We’re not talking about how to write a paper with documentation or how to publish a journal article during your freshman year. Instead, we’re talking about learning how to explore some of the most intriguing questions in your major field.
**Why Should I Read This Chapter?**

- You have no interest in research, or don’t think it has anything to do with your future.
- Or you are very interested, and have already talked to a professor about doing research.
- Or you have heard that doing research is a good idea, and aren’t sure where you fit in.
- Or you haven’t settled on a major, or might switch to a major in which you think research is or isn’t important.
- Or you want to know how to get started finding out what’s right for you.

**Why Should I Care About Doing Research as an Undergraduate?**

If there were no other reason, improving your grades and getting excellent letters of recommendation would be enough. In fact, the reasons behind these reasons run deep and long.

You’ll understand the material in your classes better because you’ll be applying what you know. And you’ll remember the basics better for your entire career, because you’ll associate what you have learned in the classroom with a long process of hands-on practice and active observation. Even though beginning researchers frequently begin with a seemingly menial task—checking references, repeating a procedure—the gradual process of building up a body of knowledge gives you a real connection to how principles in your field are developed. You start seeing connections.

The faculty who are enthusiastic about working with undergraduate researchers do so because they believe in you. Their motivation to work with you derives from the very reason they became educators: at some level, the idea of questioning and building up a body of knowledge is tremendously exciting to them. Through research, a professor can learn about your dependability, curiosity, and other qualities that make you the kind of person employers and grad schools want. As a result, the professors who mentor you in undergraduate research not only remember you when scholarships and other perks come along, but they can also write letters of recommendation that stand out: it will be obvious that this isn’t just another string of superlatives about just another good student.

Doing research will also make your university education make sense in a larger way. It is your entrance into the field of your choice, but also into the field of the unknown and the possible. It improves your life because research makes you part of the leading edge, where ideas are tested and where you have the possibility of contributing. This is as true for those studying theater history as it is for those studying nanotechnology.

In many professional fields, it’s now commonplace for top job candidates and competitive grad school applicants to have undergraduate research experience. The question is becoming “What did you do in your undergraduate research?”

**Yes, But Nobody Does Research in My Department**

You’d be surprised. While artists may conceive of research in a different context than the scientist or the historian, no field is without research. Tenure-track professors (and many who are not tenure-track) are required to demonstrate a certain level of proficiency that is not always obvious when you take a basic-level course from them. You might not know, for example, that Dr. Maladiedu Chat wrote a dissertation on feline leukemia in 19th-century New England, because the courses she teaches at Tech are in general zoology and immunology. Also, some departments
simply have a higher profile for research: they might have more photos on the website, or more grants, or more pressure to perform research in order to be promoted. But if your department doesn’t make it well known, that does not mean that there are no researchers—nor does it mean that you can’t find a talented research mentor.

Knowing now how the REU process works, I should have done a couple of applications as a freshman, simply to get myself accustomed to how to fill out the forms, how to ask professors for letters, and how to have realistic expectations about deadlines and response times. Waiting for responses is nerve wracking. Some programs don’t even bother to let you know if they don’t accept you, which is why it’s important to apply to as many as you can as early as possible. One program didn’t send me a rejection until I was already halfway through a program that did accept me.

As far as actual program content goes, experiences vary wildly. I’ve talked to many students about their REU experiences, at TTU and at other universities through REU, and most agree that that they weren’t told much about the research they were going to do until they started doing it. Students are generally paired with an advisor who is doing a research project funded by the National Science Foundation (NSF, the sponsor of REU). Sometimes there is more than one student and advisor involved. Many schools use REU as a graduate student recruiting mechanism, so you might also be able to attend a few seminars about applying to grad school while you’re there.

My first REU experience was a lot of fun. I went to the University of Nebraska at Lincoln. Their program was more than 70 students strong, but only ten of us were doing physics. We were working with lots of students who specialized in nanotechnology and virology. My project was to develop educational tools for mobile devices, which can run on any smartphone, tablet, or computer. I had to use my skills in programming and my knowledge of astronomy. The second program I participated in was studying heliophysics at the University of Alabama in Huntsville. My task was to download sets of images of x-ray jets coming out of the poles of the sun, compile the images into movies, and characterize the differences between the jets.

