17  
on researching early America



## WHY DO HUMANITIES RESEARCH

Research in the humanities aims to allow students to apply what they are learning in their liberal arts courses to real world practices. Research in these fields is heavy on independent work and facilitates strong student-professor relationships. These research opportunities are widely varied and offer students resources to pursue their own projects whether they are in writing, research, analysis, working with primary sources, or handling field-relevant materials. Day-to-day work involves locating and reading primary sources, pulling relevant information from these sources, and synthesizing the information. The final product is usually some sort of written document that makes a claim regarding the subject matter at hand. Projects, however, are as diverse as the humanities themselves. Penn has numerous funding structures such as grants to help students pursue their varied interests. If you have an idea and know what you'd like to research, it is really a matter of talking to the right people and getting on track. This document is designed as a broad overview of resources and entry-points to humanities research, but is by no means meant to be limiting. After reviewing this material, contact the appropriate department for more detailed instruction on getting involved.

“Research opportunities are widely varied, and offer students resources to pursue their own projects whether they are in writing, research, analysis, working with primary sources, or handling field-relevant materials.”

## GETTING STARTED

1

### Figure Out What You Want to Research

What do you want to learn more about? This inspiration might come from a class, a professor, a book, or current events.

2

### Subfields of Research

Look at a list of departments in the humanities to help you narrow down your fields of interest.

3

### Do Your Homework

What's going on in your field of interest now? Who is involved in that field at Penn? Talk to your friends to see if they know anyone who is doing similar research. Don't feel pressured to know everything about your potential project, but you do need to know enough to ask specific questions to people who can point you in the right direction.





## GETTING STARTED

### 4

#### Talk to People in the Know

**Department Heads:** A good place to start is department heads. Some host regular office hours for students with general questions; otherwise, just send a polite and professional email explaining that you are interested in finding out more information and would like to set up a meeting. For more information on how to send an email, see [Ramp Up to Research](#) in the Introduction. You can also ask to be added to their respective department listservs for updates on speakers, workshops, and other opportunities.

**Professors:** Ask professors about their research. Professors like talking to enthusiastic students, especially during office hours. They might not be able to offer you an opportunity directly, but oftentimes a professor knows others working on similar things. It's a good idea to read up on your professor's research before you go to talk to them about it. They won't expect you to understand the nuances, but you need to be able to ask questions and articulate your personal interest.

**Books:** One great way to engage a professor is to read their book and go to office hours to talk about it. This is a great segue into what they are working on now.

### 5

#### Research Advisors

In the humanities, your research advisor will not necessarily be an expert on the specific subject that you are researching. You become the expert through your research. Nonetheless, your research advisor's experience will help you find sources, use sources correctly, keep you informed of various opportunities to present your research, and help you articulate a strong argument. Research advisors often turn into strong mentors, and a good relationship with your advisor may lead to any number of opportunities and letters of recommendation down the road. The process of finding an advisor is fairly informal. Talk to a professor you would like to work with about being your research advisor.



## HUMANITIES



### Advice from the Experts:

Because humanities research is so self-driven, it is up to you to get what you want from your research project. Here are some tips from experienced students working on humanities research:

**Give yourself deadlines:** Even if they are self-imposed it is important to set goals and deadlines and stick to them. Without some kind of plan or timeline it is easy for your research to fall by the wayside.

**Write things down:** Keeping detailed notes on the sources you have reviewed and formulating a draft of your final product throughout your research will make the process of writing a final paper at the end much less daunting. Everyone's writing process is different, but keep a written record of the work you are doing to make it easier on yourself in the long run.

**Time management:** As you gain some experience working on a specific project, you will become better at gauging how much time any given task will take. Once you develop this understanding of your work, it will become easier to figure out what is reasonable to complete on any given day, week, or month.

## ON-CAMPUS RESOURCES

**1**

### Undergraduate Humanities Forum

The Undergraduate Humanities Forum offers resources and community for humanities scholars. Each year, the Forum organizes a conference to present research in addition to events, lectures, performances, and exhibitions around Philadelphia. It also offers grants to students pursuing independent research in the humanities, as well as a network of individuals with whom to discuss and collaborate. If interested in applying for research grants in the humanities, see the Undergraduate Humanities Forum for more information on fellowships and other opportunities: <http://www.phf.upenn.edu/uhf.shtml>



## ON-CAMPUS RESOURCES

2

### University Scholars

The University Scholars program provides an academic environment for intellectually curious students who are committed to research. The program provides mentoring and funding and hosts events to help students pursue research projects. Students can apply to the program from the end of their freshman year through the first semester of their junior year. Interested students should contact Dr. Harriet Joseph (215-746-6488). Read more about University Scholars on the CURF webpage <http://www.upenn.edu/curf/uscholars/prospective-students>.

3

### Center for Undergraduate Research and Fellowships (CURF):

Each year, the University of Pennsylvania and CURF fund numerous summer internships in Philadelphia that are specifically targeted towards the humanities. All undergraduate students are eligible. Students work as apprentices under professors or other professionals in a number of fields and receive stipends for their participation. To see the available positions and timeline for application, visit the CURF web page for the Summer Humanities Internships. <http://www.upenn.edu/curf/research/humanities-internships>

4

### Kelly Writers House

Housed on Locust Walk, the Kelly Writers House is a community at Penn for students interested in the humanities and the arts. It houses undergraduate classes and is also the home to various literary clubs and publications on campus. KWH hosts speakers and programs that are open to the Penn and the greater Philadelphia community. The Kelly Writers House offers a wide variety of Internships and Fellowships for interested students. These opportunities provide funding for independent projects such as writing and staging a play. KWH offers paid and unpaid internships. For more information, see <http://writing.upenn.edu/wh/> or just stop in at 3805 Locust Walk.



## ON-CAMPUS RESOURCES



5

### Independent Study

The most distinct thing about humanities research is that it is driven by individuals. Rather than working in a lab with graduate students, full-time staff, and faculty members like in the sciences, a student will oftentimes be the only one working on a humanities research project. Students work with faculty advisors for guidance but determine on their own how to structure day to day research time. Guidelines, restrictions, and formats for Independent Studies differ in each department. If this is an option in which you are interested, you should ask a department head or professor for more information.

6

### Research Seminars

Thesis seminars are for students writing their senior theses in a specific subject, but there are various other course offerings involving research, depending on the department to help introduce students to research. Ask a department head or your major advisor about course offerings.



