

NIH Scientific Management Review Board

Working Group on Pre-college Engagement in Biomedical Science

FINDINGS & PRELIMINARY RECOMMENDATIONS

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ROSTER

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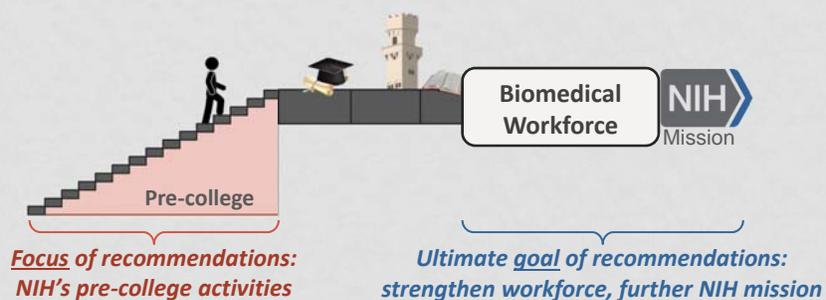
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CHARGE

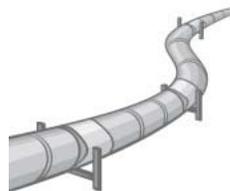
To recommend ways to optimize NIH's pre-college programs and initiatives that both align with the NIH mission and ensure a continued pipeline of biomedical science students and professionals



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PIPELINE OR FUNNEL?

To recommend ways to optimize NIH's pre-college programs and initiatives that both align with the NIH mission and ensure a continued pipeline of biomedical science students and professionals



or



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ELEMENTS OF THE CHARGE

In addressing this charge, the SMRB should:

1. Examine the **evidence base** for successful approaches for pre-college biomedical science programs aimed at strengthening the biomedical workforce pipeline;
2. Identify the attributes, activities, and components of **effective pre-college biomedical science programs**, including the role and relative importance of teacher training programs;
3. Identify those points in the pre-college **biomedical workforce pipeline** where NIH's efforts could be applied most effectively, given finite resources; and
4. Define ways for NIH to **improve the evidence base** for effective pre-college biomedical science programs.

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GENERAL FINDINGS

- **Education disparities harm millions of students, especially minority and poor students**
 - Uneven distribution of well-trained science teachers and resources.
 - Lower academic and career expectations for under-represented minority students
- **Ad hoc curriculum and standards impede preparedness for college**
 - Discrepancies in rigor of science standards and quality of curriculum
 - Efforts to change science standards and curriculum are ongoing and are often controversial
- **These issues will need to be addressed nationally by political and community leaders, policy makers, and other decision makers.**

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FINDINGS RELATED TO NIH'S STEM PROGRAMS

1. **Limited opportunities for under-represented minority and low SES students**
2. Outmoded workforce categories in the biomedical science enterprise
3. Uncoordinated governance and oversight of NIH's pre-college activities
4. Limited program evaluation
5. Untapped potential of NIH's research community
6. Need for partnering with other entities committed to STEM outreach for pre-college students

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FINDING 1: Limited opportunities for under-represented minority and low SES students

- Quality and quantity of individuals entering the STEM workforce may be sufficient, but the overall makeup is decidedly lacking in diversity, especially in positions of leadership.
- STEM attitudes are positive at a young age across gender and racial/ethnic groups, but access and performance gaps begin to appear in elementary school.
- Women are just as likely as men to persist in STEM major once chosen; however, they enter into STEM majors at different rates.
- Strong need to engage and retain under-represented and low socioeconomic status (SES) students and improve their access to educational and career opportunities.

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FINDING 1: Limited opportunities for under-represented minority and low SES students

PRELIMINARY RECOMMENDATIONS and OPPORTUNITIES

- Better target NIH-funded education outreach to students from under-represented groups and their teachers.
- Promulgate best practices of exemplar programs with a track record of directing under-represented minorities students toward careers in biomedical science.
- Utilize NIH enrichment programs (e.g., summer internship programs) as opportunities to enhance diversity.

