ACS
Chemistry for Life™

CPT
Committee on Professional Training

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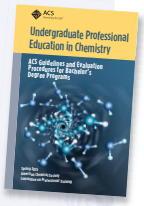
2015 ACS GUIDELINES IS RELEASED!



Please visit the CPT Web page (www.acs.org/cpt) to download a copy.

CPT OPEN MEETING

We invite you to attend the CPT open meeting at the 250th ACS National Meeting in Boston, Massachusetts, from 4:00 to 5:00pm on Sunday, August 16, 2015.

New ACS Guidelines Approved for Bachelor's Degree Programs

The Committee on Professional Training (CPT) approved new guidelines at its January 2015 meeting that are now available on the ACS website (www.acs.org/cpt). The 2015 ACS Guidelines are the culmination of a three-year process of considering guidelines that were last revised in 2008. Revisions to the guidelines are meant to keep them aligned with current trends in education and the changing professional opportunities available to chemists. The chemistry community had a significant role in informing us throughout the process.

The 2015 ACS Guidelines continue CPT's intent to provide programs flexibility in the design of the foundation courses, in-depth courses, and laboratory activities while ensuring that graduates receive the training and experience necessary for successful careers. The guidelines set standards for the institutional environment, faculty and staff, infrastructure, curriculum, safety, undergraduate participation in research, student skill development, and program self-evaluation. The 2015 ACS Guidelines emphasize student skill development in the areas of problem solving, chemical literature and information management, laboratory safety, oral and written communication, teamwork, and ethics. The guidelines encourage the use of pedagogies of engagement in the classroom and laboratory activities that develop chemistry through a process of discovery.

The general aspects of the course work required for student certification remain unchanged in the 2015 ACS Guidelines. Students must still have the equivalent of one course in each of the five foundation areas (analytical, biological, inorganic, organic, and physical chemistry) and four additional in-depth courses. Students must still complete 400 hours of laboratory instruction beyond introductory chemistry, and these laboratory experiences must include at least four of the five foundation areas. Research experiences can still be counted for up to 180 of the 400 laboratory hours.

Significant Changes in the 2015 ACS Guidelines

- Approved chemistry programs will now be required to have five full-time permanent faculty members who are wholly committed to the chemistry program. These individuals need not be tenure-track appointments, but they must be involved in curriculum development and provided with opportunities for professional development. They should hold the expectation of long-term, full-time employment. Currently approved programs with four faculty members will have until 2025 to meet this requirement.
- Slight adjustments have been made to the instructional contact hours and ability to use averaging to meet this requirement. Up to two individuals whose teaching

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New ACS Guidelines Approved *continued from page 1*

responsibilities are in the classroom and laboratory can meet the 15-hour maximum by averaging over the two semesters or three quarters that make up the academic year. Those averaging can exceed the 15-hour maximum in only one term and cannot be above 18 hours in that term. Individuals whose sole teaching responsibilities are laboratory courses must not exceed 16 total contact hours per week. Two individuals in this category can meet the 16 hours by averaging provided the 16-hour maximum is exceeded in no more than one term and does not exceed 18 hours in that term.