## TAKEAWAYS

- Organize and execute your own project: Humanities research is what you make of it, and this kind of responsibility can be especially empowering for undergraduate students. Determining your own schedule, deciding what to work on, problem solving, and ultimately completing the project are important skills for personal development.
- Build Relationships with Distinguished Faculty: Doing research is one of the best ways to get really get to know a professor and allow them to get to know you. Penn professors are some of the most distinguished in their fields. They have a wealth of knowledge and experience to share, and they also have connections with other distinguished colleagues. Many students consider their research advisors to be mentors, and stay in touch long after graduation.
- Preparation for Further Education: For many students who are considering going to graduate school, undergraduate research offers a window into what it's like to be a grad student or professional within a given academic field. You might fall in love and decide you want to continue research as a career. Even if your first experience isn't great, it will help you determine what you like and what you don't.
- Developing Transferrable Skills:
  - Writing: Nearly every student who takes part in research in the humanities is expected to produce a deliverable. This document varies depending on the nature of the project, but ultimately depends on the ability to express complex ideas in a clear way and to develop a unique perspective on a larger topic. In order to create such a document, the student must hone his or her writing skills in order to contribute to the larger body of scholarly work in the field.
  - Analyzing Primary Sources: Oftentimes, research in the humanities requires students to synthesize data from primary sources. Unlike most scientific research, humanities research doesn't necessarily entail producing original data, but rather synthesizing documents and resources that already exist.
  - Communication: Students must coordinate with professors, other scholars, and peers working on humanities research in order to be successful. No meaningful research is isolated, and students must be able to correspond and work with others in order to strengthen their own research.
  - Presentation: Research in the humanities requires clear articulation of the project objective and significance. This involves speaking skills, as well as an ability to present findings and conclusions in a thoughtful, accessible way.



## FIELD OF RESEARCH NURSING



"The research I'm doing now is such inspiration and has set up the foundation for my own future inquiries... As a future health practitioner, I am certain that I will encounter certain discrepancies that do not have explanations. I will want to dig deeper to reach their understanding."

-Tara Fernandez, NURS '15  
on conducting healthcare research



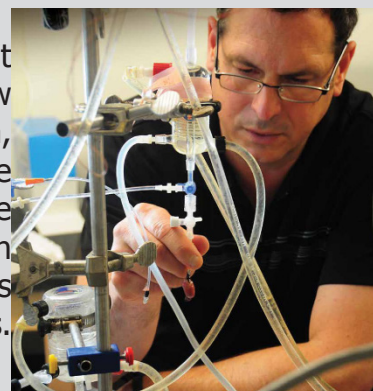


## WHY DO NURSING RESEARCH

Research in the Nursing School encourages students to focus projects around a specific issue of nursing practice. Working on these projects offers undergraduate nurses the opportunity to explore a topic they are interested in, develop professional skills, and advance their careers. This section will help de-mystify nursing research and give you a step-by-step plan for how to get involved.

### Understanding Nursing Research:

Many students think, “Why should I do research? I have clinicals.” It is true: the two do have some overlap. Clinicals teach students how to perform certain practices, like flush an IV or inject medication, but they do not offer the opportunity to reflect on why these practices are used. Through nursing research, students analyze the outcomes of the healthcare practice they test. Research stimulates critical thinking about nursing practices and integrates the knowledge gained from clinicals into best-practice proposals.



**Broad Hospital Exposure:** Research in Nursing focuses on hospital-wide issues and policies, whereas clinicals focus on the patient unit. Research is an opportunity to see the bigger picture of how administrators select healthcare practices.

**Fieldwork:** Fieldwork is closely associated with the clinical aspects of the nursing curriculum. Like clinicals, the fieldwork component of research involves taking care of patients, working with teams and getting on-the-job nursing experience. Fieldwork in nursing research, however, offers unique learning opportunities that clinical experience does not.

- **Develop Long-Term Relationships With Subjects:** In clinicals, students only spend a short time with each patient. Through research, students get the opportunity to develop long-term relationships with patients, test subjects, residents in the Philadelphia community, and others who participate in research. These research experiences give nursing students the opportunity to work on the type of relationship-building they will have to do with patients when they leave school.
- **Work With Non-Nurses:** Research teams often consist of students and professors from a variety of academic fields. This gives students doing nursing research the opportunity to work with professionals who bring different perspectives.
- **Understand New Environments:** Nursing students have the opportunity to do research in unfamiliar environments, such as impoverished neighborhoods or homeless shelters. Understanding the environment patients come from allows nurses to better treat their needs. This can also be a valuable experience for those interested in working with free clinics or programs like Doctors without Borders.



## GETTING STARTED

**1**

### Think About Your Interests

It will be easier to get guidance from your advisor if you can articulate your interests. Learn about areas of research by talking to professors, upperclassmen, and doing research online.

**2**

### Talk to Your Academic Advisor

After you develop a general idea of what you are looking for in a research position, talk to your academic advisor. Nursing advisors are well-trained to direct students to exciting research opportunities, so ask them to connect you to professors who share your interests. Your advisor will ask you about your desired research topic, time constraints, personality, and preferred work style. This will help them pair you up with available research positions. Academic advisors can also help you sort through the large body of information available online. Online resources can be difficult to navigate. Your advisor can serve as a helpful guide.

**3**

### Research Centers

Penn Nursing has eight research centers that organize and facilitate research opportunities at Penn for undergraduates, graduate students, and professors. One service these centers provide is topic-specific advising. Email the directors or associate directors of the research centers for a consultation on research opportunities. Research centers also run seminars and colloquia on undergraduate research. Announcements for these events are made through email and with signs around Fagin Hall. See "On-Campus Resources" below for more information.





## GETTING STARTED

3

### Contact Professors

Contact professors with whom you are interested in researching. Send the professor a concise introductory email discussing your interest in their research, and note who referred you. Make sure you have researched that professor's area of focus and have prepared questions that can help you figure out whether you would be a good fit for that lab. For more information on how to send an email, see the [Ramp Up to Research](#) section in the Introduction.

4

### Research-Based Courses

The Nursing curriculum has three required research courses for the Class of 2016 and beyond. Use these courses as opportunities to learn about the process of research to advance your own research projects.  
NURS 301: Inquiry and Measurement in Nursing I (Junior Fall)  
NURS 547: Scientific Inquiry for Evidence-based Practice (Senior Year)  
NURS 389: Research/Inquiry-Based Service Residency (Senior Year)

## ON-CAMPUS RESOURCES

1

### Penn Nursing Research Centers

1. Barbara Bates Center for the Study of the History of Nursing: Studies changes in nursing throughout history and corresponding changes in healthcare.
2. Biobehavioral Research Center: Studies biological and behavioral factors in healthcare.
3. Center for Global Women's Health: Addresses women's health in three categories: Safety from Violence and Harm, Equity, Empowerment, and Advocacy, Health Promotion and Disease Prevention.
4. Center for Integrative Science in Aging: Studies healthcare in relation to aging and quality of life.
5. Center for Health Equity Research: Strives to understand and remove health inequality.
6. Center for Health Outcomes and Policy Research: Studies issues nurses face in the workforce.
7. New Courtland Center for Transitions and Health: Works to better understand how to care for chronically ill patients.



