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New Expectations for the Training of Medical Students

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Participants in the Leadership Workshop. Front Row (left to right): Zhilan Feng, Gerda deVries, Mary Ann Horn, Renee Fister. Back Row (left to right): Rebecca Segal, Ellen Daniell, Holly Gaff

Opportunities for Leadership Workshop at SMB Annual Meeting

K. Renee Fister, Holly Gaff, and Rebecca Segal

This workshop sponsored by SMB and SIAM was geared to the development of women in bio-mathematics, by fostering both tangible and "intangible" qualities that are the makeup of leaders. There were approximately 40 participants with a healthy mix of men and women. Participants had the opportunity to hear about perspectives and lessons learned from professional women at different career stages pertaining to tenure and/or industrial jobs. The workshop was organized by Holly Gaff from Old Dominion University, Renee Fister from Murray State University, and Rebecca Segal from Virginia Commonwealth University. The workshop involved a lunch sponsored by SIAM, a presentation by Ellen Daniell, a break out session to simulate the aspects of a group session, and a panel discussion oriented toward issues about career and family balance, the art of saying no, and making choices about one's goals.

For over 30 years, Ellen Daniell, author of Every Other Thursday: Stories and Strategies from Successful Women Scientists has been part of a professional problem-solving group of women (and some men) who have attained extraordinary distinction in various scientific fields. The group meets every other week to help one another with the professional and personal challenges of managing highly competitive careers and fulfilling lives. In her talk, Dr. Daniell described how the group works and some specific experiences of its members during the course of their careers. The talk highlighted the importance of cooperation and of not going it alone in a competitive world.

Following Dr. Daniell's talk, the participants formed small groups in order to replicate a group problem solving session. It provided an opportunity for participants to present a problem and to have peers give opinions and food for thought. The interaction was extremely fruitful in that it illustrated the powerful dynamics of a group. It also allowed participants to meet other bio-mathematicians and to expand their professional network.

The session concluded with a lively panel discussion. The panel involved Zhilan Feng from Purdue University, Gerda deVries from the University of Alberta, Mary Ann Horn from the National Science Foundation, Renee Fister from Murray State University, Holly Gaff from Old Dominion University, Ellen Daniell, author. Rebecca Segal from Virginia Commonwealth University moderated the session and initiated thought provoking questions for the panelists to address.

New Expectations for Medical Students: An Undergraduate Preparation Perspective

Meredith L. Greer

On June 4, 2009, a new report called for extensive changes in the mathematics and natural sciences training of medical students. In its most sweeping feature, the report identifies several competencies - skills, knowledge, or attitudes – for students to master at both the undergraduate and medical student levels. For undergraduates planning to apply to medical school, this approach contrasts sharply with taking a collection of prescribed courses. For professors at undergraduate institutions, this approach allows far greater freedom for curricular innovation than has existed previously. For mathematicians, like myself, this approach deserves special note for its quantitative/mathematical component.

The Recommenders

A committee of 22 scientists, physicians, and educators, convened by the Association of American Medical Colleges (AAMC) and the Howard Hughes Medical Institute (HHMI), created the report. Both AAMC and HHMI had concerns generated by the quickly increasing pace of biological and medical research. They believe that physicians must not only

have strong science backgrounds, but also possess the inquisitiveness and skill set to integrate new scientific discoveries into their work for their entire careers. The committee further felt that medical school course requirements and admissions testing, notably the MCAT (Medical College Admission Test), did not reflect the most appropriate knowledge and thought processes. In fact, many undergraduate faculty had reported that current medical school requirements and testing actually restrict opportunities for innovation in undergraduate science curricula. Such concerns had been stated in BIO 2010, published by the National Academies in 2003, and had become a topic of continued conversation since.

The Recommendations

The committee describes two sets of expected competencies: one for students, frequently undergraduates, seeking to enter medical school, and one for students completing medical school. Accompanying each competency are several learning objectives, each with examples to illustrate specific goals.

This article focuses on the undergraduate requirements because so many of us, through our teaching and in many cases our research partnerships, have an impact at that level. For these students, some of the competencies focus on a general area of knowledge – chemistry, basic physical principles, biomolecules, evolution – and how to apply that area to the study of living systems, cells, or the diversity of life on earth. One competency focuses on the process of scientific inquiry, and expects students to be able to explain how scientific knowledge is discovered and validated. Another competency asks students to apply their understanding of the principles of how molecular and cell assemblies, organs, and organisms develop structure and carry out function. Yet another competency states, "Explain how organisms sense and control their internal environment and how they respond to external change."

The remaining competency requires students to "[a]pply quantitative reasoning and appropriate mathematics to describe or explain phenomena in the natural world." The subsequent list of learning objectives provides important details. Students must demonstrate quantitative numeracy and speak the language of mathematics. Working with data sets is extremely important: students need to be able to communicate data visually and otherwise, make statistical inferences, and extract information from large data sets. Mathematical modeling, algorithmic approaches, and principles of logic should all be familiar to an applicant to medical school. The detailed examples make clear that medicine is ever-changing. Long after medical school, physicians need to seek out new studies, sometimes reading multiple data-filled sources on a topic, then sort out conflicting information and ultimately draw their own conclusions.

The Future

"A fundamental component of any curricular change is to ensure that the faculty ultimately responsible for the education of students and physicians assume responsibility for determining the knowledge, attitudes, and skills required to achieve the competencies." With this, as with several other statements, the committee from AAMC and HHMI makes clear that its report is not a mandate. Many other institutions will play their own parts in updating the expectations for medical students. Most immediately, while the committee has identified competencies, individual colleges, universities, and medical schools will determine the level of performance required within each of the competencies. Indeed, the report encourages curricular innovation, so that students can achieve excellence at the competencies via a wide variety of academic offerings.

Assessment is a longer-term project. This includes assessment of the competencies in students. The MCAT, which AAMC administers, is currently undergoing a comprehensive review. The suggestions from this report are part of those discussions. Ultimately, AAMC and HHMI plan to assess the system of competencies, its relationship to curriculum, and the assessment of students, altogether.

In time, the competencies themselves are subject to change. This is an expected and important part of the new system. For now, undergraduate programs wishing to offer a liberal arts and/or integrated science approach have a report showing the enthusiastic support of the AAMC and HHMI.

For more information, the full report: http://www.hhmi.org/grants/pdf/08-209_AAMC-HHMI_report.pdf, Report summary and other information: http://www.hhmi.org/grants/sffp.html, AAMC's home page: http://www.aamc.org/, HHMI's home page: http://www.hhmi.org/, BIO 2010. National Academies Press, 2003.