- Departments are still required to have an operating NMR spectrometer that is used by undergraduates. If the NMR spectrometer is not suitable for ongoing research projects, the program must make arrangements for access to a suitable NMR spectrometer at a proximal site.
- Undergraduates receiving the certified degree will now need to use on-site equipment from at least four of five different categories: optical molecular spectroscopy, optical atomic spectroscopy, mass spectrometry (included GC-MS and LC-MS), chromatography and separations, and electrochemistry.
- The requirement that programs have access to Chemical Abstracts and electronic search capabilities was dropped from our program evaluation process in 2013. Students are required to have access to technical databases and other resources used in developing skills to search the literature, including structure-based searching. Programs must provide a curriculum in which certified majors develop the ability to retrieve information by searching the chemical literature, evaluate technical articles, and manage many types of chemical information.
- The 2015 ACS Guidelines strengthen several areas related to safety in an effort to promote the creation of a safety culture within chemistry programs. A program safety committee that collaborates with an institutional chemical hygiene officer is highly recommended as a vehicle to accomplish this goal.
- The 2015 ACS Guidelines require that the principles that govern macromolecular, supramolecular, mesoscale, and nanoscale systems be part of the curriculum for certified graduates. Specifics about the exact nature of this requirement and the manner in which CPT will evaluate whether a program is meeting the requirement are described as a separate item in this newsletter.
- While the 2008 ACS Guidelines stated that in all but the most exceptional cases a program must teach all foundation courses annually, the committee frequently allowed smaller programs to offer only four foundation courses a year provided all five areas were covered over a two-year period. The 2015 ACS Guidelines specify that programs must teach at least four of the five foundation courses annually and teach each foundation course once in a two-year period. Programs that have integrated foundation areas into several courses need to insure that the equivalent of four foundation courses is taught each year and that all five foundation areas are fully covered over a two-year period.
- Regarding online instruction, activities that are developed as substitutes for classroom instruction should be assigned at least the same contact hour value as equivalent face-to-face classroom experiences. Furthermore, courses taught partially or wholly online should provide at least the same skill development and content as the corresponding face-to-face experience.
- General chemistry labs that serve as prerequisites for foundation courses must be primarily hands-on, supervised laboratory experiences. Similarly, students must get hands-on experiences operating modern instrumentation. Hands-on expertise cannot be developed through virtual laboratory exercises.
- The importance of skill development is emphasized by requiring that programs develop student competence in problem-solving, use of the chemical literature, communication, teamwork, and ethics. However, the 2015 ACS Guidelines are not prescriptive about how and where this is done in the curriculum.
- The time period between periodic reports has been lengthened from five to six years. With our transition to electronic submission of documents, narrative responses on the periodic report will be available to programs at the time of the next submission.

Closing Comments

We appreciate the substantial input to this process from the chemistry community over the past three years. We look forward to working with the community in the implementation of the 2015 ACS Guidelines and in promoting excellence in chemistry programs and in the students who receive degrees from those programs. ■

CPT SYMPOSIUM AT THE FALL 2015 ACS MEETING:

Promoting Engaged Student Learning Through the ACS Guidelines

The recently approved 2015 ACS Guidelines continue to emphasize the value of developing skills such as problem-solving, use of the chemical literature, communication, teamwork, and ethics in students. The Guidelines also emphasize engaged student learning activities in the classroom and laboratory as an effective way to develop these skills as well as content knowledge in students. CPT has organized a symposium for the Fall 2015 ACS national meeting in Boston, Massachusetts, to explore strategies for incorporating engaged student learning into the curriculum. The symposium will include invited and contributed talks. Speakers will span a range of institution types including research universities, comprehensive institutions, and private four-year institutions and describe the use of engaged student learning in courses ranging from the introductory to advanced level. Examples of classroom- and laboratory-based activities will be presented. The following talks will be given at the symposium:

- Research-based laboratories across the foundational and in-depth courses - Dr. Kimberly Frederick, Skidmore College
- ACS guidelines and student skills development at the University of Wisconsin-Madison - Dr. Jeanne Hamers, University of Wisconsin-Madison
- Using supplemental instruction: Active learning and the internet to teach organic chemistry at a PUI - Dr. Philip Janowicz, California State University, Fullerton
- Chemistry major program growth and retention gains through engaged student learning at Salem State University - Dr. Ronald MacTaylor, Salem State University
- Integrating inquiry-based learning throughout the chemistry curriculum - Dr. Emily Niemeyer, Southwestern University
- Curricular changes that affect content and pedagogy - Dr. Maria Oliver-Hoyo, North Carolina State University
- Pedagogies to promote skill development in the undergraduate chemistry curriculum - Dr. Thomas Wenzel, Bates College ■

COMING SOON:

