

STEM education system needs sweeping changes, current and former university presidents agree

By Jim Erickson, Michigan News

ANN ARBOR—The U.S. system of graduate and postgraduate education in science, technology, engineering and mathematics has been the gold standard for the rest of the world for decades. However, the current STEM education system has failed to change with the times and does not meet the needs of 21st century students.

Dramatic changes are required, including a more student-focused approach that provides graduate students and postdoctoral trainees with a realistic understanding of career prospects, one that encourages them to explore options outside of academia.

Those are among the shared conclusions and recommendations of two recent reports from the National Academies of Sciences, Engineering and Medicine. Two authors, one from each committee who wrote the 2018 reports, – former University of Michigan President Mary Sue Coleman and current Johns Hopkins University President Ronald Daniels – summarized the studies at a recent U-M workshop on graduate and postgraduate STEM training for the 21st century.

The workshop was held at Palmer Commons in September and was co-hosted by the U-M Biosciences Initiative and Rackham Graduate School. In addition to the public forum on the recent reports, the workshop included a U-M faculty panel on biosciences training and a discussion with postdocs and graduate students.

U-M was the first institution in the nation to host the workshop in collaboration with the National Academy of Sciences, Engineering and Medicine.

“Our country has the best graduate education programs in the world, and our intent is to build on those strengths. But the time has come for a shift away from the current system to one that places the needs of the individual student front and center,” said Coleman, one of the authors of the report “Graduate STEM education for the 21st century.”

The current system of graduate STEM education focuses primarily on the needs of institutions of higher education and of the research enterprise itself, according to the report. In an ideal, student-centered STEM graduate education system, prospective graduate students would be able to select their graduate program aided by fully transparent, easily accessible data about costs incurred and viable career pathways, as well as the successes of previous students.

Both Coleman, who is president of the Association of American Universities, and Daniels said U-M’s Rackham Graduate School is a national leader in providing detailed information about

graduate programs on its website. Other U.S. universities and colleges should follow U-M's lead, they said.

Achieving a more student-centered graduate STEM education system will require an increased emphasis on mentoring and advising graduate students. To make that happen, academic institutions must adjust faculty incentives to reward educational as well as research accomplishments.

"The current system is heavily weighted toward rewarding faculty for research output in the form of publications and the number of future scientists produced," according to the graduate STEM education report. "It must be realigned to increase the relative rewards for effective teaching, mentoring and advising."

The report recommends that advancement procedures for faculty—including promotion and tenure policies—should be restructured at U.S. universities and colleges to strengthen recognition of contributions to graduate mentoring and education. New faculty members should receive training in teaching and mentoring, and regular refresher courses should be provided for established faculty, the report recommends.

The U-M faculty panel at the Sept. 20 workshop included Deborah Goldberg of the Department of Ecology and Evolutionary Biology, Anna Mapp of the Department of Chemistry and the Life Sciences Institute, Pierre Coulombe, chair of the Department of Cell and Developmental Biology at the Medical School, and Peter Hitchcock, an associate dean at the Rackham School of Graduate Studies.

Goldberg said that while she strongly supports the idea of a more student-centered graduate STEM education program, some tradeoffs are unavoidable.

"There are intrinsic conflicts between maximizing student and faculty success," she said. "Research grants are how faculty pay for students. To get more grants we need more publications, so the focus must be on research. That is a real conflict."

Recommendations of the NAS report on postgraduate STEM training, "The Next Generation of Biomedical and Behavioral Sciences Researchers: Breaking Through," include setting a five-year limit on postdoctoral training appointments.

After five years, any postdoctoral researcher continuing in the same laboratory should be shifted to employment as a staff scientist, with increased salary and benefits as appropriate for a permanent staff member.

Too many postdoctoral researchers pursue training experiences with the objective of later securing increasingly elusive academic positions, according to the report. In 1973, 55 percent of Ph.D.s in the biological sciences received a tenure-track academic research position within six years, compared to just 18 percent in 2009.

“This is a system where far more students will enter as graduate students than will ever end up in faculty positions,” said Daniels, who chaired the committee that prepared the report.

The focus of young scientists on securing an academic research faculty position can lead them to overlook opportunities as independent researchers in other areas, such as in start-up and established industries, foundations, and government, according to the report.

Young scientists should have a realistic understanding of their career prospects and should be encouraged “to explore other career options sooner rather than spending time in long or multiple postdoctoral positions,” according to the report.

To that end, the panel recommends that biomedical research institutions collect, analyze and disseminate comprehensive data on outcomes, demographics and career aspirations of biomedical pre- and postdoctoral researchers. To ensure compliance, the National Institutes of Health should make collection and publication of such data a requirement for additional NIH funding.

The postgraduate STEM training report also calls on Congress to establish a Biomedical Research Enterprise Council, or BREC, that would provide an assessment of progress toward implementation of the report’s recommendations.

“What’s so striking about these issues is that they are so clearly not new issues. They have been around literally for decades,” Daniels said. A dozen or more national reports have been issued on the topics of graduate and postgraduate STEM training over the last 20 or 30 years, yet little progress has been made, he said.

“We call for the creation of this institution, the BREC, so that there is sustained engagement and accountability for the report and an assessment of how it is being implemented,” he said.

[“Graduate STEM Education for the 21st Century”](#)

[“The Next Generation of Biomedical and Behavioral Sciences Researchers: Breaking Through”](#)