## ON-CAMPUS RESOURCES

8. Centers of Excellence for Autism and Developmental Disabilities Research and Epidemiology: Works on projects that study developmental disabilities and autism spectrum disorders in Pennsylvania. <http://www.nursing.upenn.edu/research/Pages/Research-Centers.aspx>
9. Hospital of the University of Pennsylvania (HUP) and Children's Hospital of Pennsylvania (CHOP): Hospital research tends to be patient-focused. HUP and CHOP also have significant funding, making this a good opportunity to find a paid research position. Speak to professors, your advisor, the Netter Center, and hospital researchers for ways to get involved.

## 2

### Online Resources

1. Office of Nursing Research website: <http://www.nursing.upenn.edu/research/onr/Pages/Office-of-Nursing-Research.aspx>
2. Research positions publicized by the School of Nursing: <http://www.nursing.upenn.edu/research/onr/Pages/Office-of-Nursing-Research.aspx>
3. Fuld/Hillman Scholars programs: <http://www.nursing.upenn.edu/research/students/Pages/Undergraduate-Research.aspx>
4. Nursing Research Lab: A resource where students gain an understanding of the scientific method through the hands-on experience of conducting lab procedures and collecting quality data. <http://www.nursing.upenn.edu/research/onr/nursing-research-lab/Pages/Nursing-Research-Lab.aspx>
5. Nursing Research Grants: <http://www.nursing.upenn.edu/research/Documents/FY-2013-Funded-Grants.pdf>



## TAKEAWAYS

- **Reviewing Literature:** Reviewing literature from scholarly journals about issues related to nursing and clinical inquiry can help students learn how to think analytically about healthcare best practices. Hospitals look for nurses who understand quality-improvement and evidence-based practices; two areas to which research assistants in nursing are exposed.
- **Data Management:** Data management skills and practices are often used in hospitals and other healthcare facilities. Learning them as an undergraduate gives students who do research in nursing relevant experience when looking for jobs down the road. Programs such as Excel, SPSS, REDcap, STATA, SAS, NVivo, and Atlas are all commonly used in research and are also used in many healthcare careers.
- **Logistical Work:** Logistical work could include designing presentations, applying for grants, applying for Institutional Review Board approval, contacting other professors or students to acquire information, and more. This gives a researcher a behind-the-scenes look at how the field works.
- **Fieldwork:** Though nursing students participate in clinicals as part of their curriculum, fieldwork provides additional opportunities to take care of patients, work with teams and get on-the-job nursing experience.
- **Career Opportunities:** Research can help nursing students pursue many career opportunities, including higher education, healthcare management, and healthcare public policy.
  - **Hospitals and Healthcare Facilities:** Students can utilize their research experience to learn about the administrative side of patient care. These managerial skills and an understanding of how hospitals function are associated with jobs such as clinical nurse leaders or charge nurses. In fact, every nurse needs to know how to delegate tasks, problem solve, and manage resources, which are skills enhanced by research participation.
  - **Healthcare Public Policy and Healthcare Management:** A significant amount of research done at Penn involves healthcare policy hospital administration and patient care practices.
  - **Graduate Degree:** Those interested in Masters and PhD programs are encouraged to do undergraduate research in order to show that they are academically prepared for the research-based components of their future coursework.



FIELD OF RESEARCH  
**BUSINESS**



"While interning, I learned valuable skills like STATA and ArcGIS that will help me as I look to do my own independent research throughout the rest of my time at Penn."

-Peter Jeffrey, W '16  
on an international research  
experience in London





## WHY DO BUSINESS RESEARCH

Research in business is a great way to build your network and learn new skills. Many projects only last a summer, semester or year, allowing students to participate in multiple projects during their time at Penn. Also, a significant amount of business research can be done from your computer, so you can do it anywhere. There are many opportunities and reasons to do research in business, regardless of whether or not you are a Wharton student.



## GETTING STARTED

**1**

### Choose a Topic of Interest

The Wharton School has 10 departments: Accounting, Business Economics and Public Policy, Finance, Health Care Management, Legal Studies and Business Ethics, Management, Marketing, Operations and Information Management, Real Estate, and Statistics. The first step in pursuing business research is determining the fields and topics that interest you the most.

**2**

### Ask People in the Know

You can find more information about business research by contacting any of the programs listed as “On Campus Resources” or the Wharton Research and Scholars Program. We also suggest you contact your professors and advisors to see if they have any suggestions on next steps. Finally, it may be useful to ask your friends if they know any students involved in research at Wharton, as they may know about available opportunities.



## GETTING STARTED

3

### Do Your Reading

Browse research papers that faculty members have written, and email professors if you are interested in their work. Make sure you have a good understanding of the professor's work and make your email personal to tell them why you are interested in their particular work. For more information on how to send an email, see [Ramp Up to Research](#) in the Introduction.

4

### Take Advantage of On-Campus Opportunities

Attend the faculty research presentations sponsored by the Joseph Wharton Seniors program. These 90-minute presentations are made by professors in the Wharton School about topics of their choice. These presentations are open to all Wharton students, and all Wharton students receive an email about 2 days before these presentations occur. Another great program is Lunch and Learn, which provides funding for undergraduates to take PhD students and professors to lunch to learn about their research. You can learn more about Lunch and Learn here: [https://spike.wharton.upenn.edu/ugrprogram/student\\_life/programs/lunchandlearn.cfm](https://spike.wharton.upenn.edu/ugrprogram/student_life/programs/lunchandlearn.cfm). After doing sufficient research on your interests, begin to brainstorm whether you would like to pursue a structured program or an independent study.





## ON-CAMPUS RESOURCES

Students can conduct research in the Wharton School through a variety of programs. In addition, some students conduct independent research for credit. Here are the most popular avenues for business research. Applications for these programs are sent out by email to Wharton students, but if you want to get a head start or are a non-Wharton student, we suggest going to the websites of the programs that interest you and emailing their respective directors. Programs for Wharton students only are indicated with an asterisk (\*).