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FINDING 2: Outmoded workforce categories in the biomedical science enterprise

- Conceptualization of the workforce is too narrow.
- New job categories are emerging.
- There is a need to cultivate cross-disciplinary science and opportunities for young people to bring new capabilities.

Biomedical Workforce

Principal investigator Clinician scientist Postdoctoral researcher

vs.

Tech transfer officer Science teacher Clinical trial coordinator Veterinarian
 Journal editor Pharmaceutical manufacturer Clinical nurse Staff scientist
 Statistician **Biomedical Workforce*** Clinician
 Principal investigator Clinician scientist Postdoctoral researcher
 Science policy analyst Computational biologist Grant manager Regulatory official

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FINDING 2: Outmoded workforce categories in the biomedical science enterprise

PRELIMINARY RECOMMENDATIONS and OPPORTUNITIES

- Emphasize the wide range of current and future career options available to students.
- Promote the cross-disciplinary nature of innovative biomedical science.
- NIH's STEM education programs should be informed by the work of the NIH Division of Biomedical Research Workforce Programs in order to:
 - understand the composition of the current biomedical workforce
 - project future workforce needs, and
 - identify emerging skills that should be fostered in K-12 education settings.

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FINDING 3: Uncoordinated governance and oversight of NIH's pre-college activities

- Governance is a key attribute of success.
- NIH supports a number of STEM programs targeted at K-12 students and teachers, (e.g., SEPA, summer research programs), but these efforts are largely ad-hoc and uncoordinated.

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FINDING 3: Uncoordinated governance and oversight of NIH's pre-college activities

INVENTORY OF NIH'S PRE-COLLEGE ACTIVITIES

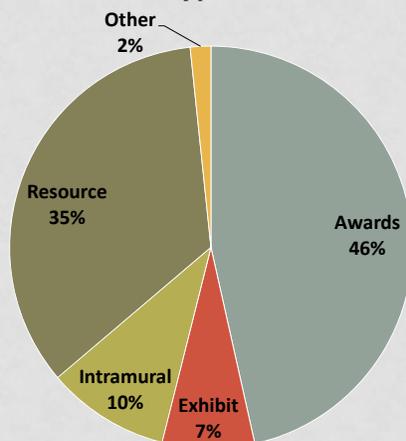
- NIH staff reported a total of 246 K-12 STEM activities
 - 35 internship programs
 - 19 curriculum supplements
 - 66 teacher development activities
- 41 percent of the activities include students from underrepresented minority groups

Note: Criteria for identifying pre-college activities may have varied by IC and office.

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FINDING 3: Uncoordinated governance and oversight of NIH's pre-college activities

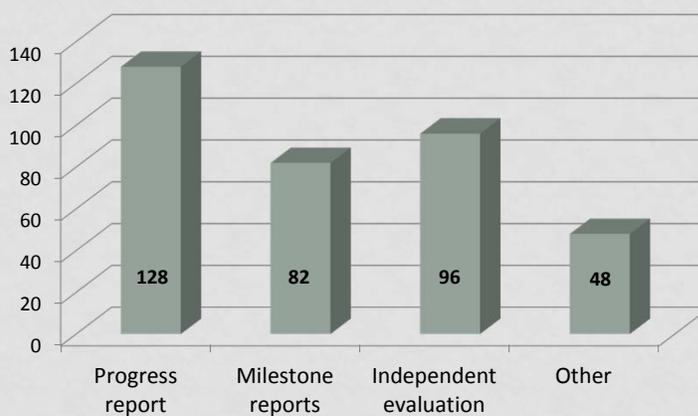
INVENTORY: Types of activities



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FINDING 3: Uncoordinated governance and oversight of NIH's pre-college activities

INVENTORY: Evaluative Methods



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FINDING 3: Uncoordinated governance and oversight of NIH's pre-college activities

PRELIMINARY RECOMMENDATIONS and OPPORTUNITIES

- Assign an office and/or leader to provide governance and coordination. Governance functions should include:
 - Report annually on NIH-supported STEM programs to the NIH Director, SMRB, and the ACD.
 - Produce and update annually a complete inventory of active NIH pre-college STEM programs.
 - Develop metrics needed to assess the effectiveness of already extant NIH STEM programs.
 - Provide more resources for those engaged in teaching or mentoring pre-college students.
 - Strongly encourage all NIH-supported STEM programs to maximize outreach to under-represented populations.
 - Identify best practices in pre-college engagement.

