ACS Chemistry for Life™

CPT
Committee on Professional Training

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Promoting Excellence in the Education of Undergraduate Chemistry Students

ACS promotes excellence in the education and training of undergraduate chemistry students through approval of baccalaureate chemistry programs. The Committee on Professional Training (CPT) makes available a series of supplements designed to provide information relevant to the design of the undergraduate chemistry curriculum, development of student skills, and program development beyond that provided by the *ACS Guidelines and Evaluation Procedures for Bachelor's Degree Programs*. CPT approved two new supplements, "Excellent Undergraduate Chemistry Programs" and "Rigorous Undergraduate Chemistry Programs", which are available at www.acs.org/cpt. This article presents an overview of the hallmarks of excellent chemistry programs. An article summarizing the characteristics of rigorous chemistry programs is planned for the fall newsletter.

Excellent programs are the product of careful planning and require the commitment of considerable financial, physical, and human resources. They are designed to build competency and promote student achievement, while meeting the needs of the institution's student body. The four facets of an excellent program – curriculum and student learning, pedagogy, infrastructure, and faculty – are discussed below.

Curriculum and Student Learning

The curriculum of an excellent program is designed to instill an appreciation of chemistry from a molecular perspective.

- **Foundation courses** in core areas of chemistry provide a modern foundation for subsequent in-depth studies.
- **In-depth courses** build upon the foundation courses, provide an in-depth treatment of a foundation area, focus on a specific area within the chemical sciences, or provide a modern chemistry perspective to an interdisciplinary topic.
- **Laboratory experiences** involve the synthesis of molecules, measurement of chemical properties and phenomena, and hands-on experience with modern instrumentation.
- **Information and literature searching opportunities** allow students to search and use the primary and secondary chemical literature and scientific databases.

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- **Computational chemistry and computer modeling** help students understand and predict chemical properties and phenomena.
- **Research** engages undergraduates in the basic discovery process leading to creation of new knowledge as a means for students to apply their chemistry knowledge and skills.
- **Student skills** are actively developed including the ability to work safely in the

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(March 2011)

laboratory, communicate effectively about chemistry in oral and written formats, work effectively as a member of a team, ask questions, design experiments, interpret results within the context of current scientific knowledge, and internalize an intellectual framework leading to ethical scientific conduct.

Pedagogy

The pedagogical approaches of an excellent program generate an integrative experience in which students learn to apply their knowledge in new contexts and can seamlessly transition to postgraduate activities. Content is delivered in a manner that is challenging, engaging, inclusive, and accommodates a variety of learning styles. Achieving these goals requires a mechanism for regular evaluation and improvement of pedagogical approaches. The development of innovative and dynamic pedagogy enhances the program's ability to achieve excellence in content delivery while aiding the development of students' skills as outlined above.

Infrastructure

A modern, well-maintained infrastructure is an essential component of an excellent program including:

- **Modern instruments** in good working order that are used by professional chemists.
- **Computational capabilities and software** to compute chemical properties and phenomena.
- **Chemical information resources** accessible to both faculty and students.
- **Physical plant** with adequate classroom, laboratory, office, and interactive spaces to accommodate all aspects of the program.
- **Administrative structure** with an appropriate level of financial and personnel support to maintain an excellent program. Administrative, stockroom, and technical support staff are available to assist faculty with ancillary activities, thereby freeing faculty to devote their time and effort to academic responsibilities and scholarly pursuits.
- **Chemical safety** in laboratories that are well-ventilated and equipped with the required safety features; chemical waste handling capabilities and expertise are available. Appropriate safety training, documentation, and protective equipment are also available to all students and faculty.

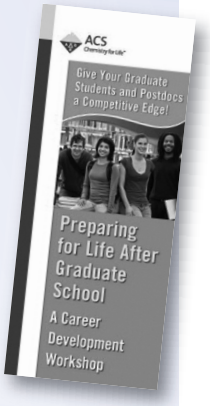
Faculty

The faculty represents an essential element of an excellent undergraduate program and performs a number of critical roles. The faculty is responsible for defining the goals of the undergraduate program and the vision for student outcomes. Moreover, the faculty is the conduit through which content knowledge and scientific skills in chemistry are transmitted to the students. As such, the faculty should be energetic and significantly engaged in the educational mission of the department through their participation in activities that support sustained program excellence (for example, curricular and program improvement, faculty-student interactions through research and seminars, etc.) Faculty maintain their professional competence at a level that reflects the current state of the discipline. Finally, faculty interface with the administration of the institution to articulate student and programmatic needs for sustaining an excellent undergraduate program.