**1**

### **Joseph Wharton Scholars (JWS)\***

Students can be accepted to JWS prior to coming to Penn or can apply as freshmen or sophomores. Those accepted take scholar seminars in Wharton and the College and perform a research project during their senior year. Students interested should apply directly to the Benjamin Franklin Scholars (BFS) program by submitting their high school and college transcripts, writing two thoughtful essays, and providing two faculty recommendations. <https://spike.wharton.upenn.edu/ugrprogram/research/jws.cfm>

**2**

### **Wharton Research Scholars (WRS)\***

Upperclassmen, usually seniors, conduct research under a faculty member. Applications are emailed to the entire Wharton junior and senior classes in the spring. <https://spike.wharton.upenn.edu/ugrprogram/research/wrs.cfm>

**3**

### **Wharton Social Impact Research Experience (SIRE)**

This program is particularly aimed at rising juniors and seniors. These students perform research that has both economic and social value under the guidance of a faculty member; a stipend is provided. Applications are emailed to students in the spring. <https://spike.wharton.upenn.edu/ugrprogram/research/sire.cfm>



## ON-CAMPUS RESOURCES

4

### Wharton Summer Program for Undergraduate Research

This program is intended for freshmen and sophomores. Students design and conduct in depth research over a ten week summer program. A stipend and housing are provided. There is also a community aspect where faculty and PhD students present their research, which is a great network for learning about new research opportunities. Applications are emailed to students in the spring. <https://spike.wharton.upenn.edu/ugrprogram/research/spur.cfm>

5

### Independent Study

Students who have completed 24 CUs with a minimum cumulative GPA of 3.4 can choose to pick a research topic of their own choosing; students should find a faculty member to approve their topic and guide their research. Students who are not in Wharton can still elect to take part in an independent study. This is a great opportunity to receive credit while also pursuing an individual interest.

6

### Traditional Research Assistant

Research assistants at Wharton are sponsored by professors who are looking for student assistance with their research. These students are usually assigned a task or set of tasks that are associated with the professor's research project. These positions can primarily be found by asking professors if they know of available positions and by searching for research positions on Penn's work-study website.



## BUSINESS

### A Guide to Finance, Marketing, and Management Research:

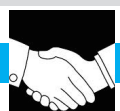
This guide will cover research in three of the most popular concentrations in Wharton: finance, marketing, and management. Of course, there are numerous opportunities in other Wharton departments, and the general strategy for pursuing research opportunities applies to any topic you intend to pursue.

### Finance

Research in Finance ranges from portfolio management to corporate finance theory. Students who are interested in finance research should take FNCE 100 and FNCE 101 as soon as possible and discuss their specific interests with their finance professors.

*Why Do Research in Finance:* Finance research can be a great opportunity for students interested in investment banking, management consulting, or corporate finance roles. Being able to find business trends and forecast results based on data collected are essential skills to these roles, and you will likely perform these tasks as a finance research assistant.

*How to Get Involved:* Students can start by talking to Finance professors, taking Finance classes, and speaking to their advisors or other students who perform research in the Finance department. We suggest learning more about the particular aspect of Finance you wish to research, whether it be capital markets or corporate finance before speaking to professors, as this choice will definitely affect which professors you will choose to work with.



## BUSINESS

### Marketing

Research in marketing focuses on methodologies to predict future business trends by analyzing consumer behavior, decision-making theory, modeling, and marketing strategy. Students who are interested in marketing research should take MKTG 101 as soon as possible and discuss their interest in marketing research with their advisors. As a marketing research assistant, your tasks will include performing statistical analyses and analyzing various marketing strategies. There are no prerequisites.

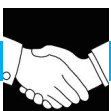
*Why Do Research in Marketing:* Marketing research can be a great opportunity for students interested in advertising, brand management, and management consultant. An ability to analyze marketing strategies and large data-sets as well as tie these findings to business implications is useful skills for students interested in pursuing these careers.

*Two Helpful Resources for Marketing Research:*

1. *Wharton Customer Analytics Initiative (WCAI):* The Wharton Customer Analytics Initiative is a research center that focuses on studying individual-level customer behavior using data. WCAI influences decision-making across many industries such as online technology, financial services, and nonprofits. As a research assistant at WCAI, you will release corporate datasets and publish their results. This will allow you to develop a working knowledge of R, SQL, and Amazon Web Services. You can find more information about WCAI here: <http://www.wharton.upenn.edu/wcai/>
2. *Jay H. Baker Retailing Center:* The Jay H. Baker Retailing Center links retail theory with practice by forming a partnership between researchers, educators, students, and global leaders in the retail industry. As a research assistant at the Baker Center, you will learn about strategic management, marketing, advertising, and statistical analysis. You can find more information about the Baker center here: <http://www.wharton.upenn.edu/bakerretail/>

### Management

Research in management involves applying social science disciplines to management and leadership problems in both the public and private sectors. Students will find that doing research in the management department will allow them to learn about a wide variety of subjects including change management, environmental management, and operations management. Students who are interested in management research should take MGMT 101 as soon as possible. As a management research assistant, it is likely that you will be analyzing corporate and business strategies, utilizing introductory management theories, and studying various management philosophies.





## BUSINESS

*Why Do Research in Management:* Doing research in Management can prepare students for a variety of roles, including management consulting, business development, and investment banking. As a business professional, conducting research using both primary and secondary sources are daily parts of the job. As a manager, you will have to collect data about the effectiveness of the organization and derive conclusions to inform further actions. This is very similar to the corporate and business strategies you will learn about and apply during the course of a research assistantship.

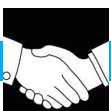
*How to Get Involved:* Prospective management research students should take the core classes as well as higher level management classes. We suggest discovering the particular types of management you would like to explore, such as strategic or environmental management, and then discussing your interests with professors.



## TAKEAWAYS

- *Applicable and Customizable Research Experience:* The applied nature of research in Wharton allows students to develop rigorous statistical and data parsing skills in the department of their choice. Since most research at Wharton does not require prerequisites, students are free to pursue research in subjects that interest them and receive most of their training on the job.
- *Building Your Network:* Professors in Wharton are generally eager to give opportunities to high-performing undergraduates. If you work hard, you will probably find that your research will be challenging as well as rewarding. Business research is especially applied and can offer students a unique opportunity to use theory learned in the classroom in real world scenarios. Most opportunities that business students pursue after graduation are research-heavy, including investment banking and management consulting roles. A research position is a great way to show future employers that you have the work ethic and skillset necessary to succeed in a data and information-driven job. Research is a way to get involved on campus that can also help you prepare for internships and future employment.

Wharton research is flexible and allows you to balance your varied research interests with coursework and other obligations. Commitment tends to depend on your schedule and dedication to the project. Wharton research is an excellent way to apply your theoretical knowledge and to build relationships with faculty.





## FIELD OF RESEARCH ENGINEERING



"Research is a competition; you learn things as fast as possible and apply other's discoveries in new ways and hopefully discover something brand new. You work with the smartest people and answer questions that really have no answer."

-Sasha Klebnikov, ENG '16  
on a research position in  
mechanical engineering

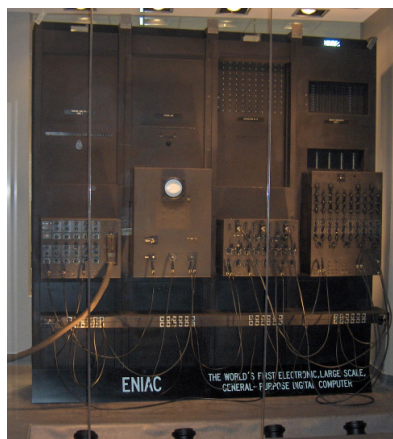


## WHY DO ENGINEERING RESEARCH

Research in engineering encompasses a variety of fields and skills. Penn Engineering research focuses on collaborative efforts among faculty and students in different laboratories and programs.

