

Differences Between Undergraduate and Graduate Students

How are undergraduate students different from graduate students?

Undergraduate students differ from graduate students in several ways:

- research and lab inexperience (safety, knowledge of chemical behaviors, skill sets, acceptable lab behavior, and ethics),
- time commitment available to the research experience, and
- mental/social maturity.

In working with undergraduate research assistants, these differences can significantly affect the workings of the research group and individual relationship between the mentor and the undergraduate.

Research Inexperience

Overall, undergraduates may appear to need more 'hand-holding' or one-on-one time than graduate students, especially in the first few weeks of research. Ultimately the goal is for this to lessen as the undergraduate researchers become more proficient and confident in their work and abilities. This ability to perform independent research should also be kept in mind when recruiting or accepting petitions from undergraduate students to work with you.

For many undergraduate students, their research experience in your lab/research group will be their first formal "outside of the classroom" foray into the research experience and process for your particular field. With this inexperience comes the responsibility of the mentor to fully explain to their new undergraduate students the appropriate behaviors in the research environment.

For example, in a classroom laboratory setting, an undergraduate student may not have had to prepare fresh solutions from concentrated stock materials. Without the proper training, the first time the undergraduate student prepares such a solution disastrous safety accident can result. In addition, time setting and time management skills, wastefulness of chemicals and resources, and respect for the equipment and personal bench space in the lab/office will all need to be addressed. Reinforcement of all of these issues should be expected to be necessary by the mentor or mentor's representatives.

In addition to the safety precautions, the ethics of research (including accurate data recording and reports) will also have to be taught as well. This can include how to keep a high quality research notebook/notes, treatment of human subjects, proper disposal of biological materials, and other field-specific issues.

Social and Mental Maturity

With undergraduate student researchers it is important to not to assume anything about their previous experiences and knowledge of how to behave, work, and interact in a research (faculty- graduate student) (laboratory) environment. Also, mentors need to be aware of the possibility of students feeling uncomfortable telling you that they do not know how to perform a task, frame a question, use a specific software program, etc as they do not want to 'disappoint' you or have you think that they are not a good enough student.

Time Commitment

Undergraduate students have a number of different time commitments/activities/classes that graduate students do not have resulting in less time devoted strictly to research. This comes into play especially in research conducted during the academic year when students are balancing classes and homework assignments, college life (clubs, sports, and relationships), part-time jobs, living alone, as well as a research project with you. Certain times of the semester also become more stressful for the student. The best method to stay aware of this is to continually check in with your undergraduate student about how everything is going.

Some references that discuss some of these differences or how to address them are listed below.

- * Merkel, Carolyn A., and Baker, Shenda M. **How to Mentor Undergraduate Research**. Washington, DC: Council on Undergraduate Research (CUR), 2002.

This booklet from the Council on Undergraduate Research (CUR) offers a brief, but thorough, overview of mentoring undergraduate student research. This is a great first resource to look at when getting started with undergraduate researchers. Some of the topics discussed are expectations of the student and what the mentors should expect from their students. In addition, the basic tenets of undergraduate research mentoring are discussed - the value of undergraduate research, the differences between summer and school year research, and what mentoring should involve. Finally, there are practical bullet-point guides to make introducing your UG student to your and his/her research project and research group.

Available From: UROP Office

- * Stiles, Paul, et al. **"Risk Management: Training Undergraduates in Research Ethics in Social and Behavioral Sciences."** Council on Undergraduate Research Quarterly Vol. 27 Iss. 4 (2007): pp. 153-157.

The risk of harm to students who serve as researchers or research assistants is an important consideration for faculty providing undergraduate research experiences. In the laboratory sciences, research environments may pose direct physical dangers, e.g., chemical hazards or dangerous devices/instruments. In contrast, the social behavioral sciences typically present low physical risk to the researcher but require careful attention to risks that may harm human subjects. As inexperienced researchers, students may not know how to anticipate and/or avoid pitfalls that increase risk to themselves or their subjects. This article describes a research ethics training program implemented as part of a Research Experience for Undergraduates (REU) and provides some insights regarding risk assessment and protection for undergraduates in research.

<http://www.cur.org/assets/1/7/Jun07Stiles.pdf>

- * Forrest, Krista D., Stastny, Bradley J., and Bruns, Jennifer A. **"Supervising Undergraduate Students in a Faculty Driven Research Program."** Developing, Promoting, & Sustaining the Undergraduate Research Experience in Psychology. Eds. Richard L. Miller, et al. Syracuse, NY: Society for the Teaching of Psychology, 2008. 224-229.

Can you teach at a small liberal arts institution and conduct research in your field of interest? Have you ever wanted to have nationally or internationally recognized research? It is possible at a small college or university if you take advantage of your most valuable asset, the student research assistant. This chapter has three goals. First we will address the major differences between faculty driven and student driven research programs including the conditions under which faculty driven programs are better suited. Second, we will discuss the benefits and costs to a faculty driven program for both professors and students. Finally, we will present some practical advice for the implementation of faculty driven programs, using current programs as examples.

While from a Psychology Society published book, this is general enough to be relevant to all fields.

