

Are you Ready for Research?

Participating in scientific research can be a highly valuable and rewarding part of your undergraduate education here at CU. Many students develop their interests, skills and contacts by working on one or more projects during their time at university. Meeting faculty, graduate students and other researchers outside of classes is a great way to get to know to the many people who work here and the wide variety of activities we do in addition to teaching classes.

Working in a research program can also be a significant help in developing and ensuring success in your post-graduation plans. Research experience is highly recommended for those who are considering post-graduate academic programs, and can help you decide whether this is the right path for you. For any career path, a research advisor can provide letters of reference and valuable contacts that will help your career in many scientific and engineering fields. Being able to describe your research accomplishments and skills can make your resume a standout when applying for nearly any type of job after graduation.

Some students start research during their freshman year, but typically students start to acquire useful skills, solidify their understanding of foundational math and physics concepts, and hone their interests after at least a year in our major. Below is a list of things you should consider, and steps you can take to help you get started.

You should keep in mind that research work for undergraduates may be competitive, and that resources may be tight (time for supervising your work, as well as pay). You will likely have to be patient and persistent to find a good match to your skillset and interests.

- 1) **Is your academic record solid?** If your GPA (either cumulative or in your math and science classes) is less than about 2.7-3.0, we **STRONGLY** suggest that you postpone an extracurricular activity like research until you can improve your grades. We offer free homework help rooms and other tutoring and mentoring support. Please talk to your academic advisor **AND** your APS mentor about resources you can access to boost your academic performance.
- 2) **Do you have useful research skills?** Many research jobs require computer programming and data analysis skills, and so we highly recommend taking ASTR 2600 (Computational Techniques) or an equivalent programming class before you start looking for a research project. ASTR 3800 (Data Analysis and Computing) can also build relevant skills, as can ASTR 3510/20 (Observations and Instrumentation), engineering and writing classes. Pre-professional work can also take the

form of being a Learning Assistant or participating in the wide range of outreach, teaching and tutoring opportunities here at CU. Beyond Boulder is a program to help you explore the many career paths you might make, and help you identify the skills you should master in college. The schedule for this weekly series is at:

<http://beyondboulder.pbworks.com/w/page/7904337/FrontPage> and is also emailed to all majors.

- 3) **Polish your resume.** A good resume can serve as an introduction to a potential supervisor and you should have one handy when starting to look for a project. Make sure your skills (above) are highlighted, as well as the relevant classes you've completed and your grades in them.
- 4) **Get to know people.** We strongly recommend attending the weekly Faculty Research talk series, which is held every fall semester. Faculty members in APS describe their research in an informal setting, and you can see if these topics excite you, ask questions, and find out about the sorts of things undergraduate students might do. **We also offer a program where small groups of undergrads can meet with non-faculty (postdoctoral scientists, graduate students) who might be potential research supervisors.** While you will probably have a faculty member oversee your work, you may work more closely with a non-faculty scientist on their specific projects.
- 5) **Follow up.** You'll almost never get someone to say "Yes, I have the perfect project for you!" on your first introduction. If you are truly interested in an opportunity, make sure your potential supervisor knows this. Send an email with your resume, and ask if you can attend their research group meetings to learn more. Research projects have been created by students who have learned about a research field during these meetings, and then came up with a good question to explore, or were able to offer a needed skill.
- 6) **Participation in research takes many forms.** Some students will want to work towards completing an independent project for publication or for an Honors Thesis. However, there are many other opportunities: data assessment and analysis, systems operations, programming, and building instruments are some examples. Learn about the methods used in different research programs and work towards developing the needed skills. Consider working as an apprentice for awhile, to get to know the people and the work, and build these skills. Figure out how you can become essential- and then you will be essential!
- 7) **Getting academic credit.** Completing a 1-credit independent study (ASTR 4840/4841) can be a great way to explore a research topic. You

will need to make a written agreement with your supervisor about what work should be completed during the semester, and what criteria will be used to assign you a grade. In general, 1 credit should be equivalent to about 5-6 hours of work a week and more than 1 credit per semester will require a very strong justification. Then you need fill out the relevant forms at the APS office. Your supervisor does not have to be a faculty member, but one has to sign your paperwork and agree to submit your grade at the end of the semester. Note that while ASTR 4840/41 are technically upper-division classes, you cannot use them for the required upper-division courses for our major.

- 8) **Getting paid.** There are sometimes paid positions available to support funded research programs. Keep your eyes open and check your CU email for these opportunities. Other positions are not advertised, and arise when you and a potential supervisor work out a plan that supports research covered by a grant. You can also apply for CU Undergraduate Research Opportunities Program (UROP) funding for your research- both salary and research expenses. There are application deadlines several times a year for both academic-year and summer funds. You can find more information at: <http://enrichment.colorado.edu/urop/>
- 9) **Writing a thesis.** Students who are eligible can get Latin Honors upon graduation if they complete an Honors Thesis, usually during their last year of studies. More information can be found at: http://aps.colorado.edu/undergrad_honors.html