Engineering research provides students with valuable hands-on experience that allows them to take what they learn in the classroom to a new level. It also challenges students and equips them with skills that will serve well in whatever field they enter upon graduation.

“The process of this research involves both discovering biological phenomena and creating new tools that enable research”



## GETTING STARTED

1

### Check out this Website

The link provided below will take you to a page on the Penn Engineering website. There you will find a comprehensive list of the many acronyms used in engineering with their associated meanings. This list could prove very helpful for those still unfamiliar with some of the engineering jargon. <http://www.seas.upenn.edu/undergraduate/freshman/pennengineering-speak.php>

2

### Research Peer Advising

Research Peer Advising (RPA) has a website (<http://www.dolphin.upenn.edu/e-rpa/>) with a forum and research opportunity section. Check out this website to search per department or lab coordinator for centralized opportunities. SEAS RPAs also host panels and discussions with professors and other research advisors. Many SEAS RPAs will be able to help you by giving advice, sharing their experiences, and introducing you to any friends and classmates they have that might have experience related to your interests.



## GETTING STARTED

### 3

#### Send an Email

Many Penn Engineering professors are happy to talk to students about their research. Find faculty members whose expertise interest you and e-mail them Faculty Expertise Directory: <http://www.seas.upenn.edu/directory/departments.php>. For more information on how to send an email, see [Ramp Up to Research](#) in the Introduction.

### Centers and Institutes at Penn Engineering:

There are many laboratories and institutes within Penn Engineering that accept undergraduate student researchers. You do not need to have a specific major to get involved with a particular type of research; you can take elective courses to give you some background knowledge and entry-level skills. Think about where your interests and skill sets lie, and consider contacting professors who work in these labs about research.

1. Center for Engineering Cells and Regeneration (CECR): This center focuses on understanding how cells work and changing subcomponents of cells to change the cell function as well as how cells form tissue. Cell engineering, tissue engineering, and regenerative medicine are all areas where you can get involved. *Majors: BE, CBE*
2. Center for Human Modeling and Simulation (HMS): This center uses computer graphics modeling and animation techniques to work on animation of human movement (gesture, gait, facial expressions, etc). *Majors: CIS, DMD, Architecture, BE, ESE*
3. General Robotics, Automation, Sensing, and Perception (GRASP): This lab focuses on interdisciplinary robotics research, such as vision/perception, control, automation, and machine learning. *Majors: MEAM, CIS, ESE*
4. Institute for Medicine and Engineering (IME): This lab is focused on research combining biomedicine and engineering/physical/computational sciences with applications to biomedical engineering and clinical practice. *Majors: BE, CBE, CIS, MEAM, MSE*
5. Institute for Research in Cognitive Science (IRCS) : This institute focuses on the development of the human mind through linguistics, logic, philosophy, computer science, and neuroscience. *Majors: CIS, ESE, MEAM, BE*
6. Laboratory for Research on the Structure of Matter (LRSM): This lab focuses on collaborative efforts in materials research, such as the design, classification, and modeling of new classes of materials. *Majors: MSE, CBE, MEAM*
7. Nano/Bio Interface Center (NBIC): This center brings together engineering, natural sciences, and medicine to work on design of molecular function and nano-biotechnology. *Majors: MSE, BE, CBE*



## GETTING STARTED

8. Penn Center for Bioinformatics (PCBi): This center works on bioinformatics and computational biology, which deals with data analysis of research in genomics, molecular and cell biology, etc. All levels of information, including the genome sequence, the state of the cell, and the phenotype, are integrated at this center. *Majors: BE, CIS*
9. Penn Center for Molecular Discovery (PCMD): This center is interdisciplinary between medicine and engineering; it focuses on screening small molecules to determine whether they would make useful biologically effective agents. *Majors: BE, CBE*
10. Penn Center for Energy Innovation (Pennergy): This center focuses on efficient use of energy, sustainable energy, and energy conversion. Some research projects include work with solar cells, solid-oxide fuel cells, thermoelectrics, nanoscale electronics, mechanics, and photonics. *Majors: CBE, MEAM, MSE, ESE*
11. Penn Genome Frontiers Institute (PGFI): This institute is dedicated to genomics research across biology/microbiology, medicine, pharmacology, genetics, chemistry, and physics. *Majors: BE, MEAM, CBE, CIS*
12. Penn Research in Embedded Computing and Integrated Systems (PRECISE): This center works to integrate cyber-physical systems, embedded systems, control theory, etc. The research is being applied to medical devices, robotics, wireless sensors, and embedded software. *Majors: CIS, CMPE, ESE, NETS*
13. Penn Research in Machine Learning (PRiML): This center works on all aspects of machine learning and data analysis, including supervision, high-dimensional spaces, computation, and statistics. *Majors: CIS, ESE, CMPE*
14. Nano/Bio Interface Center (NBIC): This center brings together engineering, natural sciences, and medicine to work on design of molecular function and nano-biotechnology. *Majors: MSE, BE, CBE*
15. Penn Center for Bioinformatics (PCBi): This center works on bioinformatics and computational biology, which deals with data analysis of research in genomics, molecular and cell biology, etc. All levels of information, including the genome sequence, the state of the cell, and the phenotype are integrated at this center. *Majors: BE, CIS*



## ON-CAMPUS RESOURCES

### 1

#### Part-Time Research Opportunities

1. Volunteering: The best way to get started may be to offer your assistance as a volunteer. It can give you a taste of the culture of the lab and the kind of work you might be able to do if you get more involved. An engaged volunteer is often offered a paid position.
2. Work-Study: Many research centers and labs are looking for work-study research assistants. The best way to find opportunities in these areas is to use the work-study job directory and e-mail laboratory directors.
3. Non-Work-Study (paid): Many labs have sufficient funds to pay students who are work-study. Do not expect to be paid as soon as you start working in a lab. This is a position that is usually earned.
4. Independent Study: An independent study in a particular engineering department consists of an average of ten hours of research per week and fulfills a technical elective requirement. To pursue an independent study in engineering, contact your academic advisor or a professor in the department of your choice. Interested students must submit a thorough project proposal and some paperwork (found in Towne 109) to get the process started. This is a great alternative to getting paid to do research.