Planning for Graduate Work in the Chemical Sciences

The Committee on Professional Training, in collaboration with the Education Division of the ACS, has developed a resource for undergraduate students to help them think through the transition to graduate work. The document will be titled *"Planning for Graduate Work in the Chemical Sciences,"* the ninth edition of this resource. Unlike prior editions, the ninth edition will be a web-based resource. As such, the new edition will be able to take full advantage of available web resources developed by the ACS and other organizations. Switching to a web-based format has led to significant changes in the scope and feel of the resource. One feature of *"Planning for Graduate Work in the Chemical Sciences"* that we hope will be particularly useful for students are the detailed outlines that aim to help both US and international students think about what they can and should be doing as they prepare to pursue graduate work in the chemical sciences. We expect *"Planning for Graduate Work in the Chemical Sciences"* to go live this summer (2015), so it can be used by students who are applying to start graduate work in 2016. Please watch for announcements. ■

Real World Work Experiences Help Prepare Students for Life after College

The ACS Guidelines for chemistry program approval and student certification stress the importance not only of maintaining a broad and rigorous chemistry curriculum but also of providing opportunities for students to develop other skills. These include skills in communication (both written and oral), problem solving, use of the chemical literature, laboratory safety, and teamwork: all skills needed for a professional career. Undergraduate research allows students to develop both their scientific and professional skills, and students who participate in a research project are participating in "experiential learning," a concept much discussed in higher education. What is experiential learning? It is simply learning through experience or learning by doing.

While many chemistry departments offer their students an undergraduate research experience, some departments offer even broader experiential learning opportunities through formal, campus-wide experiential learning programs. These programs offer students real world, off-campus work experiences that help prepare students for life after college. Such programs can be found at both large and small institutions. Two examples come from Northeastern University in Boston, Massachusetts, and Delaware Valley University in Doylestown, Pennsylvania, both of which have a long history of providing students with off-campus work experiences.

Northeastern University is well known for its cooperative education (co-op) program, which has been in existence for over one hundred years and is one of the largest in the world. The program allows students to integrate academic and real world experiences in preparation for a professional career. Students are not required to participate in the program, but at any one time up to 100 of the department's over 220 chemistry majors are off campus in co-op positions. The co-op experience entails three steps: preparation, co-op, and reflections and evaluation. Students who wish to participate must first attend an introductory co-op course that covers learning about careers, researching companies, developing professional resumes, and preparing for interviews. Each department has a Co-op Coordinator, and students first meet the coordinator in this course. The next step in the process is the actual co-op experience. After interviewing and being selected by an employer, students begin a six-month co-op rotation. These are paid positions, although students remain full-time students while on a rotation. To complete the co-op program and finish their degree in four years, students must complete two co-op rotations. Students can also complete three co-op rotations and finish their degree in five years. All of the rotations do not have to be with the same employer, thus allowing students to concentrate in one area or sample different areas. To complete the co-op experience, the student and the employer must first complete evaluations. Upon returning to campus, students must also participate in reflection activities with their Co-op Coordinator and peers. Reflection activities include the Co-op Expo, an annual event that in the College of Science provides students with the opportunity to present a scientific poster reflecting on their co-op experience to administrators, faculty, current students, and prospective students. Alternatively, students may prepare a Reflection Paper or a submission to the Coolest Co-op Video Competition. Students who fully and successfully participate in co-op receive eighteen semester-hours of Experiential Learning Credit for each six-month co-op experience.

Recent opportunities offer positions in pharmaceuticals in companies such as GlaxoSmithKline, Novartis, or Merck, where the positions may be in synthesis, analytical chemistry, or the development of computational tools for drug design.

