Optimizing NIH Efforts to Engage Pre-college Students in Biomedical Science

James M. Anderson, MD, PhD
Director DPCPSI

SMRB
July 7, 2014

The NIH Mission

"NIH's mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability."

- to develop, maintain, and renew scientific human and physical resources that will ensure the Nation's capability to prevent disease
    - In STEM education NIH is primarily focused on workforce development

Leveraging the NIH investment in people and infrastructure for STEM education

- NIH supports more than 300,000 research personnel at over 2,500 universities and research institutions in every state, Puerto Rico and DC

- In addition, about 6,000 scientists work in NIH’s own Intramural Research laboratories (six campuses in MD, NC, AZ, MT)

- No other agency has these unique resources to leverage for STEM

- How do we use them?

PAR-13-104: NIH Summer Re

grants.nih.gov/grants/guide/pa-files/PAR-13-104.html

Department of Health and Human Services

Part 1. Overview Information

Participating Organization(s)	National Institutes of Health (NIH)
Components of Participating Organizations	National Institute on Alcohol Abuse and Alcoholism (NIAAA) National Institute of Biomedical Imaging and Bioengineering (NIBIB) *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) National Institute of Dental and Craniofacial Research (NIDCR) National Institute on Drug Abuse (NIDA) National Institute of Environmental Health Sciences (NIEHS) National Institute of Mental Health (NIMH) National Institute of Neurological Disorders and Stroke (NINDS)
Funding Opportunity Title	NIH Summer Research Experience Programs (R25)
Activity Code	R25 Education Projects
Announcement Type	Reissue of PAR-11-(
Related Notices	• June 4, 2014 are essential • May 30, 2013 Dates on or a September 2
Funding Opportunity Announcement (FOA) Number	PAR-13-104
Companion Funding Opportunity	None
Number of Applications	See Section III. 3. Ad
Catalog of Federal Domestic Assistance (CFDA) Number(s)	93.113, 93.121, 93.2
Funding Opportunity Purpose	The purpose of the N Program") is to provi science teachers during the summer academic break. The NIH expects that such programs will: help attract

R25

- 8 - 15 weeks
- S/F up to $5,000 per high school student, up to $6,000 per college student, and up to $21,000 per teacher
- $1000 training expenses

- 8 Institutes
- 38 active awards in FY14
- 25 states
- Total cost $7,882,804

Discovery to Cure Internship ×

medicine.yale.edu/obgyn/discovery/education/highschool.aspx

Discovery to Cure

Obstetrics, Gynecology & Reproductive Sciences
PO Box 208063
New Haven, CT 06520-8063
obgyn@yale.edu

Discovery to Cure Internship Program

The Discovery to Cure Internship Program was established in 2003 by Dr. Gil Mor, Professor of Obstetrics, Gynecology & Reproductive Sciences, with the goal of exposing students from local schools to Yale's biomedical laboratories to open their minds to pursue career opportunities in science and medicine. The initial program enrolled four students from two local high schools with the participation of two laboratories at the Department of Obstetrics Gynecology and Reproductive Sciences. Since then, the program has grown to include over 35 schools from throughout the country as well as internationally. The program now includes undergraduates and teachers. The program is highly competitive (less than 12% acceptance) and since its inception a total of over 260 high school students, undergraduates and high school teachers have successfully completed the Program. Several interns have presented their research work at science fairs, including the Connecticut Junior Science and Humanities Symposium at UCONN, the National JSHS, Pfizer Life Science Award, Connecticut State Science Fair, International Science and Engineering Fair and the Siemens Westinghouse Science and Technology Competition, achieving semifinalist, finalist and first place status. Approximately 20% of the students have published their findings in peer-reviewed scientific journals.

The Discovery to Cure Internship Program is now a NIH supported program (NOH 1R25HD072591-01)

For more information please click on the link be

DTC High School Internship Program

schools that have never had an intern in the pro
Administrator JoAnn Bilyard at: joann.bilyard@y

DTC Undergraduate Internship Program

All undergraduates interested in applying to the
Coordinator Paulomi Aldo at: paula.bole@yale.e

DTC High School Teacher Internship Progr

R25HD072591 HICHD

- 260 HS students, HS teachers, undergrads over 9 years
- 25 slots/year, 12% acceptance rate
- 20% have published in peer-reviewed journals

About SPUR/SPUR-DAN | The ×

ctbr.hunter.cuny.edu/content/about-spur

HUNTER

Home Research Community

Research

- Faculty Researchers
- Core Facilites
- Support and Services
- Federal Funding
- **Undergraduate Training**
  - SPUR Research Tracks
  - How to Apply to SPUR

About SPUR/SPUR-DAN

Program Dates: June - August, 2014
Application Deadline: February 1 (Annually), 5pm EST

The CTBR's Summer Program for Undergraduate Research (SPUR) is an 8-week program that gives undergraduates hands-on experience in one of 53 research laboratories at Hunter College, CUNY in NYC. Our goal is to train and encourage underg students to pursue graduate study in biom research, and in drug abuse/addiction an neuroscience.

The SPUR program is now supported by Institute on Drug Abuse (NIDA) through a NIDA's mission is to lead the nation's sc research on prevention, treatment, and consequences of drug addiction. This funding enables us to offe specialized research track in drug abuse/addiction and neuroscience, in addition to our general biomedi more information about research opportunities on these two tracks, click here.

R25 DA032520 NIDA

160 undergraduate since 1994

outcomes

- 8 in Ph.D. programs
- 5 in M.D. programs
- 2 received MS
- 1 MPH

Administrative Supplements f ×

www.niehs.nih.gov/careers/research/trainingfrom/supplements/student/

NIH National Institute of Environmental Health Sciences
Your Environment. Your Health.

GO

A+ A- Share

Careers & Training
Research Training
Training, Fellowship, and Career Awards
Supplements for Special Populations
Diversity in Health-Related Research
Supplements for Summer Research Experiences for Students and Science Teachers
Reentry into Biomedical Research
Supplements to Support Research Capacity in Developing Nations

Administrative Supplements for Summer Research Experiences for Students and Science Teachers

Administrative Supplements for Summer Research Experiences for Students and Science Teachers

Purpose

As noted in the NIEHS 2006 Strategic Plan, the NIEHS will enhance opportunities for young, motivated high school and undergraduate students, and science teachers, to actively participate in environmental health research. The NIEHS hereby notifies Principal Investigators with R01, R15, R37, or P01 awards that funds are available for administrative supplements to support summer research experiences for talented and gifted high

Administrative Supplements for individuals to research awards

- summer research experiences for high school students, college undergraduates, and science teachers
- R01, R15, R37, or P01 awards

Any NIEHS-supported R01, R15, R37, or P01with a minimum of one year of funding remaining at the time of

Research Supplements to Pr… ×

www.nhlbi.nih.gov/funding/training/redbook/hsminsup.htm

Funding & Research

- NHLBI Research Programs
- Funding Opportunities
- Funding & Award Policies
- Enhancing Peer-Review at NIH
- Overview of ARRA

Research Supplements to Promote Diversity in Health-Related Research for High School Students

This supplement enables princ
students in their projects. Prio
and ethnic groups, individuals
underrepresented groups in bi
Americans, American Indians/A

The research activity proposed
student should be encouraged

The purpose of this program is
various aspects of health-relat
nursing and social sciences. St
during the period of support to
time research effort each year
school year. Principal Investiga
program (i.e., equivalent to tw

More than one high school res
(P01), or contract.

PA-12-149

Research Supplements to Promote Diversity in Health-Related Research (Admin Supp)

- 26 ICs and Offices
- Very flexible
  - 42 mechanisms
  - HS student, undergrads, grad, post docs, teachers

Research Supplements to Promote Diversity Web links:

Program Announcement (PA-12-149) for Research Supplements to Promote Diversity in Health-Related Research (Admin Supp)

Leveraging Research Centers and Resources

Office of Research Infrastru ×

dpcpsi.nih.gov/orip/CM/index

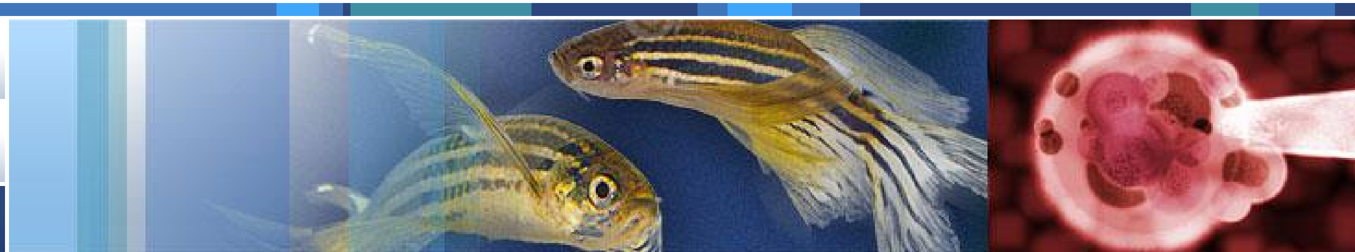
U.S. Department of Health & Human Services | National Institutes of Health | Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI)

NIH National Institutes of Health
Office of Research Infrastructure Programs

Printer Friendly | Text Size A A A

SEARCH GO

- ORIP HOME
- ABOUT ORIP
- DIVISION OF COMPARATIVE MEDICINE
  - Aquatics
  - Comparative Models
  - Genetic, Biological, & Information Resources
  - Nonhuman Primates
  - Rodents
  - Small Business Opportunities
  - Career Development Opportunites
  - Support for Conferences and Scientific Meetings
- DIVISION OF CONSTRUCTION AND INSTRUMENTS
- OFFICE OF SCIENCE EDUCATION/SCIENCE EDUCATION PARTNERSHIP AWARDS (SEPA)
- RESEARCH FUNDING



DPCPSI Home > ORIP Home > Division of Comparative Medicine

Division of Comparative Medicine

ORIP's **Division of Comparative Medicine** helps meet the needs of biomedical researchers for high-quality, disease-free animals and specialized animal research facilities. The Division supports both individuals and research organizations.
See the latest news, policies, education and training materials, and information about animals in research on the NIH Medical Research with Animals website.