## ON-CAMPUS RESOURCES

### 3

#### Penn Engineering Research Programs the Summer

1. Rachleff Scholars: Engineering students can apply to the Rachleff Scholars Program during the spring of freshman year. Rachleff requires no prior experience. Rachleff Scholars take two half-credit modules in Sophomore Fall and Junior Fall (EAS 299), which bookend a one-credit independent study in Sophomore Spring and a ten-week independent summer research project. The independent project is funded by the Rachleff Scholars program. To apply, visit the Society website. A Rachleff application form can be picked up in the Academic Programs Office (APO) in Towne 109.
2. Littlejohn Fellows: This is open to rising sophomores, juniors, and seniors. Students receive \$4500 for a ten-week research period. Students must find a faculty advisor and choose a project. A resume, one-page proposal, and essay are all part of the application. The program lasts for one summer and does not have any academic credit associated. The following link will take you to the program application: <https://www.seas.upenn.edu/research/summer/little-john/application.php>.
3. SURE (Summer Undergraduate Research in Engineering): There are many programs housed within SURE for summer research on campus, such as Littlejohn Fellows, Summer Undergraduate Research Fellowship in Sensor Technologies (SUNFEST), etc. You can find all these opportunities and find applications here: <http://www.seas.upenn.edu/research/summer/index.php>.
4. iSURE (International Summer Undergraduate Research in Engineering): The Engineering School also offers a number of international summer opportunities for service learning, research, and research-based internships. These opportunities are much more open-ended than research at Penn and are a wonderful opportunity for those looking to go abroad. For details, visit <http://www.seas.upenn.edu/community/international-opps.php#summer>





## TAKEAWAYS

Penn engineering students go on to do work in a variety of fields. Your research experience can help give you an advantage in any number of paths that you choose to take after graduation. This is not an all-inclusive list, but here are some popular options.

- *Working in Industry:* Engineering research teaches students valuable technical skills that allow them to demonstrate competence and qualifications for many industry jobs. Research experience also provides students with plenty to talk about during job interviews: working in groups, meeting deadlines, overcoming obstacles, working on long-term projects, in addition to project content.
- *PhD Programs:* PhD programs involve extensive research leading up to a dissertation. Doing research in college can get this process started early and will certainly give students lots of details to include on their applications. Often, the professors, grad students, and post-docs in a lab will have connections at other institutions that may help undergraduates find the right program.
- *Medical School:* Research is very useful for pre-med engineers. Many engineering labs and labs in the medical school combine engineering skills with clinical aspects.
- *Law School:* Many engineering students attend law school to pursue patent law, a realm that requires a technical background. Research is a great resume-booster and gives students tools that are useful to have in law school: reading academic papers, critical thinking, and analysis.
- *Consulting:* Consultants need to know how to gather the right information, analyze data, and come to conclusions. Intellectual capability and the capacity to explore new ideas are attributes that consulting firms look for, and engineers with research experience are ideal candidates for these jobs. Effective communication, time management, teamwork skills, and critical thinking are essential to doing research as well as to being a successful consultant.



# Vignettes

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**Now that you know all about getting started in research and the resources available on campus, check out these stories about real students and their research experiences.**

## Social Sciences

Meggie McCarthy-Alfano

SAS Class of 2014  
Health and Societies Major

When I arrived at Penn, I had not the slightest clue that I wanted to do research. Through my courses, I became interested in Psychology and Health and Societies. I enjoyed learning, reading academic journal articles for class, and finding literature for papers, but I did not pursue research at Penn until my sophomore year, when I applied to CURF's Penn Undergraduate Research Mentoring program, or "PURM." Driven only by my academic interests and intellectual curiosity, I applied and received a position as a research assistant under the Director of Outcomes Research in HUP's Department of Surgery. Through PURM, I discovered a

new field that has shaped my interests (patient-centered outcomes research) and I assisted in multiple projects, including a comparative effectiveness study of alternative risk data presentations for physicians and a mentoring study among junior faculty at the nation's top ten medical schools. Moreover, I learned essential research skills, such as how to perform literature searches, conduct survey research, recruit participants, and prepare presentations.



As a Health and Societies major, I am keenly interested in societal mental health. During my junior year, I worked for one of my professors in her clinical psychology lab, where I assisted with an fMRI study of anxiety and depression. The knowledge and experience I gained proved invaluable in my current research. I developed an appreciation for the extensive planning, time, and detailed work a successful study entails. In the lab, I conducted participant interviews, ran experiments, and managed a participant database. I also collected and checked data using SPSS software. I enjoyed the communal atmosphere and meeting regularly for lab meetings. Importantly, I spent substantial time interacting with participants, which improved my communication skills.

Combining my interests in patient-centeredness and mental health with a fascination with medical anthropology, I am examining parents' treatment decisions for their children with autism spectrum disorders through the Center for Mental Health Policy and Services Research for my senior thesis. I could not conduct my own study without my experiences as a research assistant, including designing my own study instruments, applying to the Institutional Review Board, interviewing participants, and organizing my results. Through my research experiences, I not only have gained skills that will be essential in any job or field, but I have learned about myself, my interests, and what motivates me (perhaps more so than from my coursework). Research has provided me with an outlet to apply classroom knowledge as well as the opportunity to learn things that I cannot learn from a textbook. As a freshman, if someone told me that I would be involved in research at Penn, I would have laughed and asked "what's research?" Each individual's path to research is different – all equally interesting, and all wonderful. Best of luck in all of your endeavors at Penn – enjoy the ride!



## Life Sciences

Audrey Harnagel

SAS Class of 2016  
Biochemistry and  
Philosophy Major

I was skeptical about working at a bench in a biochemistry lab. I had heard my fair share of stories about tedious hours in the lab, overpowering PI's, and unfriendly graduate students. But I figured I might as well try it out. As a biochemistry major, I thought I should give research a chance. I did my homework: I spoke to upperclassmen about what makes for a good research experience and what to look for in a lab, and then did some digging to find lab groups that I was interested in. Finally I spoke with my department head, who put me in touch with a Principle Investigator in the medical school.

When I first began work I was intimidated. I didn't know what was going on. I barely understood my research project and I was clumsy and slow in the lab. The first few weeks I would leave the lab mentally exhausted and emotionally frustrated, feeling like a cog in the wheel.

Over the course of a few months my lab skills drastically improved. I scoured the primary literature to start building a knowledge base and vocabulary about my work. I started feeling more comfortable asking questions. It was a process; adapting to a new environment takes time, and the lab was a totally new to me. Now, more than a year later, I can look back with pride at all I have accomplished. I started from zero, with no previous research experience. Now, I am proficient in a number of relevant biochemistry techniques, working with cutting edge software, and collaborating with some of the most innovative experts in my field.

The mentorship I've received from my PI and lab supervisor has been especially key to my development. My PI is the man – he works with the UN, gives Ted talks, is an innovator in global health, practices medicine and still manages a premier research laboratory. Despite his overwhelming accomplishments, he is one of the most welcoming and approachable people I have met in the scientific community. My experience in the lab has opened my eyes to a vibrant, interconnected network that extends well beyond academia. I am considering many different options after Penn, including graduate programs in biochemistry—a path that I would not have seriously considered without participating in research as an undergraduate.