The co-op program at Northeastern offers students an opportunity to work in a variety of chemical fields. Recent opportunities offer positions in pharmaceuticals in companies such as GlaxoSmithKline, Novartis, or Merck, where the positions may be in synthesis, analytical chemistry, or the development of computational tools for drug design. Positions are also available at several research institutes including the Dana-Farber Cancer Institute (drug discovery), the Wyss Institute for Biologically Inspired Engineering (materials science, nanoengineering), and the Broad Institute (proteomics). A student might also gain experience in radiochemistry at Oak Ridge National Laboratory or experience in electronic paper display at E-Ink. Students

engaged in their internship or activity. The courses are offered online to facilitate both student and instructor schedules and commitments. They provide students with an opportunity to reflect on their employment-related activities in real time and to engage with other students through discussion boards and other online activities.

Just as at Northeastern, the E360 program at DelVal offers students the opportunity to work in a number of chemical areas. Recent opportunities have offered positions at Dow Chemical (most recently in polymer chemistry), the state of Pennsylvania (water analysis), and the Texas Biomedical Research Institute in conjunction with the Southwest National Primate Research Center (development of HIV vaccines). Given the rise in student interest in forensic chemistry, it is not surprising that a number of students have also worked at the Montgomery County Coroner's office in Norristown, Pennsylvania. While there, they observe work in the morgue and in all areas of collecting, processing, and analyzing evidence from crime scenes. This particular internship has led to various outcomes. One student went on to get an advanced degree in forensic chemistry and is now working in a large city coroner's office while another student quickly decided that this was not for her. She instead took an internship at Dow Chemical, where she now has a full-time position. This last example illustrates one of the valuable outcomes of these programs. They enable students to make informed decisions about where they want to go, or perhaps do not want to go, in their careers.

An important goal of any undergraduate chemistry program is to prepare their graduates for success as they move along in their careers, whether in permanent positions or in further study in graduate and professional schools. The programs at both Northeastern and DelVal are models for how this can be accomplished. ■

participating in these co-op positions, some of whom become co-authors on scientific publications, bring back knowledge that can be integrated into their classroom work.

While the experiential learning program at the much smaller Delaware Valley University is not as extensive as the program at Northeastern, it shares many of the same features. DelVal, as it is often called, has a long tradition of getting students out into the real world. Until recently, all students were required to spend at least 500 hours working off campus in a field-related position. This requirement has now transitioned to the Experience 360 (E360) program, and all students must participate. All students enroll in an introductory course focused on professional development and problem-based learning. As they proceed through their college career, they must participate in various experiential activities, for which they receive academic credit. Students must participate in at least two experiences and are encouraged to do more. For the 25 chemistry majors probably the most valuable experiences come in a Career Exploration Experience and/or an internship. In both instances, students must develop measurable learning objectives before their experience and then during and after their experiences must complete reflective assignments. Students are required to enroll in an online course while they are

Fulfilling the Macromolecule, Supramolecular and Meso- or Nanoscale (MSN) Requirement

The 2015 revision of the Guidelines added a requirement stipulating coverage of at least two of the following four types of systems: synthetic polymers, biological macromolecules, supramolecular aggregates, meso- or nanoscale materials (MSN). Instruction must include the preparation, characterization, and physical properties of such systems. Programs have considerable flexibility in the manner in which they fulfill the MSN requirement.

If a department has two individuals who are especially interested in MSN areas (e.g., a biological and physical chemist or an organic and analytical chemist), the MSN requirement could be fulfilled through topics distributed in as few as two courses required for certification.

One possibility is to offer an in-depth course on materials or polymers. If such a course were the only option for a student to meet the MSN requirement, then that in-depth course would be required for an ACS-certified degree. A second way to meet the MSN requirement is distribute coverage among courses required for the certified degree. If the MSN requirement is met through a distributed model, it should constitute the equivalent of approximately one-fourth of a standard semester course.

