Integration of Strategies that Support
Undergraduate Education in STEM (ISSUES)[1]
Workshop Summary
January 30–31, 2014
MAA Carriage House, Washington, DC

This was a meeting of a small group of representatives from disciplinary societies in science, engineering, and the mathematical sciences (see appendix for full list of participants) as well as representatives of AAU, APLU, AAC&U, AAAS, HHMI, and NSF to generate seed ideas for areas where we could undertake collective action to improve undergraduate education. The intent was to find areas in which disciplinary societies could learn from each other's activities, coordinate efforts and policy statements to increase their collective effectiveness, and leverage their influence to help build interdisciplinary connections directed toward improving undergraduate education within individual colleges and universities.

On the first morning, Cathy Manduca led us in an activity in which we identified the common elements of our collective agenda. We identified the need to:

- Build an undergraduate student body in STEM that reflects national demographics,
- Move undergraduate teaching so that it aligns with research on teaching and learning,
- Encourage the development of Discipline-Based Educational Research (DBER) and assure that its fruits are integrated into the practice of teaching,
- Build inclusive communities of learning within individual STEM departments and combine this with departmental commitment to improving undergraduate instruction,
- Build opportunities for and awareness of robust and diverse professional pathways for STEM majors as well as an awareness of the essential nature and the applications of science, engineering, or mathematics among the students taking courses in these disciplines,
- Increase awareness within the research communities of the value of undergraduate education and need for serious attention to its challenges as part of one's professional identity.

This was followed by two presentations on specific programs with opportunities for collective participation by the societies. Toby Smith explained the AAU Undergraduate STEM Initiative. Bob Hilborn explained the importance of working within individual departments; the need to support them with practical, low-cost means of improving the effectiveness of their programs; and he highlighted his desire to use the early career workshops that are being undertaken by an increasing number of disciplinary societies as a vehicle for building a core of faculty dedicated

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to educational improvement and interdepartmental cooperation within each institution.

The remainder of the day was spent in small group discussions and large group responses that, by the end of the day, succeeded in identifying and beginning to flesh out five areas that require action. These are areas where the STEM disciplinary societies could be effective through collective efforts to influence cultural norms, offer resources including professional development, and provide direct programming for students.

1. **Supporting Early Career Faculty.** Within the disciplinary societies, the task is to develop workshops for and build communities of early career faculty, as well as partnering with the DBER community to assess the long-term effectiveness of this work. On individual campuses, the task is to work with deans and chairs to build cross-disciplinary networks of faculty who have been through these experiences, supported by networks of mentors both from the individual's profession and from within the individual's home institution.
2. **Strengthening Departments.** There is a need to increase the value placed on the department chair and to provide support for the chair by supplying tools for departmental self-assessment of teaching effectiveness and practical suggestions that chairs and departmental leaders can implement to improve teaching effectiveness.
3. **Communicating Career Pathways.** We need to increase the diversity of students within our disciplines by increasing student awareness of the variety of pathways that are available to them, actively recruiting students to these pathways, preparing them for a variety of careers, and introducing them to a network of potential employers.
4. **Shifting Cultural Norms.** Disciplinary societies should strive to move their members toward embracing teaching practices that align with what educational research has shown to be most effective and toward a mindset of continual efforts to improve undergraduate teaching and learning. This can be accomplished through policy statements, rubrics for assessing effective educational processes, and active promotion of these practices. Part of our collective goal should be the adoption of consistent language that reinforces this message across disciplinary boundaries.
5. **Measuring the Impact of Our Own Programs for Improving Undergraduate Education.** The disciplinary societies can benefit from developing common rubrics for assessing the effectiveness of their own programs and using these to help frame discussion and dialog across the societies.

In addition to these five broad areas where the societies could engage in collective action, we identified specific action items that we could undertake as our immediate next steps. These include:

- A partnership with AAU to begin to build, within a select set of AAU universities, networks of faculty who have shared the experience of an early

career faculty workshop within their discipline. This would be combined with extensive evaluation and assessment of this effort undertaken as a research agenda.

- A task for the DSEA (Disciplinary Societies and Educational Associations) Alliance to begin to collect examples of self-assessment of educational programs by the disciplinary societies with the goal of eventually building a set of rubrics or guidelines for such self-assessment.
- Involvement of the leadership of the disciplinary societies to advance two agendas, one fairly straightforward, the other a longer term goal:
    - Review and compare policy statements and frameworks for improving undergraduate education, with the goal of finding common language to increase the collective impact of the message that these societies are conveying, and
    - Review and compare guidelines provided by disciplinary societies or other groups, such as the Partnership for Undergraduate Life Sciences Education (PULSE), for individual departments to use for the purpose of improving undergraduate education, with the goal of creating consistently framed but discipline-specific guidelines that are developed and promoted by the societies.

The workshop concluded with a presentation of these frameworks and action items to Shirley Malcolm of AAAS, Susan Singer of NSF, and David Asai of HHMI. They had many very helpful and very specific suggestions for research to draw on, programs to plug into, and difficulties to watch out for. In particular, David Asai recommended that we look to the range of expertise and types of members of the various disciplinary societies, consider surveying the landscape to record who the disciplinary societies can reach effectively reach (and who not reach), and think about how to tie these to the faculty and programs we seek to influence. At the same time, they emphasized the need to keep the big picture in focus. This effort is directed toward bringing about a significant change in how academics in science, engineering, and mathematics understand their professional identity by helping them to see the continual improvement of undergraduate education as part of their professional responsibility.

Appendix: Participants

Bethany Adamec, American Geophysical Union
Ashok Agrawal, American Society for Engineering Education
David Asai, Howard Hughes Medical Institute
*Linda Braddy, Mathematical Association of America
*David Bressoud, Mathematical Association of America
*Amy Chang, American Society for Microbiology
Beth Cunningham, American Association of Physics Teachers
Jesus de Loera, American Mathematical Society
Michael Feder, National Academy of Sciences
Catherine Fry, PKal/AAC&U
Howard Gobstein, Association of Public Land-Grant Universities
Jack Hehn, American Institute of Physics
*Bob Hilborn, American Association of Physics Teachers
Ted Hodapp, American Physical Society
Mary Kirchhoff, American Chemical Society
Shirley Malcolm, American Association for the Advancement of Science
*Cathy Manduca, National Association of Geoscience Teachers
Gary Martin, Association of Public Land-Grant Universities
Emily Miller, Association of American Universities
*Susan Musante, American Institute for Biological Sciences
Rebecca Nichols, American Statistical Association
Michael Pearson, Mathematical Association of America
Jackie Reeves-Pepin, National Association of Biology Teachers
Susan Singer, National Science Foundation
Linda Slakey, University of Massachusetts
Toby Smith, Association of American Universities
Peter Turner, Society for Industrial and Applied Mathematics
Jodi Wesemann, American Chemical Society

* Organizing Committee