UTK Chem Students!

Have you ever had these questions cross your minds?

- Can I do research as an undergrad?
- Can I publish a paper as an undergrad?
- I plan to go to grad school after this, what should I do?
- I want to work with Professor XX, can I?
- I am interested in research; do you think I will have enough time to do it?
- I really want to do some serious experiments, not just canned labs from the class manual. How can I get to do this? Where can I get information about real research?
- What does a chemist really do?
- What can I do with all the stuff I learned here?
- How does chemistry affect my life, anyway?
- That instrument looks cool. Could I ever get to use it?
- This stuff in my chemistry book gets to be boring when all you do is sit and read about things. Is there a way I can actually see chemistry “in action”?
- I just saw the last episode of CSI. That stuff looks so cool but it’s probably just stories made for TV. Are they?

Here are a few answers to such questions

**Undergraduate Research**

- What is research?
  Research in chemistry is the investigation of matter; how it’s made, how we characterize matter and the interesting properties and reactivity matter and molecules exhibit.
- Is research the same as all the other classes I take in chemistry?
  No, research much more open ended than classwork. Usually there are no textbook answers to the questions that research focuses on. You, your lab mates and your professor have to figure out the answers and the right questions to ask. In research you begin applying what you learned in your classes to “real problems”
- Can I get credits for undergraduate research?
Yes, but not an “infinite” amount of credit. You can take one of three courses and get credit: C200 (undergrad research for any level student; P/F, 1 credit, does not count to major or minor in chemistry), C400 (senior research class; 3 credit/ Grade; research reports) and C408 (honors research in chemistry; 3 credit; honor thesis). Up to 6 credit hours of either C400 and C408 can be taken and applied to your chemistry major in the “10 additional hours of chemistry” major requirement.

- How much time would it take?
  As much as you want – the more time you’re willing to put into research, the more that you will get out of it. At the same time, scheduling time for research is more flexible. You can schedule time in the lab around your other commitments – as long as you do it safely.

- What would I get by doing research?
  ✓ Class credits
  ✓ Real experience state-of-the-art instrumentation and techniques in chemistry (NMR, IR, Raman, UV/vis, X-ray spectrometers for example)
  ✓ Real experience in running reactions: how to prepare and handle air sensitive materials, distillation, recrystallization and chromatographic purification of samples, characterization of products and reactants.
  ✓ Direct interaction with faculty and grad students
  ✓ Preparation for grad school
  ✓ Publications
  ✓ On top of all this, it’s a lot of fun!

**How can I get involved with an undergraduate research?**

Go to this web site to view the procedure:

http://www.chem.utk.edu/undergrad/research.html

Or use your smartphone to scan the QR code shown here.
Undergraduate research opportunities in chemistry  
C200, C400, C408 and paid research assistant opportunities

There are two types of courses that undergraduate students may take that allows them to join active research groups in the department and both learn about and help conduct original research in a wide variety of research areas. One of the first things that you will probably want to do as you consider spending some quality time in the lab is look at the web pages of different faculty members in the department – that’s where you’ll get an idea of what each professor focusses on in his research program.

Chemistry 200 and Chemistry 400 or 408 are classes which give you the opportunity to do research in a working research lab under the supervision of a faculty member in the Chemistry Department. The Department of Chemistry offers these courses year-round to allow each student to fit undergraduate research into their academic plan. Registering for Chemistry 200 and 400 requires departmental approval and selection of a research advisor (a faculty member). So the first step in getting into undergraduate research is to find an area that sounds interesting to you and go and talk to the professor. There are two questions to be answer initially:

- What are the focusses of your research program and
- Would you allow me to join your research program as an undergraduate student?

Chem 200 (1 hour/sem) is the class that you will sign up for when you are not a senior. It will not count toward your major and can only count up to X credit hours toward your general graduation credit hour requirement. Getting more units is usually this is not the reason you are looking at getting into research.

Chem 400 is Senior research and Chem 408 is Honors Senior research. Each is a 3 hour/sem course and each may be taken when you have reached senior status and can be taken for 2 semesters. Up to XX units of C400-408 can count toward your required 10 units of chemistry major elective hours. If you plan to get an honor’s degree in chemistry (or any other honor’s degree) you should definitely think about C408. Beyond that there is little actual difference between what you do in C400 or C408 – both put you in the lab doing research. Both C400 and
C408 are graded courses that require a final report or thesis to be submitted to your research advisor. If you are doing thesis research you must also present a summary of your research results to a committee of faculty and defend it to them orally.

Finally, there are some opportunities to conduct research on a paid, lab technician basis. You cannot simultaneously be paid to do experiments in a research lab and get university credit for the work. Opportunities to work as a paid undergraduate research assistant depend totally on funding that an individual professor has available as a part of their research program. Interested students need to apply directly to faculty for such positions.

Finally, here are the thoughts of some recent and current undergraduate students involved in undergraduate research in the chemistry department.