- Aquatics
- Comparative Models
- Genetic, Biological, and Information Res
- Nonhuman Primates
- Rodents
- Small Business Opportunities
- Career Development Opportunities
- Support for Conferences and Scientific Meetings

SELECTED SUPPORTED SCIENTIFIC ADVANCES:

modulators of inflammation and immunity (PGE2, TSG6, and STC1)
Stem Cells. 2013; 31(11):2443-56.
PMC3834191

demethylation and a blastocyst-like state in ES cells

COMPARATIVE MEDICINE LINKS

- Staff Contacts

Yerkes -- ION@Yerkes Accep

www.yerkes.emory.edu/about/news/2014_ION_Applications.html

About
Vision, Mission and Values
Stuart Zola, PhD, Yerkes Director
History
Research Advances
News
Animal Resources
Behavioral Neuroscience and Psychiatric Disorders
Developmental and Cognitive Neuroscience
Microbiology and Immunology
Neuropharmacology and Neurologic Diseases
Pathology
Honors
Animals

Home » About » News »

ION@Yerkes Accepting Applications; Summer 2014 Program Open to High School Students and Middle and High School Teachers

January 23, 2014

Media Contacts

Lisa Newbern, 404-727-7709, lisa.newbern@emory.edu

The Yerkes National Primate Res with the Center for Behavioral N Neuroscience (ION)@Yerkes, an looking for highly motivated hig and high school teachers.

The program, which will begin Ju

Week one – Scholars will partici Yerkes National Primate Resear and hands-on activities. Scholar art research techniques and par communication, scientific ethics

Next seven weeks – Scholars wi mentored research may take place at Yerkes, Emory University, Georgia State University, the Georgia Institute of Technology or Morehouse College. Teacher Scholars will be

P51 National Primate Research Center

- Participants: The Yerkes Center, Emory University, Georgia State University, the Georgia Institute of Technology and Morehouse College
- 10 high school students/year
- 3-4 middle or high school science teachers/year
- Institutionally supported

ASSET:
ADVANCING SECONDARY SCIENCE
EDUCATION THRU TETRAHYMENA

Home | About the program | Modules | Workshops | **Photos** | Resources | Forms

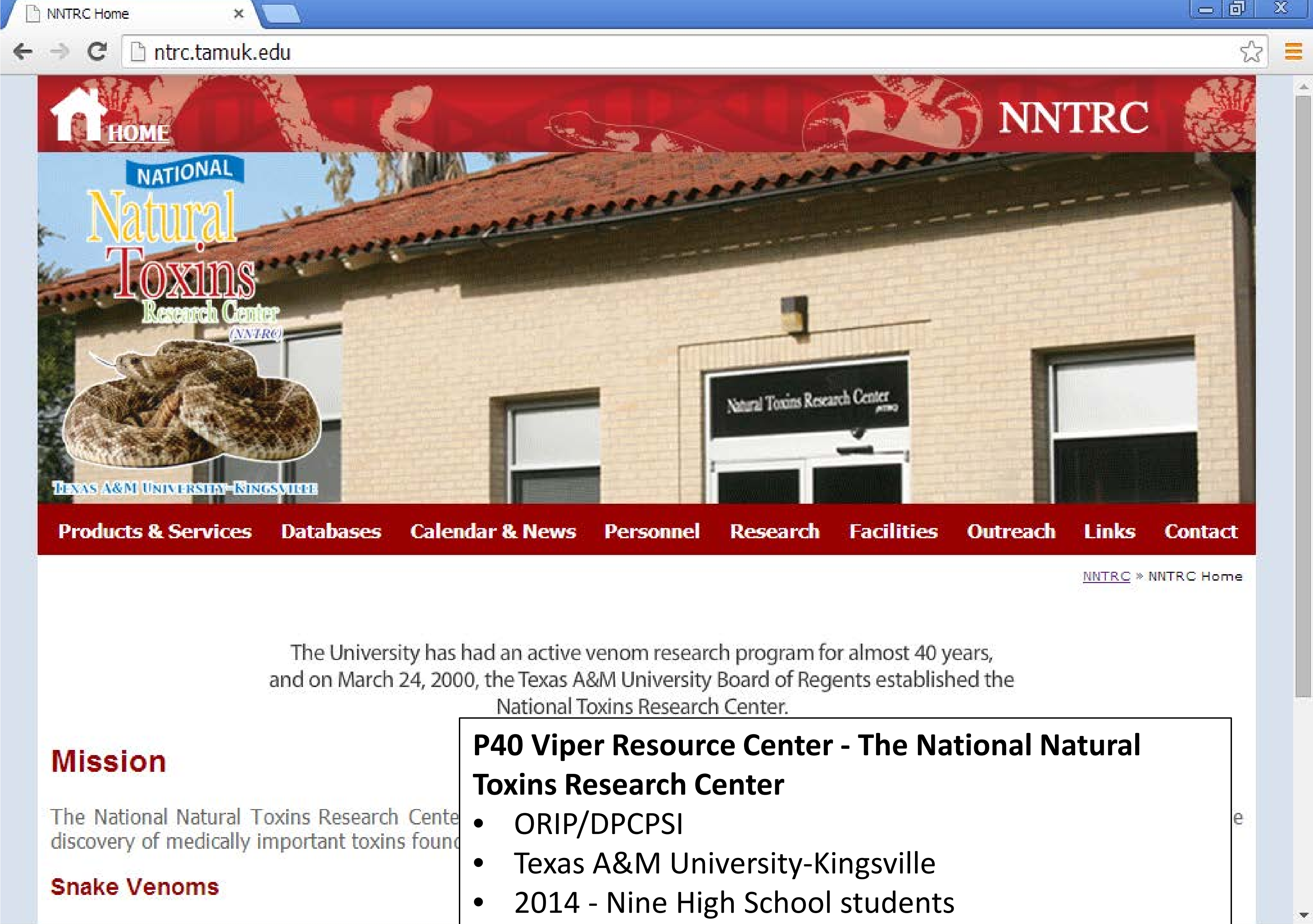
P40 Resource Center for Tetrahymena thermophila
R25 Science Education Partnership Award (SEPA)
- Cornell University College of Veterinary Medicine

- Self-contained <u>biology teaching modules</u> for use in high school and middle school
- Modules utilize live cultures of *Tetrahymena thermophila*, a safe, easy to grow protozoan
- Hands-on, inquiry-based approach designed to address core biological concepts
- Multi-tiered for use in middle or high school classes
- Summer teacher workshop

Yesterday we did our first Tetrahymena experiment by feeding them India Ink particles to observe food vacuole formation over a period of time. Today we analyzed the data and brainstormed other ways to test food vacuole formation.

Groton NY Science Fair 2011

Three students from Mr. DeVoe's 7th Grade Life Sciences class designed an experiment utilizing Tetrahymena thermophila to studied the effects of temperature on the feeding behavior of tetrahymena



P40 Viper Resource Center - The National Natural Toxins Research Center

- ORIP/DPCPSI
- Texas A&M University-Kingsville
- 2014 - Nine High School students
- DoEd Upward Bound Math & Science

Student Training

- Purification and characterization of venoms:
  - *High Performance Liquid Chromatography (HPLC)*
  - *SDS Electrophoresis*
  - *Electrophoretic Titration*
- Various activity assays:
  - *Hemorrhagic*
  - *Proteolytic*
  - *Coagulation*
  - *Fibrinolytic*
  - *Aggregation*
- Cloning from cDNA libraries for disintegrin molecules
- Tissue culture assays
  - *Cell binding*
  - *Cell migration*
- Creation of Research

Viper Resource Center - The National Natural Toxins Research Center

Student comments from the 2009 Summer Research Program at NNTRC

Jennifer Allen:
"Working at the NNTRC has allowed me the opportunity to learn lab techniques alongside several accomplished researchers and professors. Prior to joining the NNTRC, I did not have any research experience. I am now aware of how venom proteins may be able to cure or prevent illnesses."

Tracey Alvarado:
"I was able to learn about the different instruments used and how to apply these techniques to important biochemical research. This opportunity has opened my eyes to the career of doing biomedical research."

Cody Bigelow:
"I'm a sophomore in high school. Before attending this research program, I had no background in a research lab. Thanks to this program, I have learned about the different types of instruments that are used in the lab and how to use and apply them in different assays."

Kelsi Gulick:
"I have learned many concepts in the field of Molecular Biology that correlates with medical research. After being so directly involved in medical research I have now gained a new respect for people who work so diligently to develop a new drug."

