

NIH Scientific Management Review Board

Working Group on Pre-college Engagement in Biomedical Science

PRELIMINARY FINDINGS

JULY 7, 2014

ROSTER

Non-Federal Members

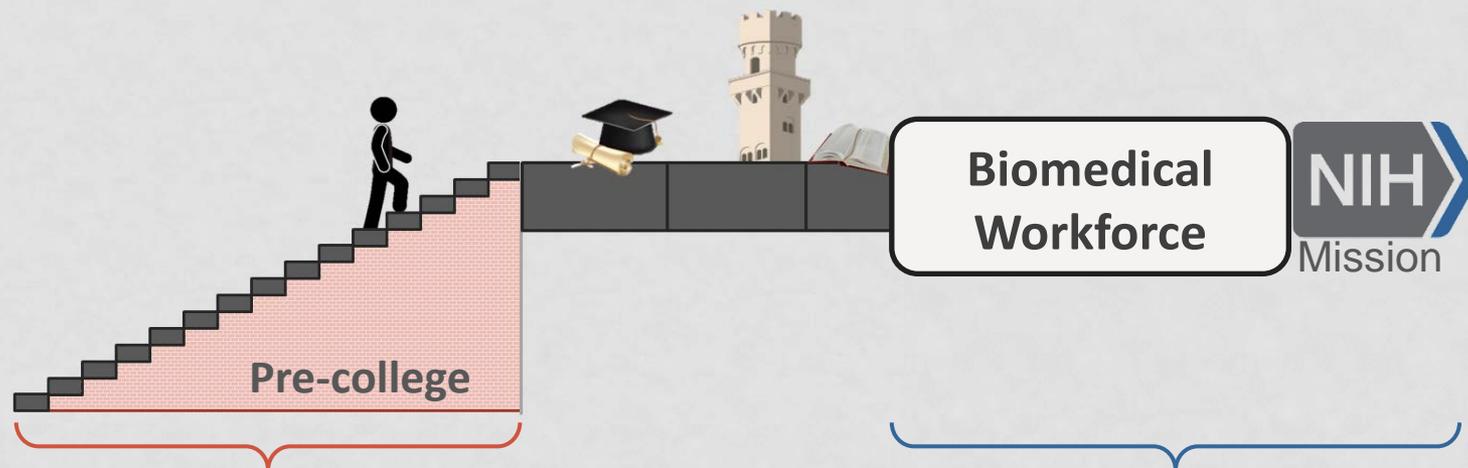
- Clyde W. Yancy, M.D. (Chair)
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- Norman R. Augustine
- Lee E. Babiss, Ph.D.
- Gilbert S. Omenn, M.D., Ph.D.

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- Josephine P. Briggs, M.D.
- Gary H. Gibbons, M.D.
- Alan E. Guttmacher, M.D.
- Stephen I. Katz, M.D., Ph.D.
- Roderic I. Pettigrew, Ph.D., M.D.

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



Focus of recommendations:
NIH's pre-college activities

Ultimate goal of recommendations:
strengthen workforce, further NIH mission

NIH MISSION: GOALS OF THE AGENCY

- Foster fundamental creative discoveries, innovative research strategies, and their applications as a basis for ultimately protecting and improving health
- **Develop, maintain, and renew scientific human and physical resources that will ensure the Nation's capability to prevent disease**
- **Expand the knowledge base in medical and associated sciences in order to enhance the Nation's economic well-being and ensure a continued high return on the public investment in research**
- Exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science

BIOMEDICAL WORKFORCE

Preliminary findings:

- The evolution of biomedical research produces new job categories and opportunities for young people to bring new capabilities for emerging areas of research. This puts a premium on teaching and learning experiences that recognize and anticipate these changes
- The number and quality of individuals going into biomedical research appear to be adequate, but the diversity of the workforce needs improvement
- Some groups are underrepresented in the biomedical workforce and in positions of leadership
- Gender, race/ethnicity, and SES show clear gaps

BIOMEDICAL WORKFORCE *(CONT.)*

Preliminary finding:

- Current conceptualization of the workforce is too narrow

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

X-ray technician

Grant manager

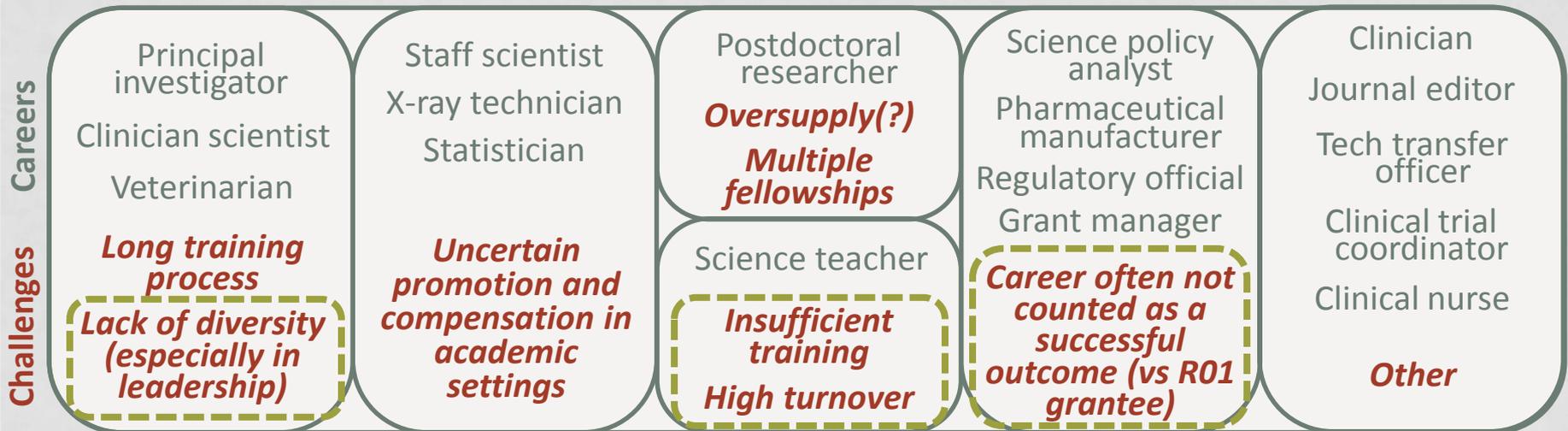
Regulatory official

*For a list of fields of study, see <http://www.nsf.gov/pubs/2012/nsf12599/nsf12599.htm#appendix>

BIOMEDICAL WORKFORCE *(CONT.)*

Preliminary findings:

- Some workforce challenges can be addressed through pre-college activities (*see circled challenges*)



- Other workforce-related challenges include:
 - Student preparedness for college coursework
 - Student access to educational and career opportunities
 - Perception of the scientific workforce as being solely academic

BIOMEDICAL WORKFORCE *(CONT.)*

Topics/perspectives for further study:

- Skills and training high school graduates need in order to succeed in post-secondary and graduate biomedical science programs and the biomedical workforce
- Analysis of the racial/ethnic/gender makeup of biomedical workforce in particular fields and in positions of leadership in the context of national demographics
- Approaches to engaging graduate students and post-docs in informal science teaching/learning settings and identifying science teaching as an attractive career option
- Identify the types of jobs that should be considered successful outcomes of NIH-funded training and outreach

ELEMENTS OF THE CHARGE

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
4. Define ways for NIH to improve the evidence base for effective pre-college biomedical science programs

Next: preliminary findings and data needs for each element

CHARGE ELEMENT 1: SUCCESSFUL APPROACHES

“Examine the evidence base for successful approaches for pre-college biomedical science programs aimed at strengthening the biomedical workforce pipeline.”

Preliminary findings:

- It is helpful to expose students to positive science environments, provide science education outside of the classroom, and link learning to career opportunities
- Pre-college curricula tend to focus on general science (not biomedical science), although high school biology is commonly taken
- Human biology and biomedical research should be a greater part of the high school biology course/curriculum
- There is a need to engage and retain students from underrepresented minority populations, and improve access to educational and career opportunities

CHARGE ELEMENT 1: SUCCESSFUL APPROACHES *(CONT.)*

Topics/perspectives for further study:

- 2011 NRC report on “Successful K-12 STEM Education: Identifying Effective Approaches in STEM”
(http://www.nap.edu/catalog.php?record_id=13158)
- Insights from experts in pre-college science education; areas could include curriculum, teacher training, and education theory
- Identify ways to evaluate the effectiveness of educational and outreach approaches

CHARGE ELEMENT 2: ATTRIBUTES OF EFFECTIVE PROGRAMS

“Identify the attributes, activities, and components of effective pre-college biomedical science programs, including the role and relative importance of teacher training programs.”