<http://teachpsych.org/ebooks/ur2008/index.php>

- * Henderson, LaRhee, Busing, Charisse, and Wall, Piper. **"Teaching Undergraduate Research."** Biochemistry and Molecular Biology Education Vol. 36 Iss. 1 (2008): pp. 28-33.

Undergraduate research in the biochemistry, cell, and molecular biology program at Drake University uses apprenticeship, cooperative-style learning, and peer mentoring in a cross-disciplinary and cross-community educational program. We call it the one-room schoolhouse approach to teaching undergraduate research. This approach is cost effective, aids learning, supports the development of science and transferable management skills, is productive, and supports diversity. It allows a small set of faculty to involve large numbers of students in research and maintain a productive scholarship program. It provides students with skills in scientific research and transferable skills that they apply to a wide set of careers.

<https://iubmb.onlinelibrary.wiley.com/doi/pdfdirect/10.1002/bmb.20134>

- * Mickley, G. Andrew, Kenmuir, Cynthia, and Remmers-Roeber, Dawn. **"Mentoring Undergraduate Students in Neuroscience Research: A Model System at Baldwin-Wallace College."** The Journal of Undergraduate Neuroscience Education (JUNE) Vol. 1 Iss. 2 (2003): pp. A28-A35.

While this article is entitled for neuroscience research, it is equally relevant for all science and engineering labs in establishing an undergraduate research lab experience. Most helpful is the appendix where the authors provide their guidelines/rules for working in the laboratory. Especially to note is how the list is written in the positive and not a list of "Do Not do this".

<http://www.funjournal.org/downloads/MickleyA28.pdf>
<http://www.funjournal.org/>

- * Wadkins, Theresa, and Miller, Richard L. **"Bending Twigs: The Act of Mentoring Undergraduate Student Research."** Developing, Promoting, & Sustaining the Undergraduate Research Experience in Psychology. Eds. Richard L. Miller, et al. Syracuse, NY: Society for the Teaching of Psychology, 2008. 209-214.

Available From: Online

<http://teachpsych.org/ebooks/ur2008/index.php>

- * Whiteside, Ursula, et al. **"Initial Suggestions for Supervising and Mentoring Undergraduate Research Assistants at Large Research Universities."** International Journal of Teaching and Learning in Higher Education Vol. 19 Iss. 3 (2007): pp. 325 - 330.

This article specifically addresses undergraduate students attending large research universities who often have the opportunity to participate in the design, conduct, analysis, and dissemination of research initiated by faculty, postdoctoral fellows, and graduate students. To date, guidelines for the conduct of this specific type of relationship - that of an academic researcher to an undergraduate research volunteer in a large team based research laboratory - remain absent from the peer-reviewed education literature. Included in this article are specific suggestions for success in facilitating this relationship within the context of a large, research-oriented university department.

<http://www.isetl.org/ijtlhe/pdf/IJTLHE280.pdf>

The Millennial Generation:

The current generation of undergraduate students, those born from about 1979 to 1994 (or ending dates of 1995, 1997, or 2000, 2002) – depending on sources), are classified as the “Millennial” generation. Millennials are currently between 15 and 30 years of age. Other common names for this age group have been Gen Y, Generation Next, Nexters, Boomlet, Generation Me, and mini Boomers. This generation is the largest since the “Baby Boomers”.

Richard Sweeney has been an investigator in the differences between this new generation and previous generations when compared at the same age. His handout “Millennial Behaviors and Higher Education Focus Group Results - How are Millennials different from previous generations *at the same age?*” (available from UROP and online) is very informative. Some key points that may be relevant in regards to mentoring and relating to undergraduate researchers are summarized below. **However, please remember that these are generalizations of a large population and do not describe every generational member exactly.**

Millennials are described as **impatient** and having little to no tolerance to delays, expecting things to be done when they want them or expecting them to be done quickly and on their internal personal time frame. Along with this, they expect and search for ways to perform tasks with the most time efficiency – as they perceive it. Instant gratification is also used as a way to describe their impatience. Millennials are classified as **experiential learners**, those who prefer to learn by doing instead of reading and following the written directions. This is also where a third characteristic, as a **less reading** generation, also emerges. However, Millennials do **value intelligence** and **education**. Throughout their lives, group work and collaborative teamwork has been emphasized and so Millennials are able to **work in groups effectively**. Partially due to this, they **prefer merit systems** to other systems for promotion and more **frequent job performance reviews** (formal and informal). Finally, **flexible schedules** and leading a **balanced life** are very important to Millennials and they truly expect this flexibility from their employers and teachers. This can be demonstrated with the lack of concern over time schedules and showing up on time. However, this is also demonstrated by their **volunteerism** tendencies and willingness to

Finally, there is also a new idea towards viewing the Millennial generational characteristics as referenced to a shorter time span that bridges the Gen X’ers and the next group, tentatively being called the Moat Generation. In this new definition, Millennials are born roughly between 1977 and 1994 (the original definition of the Millennials), while those born from 1995 – present is viewed as the next generational group (0 - 14 years). The following article refers to the “Moat Generation”. However, this is the only reference that I could find about this new generation despite that Richard Sweeney has defined Millennials from 1979-1994.