It’s hard to summarize 20 weeks of research and countless hours of writing applications, but if you want to have this experience for yourself, more information can be found at http://www.nsf.gov/crssprgm/reu/.
Some Examples: Real Tech Honors Get Started

I was talking to an Honors student last year who thought there were no research opportunities in his major. So I asked him what courses he’d taken last semester, and if he’d written any papers that he liked. It turned out that he’d done a major research paper using leading-edge theory and methodology, but he didn’t know that; all he knew was that it was an interesting subject, and the professor gave him an A. When I asked whether he would like to work with that professor again, he said he would, but he wasn’t sure that his curriculum would allow time for that. With a few basic guidelines, he was able to go back to the teacher, and talk about the possibility of being a research assistant. The professor, being familiar with the quality of his work and communication style, gratefully put him to work reading and commenting on some articles she was preparing for publication. She also helped him find a conference that accepts student participants, so that he could submit the paper he wrote in her class. The professor hadn’t worked with an undergraduate researcher in the past, but she realized that she did not want to pass up this opportunity to mentor a highly motivated student.

Another student heard me talking about how doing research was important, but she had never thought about doing it herself. She couldn’t find any other students in her department who did it, and was alarmed to find that some didn’t even seem to grasp the concept. When she started asking faculty, she was initially disappointed by a lack of responses, perhaps because they, too, weren’t unaccustomed to this possibility. It was, for them, a new question that they wanted to answer carefully. The student kept asking, and eventually she found a solid mentor through sheer persistence and politeness, positive willingness. She’s told other students in her department about her work, how satisfying it is, and how she was able to garner a competitive internship as a result. Now they want to do research, too. This student has really accomplished something: she’s quietly helped her department take its first steps toward creating a culture of research—meaning that the notion of undergraduate involvement with faculty projects is becoming normalized, rather than an unusual occurrence. Everyone benefits.

Some Ways to Get Started on Research Through Honors

• Starting this year, Honors is hosting a series of workshops on topics related to undergraduate research. Watch for announcements!
• HPEO: Use your research or work units to get started finding a mentor.
• Honors Contracts: Design a project that lets you start to explore an area that fascinates you, meanwhile developing a working relationship with the professor who teaches the class.
• Honors Directed Studies: Plan at least one semester in advance for a semester-long independent study.
• Honors Colloquia: If your colloquium has a research requirement, you might be able to devise a topic that creates a bridge to your major. This requires lots of advance planning and permission of the instructor.
• Tailored advising: Not sure where to begin? Make an appointment with Dr. Barnes to brainstorm and plan for an approach that fits your individual situation. Your Big Sibs, Honors 1010 peer mentors, and of course, your Honors 1010 faculty are also supportive grapevines that yield tons of collective experience.
• The Tennessee Collegiate Honors Conference (TCHC) will be held at Tech in February 2013, providing a convenient and friendly first experience for presenting your research.
• The Everett G. and Amanda B. Roettger Distinguished Undergraduate Scholarship and Research Award is offered annually for outstanding research by an Honors Program student for a Directed Study or Honors Thesis. Eligible students can apply for this $500 award in the spring of each year. See http://www.tntech.edu/honors/roettger/ for details.
Essential Traits of the Beginning Researcher

- The desire to get in there and learn procedures, standards, and basics, even if they’re not flashy
- Initiative: don’t stand around waiting to be spoon-fed
- Humility: balance initiative with an understanding that there’s a lot you don’t know
- Willingness to ask questions: never pretend that you understand when you don’t
- Responsibility: show up and follow protocol, and carry your own weight
- The ability to admit mistakes: your mentor would rather know!
- Understanding that the research is not about you: this is an apprenticeship
- A team sensibility: whether you’re working somewhat independently, or with a group of others, you are responsible for thinking about how your actions and the quality of your work relates to others who are exploring similar questions, and that it’s not a competition
- Communicating with and actively listening to your research team, clearly and precisely
- Committing to learning about cutting-edge journals, researchers, and institutions beyond what is readily available
- A vital sense of curiosity

And If You Don’t Have All These Traits Yet…

Strive for them. Try to do something practical every day that helps you cultivate one of these traits. For instance, if you fear admitting that you’ve made an error, let yourself practice. Say to your boss, “I think I made a mistake when I transferred the furry calibrator to the low-intensity heat muzzler.” Your boss will probably just ask why you think so. You’ll find yourself in a professional conversation: experts talk about their mistakes all the time, and they know that this is a part of the research experience—sometimes in a productive way.