**Here’s what some recent students have said about their undergraduate research experiences**

**James Humble, Class of 2011**

I can honestly say that the most valuable part of my entire college education has been the time that I have spent performing independent research in Dr. Barnes’ research group. During the time that I spent working on my projects, I traveled with the group up to the National Synchrotron Light Source (Brookhaven National Laboratories, NY) to collect data on the titanium catalysts that I prepared. I also presented my research at the Southeast Regional meeting of the ACS. I learned more by doing research than I have in any of the formal classes I have taken, and I strongly recommend all chemistry majors try to sign up for at least two years of research as part of their training. I came to UT without any plans of pursuing a career in chemistry, but I ended up being torn between following my childhood dreams of becoming a
doctor and my new dream of being a chemist. This would never have happened had I not spent time learning how fascinating independent research could be. Although I ended up deciding on a career in medicine, I know that I would have been equally happy either way.

James Humble

Andrew Moss, Class of 2014:

When I first came to UT in the Fall of 2010, I heard about participating in undergraduate research through the Chancellor's Honors Program, in which I am a member. I wasn't really sure exactly what it entailed, but I wanted to get involved. I knew I wanted to major in chemistry, so I began reading about different professors' research to see what interested me. Dr. Baker's research sounded very interesting, so I emailed him and met with him to discuss possibly working in his lab. It went well and I began working in his lab my first semester. It was a bit overwhelming at first as a freshman, but I was able to work with another undergrad from whom I learned about the project I would be working on. By spring semester, I had really begun to enjoy the research, and I applied for and received a Summer Research Grant through UT. I have continued to work in the lab since last summer and will once again be working this summer through the grant. The project I have been working on is still in progress, but below are some of the activities and honors I have been involved in for research:

Poster presentation; National Collegiate Research Conference at Harvard University (Jan. 2012)

Oral presentation; Annual Undergraduate Research Conference at the University of Memphis (Feb. 2012)
Poster presentation; Exhibition of Undergraduate Research and Creative Achievement (EURECA) at the University of Tennessee (March 2012); Award recipient at EURECA
Oral Presentation at Honors Symposium at the University of Tennessee (March 2012)

To sum up, my undergraduate research experience has been one the highlights of my undergraduate career thus far. It has given me the opportunity to work closely with a faculty member (Dr. Baker), and allowed me to apply the skills I learn in the classroom in a real world setting. This has helped me develop independence in furthering my academic achievement.

Andrew Moss

Britta Johnson, Class of 2011

I have been working as an undergraduate research assistant for three years in Dr. Hinde’s computational/theoretical chemistry lab. I took Honors General Chemistry my freshman year, and my professor recommended that I look into doing research with a faculty member here. He gave me some names of professors who were looking for undergraduate researchers. One of those professors was Dr. Hinde. His research was very different from what I expected because he does computational/theoretical chemistry research. Since I was also majoring in mathematics, I was extremely interested in his research since it combined chemistry, mathematics, and even a little physics and computer science. I began working as a full-time research assistant in his lab the summer after my freshman year. (I was supported by the Office of Research and Chancellors Honor Program Summer Research Grant). I enjoyed the research so much that I continued to work in his lab for the rest of my time at UT. While I had always thought about possibly getting some experience in a “wet” chemistry lab, I never wanted to stop working on the project in Dr. Hinde’s lab. During my junior year, we published an article in which I was first author entitled “A pairwise additive model for the He-MgO(100) interaction” in the Journal of Physical Chemistry. I eventually changed my major to College Scholars so that I could integrate more math and physics classes into my chemistry curriculum as well as devote
more time to research. My emphasis is entitled Mathematical and Chemical Physics. I’ve presented my research at two of the Honors Symposium here at UT as well as participated in EUReCA (Exhibition for Undergraduate Research and Creative Achievement). I have enjoyed my research so much that I’ve decided to attend the University of Wisconsin-Madison next year to start work on my PhD in Physical Chemistry. I hope to continue to work in a theoretical lab there as well. Doing research was probably the most influential experience I had as an undergraduate here at UT.

Britta Johnson

**Desta Bume, 2009 Haslam Scholar. Class of 2014**

While I was in high school, I always wanted to do research but my desires were constrained by lack of resources for undergraduate research in Hawassa University in Southern Ethiopia. When I got the opportunity to come and study at University of Tennessee Knoxville, I started thinking my dream of conducting the undergraduate research was coming true. After a busy freshmen Spring semester, I learned about undergraduate research through my Honors General Chemistry professor, Dr. Kovac. I started working in Dr. Barnes research laboratory that summer. My project involves making controlled metal oxide monolayers on silicon wafers that are no more than a nanometer thick. Working with Dr. Barnes on this project has been eye opening and has given me a priceless experience. I have learned a lot about the “craft” of research and using different instruments to characterize samples. It has given me a new perspective about a research in science and valuable experience that will shape my future career in a field of Medicine (MD/PhD program) or graduate school in Chemistry.

Desta Bume