NIH Intramural Summer Internship Program

- Eight+ week research experience at all levels
  - High School
  - College
  - Medical/Dental
  - Graduate (MS. PhD, PharmD, PsyD, etc)
- Many workshops and other educational opportunities
- Access to pre-graduate advising
- End-of-summer poster session

- ~ 1200 students each summer (25% HS students)
- ~1250 intramural labs with ~ 7,500 investigators and trainees

http://www.training.nih.gov/student/sip/

Observations

- Leveraging the investment in people and research infrastructure is the unique contribution NIH can make in STEM

- There are many approaches
  - Group training programs
  - Individual supplements to existing research awards
  - Appropriate use of NIH-supported resources with co-funding

- It is widely done (but challenging to quantify)

U.S. Department of Health & Human Services

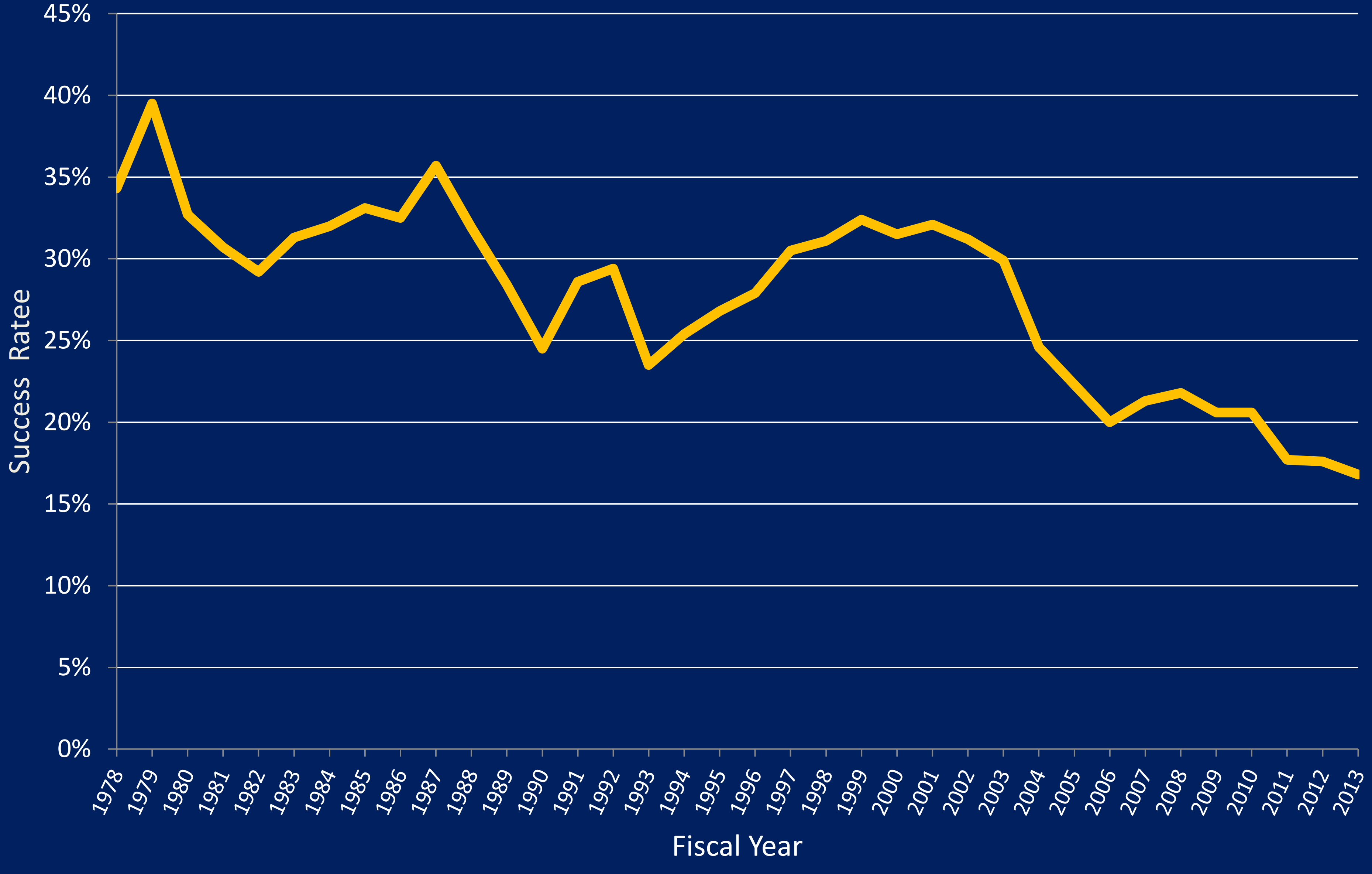
NIH Center for Scientific Review

CSR Presentation to SMRB
Speeding submission to award

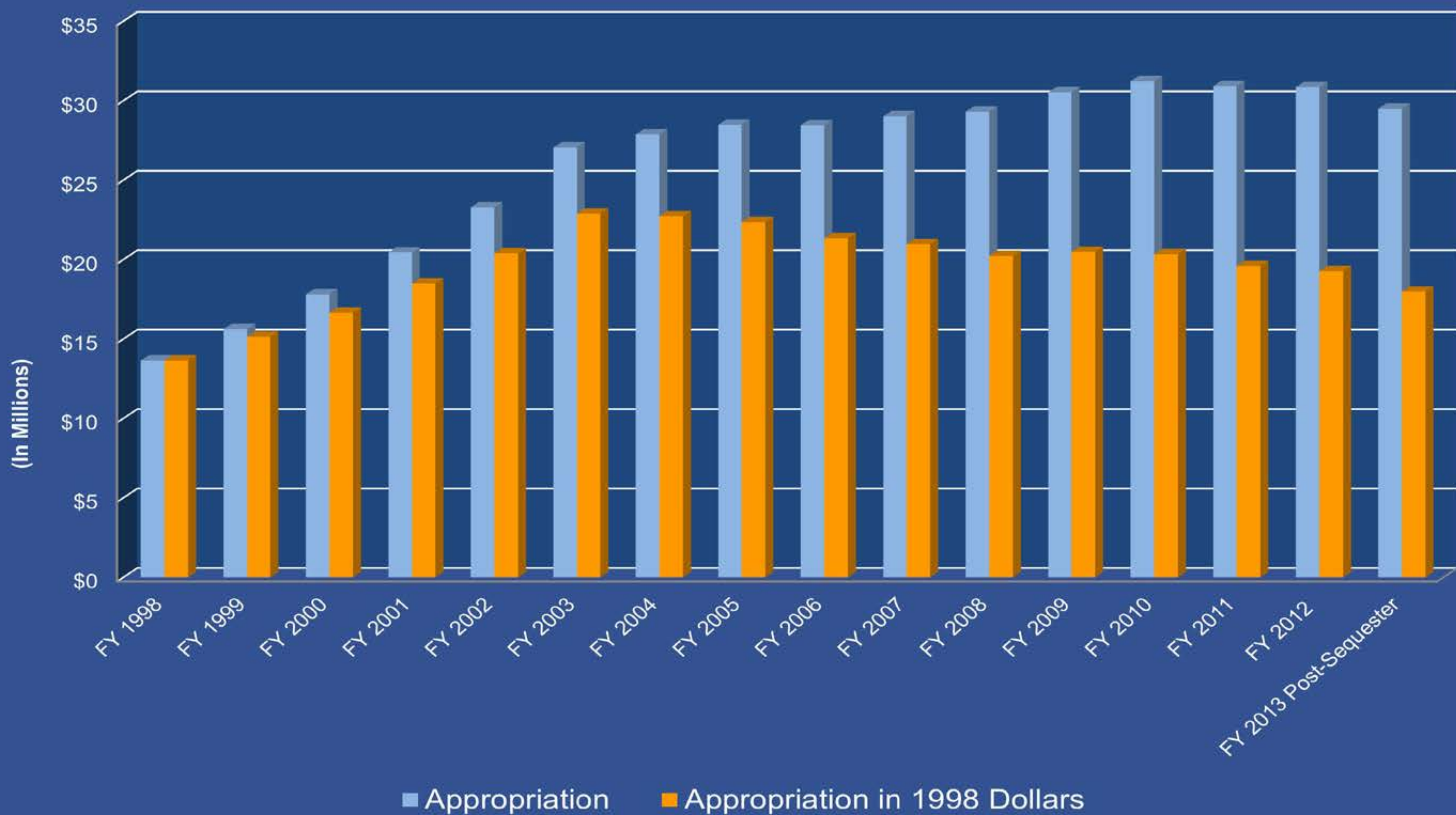
Richard Nakamura

July 2014

Grant Success Rates
FY 1978-2013

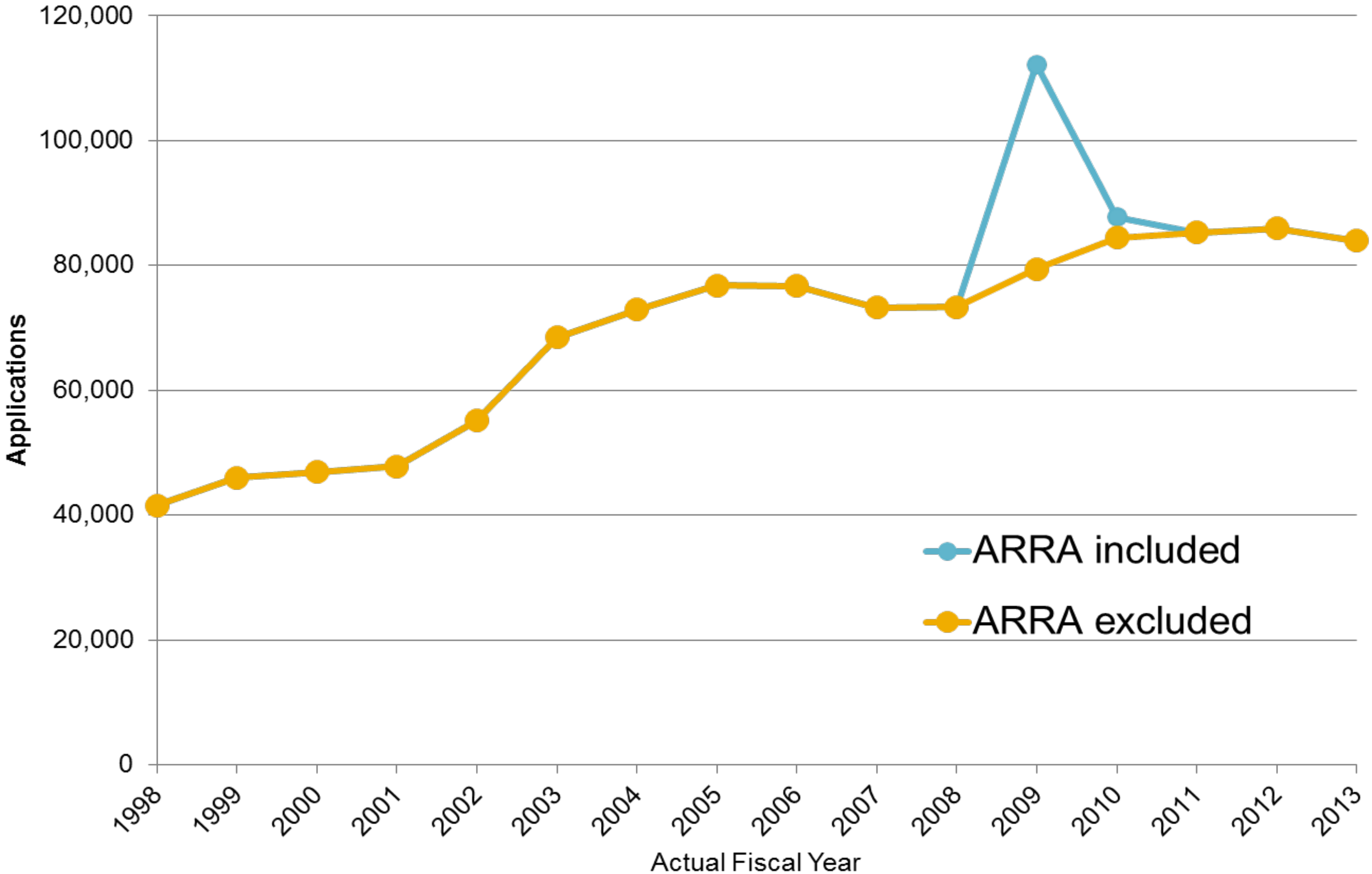


NIH Program Level in Appropriated Dollars and Constant 1998 Dollars



NIH Center for Scientific Review

Number of Applications Received by Fiscal Year



Center for Scientific Review

Expectations for CSR

- Highest quality
- Cost effective (cheap)
- Fast

Goals of CSR

- Improve continuously:
  - Fairness of review
  - Quality of review
  - Efficiency of review
  - Morale of staff and reviewers
- Create a science of peer review

CSR Peer Review – Fiscal Year 2013

- 84,000 applications received by CSR
- 73% of NIH grant applications reviewed by CSR
- 173 standing study sections
- 236 Scientific Review Officers
- 1,500 review meetings
- 17,000 reviewers

