How do I do research?
A short introduction to academic science

High school students ask important scientific questions every day: how chromosomes separate when a cell divides? What keeps atomic nuclei from flying apart? How can we see inside living people? What is past the edge of the Universe? As it turns out, all of these (and more) are areas of investigation in laboratories across the world.

As a young student, I asked these questions, and I was unsatisfied by the answers I got from teachers. Usually, I assumed this to be the teacher's fault. I was mostly wrong about that: it turns out that many of the fundamental questions about our universe remain mysterious. In other cases, I desperately wanted to find the answers myself. But, except for the internet and the library, I had no idea where to begin. Here, I will start to answer that question – years too late for me, but hopefully just in time for you.

Academic research, where most basic science happens, is organized into research groups. These are sometimes called labs (especially for biologists, chemists, and applied physicists). These groups focus on questions, just like the ones listed above. Sometimes, they focus on ideas, like making a better cancer drug or building a special kind of laser.

At the helm of every research group is almost always a professor. This person brings in the money to do the experiments and has the final word on who comes to work in the group. Additionally, this person gets to decide on long-term research goals. Most academic departments list their professors (called the faculty) online, along with a short description of their research interests and contact information.

While the professor is off trying to get funding and giving talks, graduate students, post-doctoral fellows, and assistants are the people doing experiments. Graduate students have finished college and are working towards Ph.D. or Masters degrees (in most cases). Despite being called students, they teach and work in the lab more than they do coursework. Post-doctoral fellows are students who have finished their graduate work. These people concentrate full-time on research. An assistant is a catchall term for an employee of the professor not fitting into either of the other two categories. Many groups also support undergraduate research projects.

You may be wondering how this answers the question, "How do I do research?" Science is almost never a solitary activity. It requires communication of results and exciting ideas, so you will require the company of other smart people as you begin on your path as a young investigator. Knowing who the scientists are and how they organize themselves will be a big help.

There is still something missing: your question. Don't worry. For now, this can be pretty vague. Then, like any scientist, you have to do some reading. Stay away from jargon and confusion, and see how much you can make sense of what you have. Next, think about what you have read. Let your curiosity run wild! Formulate new questions, and keep reading to answer your questions. If you are still interested (or maybe even more interested!), then it's time to ask a professor for their opinion.

Use the contact information online and send an email or write a letter. Many of these people get hundreds of communications every day, but probably none from excited high school students with an interest in their field. You may be surprised to get a nice response with an idea for some experiments. Now you're doing exciting research!

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