Research has become a defining aspect of my Penn experience. Through great mentorship I have taken ownership of my project, and now view my research as a source of pride and empowerment. To all of the research skeptics like me, I highly encourage you to try it. Don't go in blind, though. Find good people who will invest in you. Be patient with yourself, and don't expect to understand everything right away. You never know, it could change your undergraduate experience.



When I came to Penn, I was not even thinking about doing research as an undergraduate. However, I was very lucky to go out and try to get involved in undergraduate research because it has been a very rewarding experience for me. The way I found myself participating in Professor Srolovitz's Lab was by searching through physics and engineering professor websites and looking for interesting topics. It's important to search for something that is really thought-provoking for you and to skim some research papers to get a good feel for what a specific lab is all about.

Doing research in material science

has been a wonderful experience for me. Working as an undergraduate at the Penn Institute for Computational Sciences, I was able to develop and nourish my understanding of both math and physics. Research is a great way to develop very important skills, such as verbal and technical written communication, effective time management, scientific literacy, and, most importantly, creative problem solving. My research has been a great way for me to learn how to creatively come up with new ideas and contribute to the field. It has given me an opportunity to individually take charge of my learning and apply many abstract concepts from my classes to problems in the real world. It has allowed me to explore my own strengths and weaknesses in the fields that matter to me. Research is a great way to personally develop and nourish an interest in a specific interest or explore the type of things that one could potentially do after graduation. Another important result from doing research as an undergraduate for me was improving my coding skills with Matlab, Mathematica, and, most importantly, C++. Such skills open many doors for potential future endeavors.

At Penn there are many great opportunities for doing exciting research in fields that really interest you. It is important to keep trying, even if the first or second professor you email doesn't respond, as Penn professors are often very busy and scheduling appointments or visiting during office hours is a great way to get your foot in the door. As I plan to do graduate studies in either Physics or Applied Mathematics, I think the unique experience I have had doing research gives me a definitive advantage and has really helped me learn what sort of things are interesting for me to look at in the future. It has given me a lot of room for personal growth and I have had a great deal of fun in the process.

## Physical Sciences

**Hannes Leipold**

SAS Class of 2016  
Physics; Math; Logic,  
Computation, and Information  
Major



## Humanities

Alicia DeMaio

SAS Class of 2014  
History Major

I love the smell of 200-year-old ink and paper in the morning. I love seeing the remnants of wax seals on woven linen paper. I love feeling the original board of a book in between my hands. These objects—books, papers, occasionally objects, a house if I’m lucky—are the only tangible items that connect me to the people of the past, the foreign country called “early America” that I enjoy spending time in. With a love like that, how could I not be interested in research?

Sometimes, it’s not all as glamorous as what I’ve described—sometimes you have to pour through census records,

or ancestry.com entries, or books of laws, or records of congressional debates, and you are so bored you’re ready to throw your laptop and all your notes out the window. Sometimes, your research hits a wall—a footnote pointing you to a source proves fruitless, a valiant Google search ends in failure. But the love of the hunt is what kept me going, the desire to know all I could know, to understand the people who lived before me and what they thought about the country they created for me. If I understood their thoughts, I could better understand the world I interact with every day.

My research at Penn started in the most unglamorous way possible—pouring over reels of difficult-to-read microfilm containing the annotated newspapers of Boston shopkeeper Harbottle Dorr, who recorded his thoughts about current events during the fomenting of the American Revolution, from 1765 to 1776. A trip to Boston allowed me to finally see the newspapers I had worked with for so long, touch the tiny handwriting of the person I had lived with for the second semester of my freshman year and the summer after freshman year had finished. The Massachusetts Historical Society has now digitized Dorr’s newspapers, making them more accessible (and far more readable!) to future researchers. I couldn’t be more thrilled. It was a wonderful first research experience—it provided me an opportunity to visit archives and delve into original material. It also gave me the confidence to know that I could pursue my own independent project. I turned instead to historical interests that had resided in my brain since before I got to Penn—politics in the early American republic, the national





culture that was beginning to blossom with these American political movements, and the Lewis and Clark Expedition. But how to blend all of these interests? And wasn't the Lewis and Clark Expedition so over-researched? What could possibly be left for me, a lowly Penn undergraduate, to say?

To find out, I read and read and read, as much as I could about Lewis and Clark, and sure enough, I found something that hadn't been addressed to my satisfaction. Most books about the expedition focus on what happened out west. But nobody talks about what happened when they came back—what did Americans say? What did they think about what Lewis and Clark had achieved? What did it mean to them and to their young country?

These are the questions my honors thesis in history set out to answer. Though the general perspective of Americans is difficult to ascertain in the early nineteenth century, since white men left most written records. However, these written responses to the Lewis and Clark expedition—which appeared in books, letters, newspapers, and congressional debates—do indicate that Lewis and Clark's venture was used as part of the creation of America's national identity, an identity that was constantly changing with the western expansion of the United States.

My favorite thing about doing historical research is being able to contribute to the discipline that I so dearly love. One of the first things you learn as a history major at Penn is that the record of the past created by historians is not one made up of black and white facts, but of interpretations made by historians that puzzle out the meanings and contexts of these facts. Two historians can read the same sources and have radically different interpretations, and that's what makes the field so fascinating. For historians, the past is not dead at all—it is a living, breathing thing that constantly changes as we gain more knowledge. Because of my research experience at Penn, I decided that my passion for academic history was too great to be relegated to a side interest in my life. Therefore, I will be pursuing graduate studies in history next year at a school unknown to me as of right now. I know that no matter where I end up, I will always be thankful to Penn for providing me the opportunity to do research in the humanities. You'll never know if you like something until you try it—and once you try it, you may never want to go back. I know I didn't.



**Nursing****Tara Fernandez**

Nursing Class of 2015

Research was an abstract entity to me when I started college. I always assumed that it came in the form of test tubes and microscopes. My perception transitioned into the realization that research was not just the bench work I experienced in the lab during my freshman biology course. Instead, I learned research could be an inquiry from any discipline looking for a conclusion. My interest for research really developed when I began taking courses beyond the core science classes. These classes were able to frame research in a new, interesting way. Topics in lecture such as racial disparities in health care, rising costs in the America's

health system, and health status of people with insurance versus no insurance ignited the turning gears in my head. These topics, and many more, surfaced and left me intrigued, wanting more answers to as to why these things were the way they were. The research articles assigned to me as homework were giving me the information I wanted, but left me on end product side of the research process. I began picturing myself contributing to the research field, wanting to be on the opposite, beginning side of the research process. I began actively seeking out a research assistant position my sophomore year and I knew I wanted it to relate to my interest in healthcare. I eventually began working for the Robert Wood Johnson Scholar program. This experience continued to fuel my interest for looking at the relationships between healthcare and society.

