The Role of the ACS Guidelines for Bachelor's Degree Programs

American Chemical Society Committee on Professional Training

Anne B. McCoy, Chair
Chemical Sciences Roundtable
May 22, 2013
Origins of CPT

In 1935 – the ACS Council established a “Committee for Accrediting Educational Institutions” with Thomas Midgley, Jr. as the Chairman

Became a standing committee of the ACS in 1936

Mandate: “The responsibility for properly accrediting institutions is wholly within the province of the permanent committee and it is hereby granted authority commensurate with this responsibility.”

Initial tasks included:

Establish "minimum standards of eligibility", institutions to apply for approved status.

Survey of current practices sent to 750 universities and colleges, 450 replies received and analyzed.

Data included staff, training, teaching loads, research activity, educational practices, procedures, etc.

 Classified and tabulated to provide comprehensive picture about "professional training of chemists at the collegiate level".
Current focus of CPT:

Our goals:

• Promoting and assisting in the development of **high standards of excellence in all aspects of post-secondary education**, and undertaking studies important to their maintenance.

• Collecting and making available information concerning trends and developments in modern chemical education.

• Cooperating with the American Chemical Society and other professional and educational groups having mutual interests and concerns.
What do we do?

• Establish and administer the approval program
  – The ACS through CPT approves chemistry programs

• Conduct surveys to understand current trends in areas related to the professional education of chemists

• Other activities relating to the professional training of chemists
  – ACS Directory of Graduate Research
  – Coordinating efforts to establish workshops
  – Coordinate meetings of the academic community e.g. department chairs, visiting associates
The approval program

Conduct and enhance an approval procedure for bachelor’s degree programs in chemistry.

- CPT approves degree programs according to the 2008 guidelines. Currently 669 programs are approved.

- Individual departments then certify students who meet the approved program curricula.
Approved programs:

In 1940, there were 65 approved programs. Today, there are 669!
Distribution of approved programs among program types:

- research universities depend critically on the baccalaureate degree recipients of smaller programs to staff their graduate programs
- some level of uniformity in programs and standards of excellence is beneficial to the profession
Committee on Professional Training

Program Approval

• Institutional Involvement
• Faculty and Staff
  Adjunct, temporary and part-time
  Teaching contact hours
  Support staff
• Infrastructure
  Instrumentation
  Computational capability
  Chemical information resources
  Chemical safety resources

• Curriculum
• Undergraduate research
• Development of student skills
• Self-assessment

www.acs.org/cpt
The Chemistry Profession is Changing
Curricular requirements and course delivery

• The philosophy behind the Guidelines is not to be overly prescriptive in terms of specific course requirements or laboratory experiences.

• Rather the Guidelines provide a scaffold on which programs develop a curriculum that is appropriate for their students. Programs are encouraged to include contemporary topics in chemistry and to employ a variety of approaches in delivering the curriculum.

• Specific requirements:
  – The equivalent of a one semester course in Analytical, Biological, Inorganic, Organic and Physical Chemistry
  – 4 in-depth courses that build on the foundation experiences
  – A minimum of 400 laboratory hours (after general chemistry) that cover at least four of the five foundation areas

• Programs must teach these courses on an annual basis.
The 2008 Guidelines introduced an emphasis on Student Skills:

Professional skills need to be learned and assessed within curriculum

- Problem-solving
- Chemical literature
- Laboratory safety
- Oral and written communication
- Working in teams
- Ethics
Where are we now?

- CPT is presently working on revising the Guidelines
- The new edition of the Guidelines is expected to be adopted in 2014
  - The process began with the deployment of a survey of approved programs on the impacts of the 2008 Guidelines (which had an 64% response rate)
  - In January 2013 we shared a white paper of possible revisions
  - We are presently encouraging the community to provide feedback on proposed changes
What do we do?

• Establish and administer the approval program
  – The ACS through CPT approves chemistry programs

• Conduct surveys to understand current trends in areas related to the professional education of chemists

Some outcomes of the 2012 Guidelines impact survey:

– Coordinate meetings of the academic community e.g. department chairs, visiting associates
Curricular changes

Overall the survey indicated that curricular changes were modest and likely reflect the short time since the introduction of the 2008 Guidelines and the additional fiscal stresses felt by departments since 2008.
Ability of programs to offer an approved program

- The majority of programs (~2/3) had no trouble offering an approved curriculum
- ~ 25% had difficulty on occasion
- < 5% had difficulty on a regular basis

- In response to this, we have proposed increasing the minimum faculty size from four to five individuals as part of the proposed revisions
How many programs report offering online courses and offer lab courses that are largely or exclusively virtual?
Role of online courses

- as appropriate for courses leading to certification
- as appropriate for all courses
- introductory and foundation
- introductory courses only
- inappropriate
Role of virtual labs

In response to this, we have proposed requiring programs to provide significant hands-on laboratory experiences prior to starting the foundational lab experience.
Undergraduate research

In response to this, we have proposed introducing a requirement for a capstone experience which could be undergraduate research.