The NIH Peer Review and Award Process

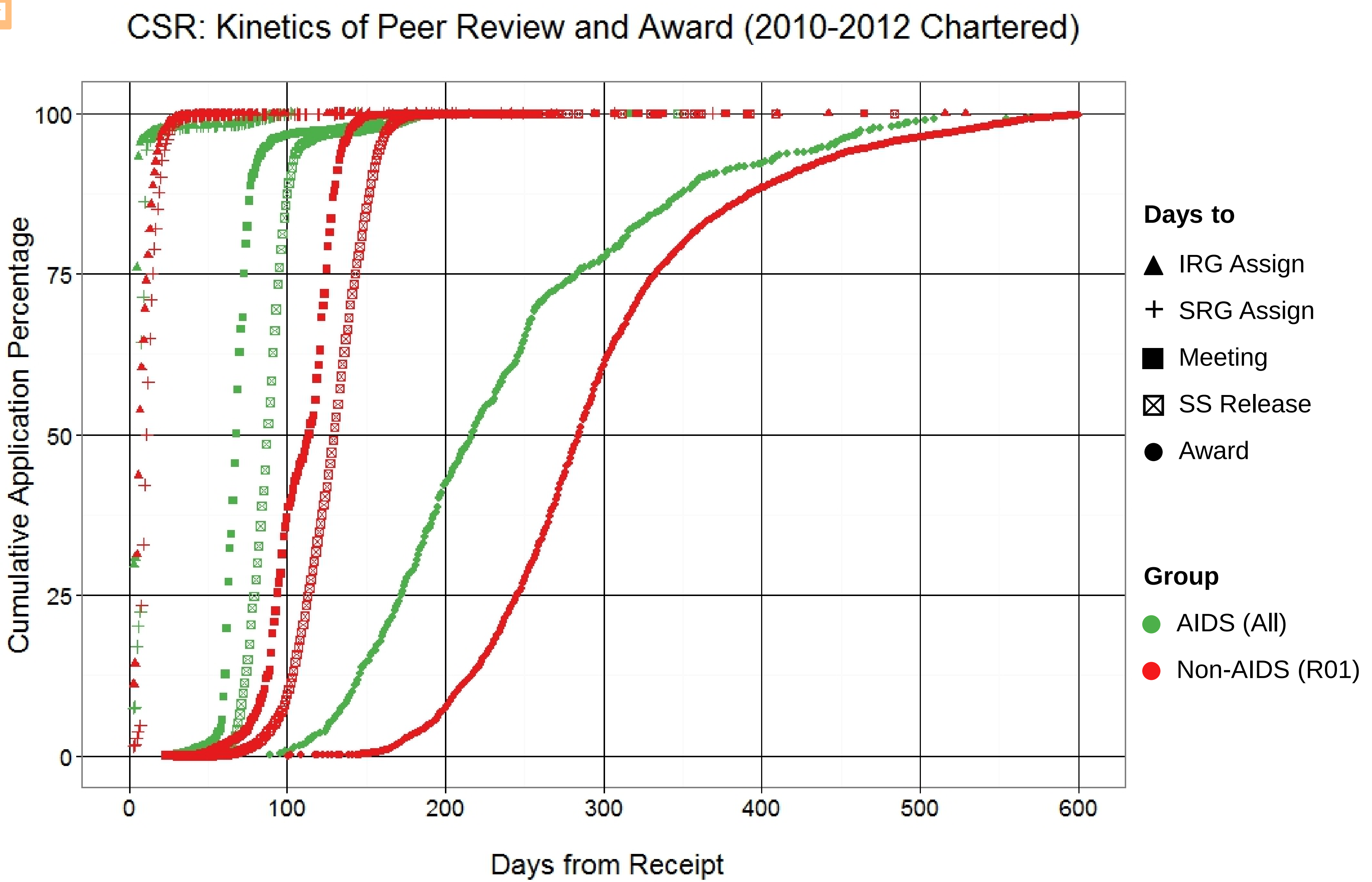
PI Applicants:
PI Initiative/RFAs

Peer Review
Applications → Study Sections → Ranking → Percentiling

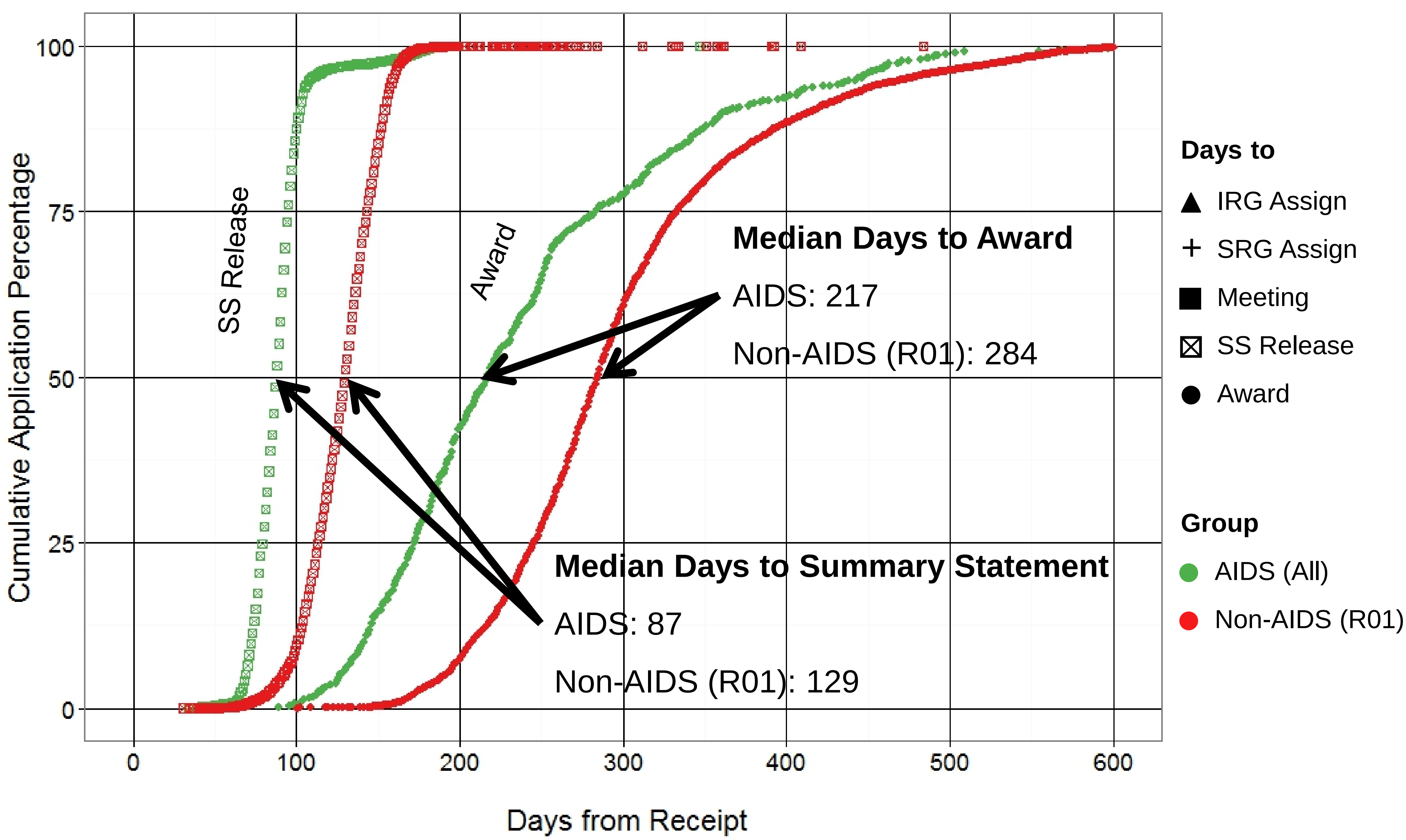
IC
Strategic Goals/Awards/ Funding

Research

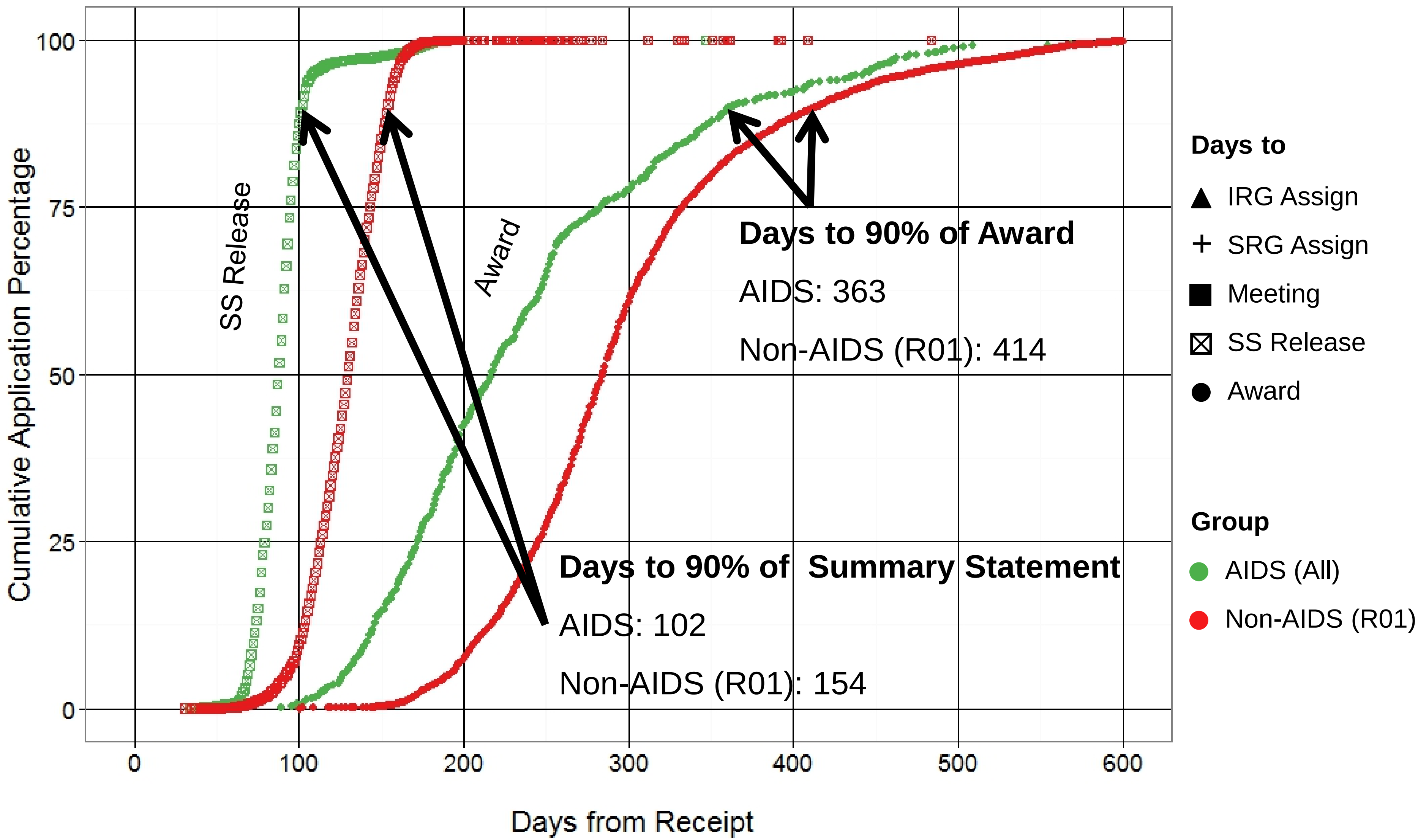
- Outcome Progress (Publications/Citations)
- Public Health


CSR: Kinetics of Peer Review and Award (2010-2012 Chartered)
Cumulative Application Percentage
0
25
50
75
100
0
100
200
300
400
500
600
Days from Receipt
Days to
IRG Assign
SRG Assign
Meeting
SS Release
Award
Group
AIDS (All)
Non-AIDS (R01)

CSR: Kinetics of Peer Review and Award (2010-2012 Chartered)



CSR: Kinetics of Peer Review and Award (2010-2012 Chartered)