Within the distributed option, there are many ways a program could fulfill the requirement. One possibility would be to distribute coverage among several of the required courses (e.g., coverage of biological macromolecules in the foundation biochemistry course, aspects of polymer synthesis in organic chemistry, inclusion of polymer or supramolecular analysis in analytical chemistry, nanomaterials in physical chemistry, silicone polymers in inorganic chemistry, etc.). It is important to note that it is not necessary for coverage to be included in all of the subdiscipline areas, and coverage can be distributed between both foundation and required in-depth courses. Departments have the flexibility to incorporate MSN topics in a manner that fits best with their program and the strengths and interests of their faculty. For example, if a department has two individuals who are especially interested in MSN areas (e.g., a biological and physical chemist or an organic and analytical chemist), the MSN requirement could be fulfilled through topics distributed in as few as two courses required for certification.

Some programs may choose to emphasize MSN topics in class material whereas others may emphasize them in laboratory activities within the 400-hour laboratory requirement. It is also possible for a program to have multiple paths for completion of the MSN requirement, especially for programs with multiple chemistry tracks. Such paths may involve different selections of in-depth course electives or different elective laboratory experiences.

As part of the six-year periodic reviews, programs will be asked to provide information on how they are meeting the MSN requirement. They will be asked to designate the systems that are covered (synthetic polymers, biological macromolecules, supramolecular aggregates, meso- or nanoscale materials), the areas covered (preparation, characterization, physical properties), and the courses in which coverage is provided. While it is desirable for programs to meet this new MSN requirement as soon as feasible, it is understood that departments may need time to develop and incorporate appropriate content. Even if the committee determines that the requirement is not met at the time of a program's next periodic review, the program will maintain approval and have until the ensuing periodic report to demonstrate compliance with this requirement. ■

Announcements

Changes in CPT Membership

In 2015, two new members and one associate member were appointed to CPT: Dr. Stephen Lee, Dr. Greg Swain, and Dr. Steven Fleming. Dr. Lee is a Professor in the Department of Chemistry and Chemical Biology at Cornell University. Dr. Greg Swain is a Professor in the Department of Chemistry at Michigan State University. Dr. Fleming is a member of the Teaching Faculty in the Department of Chemistry at Temple University.

The Committee members would like to express their very special appreciation to Dr. George Wilson (University of Kansas) for his contribution to the work of CPT. After 12 years as a member and then a consultant, Dr. Wilson concluded his service on CPT in January 2015.

DGR web | ACS Directory of Graduate Research

DGRweb is a free, searchable online database that provides the most comprehensive compilation of information on graduate study in the chemical sciences at universities in North America. The 2014 Edition has improved and expanded searching capabilities, including the ability to generate spreadsheets with statistical data on the number of graduates, faculty, and enrollments based on user-defined search criteria. Also, this new edition provides the ability to find NSF Research Experiences for Undergraduates (REUs). The *DGRweb* home page also has links to two training videos on how to search the database.

Conduct free online searches at www.acs.org/dgrweb!

CPT Open Meeting

We invite you to attend the CPT open meeting at the 250th ACS National Meeting in Boston, Massachusetts, from 4:00 to 5:00pm on Sunday, August 16, 2015. Please check the CPT web page (www.acs.org/cpt) later for details.

Congratulations!

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

Albany State University

Messiah College

Ripon College

The current number of ACS-approved programs is 681.

Certificates Available for ACS-Certified Graduates

Chemistry majors who receive a baccalaureate degree from an ACS-approved program and complete a curriculum described in the ACS Guidelines may be certified to the Society by the head or chair of the approved program. If you would like to have certificates available for presentation to your certified graduates, please contact the office by email at cpt@acs.org.

Thank You! We Could Not Have Done It Without You!

The Committee would like to express its appreciation for the contributions of Visiting Associates to the approval process. These volunteers play a critical role in the evaluation of programs that are applying for ACS approval.

Jeffrey Bartz – Kalamazoo College

Robert Cave – Harvey Mudd College

James Duncan - Lewis and Clark College

Natalie Foster – Lehigh University

Scott Bailey-Hartsel – University of Wisconsin-Eau Claire

Gary Miessler – Saint Olaf College

Nancy Mills – Trinity University

Ruth Reed – Juniata College

Michael Seymour - Hope College

Brock Spencer – Beloit College

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