Yet, it wasn't till I started exploring my options for summer was when I stumbled across the versatile field of health services research. I applied and was accepted into the Summer Undergraduate Minority Research Scholar Program sponsored by the Leonard Davis Institute of Health Economics. I was given the opportunity to participate as a research assistant for two projects over the summer. The first was a project under the guidance of Therese Richmond, PhD, CRNP, FAAN from the School of Nursing. This particular project was looking at how urban black males emotionally respond to acute trauma injury. One of the project's focus includes screening for participants who are potentially at high risk for developing psychological consequences after injury such as depression and posttraumatic disorder. The second project I worked on was on under the mentorship of Rinad Beidas, PhD of the Department of Psychiatry of Perelman School of Medicine. This project, Policy to Implementation, is evaluating the impact of policy mandate on the implementation of evidence based practice into public mental health facilities. More specifically, it's



evaluating the internal structure of leadership and organizational variables that may facilitate or barricade the adoption of evidence based practices; practices that have shown to be efficacious and produce favorable outcomes. I enjoyed my summer experiences so much that I continued working for both projects and plan to contribute more to their development in the future.

A day in the life of a nursing research assistant includes an array of tasks. Sometimes my day begins by entering data into the database from the participants enrolled during the week. This creates the foundation for which results will come from to help materialize our conclusions. Other days, I spend my time listening to recordings of participants' testimonies and experiences and transcribe the conversation manually. Although transcribing can be difficult at times, it is one of my favorite duties because some of the questions are very open ended and it really gives a chance for our participants to open up. During these encounters, a lot of interesting perspectives and emotionally charged topics surface. On a busy week, I get the opportunity to take a trip to the hospital and interview participants who are admitted for traumatic injuries. I spend about forty-five minutes with them asking them lots of different questions about their injury and their experience. It allows for a nice balance between interacting with an individual versus a computer. Not to mention, occasionally I accompany my supervisor on home visits for our follow up portion of the project. We travel into the community to interview these participants to evaluate their recovery.

Entering the world of research has allowed me to explore a more scholarly approach to learning. Seeking evidence to feed my curiosity and learning how to extrapolate data is an exciting process. The newfound skills of collecting data, organizing, restructuring project logistics, and analyzing are skills that allow me to think about the world in a new way. Not to mention, the relationship forged between my mentors have been phenomenal. Their guidance has helped me take on new responsibilities and further develop new skills to help become more conscious of how systems work and come into play with one another. Their knowledge and expertise are grand resources to help work out the intricate details whenever problems manifest and are constant motivators for me to achieve the most I can.

The research I'm doing now is such inspiration and has set up the foundation for my own future inquiries. Although my future after Penn isn't set in stone, I know that I will want to incorporate research into my career. As a future health practitioner, I am certain that I will encounter certain discrepancies that do not have explanations. I will want to dig deeper to reach their understanding, and hopefully be able to progress our healthcare system for the future by finding solutions to problems.



**Business****Peter Jeffrey**Wharton Class of 2016  
Finance concentration

The path leading me to the engaging research communities at Penn and Wharton started my freshman year and began with rejection and disappointment. Like every freshman, I tried applying to the various clubs that were offered and was unfortunately rejected from many I attempted to join. Frustrated, I tried to look for other ways to engage in my interests and stumbled upon an online CURF listing seeking a research assistant for a Wharton Ph.D. student analyzing education issues in the Business Economics and Public Policy department. I emailed the Ph.D. and met up with him the next day, when he hired me to collect

data and background information on teacher compensation preferences. Like everything here at Penn, this great opportunity was also a door for additional opportunities. Since I was working with the BEPP department, I began hearing a lot about the then recently launched Penn Wharton Public Policy Initiative. Interested in this, I applied and was accepted to work as a PPI economic indicator blogger the second semester of my freshman year.

I spent the semester blogging about economic indicators that were released by the Treasury and Federal Reserve, while also keeping up on the research assistantship from the previous semester. That summer, I worked with PPI, working in the newly launched Washington D.C. office. During my internship I was assigned with researching and writing memos on pertinent policy topics. Additionally, I focused a large portion of my internship to assisting Professor Mark Duggan on his Congressional Testimony to the House Subcommittee on Social Security. I did background research on recent facts and figures presented in his testimony, which was a very cool way to engage in academic research on the frontlines of policymaking.

My sophomore year I kept up with my involvement in research communities as a member of the Wharton Undergraduate Research Board, which I currently co-chair. WURB works on initiatives to expand research opportunities and cultivate an academic environment for intellectual curiosity at Wharton. This past summer, I had the honor to pilot one of the new initiatives—the Global Research Internship Program (GRIP). GRIP funds students to work as a research assistant for a university or think tank abroad. I spent my summer in the beautiful city of London, where I worked for three professors in the Economic Geography Department of the London School of Economics. I worked on a project that looked at both historic patterns and current trends in



the growth of over 100 cities in an effort to predict the future prime economic locations. While interning, I learned valuable skills like STATA and ArcGIS that will help me as I look to do my own independent research throughout the rest of my time at Penn.

How do glasses break? Interviewing for my position as a student researcher, I had no idea that this four word question would come to dominate my life. I am a Mechanical Engineer, and Dr. Daniel Gianola saw a space for me in his lab. During the spring semester, an Independent Study program let me become better acclimatized with the field, while over the summer, I devoted every day to work. It was confusing. It was frustrating. It was wonderful.

Research is a competition; you learn things as fast as possible and apply other's discoveries in new ways and hopefully discover something brand new. You work with the smartest people and answer questions that really have no answer. I would work from 10 in the morning to 9 or later many nights, as I tried to finish that last bit of code or to figure out exactly what a specific formula did.

My work was looking at colloidal pillars - balls of plastic, which are great proxies for atoms - and trying to find a way to understand how and why they splinter into pieces. To do this, Dr. Gianola asked me to investigate how other past groups had tracked every single particle (tens of thousands of them) and to reconstruct those techniques. It involved learning the physics of how spheres move past each other, the math behind signal processing, and hours and hours of Matlab coding.

My research has made me a more well rounded person. It complements my Mechanical Engineering curricula, while offering insights into new fields. The confidence I gained - knowing I can enter an alien field and start to contribute - has given me great confidence looking towards careers and internships. I am now part of a new world of professors and PhDs, attending several seminars a week (all with free food). By doing research, I have learned vital skills such as programming, collaboration, and how to stay completely silent while genius professors discuss the great questions of the universe. However, soft skills like learning how to break down convoluted primary sources, honing my writing skills, and improving time management all are worth it.

## Engineering

Sasha Klebnikov

Engineering Class of 2016  
Mechanical Engineering  
major