For students to be broadly educated in chemistry, the faculty is comprised of a suitable number of members with the appropriate educational background and expertise. Faculty members hold the PhD degree, have collective expertise in the major subdisciplines of chemistry, and are reflective of the diversity of the undergraduate student body. An excellent program also has suitable mechanisms for identification of new faculty members and assessment of their competence in areas related to the performance of their jobs in terms of teaching, research, and service as appropriate to the institutional mission.

Preparing for Life After Graduate School Workshop

A career development workshop



Hosted by the participating department, this two-day workshop is designed to inform chemistry graduate students and postdocs about their career options after graduate school and how to prepare for them. About two-thirds of the workshop is directed toward nonacademic careers in business and industry.

The workshop:

- Examines careers for PhD chemists
- Teaches critical non-technical skills
- Describes how to find and apply for employment opportunities

A third, optional day includes mock interviews and resume reviews.

Workshops have been held at over 15 chemistry departments and have received outstanding evaluations from the graduate student participants. If your department is interested in hosting a session of PfLAGS, please contact the ACS Office of Graduate Education: GradEd@acs.org; 202-872-4588.

CPT Meets with Representatives from PhD-Granting Departments

In 2010, the Committee on Professional Training (CPT) will host two conversations with chairs of PhD-granting chemistry departments, to be held at the two national meetings of the ACS. Approximately forty people participated in the meeting held in San Francisco on Sunday, March 21. The discussions focused on the advantages and challenges of the ACS approval process. We also discussed how the approval process and certification of chemistry majors could help ensure that students entering PhD programs have the preparation necessary to embark on graduate work in chemistry.

The participants were divided into seven smaller groups for the purposes of discussion and reported their key observations to the full assemblage. Certification offers students the opportunity to gain an ACS "stamp of approval" on their degree. This is something that entering undergraduate students and their parents are asking about as they decide which college or university they will attend. Likewise, by defining the requirements for a certified degree, the approval program was seen to help define what is meant by "a well-prepared student" in terms of the chemical concepts she or he is required to master as well as the necessary skills, which is a new aspect of the 2008 ACS Guidelines. Several participants also identified advantages to their departments of having an external quality indicator, particularly at the time of the university's accreditation process. Examples were provided of ways the requirements of the approval process have been used to maintain resources, particularly in the current economically challenging times that most of us are facing: specifically, maintaining seats for SciFinder Scholar and setting limits for maximum contact hours for faculty and instructional staff.

This last advantage was also seen by some as a potential challenge in the longer term. Specifically, as more and more compromises will need to be taken to reduce universities' budgets, due to decreases in state or investment funding streams, it will be harder to maintain some of the requirements of an approved program. Several individuals also expressed concern with respect to their reduced ability to influence the content and method of instruction of courses that are taught in other departments, particularly biochemistry. These are challenges that are being faced by colleges and universities of all sizes. Some other challenges were unique to PhD-granting departments, where advanced undergraduate students and graduate students take the same courses. As the graduate courses usually do not have a laboratory component, some of these departments found the 400-hour laboratory requirement difficult to meet.

Finally, impacts of the approval process on the preparation of students for graduate work in chemistry were discussed. Several people raised concerns over the reduction in the minimum requirement of physical chemistry course work from two semesters to one semester. On the other hand, the emphasis of the 2008 ACS Guidelines on the importance of undergraduate research and the development of the associated skills was seen as important for students continuing with graduate work.

In the end, the conversation was highly informative for the members of CPT and staff and for the participants who represented their departments. A second conversation is being planned for the Boston ACS meeting in August. Invitations will be sent to the chairs of PhD-granting departments early this summer.

Academic Employment Initiative Poster Session

FALL 2010 ACS NATIONAL MEETING

Boston, MA

Monday, August 23, 8:00 to 10:00 PM

Sci-Mix

If you are planning to hire new faculty in your department, you are invited to attend the AEI Poster Session at Sci-Mix, the popular interdisciplinary poster session.

At the AEI poster session, candidates seeking faculty positions will present posters on their research interests, teaching philosophy, and experience to faculty recruiters who will have the opportunity to meet and evaluate candidates in an informal setting.

Before attending the AEI poster session, recruiters will have an opportunity to view candidate profiles beginning early July at www.acs.org/AEI. For further information, contact the ACS Office of Graduate Education at GradEd@acs.org.

Announcements

Upcoming CPT Symposia and Events

Practices and Policies that Foster Excellence in the First Two Years
A full day symposium will be held at the Biennial Conference on Chemical Education at the University of North Texas on August 3, 2010.

Excellence in Undergraduate Education: A Global Perspective
A full day, presidential symposium will be held at the ACS National Meeting in Boston on August 23, 2010.

CPT Open Meeting
CPT's open meeting will be held from 4-5 PM on August 22, 2010, at the ACS National Meeting in Boston. Location to be announced.

Congratulations!

