GRADUATE STUDY IN
MATHEMATICS AND NATURAL SCIENCES

What is “graduate school”? Graduate school is a generic term that refers to specialized, advanced education in an academic discipline like biology, chemistry or mathematics. If you wish to study a subject in greater depth, you would probably be interested in academic graduate programs. However, if your goal is to learn the skills and develop the knowledge needed to succeed in a profession like medicine or accounting, you would pursue an education which would culminate in a professional degree.

If you think you might want to become a practitioner of some sort, investigate professional education. You might research professionally-oriented terminal master's programs such as a master's in environmental management, financial mathematics, engineering, science education, operations research, meteorology or public health, or professional doctoral programs such as pharmacy and medicine. Because of its directed focus, graduate school does not serve as an opportunity to further explore possible career paths, as in your early years of college. So, if you have not yet found a discipline that you really love, the Career Services Center can help you explore career options.

What degree can you earn in graduate school? The Master of Science (M.S.) and the Doctor of Philosophy (Ph.D.) are the most commonly conferred degrees in the life sciences, physical sciences and mathematics. A master’s degree is appropriate if you want to study a subject in depth for a year or two to prepare for doctoral studies, more advanced work in industry or to teach at the secondary school or community college level. The doctorate (Ph.D.) is appropriate for those planning to become professors and/or researchers in colleges and universities or researchers in industry or government. The features that most clearly distinguish the doctorate from the master’s degree are the expertise in advanced research techniques and the dissertation. The Ph.D. dissertation requires a contribution to a field of knowledge based on substantial, original research on a topic of intellectual significance within the field of specialized study, typically in a sponsoring professor's research group. While there is no fixed number of years for a Ph.D. program, students generally complete the Ph.D. in four to eight years. Completion of a master’s degree prior to enrollment in a doctoral program typically does not shorten completion time. If you have firmly decided to earn the Ph.D., you should apply directly to a Ph.D. program.

Note: When UCSD faculty members talk about graduate school, they are usually referring to Ph.D. programs. Because of this, if you are interested in a master's, you might easily become confused. If you are not interested in obtaining a Ph.D. keep in mind that some of the advice which follows is geared toward Ph.D. program applicants.

What is graduate school like? Here is a description of the nature of doctoral study written by Dennis C. Henry, in Planning for Graduate Studies in Physics and Related Fields:

Graduate study is not a simple extension of undergraduate work. Success as an undergraduate does not necessarily imply success in graduate school. You must objectively appraise your talents and capacities and consider them in relation to those required for success in graduate work. It is difficult to define the combination of qualities that ensure success in graduate school. Imagination, ingenuity and intelligence are definitely important, but maturity, motivation and effort are just as important. Success in graduate study demands intense dedication to the task at hand, perseverance, optimism and resilience. Most people who have been successful in graduate work and in their subsequent careers have found that graduate study demanded more hard work, commitment and concentrated effort than any previous undertaking. Many also have found graduate study exciting, exhilarating, and a very satisfying capstone to their formal education. If you have already experienced the thrill of discovery on any scale, or of suddenly reaching a new level of understanding in science, you can expect even more such experiences in graduate study and research. (Henry, 5)

Where Can I Get Information About Graduate Programs?

Print and online directories like Peterson's Annual Guide to Graduate Study in the Biological Sciences, and Peterson's Annual Guide to Graduate Study in the Physical Sciences, Mathematics, Agricultural Sciences, the Environment and Natural Resources, available for reference in the UCSD Career Services Center and in Geisel Library, include short descriptions on programs of study; admission requirements and deadlines; expenses and support available; and faculty research interests. Peterson's website, www.petersons.com, is searchable by keyword for programs as is http://www.gradschools.com/. In addition to these directories, you may find specialized sources very helpful. For example, the websites of The Biophysical Society (http://biophysics.org), the American Chemical Society (http://dgr.rints.com) American Institute of Physics (http://www.gradschoolshopper.com), the Association of Neuroscience Departments and Programs (http://www.andp.org), and the American Physiological Society http://www.the-aps.org/education/degrees/index.htm link to graduate programs and information about these fields.
Department websites of programs that interest you should be your next stop. Web pages of some institutions include applications as well as admission and program information.