NIH Center for Scientific Review

R01 Official Review Schedule

Due Dates	Merit Review	Council	Award	To SS	To Awd
Feb 5, Mar 5	Jun-Jul	October	December	7 mo	11 mo
Jun 5, Jul 5	Oct-Nov	January	April	6 mo	11 mo
Oct 5, Nov 5	Feb-Mar	May	July	6 mo	10 mo

Review regularly beats this schedule: 5 months to 90% of summary statements

Awards often delayed: 13.5 months to 90% of awards

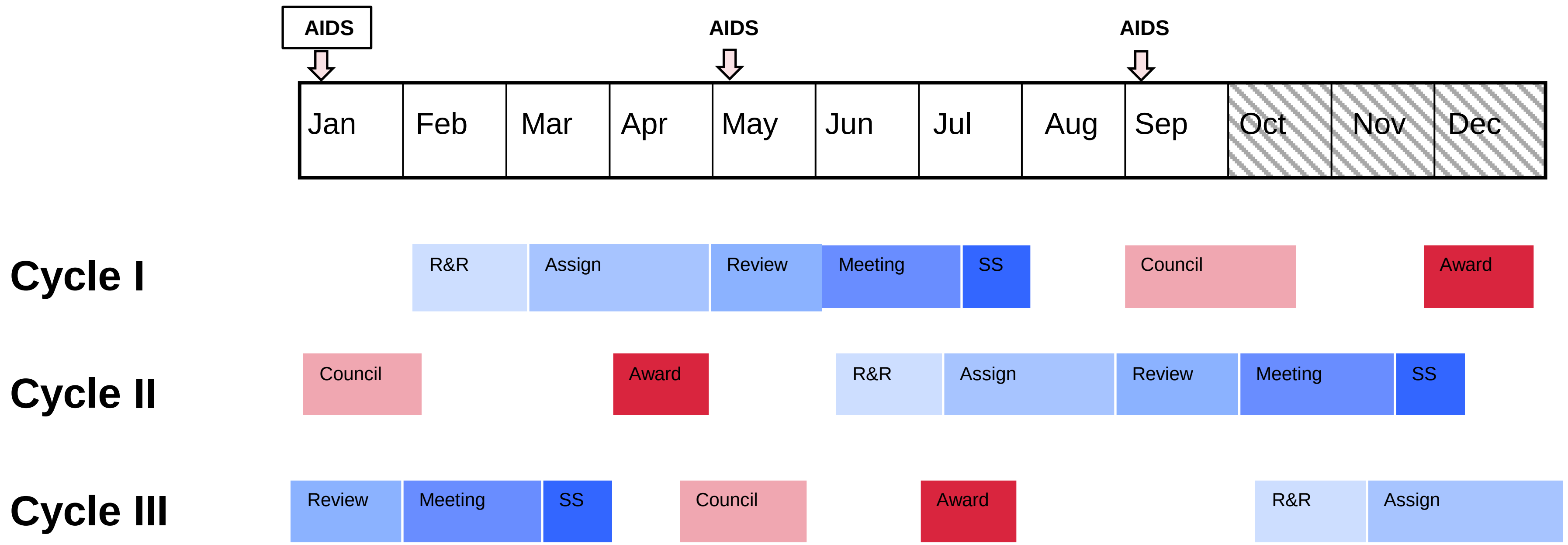
AIDS Review Schedule

Due Dates	Merit Review	SS Due	Council	Subm to SS
May 7	July	August	September	4 mo
September 7	November	December	January	4 mo
January 7	March	April	May	4 mo

This is the fastest schedule for CSR review and results in some quality compromises.