Preliminary findings:

- Some programs have proven effective at raising the skill-level and effectiveness of science teachers but are often too costly to scale up
- The most effective programs are sustainable and scalable
- Effective programs improve teaching, equip students with necessary skills, engage students, and/or give students greater access to biomedical science learning opportunities

CHARGE ELEMENT 2: ATTRIBUTES OF EFFECTIVE PROGRAMS *(CONT.)*

Preliminary findings:

- Improvements are needed in science teacher preparedness and retention, with an emphasis on elementary and middle school teachers, especially those teaching lower income populations
 - Science teachers receiving <6 hours of subject-specific professional development in the past three years: elementary = 65%, middle school = 30%, and HS = 23%
 - Science teacher turnover rates are very high

Topics/perspectives for further study:

- Experience of institutions that fund pre-college engagement programs
- Insights from experts in pre-college science education; areas could include curriculum, teacher training, education theory
- Review successful pre-college programs (e.g., Stanford Medical Youth Science Program)
- Identify ways to evaluate the effectiveness of programs

CHARGE ELEMENT 3: OPTIMAL USE OF NIH RESOURCES

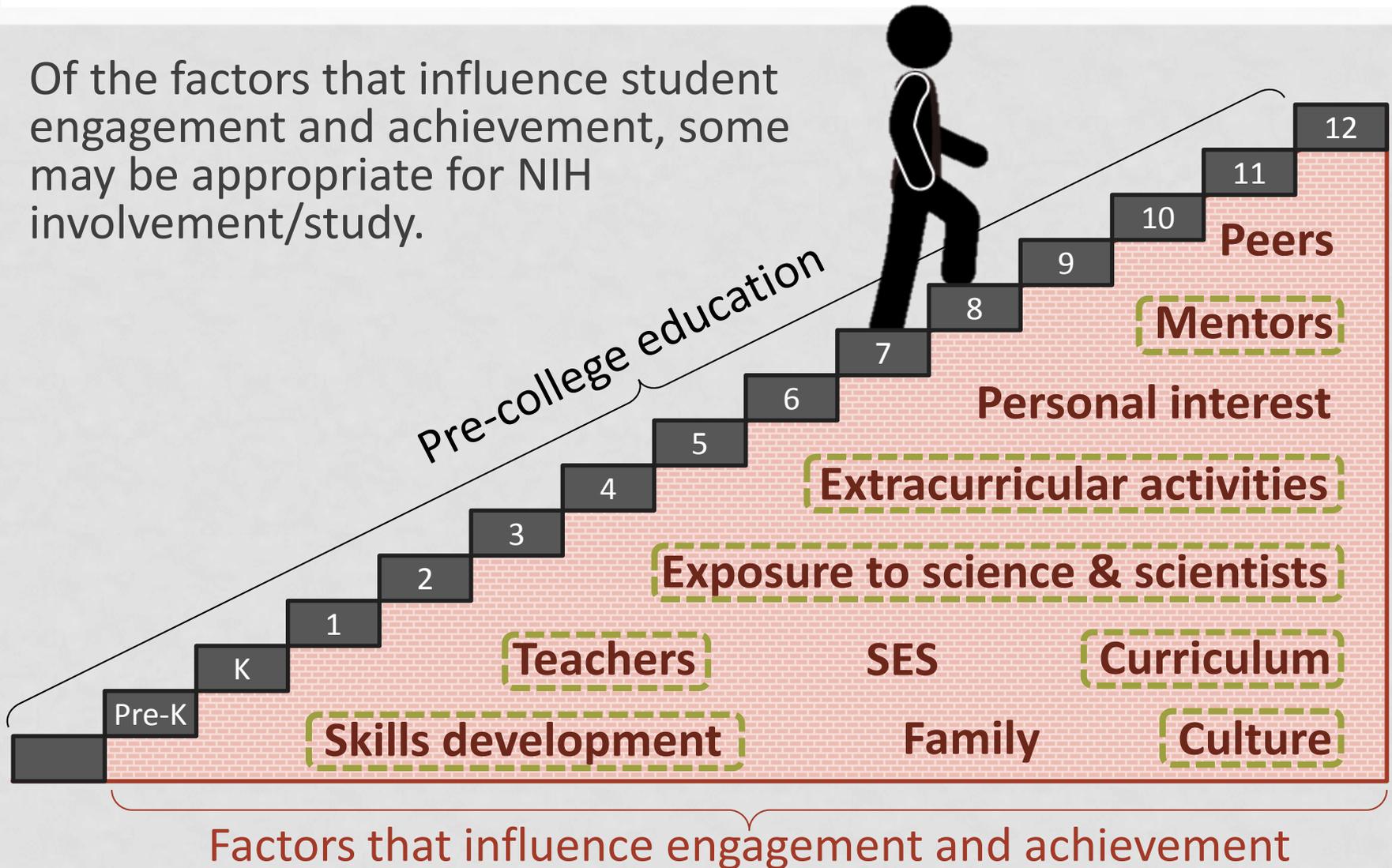
“Identify those points in the pre-college biomedical workforce pipeline where NIH's efforts could be applied most effectively, given finite resources.”