- Summer research at an academic institution could be used
- At least 1 semester should be required
- This requirement would impose an unmanageable hardship
- This requirement would impose a
One-semester organic and physical chemistry courses

• Another area of concern was the removal of a requirement for two semesters of organic and physical chemistry

• 4% of the programs introduced a 1-semester integrated organic chemistry course

• 1% reduced the requirement for physical chemistry to 1-semester for at least one degree track

• 1 to 3% of the responding programs are considering making such changes
Some other proposed changes

• Boosting emphasis on student skills particularly in the areas of information retrieval, safety and leadership opportunities

• Allowing programs to use an off-site NMR to fulfill this requirement

• Requiring student exposure to at least one instrument in each grouping of optical atomic spectroscopy, optical molecular spectroscopy, mass spectrometry, electrochemistry, chromatography/separations
Where we are heading

- The guidelines in general and, in particular, the current revisions process is a community activity, and we appreciate suggestions and comments as we consider the appropriate guidelines for approved programs and certified majors.

- Please send these to cpt@acs.org.
## Current CPT membership

**Anne B. McCoy, chair**  
(Ohio State)  

**Ron Darbeau, vice-chair**  
(McNeese State)  

Edgar Arriaga  
(University of Minnesota)  

Ron Brisbois  
(Macalester College)  

Joseph Francisco  
(Purdue University)  

Bob Howell (Central Michigan University)  

Jeffrey Johnston  
(Vanderbilt)  

Kerry Karukstis  
(Harvey Mudd College)  

Laura Kosbar (IBM)  

**Clark Landis**  
(University of Wisconsin – Madison)  

Cynthia Larive  
(University of California, Riverside)  

Christopher Meyer  
(CalState Fullerton)  

Lee Park (Williams)  

Richard Schwenz  
(University of Northern Colorado)  

Thomas Wenzel (Bates)  

Suzanne Harris  
(University of Wyoming)  

**Joel Shulman**  
(University of Cincinnati)  

George Wilson  
(University of Kansas)  

Cathy Nelson (ACS, Committee Secretary)

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American Chemical Society
EXTRA SLIDES
Coursework Required for Certification

**General chemistry**
0-2 sem general

**Foundation courses**
1 sem analytical
1 sem biochemistry
1 sem inorganic
1 sem organic
1 sem physical

**In-depth courses**
4 sem that build upon the foundation

**Laboratory**
400 hours beyond Gen Chem

**Research**
Can count for up to 180 lab hours with a comprehensive written report

**Cognate courses**
2 sem calculus
Multi, lin alg, diff eq strongly rec
2 sem physics
## Flexibility for Department-Defined Degree Tracks:

<table>
<thead>
<tr>
<th>Chemistry</th>
<th>Biochemistry</th>
<th>Synthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foundation:</strong></td>
<td><strong>Foundation:</strong></td>
<td><strong>Foundation:</strong></td>
</tr>
<tr>
<td>Gen Chem I and II</td>
<td>Gen Chem I and II</td>
<td>Gen Chem I and II</td>
</tr>
<tr>
<td><strong>In-Depth:</strong></td>
<td><strong>In-Depth:</strong></td>
<td></td>
</tr>
<tr>
<td>Analytical Chem</td>
<td>Analytical Chem</td>
<td></td>
</tr>
<tr>
<td>Biochemistry</td>
<td>Biochemistry I</td>
<td></td>
</tr>
<tr>
<td>Inorganic Chem</td>
<td>Inorganic Chem</td>
<td></td>
</tr>
<tr>
<td>Organic Chem I</td>
<td>Organic Chem I</td>
<td></td>
</tr>
<tr>
<td>Physical Chem I</td>
<td>Physical Chem</td>
<td></td>
</tr>
<tr>
<td><strong>In-Depth:</strong></td>
<td><strong>In-Depth:</strong></td>
<td></td>
</tr>
<tr>
<td>Instrumental Analysis</td>
<td>Biochemistry II</td>
<td>Mechanisms</td>
</tr>
<tr>
<td>Organic Chem II</td>
<td>Organic Chem II</td>
<td>Spectroscopy</td>
</tr>
<tr>
<td>Physical Chem II</td>
<td>Physical Chem</td>
<td>Polymers*</td>
</tr>
<tr>
<td>Advanced Elective*</td>
<td>Molecular Biology</td>
<td>Catalysis*</td>
</tr>
<tr>
<td>(* or Research)</td>
<td>Advanced Elective*</td>
<td>(* or Research)</td>
</tr>
</tbody>
</table>

