

Research Brief

What Have We Learned? Across the U.S., Ph.D. Programs in Chemistry Are Changing to Meet Contemporary Demands

First Findings from a Study of Professional Preparation of Chemistry Ph.D.s

Maintaining Top-Notch Programs is Hard Work

We interviewed department chairs and graduate directors from 14 highly ranked chemistry Ph.D. programs. They described the challenges of maintaining competitive research and educational units:

- Equipment and facilities are expensive,
- Funding is a growing challenge, and
- Competition among institutions is fierce.

However, developing strong interdisciplinary relationships and creating maximum flexibility within research options allows some universities outside the top ten to attract outstanding faculty and students.

Disciplinary Boundaries are Shifting

Interdisciplinarity has taken hold in chemistry departments, and faculty hold a range of views about change driven by cross-disciplinary research practices. One respondent viewed interdisciplinarity as “the name of the game”; another called it “the latest flash in the pan.” Faculty find themselves

- Sharing equipment and space with collaborators to reduce redundancy and costs,
- Developing research interests with faculty and graduate students in different fields,
- Enjoying the intellectual challenges and discoveries in new areas of study, but also
- Adapting to the loss of close collaborations with other chemistry faculty.

Departments Are Restructuring Traditional Ph.D. Work Given Workforce and Student Demands

Universally, Ph.D. graduates are expected to be independent researchers and thinkers. However, top-notch research ability is not enough to succeed in today’s job market. Respondents described an array of desirable career skills for graduates and how traditional lab practices have changed to help students gain such skills. As faculty across the country find themselves needing to generate more research activity, they have less time for training, advising, and mentoring in their research groups. While the research group is still an important venue for developing professional skills, many departments are providing career-development activities for graduate students that take place **outside** the traditional research group (Table 1).

Table 1: Departmentally Supported Professional Development Initiatives

Skills	<ul style="list-style-type: none">• Chemistry literature reading groups• Professional communication<ul style="list-style-type: none">○ Proposal writing courses or seminars○ Presentation experience• Practice conducting seminars• Preparation in leadership and management• Ethics in research training
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Career Information	<ul style="list-style-type: none"> • Exposure to non-academic careers • Industry internships • Teaching preparation
Support	<ul style="list-style-type: none"> • Mentoring and advising (formal and informal) • Graduate student support groups • Departmental handbooks of standard practice and policies

Generational Changes Are Leading to Departmental Changes

Students and faculty in their 20s and 30s hold different workplace and lifestyle expectations than older researchers. These factors include needs of dual-career couples and changed child-rearing practices.

- Student dissatisfaction is leading to movement away from traditional cumulative exams; in about 50 percent of the departments we interviewed, cums have been abandoned because of student demands.
- Younger scientists are concerned with work/life balance, including time on the job, shared parental responsibilities, and the pace of professorial lives.

Diversity Provides Benefits and Challenges

All the departments we spoke to described their experiences with diversity and an array of approaches to changing the demographic mix of their programs:

- Some institutions are actively seeking more diverse faculty and students and are implementing support mechanisms to enhance their recruitment efforts.
- Representation of female students ranges from gender parity to only about 10 percent.
- Diversity has a snowball effect: when a department has deliberately created conditions to nurture a critical mass of a particular demographic group, recruitment and retention concerns seem to take care of themselves.

Conclusion

Across the U.S., chemistry Ph.D. programs face multiple challenges to remain competitive. Our research to date illustrates the creativity and range of solutions departments are implementing to meet contemporary demands.

This research was conducted as part of NSF-funded "Professional Socialization and Career Selection in Ph.D. Education: An Empirical Research Study," Award 0723600. Researchers Sandra Laursen, Ph.D., Heather Thiry, Ph.D., and Heidi G. Loshbaugh, Ph.D. conducted 22 interviews at 14 institutions between July and October 2008. Departments that these respondents described as peers include UNC Chapel Hill, Princeton, U. Wisconsin-Madison, U. Texas-Austin, Northwestern, Washington U. (St. Louis), and Johns Hopkins. The research will continue with detailed case studies of a smaller set of programs. All assertions are those of the authors and not of the National Science Foundation.

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