Preliminary findings:

- Potential targets for NIH activities include students, teachers, parents, schools, communities, and curriculum, as well as NIH-funded trainees, researchers, and others interested in teaching or mentoring pre-college students
- Leveraging NIH's existing network of funded research centers would be a more cost-efficient way to support pre-college outreach (especially to underrepresented groups) than generating a new office or program
- NIH could partner with other agencies and organizations that already engage or study pre-college students (e.g., Department of Education, NAS, NSF, Next Generation Science Standards)
- SMRB should develop short-, medium-, and long-term steps NIH can take to improve pre-college engagement in biomedical science

CHARGE ELEMENT 3: OPTIMAL USE OF NIH RESOURCES *(CONT.)*

Of the factors that influence student engagement and achievement, some may be appropriate for NIH involvement/study.



CHARGE ELEMENT 3: OPTIMAL USE OF NIH RESOURCES *(CONT.)*

Topics/perspectives for further study:

- Review of pre-college engagement programs supported by NIH (e.g., BUILD, Summer Internship Program, NIH Institute and Center activities)
- Curriculum development and Next Generation Science Standards
- Resources and logistics needed to operate programs like Stanford Medical Youth Science Program
- Willingness of NIH grantee institutions to engage and mentor pre-college students
- Forming partnerships with non-academic partners in pre-college outreach efforts
- Social and cultural factors that contribute to interest and achievement in science across gender and racial/ethnic groups

CHARGE ELEMENT 4: IMPROVEMENTS TO EVIDENCE BASE

“Define ways for NIH to improve the evidence base for effective pre-college biomedical science programs.”

Preliminary findings:

- There may be opportunities for NIH to partner with NSF and others to collect data that will be useful for biomedical workforce analysis
- NIH’s Science Education Partnership Awards (SEPA) Program plans to introduce an evaluation component for new awards
- NIH-funded basic research could increase understanding of the learning process

Topics/perspectives for further study:

- Potential partnership with NSF Center for Science and Engineering Statistics (<http://www.nsf.gov/statistics/>) to collect biomedical-specific data
- Basic research findings regarding child development and learning

NEXT STEPS

- **July 7–8 SMRB stakeholder meeting**
 - Receive input from experts and stakeholders in pre-college engagement
- **Summer Working Group activities**
 - Briefings from experts and stakeholders (e.g., SEPA awardees, NIH and IC program staff, education evaluators)
 - Develop and announce initial findings and recommendations; draft report
- **October 14 SMRB stakeholder meeting**
- **Fall Working Group activities**
 - Refine report
- **December 15 SMRB meeting/teleconference**
 - Discussion of PEBS findings and recommendations

JULY 7 SMRB MEETING AGENDA

- **Optimizing NIH Efforts to Engage Pre-college Students in Biomedical Science**
 - **James M. Anderson**, M.D., Ph.D., Director, Division of Program Coordination, Planning, and Strategic Initiatives, National Institutes of Health
- **Panel I: Perspective of Science Teachers**
 - **Steven Ahn**, High School Science Teacher, Abingdon High School, Abingdon, Virginia
 - **Megan Fisk**, High School Science Teacher, Eastern High School, St. Michaels, Washington, DC
 - **Lola Odukoya**, Middle School Science Teacher, Langdon Education Campus, Washington, DC
- **Panel II: Gender and Racial/Ethnic Disparities in Pre-college Engagement in Biomedical Science**
 - **Matthew Z. Anderson**, Ph.D., Postdoctoral Researcher, Molecular Microbiology and Immunology Department, Brown University
 - **Catherine Riegler-Crumb**, Ph.D., Associate Professor, Department of Curriculum & Instruction, University of Texas at Austin
 - **Allison Scott**, Ph.D., Director of Research and Evaluation, Level Playing Field Institute

JULY 7 SMRB MEETING AGENDA *(CONT.)*

- **Panel III: Science Standards, Curriculum Development, and Teacher Training**
 - **Talia Milgrom-Elcott**, J.D., Program Officer in Urban Education and Senior Manager of STEM Teacher Initiatives at Carnegie Corporation, and Co-Founder and Lead of 100Kin10
 - **Stephen L. Pruitt**, Ph.D., Senior Vice President, Content, Research & Development, Achieve, Inc.
 - **Brian J. Reiser**, Ph.D., Professor of Learning Sciences, School of Education and Social Policy, Northwestern University
- **Panel IV: Science Outreach Programs Supported by Private and Nonprofit Institutions**
 - **Terri M. Taylor**, Assistant Director for K-12 Education, Education Division, American Chemical Society
 - **Jean Lim Terra**, President, Amgen Foundation, Amgen, Inc.
 - **Claus von Zastrow**, Ph.D., Chief Operating Officer and Director of Research, Change the Equation