Adapted from American Chemical Society's Chemistry for Life initiative.
The process:

Currently schools begin the process with a preapplication which is acted upon within 2 months of the 2008 guidelines. The goal of the 2008 guidelines was to streamline the application process and feedback to departments following receipt of the 5-year reports as basis for continuing approval of a program.
Relationship Between CPT and Chemistry Department Chairs:

- We highly value the input from departments.
- Through the five-year reports, we look to individual departments for examples of different approaches to degree tracks, ensuring students obtain the needed skill-sets, etc.
- Guidelines can be used as a way for departments to argue with higher levels of University Administration for resources needed to provide a high-quality education including – instrumentation, access to Scifinder scholar, upgrades to laboratories to address ventilation issues, …

- We started holding luncheons with chairs of PhD granting departments at ACS meetings. Two were held in 2010 and more are planned in the future.

Plans are in place for a luncheon on Sunday at the Denver ACS Meeting.
Topics that Came up in the Networking Lunches:

• Concern was expressed over the push for virtual laboratories and distance learning experiences.

• Departments are using the requirements of an approved program, laid out in the guidelines to leverage support from their institutions and to argue against pushes for changes in practices that the department feels is not in the best interest of its students.

• While many prospective undergraduate students look for opportunities for certification at the time of University admissions, they often don’t include this information on their applications for jobs or graduate programs.

• Undergraduate research is an important part of the preparation of students for graduate work in chemistry.

• The role and benefits provided to non-tenure track faculty in the teaching programs of PhD granting departments varied greatly. In some institutions the level of benefits is close to those offered tenure-track faculty, while in others they are fairly modest.
An overview of other activities:

- A central activity is conducting surveys to understand trends in the education of chemists

- Recent surveys include
  - A survey of PhD Degree Programs (Spring 2008)
  - Survey of MS Degree Programs (Fall 2009)
  - Enrollment Survey (Spring 2010)
Want to pick up covers/titles fro web
Anne B. McCoy, 4/29/2011
## Enrollment Report (2001-2007)

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Intro Chem of Total UG Enrollment*</td>
<td>7.25</td>
<td>10.24</td>
<td>7.69</td>
<td>7.03</td>
</tr>
<tr>
<td>Ratio Intro Chem/Chem Major*</td>
<td>38.1</td>
<td>16.9</td>
<td>34.1</td>
<td>42.3</td>
</tr>
<tr>
<td>Ratio Org. Chem II/Chem Major*</td>
<td>9.3</td>
<td>4.5</td>
<td>7.6</td>
<td>10.5</td>
</tr>
<tr>
<td>Ratio PChem I/Chem Major*</td>
<td>1.8</td>
<td>1.3</td>
<td>1.5</td>
<td>1.9</td>
</tr>
<tr>
<td>% Biochem Conc. of Total Chem. Majors*</td>
<td>40.3</td>
<td>46.5</td>
<td>39.2</td>
<td>39.6</td>
</tr>
</tbody>
</table>

*AY 2006-2007

Small - <2500; Medium – 2500-10,000; Large - >10,000

- Compared to AY 03-04 the number of chemistry majors increased by 85% (All)*
- Compared to AY 03-04 the percentage of chemistry majors concentrating in Biochemistry increased by 47% (All)*
An overview of other activities:

• Conducting Surveys

• Recent surveys include
  – A survey of PhD Degree Programs (Spring 2008)
  – Survey of MS Degree Programs (Fall 2009)
  – Enrollment Survey (Spring 2010)
  – Faculty Status Survey (Fall 2010)
Want to pick up covers/titles fro web

Anne B. McCoy, 4/29/2011
# Faculty Gender Breakdown for all 662 ACS Approved Chemistry Programs - 2009-2010

<table>
<thead>
<tr>
<th>Totals for All Schools</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>% Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time, tenure-track/tenured</td>
<td>9504</td>
<td>7090</td>
<td>2414</td>
<td>25.4%</td>
</tr>
<tr>
<td>Full-time, permanent instructional staff</td>
<td>1494</td>
<td>788</td>
<td>706</td>
<td>47.3%</td>
</tr>
<tr>
<td>All others (full-time equivalents)</td>
<td>2045.3</td>
<td>1077.9</td>
<td>967.5</td>
<td>47.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average per School</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time, tenure-track/tenured</td>
<td>14.4</td>
<td>10.7</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Full-time, permanent instructional staff</td>
<td>2.3</td>
<td>1.2</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>All others (full-time equivalents)</td>
<td>3.1</td>
<td>1.6</td>
<td>1.5</td>
<td></td>
</tr>
</tbody>
</table>
Faculty Status Report (2009)

