

A Matter of Degree

Which Graduate Degree Program Is Right for You?

BY NANCY McGUIRE

In this economy, is earning a B.S. degree in chemistry enough to land a job? Will you need to earn a Ph.D.? What other options do you have? The answers depend on what you're looking for and the direction you intend for your career to take.

Ph.D.s have a wide range of career options open to them. They weathered the Great Recession better than their counterparts with B.S. and M.S. degrees, and on average, they earn higher salaries. On the other hand, getting a Ph.D. means more time out of the main workforce, at least several more years living on a tight budget, and very likely, a postdoctoral fellowship or two.

Not everyone who goes to graduate school wants to go into basic research or academia, and not everyone can. Graduate schools in the United States have been churning out many more science graduates than there are laboratory or academic jobs available in these sectors (1,2). Fortunately, many scientists with graduate degrees find fulfilling jobs in a wide variety of career areas, with or without graduate degrees (3,4). The National Science Foundation's *Science and Engineering Indicators* report for 2014 states, "Many more individuals have science and engineering degrees than work in science and engineering occupations" (5).

Choosing a field of study

If you do decide to go to graduate school, how can you make sure you get the education you need for the career you want? To some extent, your choice may be a numbers game. If you pursue a career in a popular field, you must find a way to distinguish yourself and your work from your many colleagues. If you go into something more obscure, you may struggle to find job openings in your specialty or you may have to explain to a potential employer how your experience makes you the ideal candidate for a job opening that may be tangentially related to your graduate work.

According to the 2014 ACS Salaries and Employment survey results report in the September 1, 2014 issue of *Chemical & Engineering News*, employment of ACS members has risen in agricultural and food chemistry, specialty and fine chemicals and coatings, paint, and ink, while employment continued to decline in the pharmaceutical and medical device industries. Steven Meyers, assistant director of ACS's Career and Professional Advancement Office, also noted that the service sector has seen increased employment in analytical testing and other professional services relating to science, engineering, and the law. Basing a career

choice strictly on employment projections is risky, as employment trends can change over time. However, if your interests coincide with an area of high demand, the job market is one factor to consider.

A graduate degree can, and should, offer benefits beyond technical training and job credentialing. The contacts you make in graduate school can provide access to professional networks and opportunities that you might not have otherwise. Attending conferences, making presentations, and publishing your research can develop your communication skills and raise your visibility within the professional community. Working on collaborative projects, especially with colleagues in various disciplines or geographic locations, is valuable practice for team projects after you graduate. Mentoring undergraduate students and managing lab projects provides valuable experience in personnel and project management.

Science graduates can find that their training is an asset in a completely different field. Fields in technical communication





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benefit from professionals who have honed their critical thinking and research skills in science. Scientists with law degrees can tackle highly technical court cases. Depending on how far afield you go, you may need to do extra coursework to fulfill the prerequisites for your graduate program.

The best degree program for you depends on your field of study and your career goals. If you stay with chemistry, the most common options are the doctorate, the master's degree, and a graduate certificate.

Ph.D. programs

Typically, Ph.D. students spend their first couple of years taking courses, taking cumulative exams, and teaching undergraduate laboratories and recitation sections. Depending on the university and your area of specialization, you will have anywhere from a few months to a year or so to identify a research area and a faculty mentor. The remaining years are spent doing laboratory research and writing a dissertation.

The Ph.D. student is expected to generate new knowledge by solving novel problems or finding novel ways of solving problems. This model is designed to produce academic scientists who do basic research.

Science Ph.D. graduates who work in industry often note that the biggest adjustment they have to make is learning to produce quick, practical results that meet the company's needs. They must learn to fulfill client expectations and communicate the results and relevancy of their projects to busy managers, who might have little to no technical background. Getting this experience during graduate school may be difficult because many Ph.D. programs discourage or even prohibit outside employment. Ph.D. students will often work around these rules by taking extra courses or becoming active in a professional organization to gain these skills.

On the plus side, Ph.D. graduates learn to be self-motivated and think independently, skills that can be applied in many different fields. Earning a Ph.D. is solid evidence that you can take on a difficult project and see it through to completion, an accomplishment that many employers value highly.