University catalogs and program brochures describe the courses offered by a department and provide information about the educational background and research interests of the faculty. Brochures tend to describe admission information (such as deadline and costs), while catalogs detail requirements for graduation. No applicant should seriously consider applying to or enrolling in a program without a thorough review of all information.

Talk with knowledgeable people like professors, research mentors, postdoctoral fellows, graduate students and other contacts in your field of interest, and with graduate school advisors in the Career Services Center to begin creating a network of people who can help guide you in choosing programs. Be as specific as you can in expressing your goals, so that they will best be able to advise you.

What Should I Look For in a Graduate Program?

- Quality of the graduate department, not just the institution. Prestigious universities may have some weak departments, just as some lesser-known universities may have distinguished faculty in your discipline. UCSD faculty can advise you on programs where theoretical issues and areas of research of interest to you are strongly in evidence.

- Ph.D. applicants should pick the people, not the institution. Learn about the reputation of the faculty in your area of interest. Faculty members are most frequently judged by the quality of their research or projects with which they have been associated. Research that you do as a graduate student will be supervised by a faculty member. Your relationship with your advisor will be critically important. If your interest lies in a subfield that is not broadly represented in the department, make sure that there is more than one faculty member who is interested in your special area. If you are not yet sure in which subfield you are interested, you might select a large department with a diversity of subfields represented. Review a recent list of faculty publications. The age of faculty members may come into play should any of them retire before you complete your degree.

- Mission statement and instructional philosophy (the structure of the curriculum) of the department.

- Attrition rate of students in the program.

- Institutional resources such as libraries, laboratories, museums, computing and research facilities, and field stations.

- Ratio of faculty to students. Large universities may have larger classes and less accessible faculty. Small universities may have restricted offerings, limited facilities, and scarce resources, yet greater access to faculty.

- Type and amount of financial aid available and the percentage of students supported. If you are in a doctoral program you may expect to receive support (other than loans) from the department as part of their offer of admission.

- Additional considerations may include: the cost of tuition (may not be an issue if support is adequate), availability and cost of housing, student support services, placement record of graduates, geographic location, diversity of students within the program, student organizations, the availability of recreational activities and child care.

What Do I Need to Understand about Degree Requirements?

- Programs vary in the number of courses required. While some programs require specific courses, others allow more freedom of choice.

- Time spent at the institution in study or research is referred to as residency. The “in residence” time requirement could extend the overall length of your degree program.

- Graduate programs may differ in the number, type and timing of the required examinations (e.g., departmental exams, comprehensive exams, and qualifying exams) which they require of graduate students. You should understand what examinations you will face.

- Requirements for advancement to candidacy (number of courses required for Ph.D.) vary from program to program.
- **Apprentice teaching** (teaching assistantship) is a required component of some Ph.D. programs.

- Some master’s programs require a **thesis/research project** while others require a **comprehensive exam** following the completion of courses.

- Some Ph.D. programs have a **foreign language requirement**, which can, extend the length of graduate study.

**What are the Requirements for Admission?**

Most graduate admission committees look for students with excellent critical thinking and problem-solving abilities, strong motivation, perseverance, and a zest for knowledge. To assess each candidate, committees typically use some combination of or all of the following:

- **Academic preparation** and **performance** requirements vary. While a bachelor's degree is required, it does not necessarily have to be in the same field as your proposed area of graduate study. At a minimum, some undergraduate coursework (there may be certain key courses) in the field is required preparation. While a **GPA** of 3.0 is often specified (with an emphasis on your upper division major GPA), think of this as a bare minimum requirement – most programs expect a higher level of achievement from their prospective students. Certain master's degree programs, particularly at state or small private universities, may have a lower required minimum GPA (2.5 or 2.75) than do Ph.D. programs at research universities (3.0).

- Ph.D. programs will expect applicants to have had **research experience**.

- Competitive scores on the **Graduate Record Examination (GRE)**. The General Test measures certain developed verbal, quantitative and analytical writing abilities important for academic achievement. The GRE General Test is a computer-based test available throughout the year. The GRE Subject Tests gauge undergraduate achievement in specific fields. Tests offered include Biochemistry, Cell and Molecular Biology; Biology; Chemistry; Mathematics; and Physics. Registration for the GRE General Test and the Subject test (offered just three times per year in paper and pencil form only) can be done online at [www.gre.org](http://www.gre.org). Test preparation help is available at [www.gre.org](http://www.gre.org).

