Fostering Alignment Between the ACS Guidelines for Degree Programs at 2-Year and 4-Year Institutions

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Why I shouldn’t be giving this talk

- Bates does not accept transfer credits from two-year institutions
Why I should be giving this talk

- My son’s first three college semesters were at three different institutions

- He took the first semester of general chemistry three times

- 4½ years and some summer courses to complete graduation requirements
I’m impressed with the level of agreement between the 2-year and 4-year guidelines
4-Year Guidelines

- Silent on general chemistry (student dependent)
  - Although need for hands-on lab is specified
- Five foundation courses (ABIOP)
  - Can be stand alone or integrated courses
  - Can’t use general chemistry textbook
- Four in-depth courses – unspecified
- 400 lab hours beyond general chemistry (4 of 5 sub-disciplinary areas)
2-Year College Courses Likely to Count in a 4-Year Certified Degree

• Organic 1 – Foundation (class and laboratory)
• Organic 2 – In-depth (class and laboratory)
  – Virtually all departments require the second semester of organic chemistry for the certified degree
• Cognate courses – Year of calculus and physics
• Analytical, Inorganic, Physical, Biochemistry – Foundation
Courses and Labs

• No mandatory coverage of topics
  • Disciplinary supplements on CPT website
• We do examine (1) rigor and (2) breadth
• Example problem (rigor)
  • Exam questions all or almost all rote memorization
• Example problem (breadth)
  • Analytical foundation course that only covers electrochemistry
  • Analytical lab that overemphasizes titrations
On-line Courses

- No position on relative value of on-line versus face-to-face courses
- Instructor should get teaching credit commensurate with courses taught face-to-face
- Same level of skill development and content
- Adequate access to instructor
- Opportunities to collaborate with peers

- CPT’s next major survey will be on this topic
Virtual Laboratories

- Labs in general chemistry must be primarily hands-on, supervised experiences
  - Components of general chemistry lab: Basic lab skills, safety practices, keeping a notebook, use of electronic balances, volumetric glassware, preparation of solutions, measurements using pH meters and spectrophotometers, data analysis, report writing
- Hands-on experiences cannot be developed through virtual lab exercises
- Virtual labs may supplement hands-on exercises but must not replace them – not part of 400 hours
Laboratory Experiences Must Involve

- Synthesis of molecules
- Measurement of chemical properties
- Determination of structures
- Hands-on equipment usage
- Data analysis
- Computational modelling
Instrumentation

- Need NMR on-site that undergraduates use
- Undergraduates use equipment from at least four of the five following categories
  - Optical molecular spectroscopy
  - Optical atomic spectroscopy
  - Mass spectrometry (includes GC-MS/LC-MS)
  - Chromatography and separations
  - Electrochemistry
New MSN Requirement
Some Observations

• Some undergraduate curricula focus overwhelmingly on aspects of small molecules

• Large molecules and aggregated systems often have strikingly different properties than small molecules
  • Different properties often based on sizeSCALE and not predicted by extension of small molecule properties

• Macromolecular, supramolecular, nanoscale and mesoscale systems are important to chemists and to society
New MSN Requirement

• Principles that govern macromolecular, supramolecular, mesoscale and nanoscale systems must be part of the certified curriculum
  • Preparation, characterization and physical properties
  • Two of the following four: synthetic polymers, biological macromolecules, supramolecular, meso-or nanoscale
Meeting the MSN Requirement

- Required in-depth course (perhaps combined with some foundation)
- Distributed coverage – equivalent to approximately one-fourth of a standard semester course
  - Can be within 5 foundation courses
  - Can be a mix of foundation and in-depth
  - Can involve required lab experiences
- For many programs, Organic 2 may be an important component of meeting this requirement
Student Skills

- Programs must develop student competence in problem-solving, use of the chemical literature, communication, team work and ethics
  - Problem solving
    - Clearly define problems
    - Develop testable hypotheses
    - Design and execute experiments
    - Analyze data using appropriate statistical methods
    - Understand uncertainties in experimental methods
    - Draw appropriate conclusions
  - Programs must promote a safety culture
  - Integrate throughout the curriculum
Transfer Students

• Should provide an advisor
• Should engage in activities to encourage and ease transfer student matriculation
• Should provide a vibrant supportive framework for transfer student success

• Expectation that there is communication with regional 2-year institutions to facilitate success of transfer students
Questions/Comments?