Traditional M.S. degrees

Traditional M.S. degree programs are robust and take approximately two years to complete. As Sam Pazicni, assistant professor of chemistry and chemistry education at the University of New Hampshire, explains, "Students who are interested in developing a high degree of proficiency in a specialized research area while gaining modest exposure to independent research should consider enrolling in a traditional M.S. program." Coursework and research are required; a thesis may be optional. Students who earn M.S. degrees frequently go on to doctorate programs, and when they do, typically they find that they are well prepared to handle the rigors of those programs. M.S. degrees are also awarded to graduate students who have successfully completed their coursework in the Ph.D. programs but are unable to complete their Ph.D. research and dissertation.

Often, however, master's graduates find that their degree satisfies their objectives as well as or better than a Ph.D. Master's degree holders can pursue careers in management, in policy, or as research assistants or legal aides. Colleges and high schools hire master's graduates as instructors or laboratory coordinators.

Master's students complete the same coursework, including advanced theoretical courses, as their Ph.D. colleagues, and they may finish a scaled-down version of their dissertation research. Pazicni recommends that master's degree students complete a thesis project, even if it's not strictly required, because many employers seek applicants with research experience.

Returning to finish a Ph.D. program can be easier with an M.S. degree than with other graduate degrees, since the coursework is the same. However, M.S. graduates who return after more than a few years might have to repeat some courses or re-take qualifying exams.

Professional Science Master's degrees

The Professional Science Master's (PSM) degree is a relatively new development, but about 300 such programs exist in the United States as of 2014. Touted as "the MBA degree for science," these programs train students who intend to go into law, government policy, management, journalism, or other non-laboratory careers that nevertheless require an advanced knowledge of scientific principles.

The coursework and internships in PSM programs give students job-focused experience in their areas of interest. Generally, PSM students do not do basic research, and not all programs require a thesis project. PSM students have their eyes on a specific career path, and their internships give them and their potential employers a chance to check each other out.

It's critical to investigate what a particular PSM program has to offer before signing up. The best PSM programs provide students with a course of study and practical experience specifically geared toward their target careers, as well as access to potential employers and career entry points. Smaller and less well-developed programs may have PSM students taking the same science classes as students pursuing M.S. and Ph.D. degrees, with some internship experience added in.

PSM graduates are of most interest to employers in the industries and geographic regions where they get their degrees. Universities attract corporate cosponsorships by promising local companies a supply of highly focused graduates trained in relevant skills.

Employers not directly involved in PSM sponsorships commonly make no distinction between the PSM degree and the M.S. degree, so cross-disciplinary training and productive internships are of key importance to getting the greatest value from the PSM.

Graduate certificate programs

Certificate programs attract students who need to meet state or national licensing requirements or those who already hold a bachelor's degree but seek to launch a new career not related to that degree. Certificate programs typically consist of 3 to 12 courses that help you develop career competency in a single subject within 12 or 18 months, but the programs can vary greatly. For example, Arizona State University offers certificates in conjunction with conventional Ph.D. programs as a formal recognition that a student has completed additional coursework in areas such as business administration or communications.

Stevens Institute of Technology (Hoboken, NJ) takes a different approach, offering science and engineering graduate certificates upon completion of one of several four-course programs,

geared toward working professionals who want to broaden their skill sets and advance their careers.

Montgomery College (Germantown, MD) offers a third type of graduate certificate, for students seeking careers in the biotech industry. This effort started as a two-year associate's degree program, but now it also provides supplemental training to students who already have their bachelor's degrees. Collins Jones, biotechnology industry coordinator for the program, works closely

with local biotech businesses to design coursework and lab facilities and industry internships. Students gain hands-on experience with the equipment and methods that they will encounter in the workplace, and the companies often hire their most promising student interns.

Making the choice

In the final analysis, getting the most from a graduate program is a balancing act. Going after a targeted, specific goal can help you land a job in a specific employment sector, but pursuing a broader education can give you basic reasoning, investigative, and problem-solving skills that you can apply just about anywhere.

The conventional Ph.D. program offers definite advantages in respect and recognition, and the independent research provides experience that can be applied to a wide range of fields. Graduates who

make the commitment of time and effort and see their programs through to completion are valued assets for many employers.

Master's degree, PSM degree, and graduate certificate programs offer advantages to students who are pursuing specific career paths. Students can enter (or re-enter) the workforce more quickly, and they may eventually return for a higher degree.

Choosing the best program for you requires a general idea of the direction you want to go, along with the flexibility to pursue unexpected opportunities along the way. **IC**

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