American Chemical Society

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

Thomas Wenzel

Bates College

Lewiston, ME 04240

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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

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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 size/scale 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?