Current Timeframe for R01s -- Submission to Award

Three Main Overlapping Cycles per Year



http://grants1.nih.gov/grants/funding/submissionschedule.htm

Peer Review: Good timing for face to face review

REVIEW: Submission to Summary Statement

Submission: Should be 1 DAY for any mechanism with 2 WEEKS flex

Receipt and referral: 2 WEEKS

Reviewer recruitment and application assignment by SRO: 4 WEEKS

Reviewer time with applications and writing critiques: 4 WEEKS

Meetings: SPREAD OVER 4 WEEKS (40 meetings per week)

Writing summary statements: 4 WEEKS

Total time needed for review from submission to SS: 4.5 MONTHS

Suggested Review Schedule R01

Due Dates	Merit Review	SS Due	Council	Subm to SS
January	April	May	July	4.5 mo
May	August	September	November	4.5 mo
September	December	January	March	4.5 mo

This is a faster schedule for CSR review and has no quality compromises but creates some workload distribution and flexibility problems. The latter may be solved by sliding due dates a month earlier and allowing more internal adjustments for a 5-5.5 month time to summary statement.

New Cycle 1 on 2015 Calendar

January — Submission DRR

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February — SRO Recruit & Assign

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

March — Reviewer Critiques

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April — Review Meetings

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May — Summary Statements

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June — Select Awards

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

July — Council

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August — Prep Awards

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

September — Awards

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

October

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

November

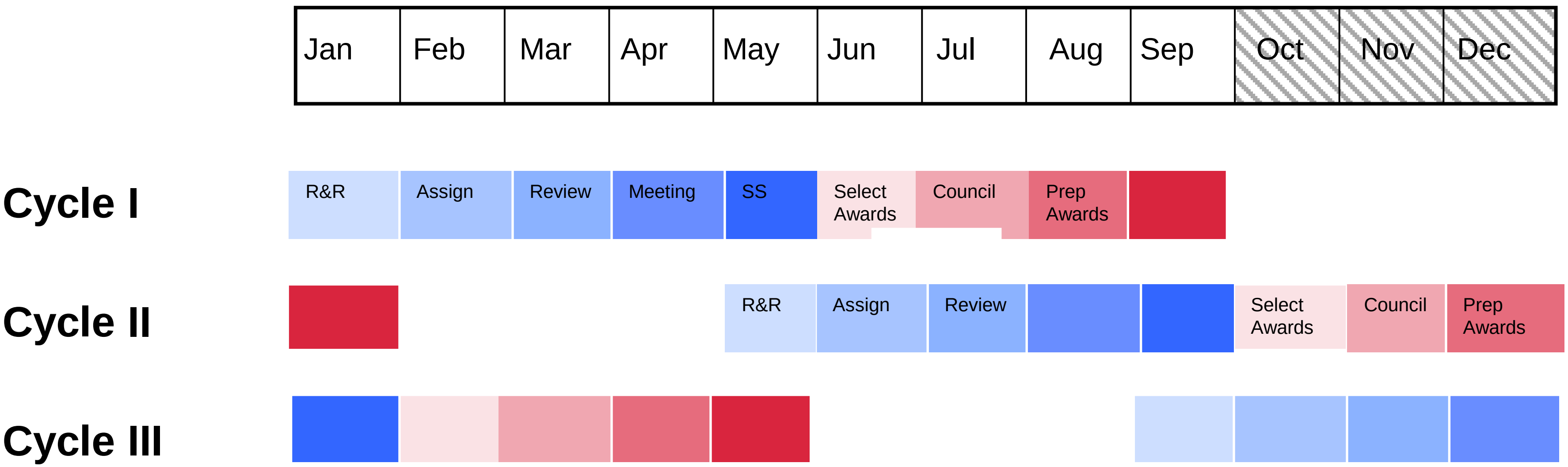
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

December

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Proposed Timeframe for R01s -- Submission to Award

Three Main Overlapping Cycles for 2015



http://grants1.nih.gov/grants/funding/submissionschedule.htm

NIH Center for Scientific Review

Where to make improvements in submission to award

- Start with awards – help NIH avoid fiscal year startup blues. Consider January, May, and September as award months.
- Make application submission through Grants.gov smoother. Provide strong support for new software
- Give more positive reinforcement for reviewers- light refreshments and better travel rules
- Help us control the number of applications

For review of the full load of applications we think that about 4.5 months from submission to summary statement can be done; to try to go faster under current application loads will compromise quality.

This Is CSR

Questions? Comments?

CSRDirector@csr.nih.gov

Recommendation on engaging students in science

Matt Anderson

SMRB Meeting

070714

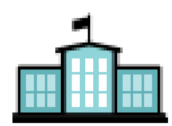
I. Personal experience

- Interest in natural world
- Stubbornness
  - "Especially Weigand; he looks just like the guy who slapped my head and roared at me about football, the guy who taught us science but didn't know the difference between the three classes of levers"
    - Reference to forming club by Anon
- Lots of self doubt

II. Challenges and Opportunities

- Challenges
  - Lack of academic rigor/exposure
  - Lack of context
  - Connection to future
  - Lack of resources

Many people assume that most Native students attend Bureau of Indian Education schools. In reality, however, only **7 percent** of Native students attend BIE schools.



The vast majority — **93 percent** — attend regular public schools.

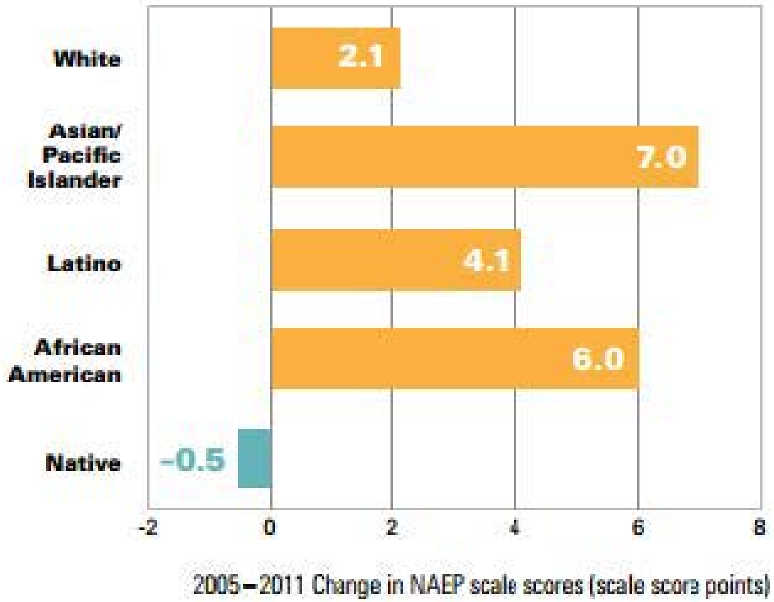
While Native students are more likely than their peer attend rural schools, about **one-third** of student attend urban or suburban schools.