- **Recommendation letters** (usually three) from faculty who can comment on your academic preparation and potential for graduate study and, for Ph.D. program applicants, research. These letters should be from persons who know you fairly well. A handout on obtaining letters of reference is available in print and online from the Career Services Center.

- The **application** itself (found on the program’s website) should be filled out thoroughly and accurately. A **fee** is typically required with each application.

- Your **statement of purpose** should focus on your discipline-specific reasons for pursuing graduate study, with descriptions of your coursework and research experience. A handout on writing a statement of intent is available in print and online from the Career Services Center which also offers a statement critique service.

**How Might I Finance Graduate Study?**

Most graduate financial aid awards are based upon a combination of academic achievement, scholarly promise, and financial need. Some fellowship programs target women and minorities. Most Ph.D. students receive financial support directly from their graduate institutions. Some awards are available from other agencies. **The office that handles graduate student financial aid at the university where you matriculate will serve as your primary source for information and help.** Not only will the in-house experts be able to apprise you of loan and fellowship information, but they can direct you to other sources of funding. Sources of support generally include one or a combination of the following types of awards:

- **University-sponsored assistantships** requiring the performance of research or teaching in exchange for financial support, or **departmental fellowships** which provide support for a student's own research.

- **Grants** based on financial need, requiring no work, service, or repayment.

- **Loans** by the institution or outside sources such as foundations and the federal government. Such loans must be repaid upon the completion of a degree program or course of study.

- **Fellowships or scholarships** from outside agencies based on academic merit, requiring no work or service performed...
A list of fellowships is available at http://www.princeton.edu/pr/pub/pfg/. For a fellowship database searchable by keyword, go to http://www.gradschool.cornell.edu/?p=132. TritonLink has a page which lists some national competitive scholarships. The National Physical Sciences Consortium (www.npsc.org), The National Science Foundation, and the Hertz Foundation offer substantial fellowship support for graduate study in some areas. These programs are competitive. Applications are available in early fall. Deadlines are typically between late October and January. For other sources of funding, search www.finaid.org.

What Sort of Timeline Should I Follow?

Most deadlines fall between January and March for matriculation the following fall, but deadlines can be as early as December 15. Applicants for programs with rolling admissions are advised to apply early.

During your college years

- Take advantage of independent study opportunities (199), honors programs, and research opportunities. See the Summer Research Opportunities page at http://career.ucsd.edu, UCSD Undergraduate Research (http://ugresearch.ucsd.edu) and the Academic Internship Program (http://aip.ucsd.edu). The Career Services Center also lists paid research and internships on Port Triton at http://career.ucsd.edu.

A year and half before matriculation

- Research programs and their admission requirements. If the programs require the GRE Subject Test, plan your course schedule to be sure that you will be adequately prepared.

- Begin talking with faculty about your intention to pursue a graduate degree.

A year before matriculation

- Define your interests well enough so that you can identify graduate faculties that will match them.

- As you begin to look for programs, review the research interests of the faculty. Ask admissions staff any pertinent questions, such as: applicant/admit ratio, attrition rate, median test scores and GPAs of those admitted, and aid offered to admitted students.

- Register for the GRE. Give yourself plenty of time to prepare for it and the GRE Subject Test if required.

- Take the GRE in fall (or earlier) so your results will arrive in time to meet the application deadlines.

- Be aware of application deadlines and connect with faculty who may write letters of reference for you. Request letters of reference well in advance of deadlines. Allow at least one month for letters to be written.

- Write your statement of purpose; fill out application forms and any necessary financial aid materials. GRE scores, letters of reference, and transcripts may be sent to graduate admissions offices before you send your application forms, but all must be received by the application deadline.

Spring before fall matriculation

- You will be notified about your admission status and any offer of financial assistance generally by mid-April and will have a few weeks to make your decision about attending that institution. Some Ph.D. programs will invite applicants to visit on a set day or weekend. Visit institutions that accept you. Meet with faculty and graduate students to help you make your final choice.

- Send thank-you notes to people who wrote reference letters for you and tell them of your success.