### Table 2. Gender Distribution at Public Institutions

<table>
<thead>
<tr>
<th>Faculty Category</th>
<th>BS Total</th>
<th>Male</th>
<th>Female</th>
<th>MS Total</th>
<th>Male</th>
<th>Female</th>
<th>PhD Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenure-track</td>
<td>721</td>
<td>73.9%</td>
<td>26.1%</td>
<td>544</td>
<td>74.8%</td>
<td>25.4%</td>
<td>1749</td>
<td>89.3%</td>
<td>16.4%</td>
</tr>
<tr>
<td>Long-term, F/T</td>
<td>119</td>
<td>43.7%</td>
<td>56.3%</td>
<td>71</td>
<td>52.1%</td>
<td>47.9%</td>
<td>279</td>
<td>60.6%</td>
<td>39.4%</td>
</tr>
<tr>
<td>Long-term, P/T</td>
<td>148</td>
<td>59.5%</td>
<td>40.5%</td>
<td>77</td>
<td>54.5%</td>
<td>45.5%</td>
<td>70</td>
<td>62.9%</td>
<td>34.1%</td>
</tr>
<tr>
<td>Temporary</td>
<td>220</td>
<td>62.7%</td>
<td>37.3%</td>
<td>153</td>
<td>58.2%</td>
<td>41.8%</td>
<td>165</td>
<td>61.2%</td>
<td>38.8%</td>
</tr>
</tbody>
</table>

### Table 3. Gender Distribution at Private Institutions

<table>
<thead>
<tr>
<th>Faculty Category</th>
<th>BS Total</th>
<th>Male</th>
<th>Female</th>
<th>MS Total</th>
<th>Male</th>
<th>Female</th>
<th>PhD Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenure-track</td>
<td>899</td>
<td>66.2%</td>
<td>33.8%</td>
<td>96</td>
<td>75.0%</td>
<td>25.0%</td>
<td>524</td>
<td>83.0%</td>
<td>17.0%</td>
</tr>
<tr>
<td>Long-term, F/T</td>
<td>132</td>
<td>40.9%</td>
<td>59.1%</td>
<td>26</td>
<td>52.0%</td>
<td>48.0%</td>
<td>85</td>
<td>57.6%</td>
<td>42.4%</td>
</tr>
<tr>
<td>Long-term, P/T</td>
<td>154</td>
<td>51.9%</td>
<td>48.1%</td>
<td>35</td>
<td>65.7%</td>
<td>34.3%</td>
<td>21</td>
<td>66.7%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Temporary</td>
<td>255</td>
<td>50.6%</td>
<td>49.4%</td>
<td>28</td>
<td>53.6%</td>
<td>46.4%</td>
<td>35</td>
<td>68.6%</td>
<td>31.4%</td>
</tr>
</tbody>
</table>

BS (also BA), MS and PhD above refer to the most advanced degree offered by an institution.

### Table 4. Racial/Ethnic Distribution among Faculty and Instructional Staff at All 422 Institutions

<table>
<thead>
<tr>
<th>Faculty Category</th>
<th>Asian American</th>
<th>African American</th>
<th>Hispanic American</th>
<th>Native American</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenure-track</td>
<td>8.8%</td>
<td>3.0%</td>
<td>2.1%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Long-term, F/T</td>
<td>6.4%</td>
<td>3.5%</td>
<td>1.9%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Long-term, P/T</td>
<td>7.7%</td>
<td>4.0%</td>
<td>0.4%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Temporary</td>
<td>9.3%</td>
<td>2.9%</td>
<td>2.1%</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

www.acs.org/cptfacultystatusreport
The Report also discusses other issues such as:

• Degree distribution among faculty and instructional staff

• Average lecture and lab contact hours

• Who is teaching the introductory chemistry for chemistry majors?

• Faculty release time

• Benefits

• Percent of non-tenure track faculty teaching at more than one institution (4-28%)
An overview of other activities:

- Conducting Surveys:
  - Collect demographic data on chemistry degree recipients nationally
- Organize and coordinate workshops
- Directory of Graduate Research
Want to pick up covers/titles fro web

Anne B. McCoy, 4/29/2011
ACS Directory of Graduate Research:

First published in 1953. Published biennially.

How should the role of the Directory of Graduate Research evolve with developments in other electronic resources?

(1500+ pages of data in the 2009 Edition.)
Future challenges

What is the role of virtual laboratories and distance learning in the undergraduate chemistry curriculum? Can virtual laboratories be as effective at providing content and understanding as traditional laboratories? How do we assess faculty teaching contact hours for a non-traditional class?

• With budget issues, what are the impact on undergraduate education of increased reliance on non-tenure track faculty?

• How do we ensure the guidelines are consistent with current available electronic information resources? How do we ensure our students know how to use them effectively?