http://www.edtrust.org

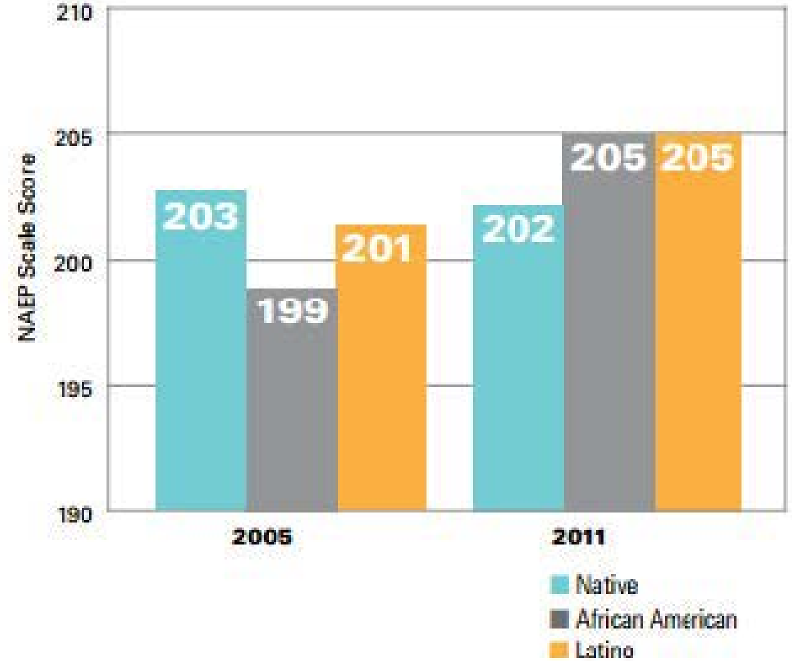
II. Challenges - Resources

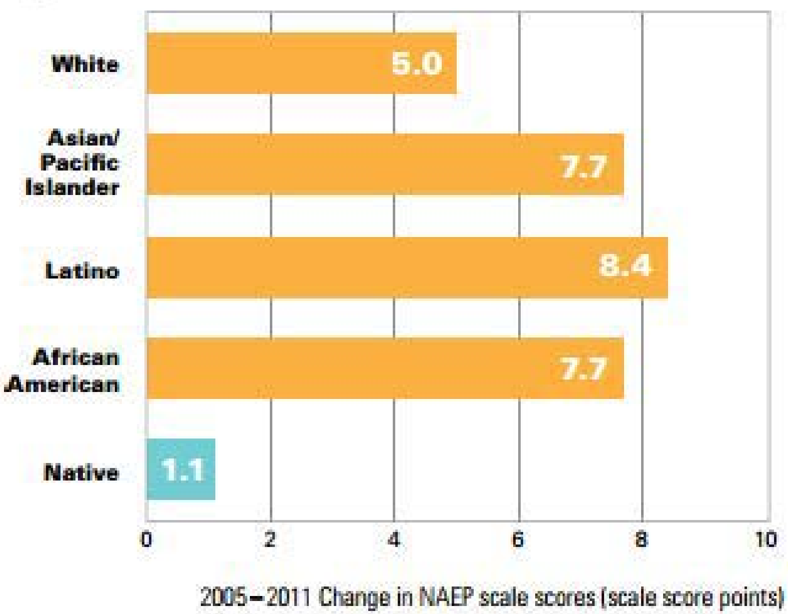
- Physical resources
  - Infrastructure
  - Access to technology
- Financial
  - Cost of college
  - Tribal/CCs with fewer scientific tracts
- Personnel
  - Teacher quality
    - **TFA**
- **Mentors**
  - Connecting science to community
  - Research experiences

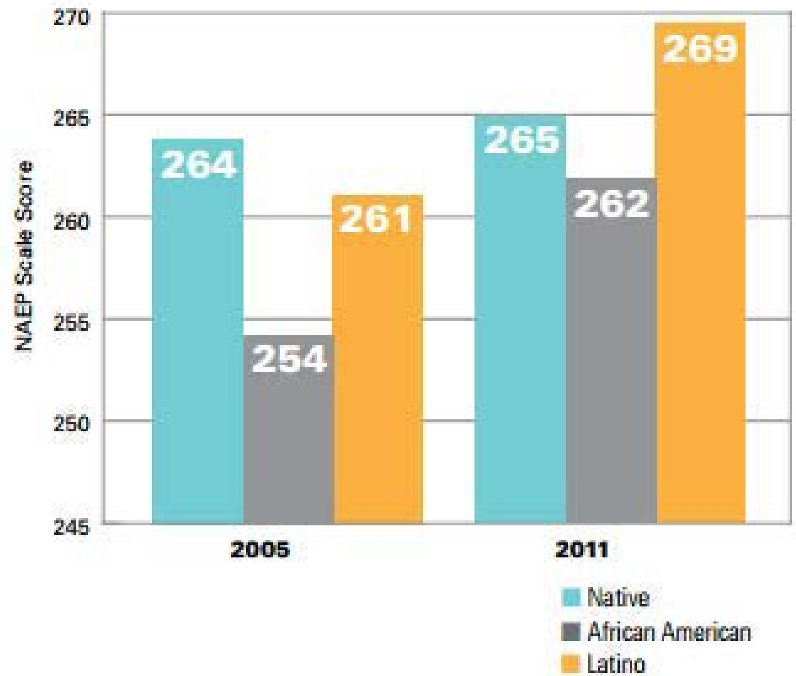
2005–2011 Improvement: Fourth-Grade Reading



NAEP Performance: Fourth-Grade Reading

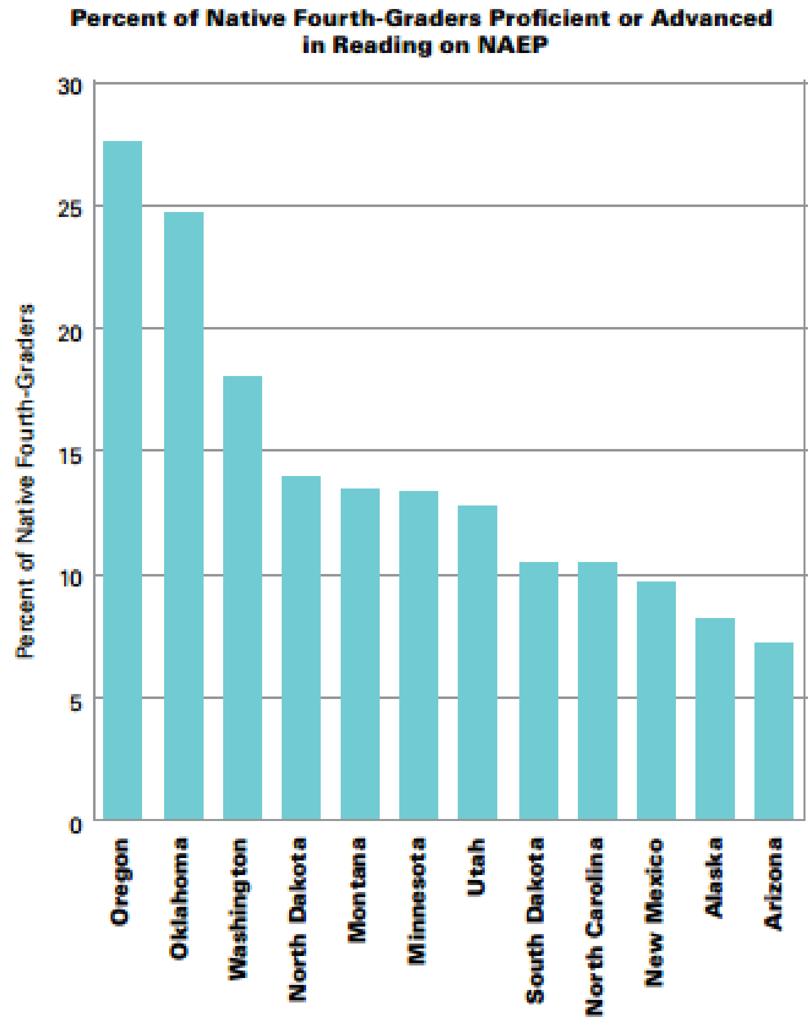






II. Opportunities

- Support organizations
- Pipeline programs
- Learning/research opportunities
- Understanding context
- Role models

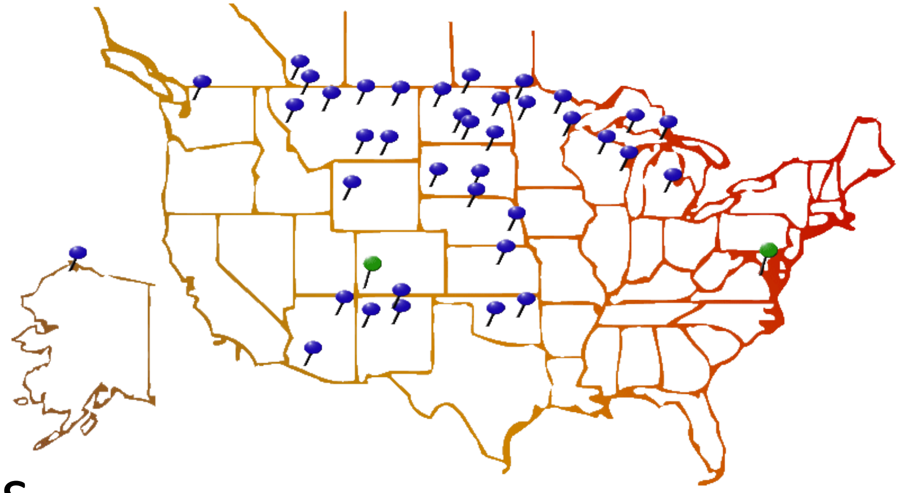


II. Opportunities - Support

- AISES
- NIM
- ANAMS
- SUUMA

II. Opportunities – Pipeline and Research

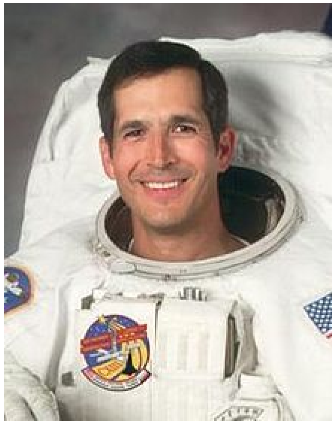
- Pipeline
  - College Horizons
  - Native American High School Summer Program (Harvard)
  - Na Pua No'eau
- Research
  - Tribal colleges
  - government programs
  - R1 academic institutions



http://www.tribalcollegejournal.org

II. Opportunites – Context and Mentors

- Context
  - Teaching in a culturally sensitive way
    - i.e. genetics
  - Tying research to community
    - i.e. NAHSSP focused on addiction
- Mentors
  - Validation
  - Peer-to-peer without competition
  - Work in cohorts
  - Highlighting role models



III. Advice - Engagement

- Engagement
  - Travel to communities to engage students
    - What is science like
    - What can you do with it
    - How is it used to benefit society/communities
  - Work directly with Tribal colleges
  - Offering NIH research opportunities

III. Advice - Support

- Holding up the pipeline
- Encourage mentorship
- Data collection on career paths
- Target broad spectrum of students