The Research Jump-Start Approach

You might also need some more time to build up your curiosity and excitement. The following steps are designed to introduce you to the more exciting work that researchers are doing in your field. In fact, you might find a sympathetic faculty mentor—a kind of proto-mentor, really—who is willing to advise you as you go through this process.

1. Make an annotated list of leading journals in your field. Find at least three peer-reviewed scholarly periodicals in your intended field that are highly regarded by professionals for publishing leading-edge research. Write down the full name of journal, editor(s), the organization that publishes it, and the URL of their website if applicable. For each journal, write a sentence or two describing in your own words the scope of the publication: who publishes their work in it, the area(s) of specialization it covers, and other distinguishing features. Take this list with you when you do the next step.

2. Make a list of Tech faculty who are active researchers in your area(s) of research interest. What are their areas of specialization, and what opportunities exist for student researchers to work with them? Some may be in departments other than your own. This means taking the initiative to find them by asking students and faculty for suggestions, as well as using the Tech website and other resources.

3. Make a list of outstanding national and international researchers currently working in your field. This isn’t as hard as you might think, once you know where to look. As you browse the journals you’ve discovered, notice the names that appear repeatedly in the citations. When you start talking to professors who are active researchers, they
might give you some leads, based on the scholars who have been most influential to them. This should be a list of contemporary (or recently deceased) leaders in the field, though: the list should not include long-dead scholars whose work, though crucial, is not viewed as the latest thing. What are these researchers known for, specifically, and where do they work?

4. Where is some of the most exciting research being conducted? Do not consult pop-culture sources such as *U.S. News and Report*. Instead, consult the resources you’ve developed in the three steps above. If you’re a pre-med, look at this question in terms of a specialization you might want to pursue, such as pediatric oncology. Even if you’re not that certain of your future focus, find one that sparks your passions for going into your major in the first place.

5. Start investigating some major internships, research opportunities, and awards for undergraduates in your intended field. Learn about some national and international programs that undergraduates or graduating seniors can pursue in your field. Make a list of the requirements and qualities you need to start cultivating for yourself in order to become a viable applicant.

6. Reflect on your sense of service and values. In the third class session of Honors 1010, all Honors students enter an important discussion: how to articulate and
balance one’s values in a complicated world. Apply this to your career aspirations and your intellectual passions. What can you do as a researcher that will help others? This isn’t just an invitation to cure cancer. One music performance major did research through an Honors Contract to relieve chronic back and neck injury among flute players. If you consider the positive impact of music in the lives of people around the world, it’s easy to understand why gifted musicians need this kind of knowledge. Many mechanical engineering students have taken part in Dr. Steve Canfield’s design projects, helping physically challenged children by creating adaptive mechanisms that let them feed themselves, play games, and ride bikes.

7. **Commit to reading at least one article in a professionally vetted journal in your field every semester.** At first, there’s a lot you won’t understand. Make a list of questions, and read through it again over break. When you’re ready, find a faculty member with whom you’ll feel comfortable discussing the reading.

8. **Develop a realistic plan.** Draft a plan for getting started on your undergrad research. Everyone does this at a different rate, but if you’re faithfully learning about your field and working on the desirable traits of a researcher described here, you’ll be doing your best to be proactive and ready for research.

**Will You Be My Research Mentor?**

There’s not a template for asking. You can’t expect to just show up in a professor’s office and pop the question, though, since you would be asking a stranger to invest huge amounts of time, trust, and mental effort. Use the steps in this chapter to lay a groundwork. When the right time comes, professors might even ask you. And of course, doing very well in someone’s class doesn’t hurt. If you’re turned down, realize that it’s not the right match, and move on. As with research itself, the process is everything.