The Committee congratulates the following schools on their newly ACS-approved bachelor's degree program in chemistry:

- Cameron University
- Iona College
- University of St. Thomas
- Southern Utah University
- University of Tampa

The current number of ACS-approved programs is 661.

Request Free Certificates

Chemistry majors who receive a baccalaureate degree from an ACS-approved program and complete the course work described in the ACS Guidelines may be certified to the Society by the head or chair of the approved institution. Department chairs may request certificates by emailing students' names, the number of certificates needed, and the date they are required to **cpt@acs.org.**

Changes in CPT Membership

In 2010, the Committee on Professional Training welcomed Dr. Clark Landis. Dr. Landis is a professor in the Department of Chemistry at the University of Wisconsin-Madison. He conducts multidisciplinary research on catalysis involving transition metal complexes.

The Committee would also like to express its appreciation for the many contributions of Dr. George Negrete who concluded his term of service in 2009.

A special thank you is due Dr. Jeanne Pemberton, who finished many years of service to CPT as a former chair, member, consultant, and expert advisor. Her outstanding contributions to the ACS approval program and to undergraduate chemical education are greatly appreciated.

Faculty Status:
A Semester Snapshot

A Preview of the Results from the Faculty Status Survey

Although there has been considerable discussion about the apparent increase in non-tenure-track faculty at colleges and universities,[1] no hard data have been available to measure the increase or to show how non-tenure-track faculty and instructional staff were utilized in chemistry programs. In fall 2009, the Committee on Professional Training surveyed 1012 chemistry programs in the United States and its territories to determine which category of faculty or instructional staff teaches different types of courses. For example, who teaches the courses (such as general chemistry) in which the greatest number of students are enrolled? Department chairs from 422 chemistry programs provided data on their faculty employment practices.[2]

Preliminary findings include:

- Of the 422 programs responding to the survey, 69% of the faculty and instructional staff were tenure-track; approximately 80% of those tenure-track faculty were male. While only 31% of all faculty and instructional staff were non-tenure-track, the gender distribution was strikingly different. The greatest difference was found in the long-term, full-time non-tenure-track faculty where only 53% were male.
- A further breakdown of the data (not shown here) shows that tenure-track faculty represent 77% of the faculty and instructional staff at PhD-granting institutions, while they represent only 61% at institutions where the highest degree granted is a bachelor's.

Table 1.
Gender Distribution among Faculty and Instructional Staff

Type of Employment	Total Number of Faculty and Instructional Staff	Percentage of Male Faculty and Instructional Staff	Percentage of Female Faculty and Instructional Staff
Tenure-track	4,542	79.5%	22.4%
Long-term, full-time	712	52.7%	48.3%
Long-term, part-time	505	57.6%	39.6%
Temporary	867	58.0%	41.3%

- The highest degree earned by faculty also varies with the type of employment. Nearly 100% of the tenure-track faculty have earned PhDs, while only about 60% of the temporary faculty have their PhD. (Slightly over 10% of the temporary faculty hold only bachelor's degrees.)

Table 2.
Degree Distribution among Faculty and Instructional Staff

Type of Employment	Highest Degree Held is Bachelor's	Highest Degree Held is Master's	Highest Degree Held is PhD
Tenure-track	0.1%	0.9%	98.2%
Long-term, full-time	5.6%	23.2%	71.2%
Long-term, part-time	6.9%	33.1%	61.8%
Temporary	12.6%	25.0%	61.2%

- The percentage distribution of different ethnic groups remained consistent throughout the categories of employment with Asian Americans making up the largest group and Native Americans the smallest.

Table 3.
Ethnic Distribution among Faculty and Instructional Staff

Type of Employment	Percentage of Asian American Faculty and Instructional Staff	Percentage of African American Faculty and Instructional Staff	Percentage of Hispanic American Faculty and Instructional Staff	Percentage of Native American Faculty and Instructional Staff
Tenure-track	8.8%	3.0%	2.1%	0.8%
Long-term, full-time	6.4%	3.5%	1.9%	1.0%
Long-term, part-time	7.7%	4.0%	0.4%	0.2%
Temporary	9.3%	2.9%	2.1%	0.3%

The full survey report will explore which categories of faculty are teaching lab and lecture courses and who is seeing the greatest number of students in each type of chemistry course. The report also explores the benefits offered to different categories of faculty and instructional staff at these institutions.

[1] "Tracking the Invisible Faculty," The Chronicle of Higher Education (December, 2006) http://chronicle.com/article/Tracking-the-Invisible-Faculty/35173/ (last accessed 4/2/2010).

[2] 354 ACS-approved programs and 68 non-approved programs responded.

[3] The percentages for male and female given in Table 1 do not add up to 100% because the numbers of male and female faculty did not equal the total number of faculty reported by some respondents.

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