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5. Untapped potential of NIH's research community
6. Need for partnering with other entities committed to STEM outreach for pre-college students

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FINDING 4: Limited program evaluation

- NIH's pre-college engagement programs are not routinely or consistently evaluated for their impact on students and teachers, effectiveness in advancing NIH's goals, or scalability.
- There is little empirical evidence on specific programs or educational approaches that are effective, either for improving science teaching or student learning outcomes.
- Without an evidence base for what works, it is impossible to precisely define the attributes of effective STEM programs;

HOWEVER...

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FINDING 4: Limited program evaluation

- ... NIH's programs should aim to:
 - improve teacher preparedness and retention,
 - equip students with cross-disciplinary skills,
 - engage students' interests in biomedical science careers, and/or
 - give students, particularly under-represented populations, greater access to biomedical science learning opportunities.

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FINDING 4: Limited program evaluation

PRELIMINARY RECOMMENDATIONS and OPPORTUNITIES

- Work with other federal agencies to build the evidence base for STEM education
- Establish systematic and comparable evaluation practices for NIH's pre-college programs
- Identify appropriate metrics and outcome measures
- Work with other agencies to improve the collection of longitudinal, student-level data, especially as they relate to K-12 student's exposure to biomedical and human health learning experiences and eventual career trajectories

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FINDING 5: Untapped potential of NIH's research community

- NIH can increase the impact and reach of its STEM education efforts by leveraging existing investments in university researchers, trainees, and infrastructure.

PRELIMINARY RECOMMENDATIONS and OPPORTUNITIES

- Encourage and incentivize grantee institutions, researchers, and trainees to engage pre-college students in biomedical research.

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FINDING 6: Need for partnering with others

- Many other agencies and institutions are engaged in STEM education outreach and influence audiences beyond the reach of NIH.
- NIH makes a unique contribution to biomedical education and outreach.
- By using the leverage of NIH, the varied entities in this space could improve the coordination of their collective efforts with the goal of complementing each other's roles, thus achieving greater impact than working in isolation.

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FINDING 6: Need for partnering with others

- CoSTEM (Committee on Science, Technology, Engineering, and Math Education) is made up of 14 federal entities:
 - Department of Agriculture
 - Department of Commerce
 - Department of Defense
 - Department of Education
 - Department of Energy
 - Department of Health and Human Services
 - Department of Homeland Security
 - Department of the Interior
 - Department of Transportation
 - Environmental Protection Agency
 - Executive Office of the President
 - National Aeronautics and Space Administration
 - National Science Foundation
 - Smithsonian Institution

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FINDING 6: Need for partnering with others

- CoSTEM subcommittees are addressing five national goals:
 - Improve STEM instruction
 - Increase and sustain youth and public engagement in STEM
 - Enhance STEM Experience of Undergraduate Students
 - Better serve groups historically under-represented in STEM fields
 - Design graduate education for tomorrow's STEM workforce

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FINDING 6: Need for partnering with others

PRELIMINARY RECOMMENDATIONS

- Build relationships with industry and non-profits:
 - Develop a Pre-College Biomedical Science Council with organizations that support pre-college programs and biomedical science outreach.
- Leverage federal interagency efforts and assets:
 - Work closely with the National Science and Technology Council's Committee on STEM Education (Co-STEM).
 - Leverage NIH's resources to support government-wide efforts to improve STEM education and strengthen the evidence base.
 - Partner with ED and NSF to build and implement evaluation standards for NIH's STEM programs.
 - Partner with NSF to improve data collection at the undergraduate and pre-college level that will be useful for biomedical workforce analysis.

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NEXT STEPS

- **Fall–Winter Working Group activities**
 - Explore opportunities to work with CoSTEM organizations
 - Refine recommendations and findings
 - Draft report
- **December 15 SMRB meeting**
 - Vote on PEBS findings and recommendations

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