NEXT GENERATION

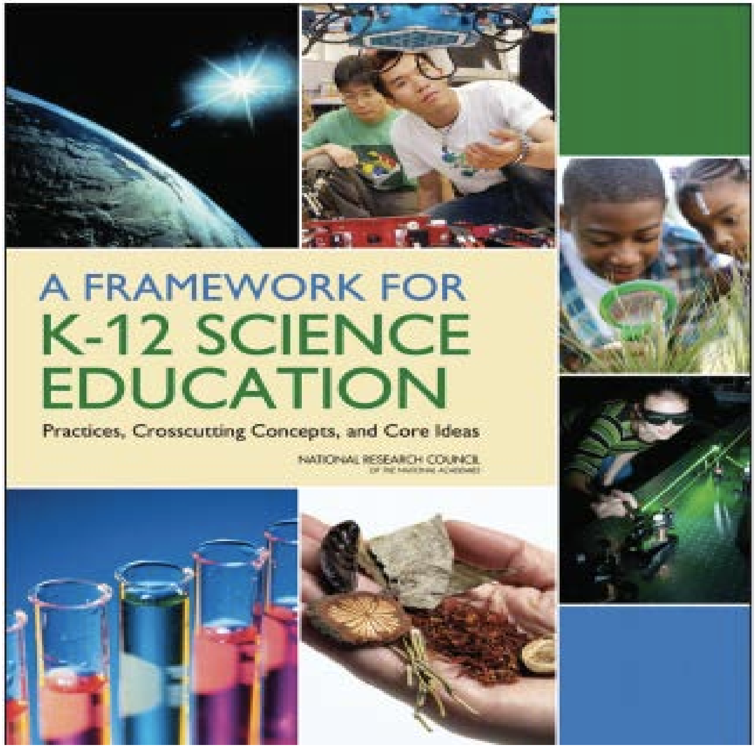
SCIENCE

STANDARDS

For States, By States

Developing the NGSS

Phase I



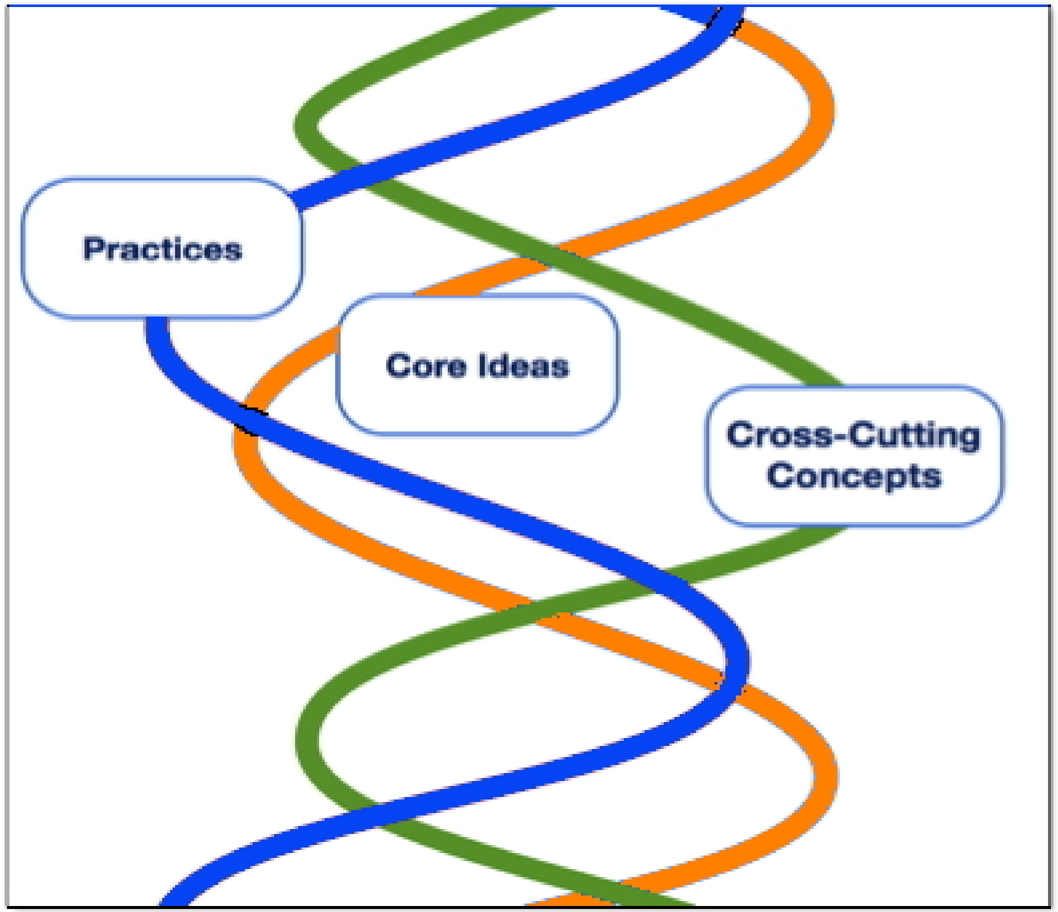
1/2010 - 7/2011

Phase II

NEXT GENERATION
SCIENCE
STANDARDS
For States, By States

7/2011 – April 2013

Three Dimensions Intertwined



- The NGSS are written as Performance Expectations
- NGSS will require contextual application of the three dimensions by students.
- Focus is on how and why as well as what

NEXT GENERATION SCIENCE STANDARDS
For States, By States

NEXT GENERATION SCIENCE STANDARDS

For States, By States

What's Different about the Next Generation Science Standards?

Current State Science Standard Sample

Inquiry Standards

a. Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.
b. Students will use standard safety practices for all classroom laboratory and field investigations.
c. Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.
d. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures.
e. Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.
f. Students will communicate scientific ideas and activities clearly.
g. Students will question scientific claims and arguments effectively.

Content Standards

a. Distinguish between atoms and molecules.
b. Describe the difference between pure substances (elements and compounds) and mixtures.
c. Describe the movement of particles in solids, liquids, gases, and plasmas states.
d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).
e. Distinguish between changes in matter as physical (i.e., physical change) or chemical (development of a gas, formation of precipitate, and change in color).
f. Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.
g. Identify and demonstrate the Law of Conservation of Matter.

Standards Comparison: Structure and Properties of Matter

Current State Middle School Science Standard

a. Distinguish between atoms and molecules.
b. Describe the difference between pure substances (elements and compounds) and mixtures.
c. Describe the movement of particles in solids, liquids, gases, and plasmas states.
d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).
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NEXT GENERATION SCIENCE STANDARDS
For States, By States

Standards Comparison: Structure and Properties of Matter

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f. **Recognize** that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.

g. **Identify and demonstrate** the Law of Conservation of Matter.

NEXT GENERATION SCIENCE STANDARDS
For States, By States

Standards Comparison: Structure and Properties of Matter

NGSS Middle School Sample

Students who demonstrate understanding can:

1. Develop models to describe the atomic composition of simple molecules and extended structures.
2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*

NEXT GENERATION SCIENCE STANDARDS
For States, By States

Standards Comparison:
Structure and Properties of Matter

NGSS Middle School Sample

Students who demonstrate understanding can:

1. **Develop models to describe** the atomic composition of simple molecules and extended structures.
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NEXT GENERATION SCIENCE STANDARDS
For States, By States

Shifts in the NGSS

1. Evidence of learning
2. Learning Progressions
3. Science and Engineering
4. Coherence of Science Instruction
5. Connections within Science and between mathematics and literacy

NEXT GENERATION SCIENCE STANDARDS
For States, By States

Contact Information

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spruitt@achieve.org

www.nextgenscience.org

NEXT GENERATION SCIENCE STANDARDS
For States, By States

AMGEN®

Pioneering science delivers vital medicines™

Amgen's Commitment to Inspiring the Next Generation of Scientists

Jean Lim Terra
President
Amgen Foundation

July 7, 2014

A Long-Standing Commitment to Advancing STEM Education in the United States and Abroad

AMGEN®

- World's largest independent biotechnology company
- Approximately 20,000 employees
- In over 75 countries
- Reaching millions of patients

Through the Amgen Foundation—Amgen's primary philanthropic vehicle—we emphasize and deliver a suite of world-class **STEM education** initiatives that demonstrate Amgen's commitment to science and society	▪ Tie meaningful initiatives to company identity and core competencies ▪ Emphasize solicited, long-term signature initiatives with a measureable impact ▪ Focus on inspiring the next generation of scientists and strengthening scientific literacy

Two Major Strategies in Science Education

Supporting Teacher Quality	Pivotal, Hands-On Science Experiences

To date, Amgen and the Amgen Foundation have committed over $80 million to nonprofit organizations in the U.S. and abroad to advance STEM education.

Select Amgen Investments in Pre-College STEM Education

Amgen Biotech Experience

Effectively brings biotechnology to high schools in Amgen communities in the U.S., U.K., and Ireland

Starting with one high school in 1990, the program today reaches over 60,000 students annually with engaging labs

Strong teacher professional development and support is a hallmark of the program

Nat'l Board for Professional Teaching Standards

Strengthening science instruction and student achievement in Amgen communities

Creates a cadre of National Board Certified Teachers in science in Amgen communities to improve student performance

Developed online courses using performance data to improve science teaching nationwide

National Academy Foundation

Network of career-themed academies for underserved high school students

Course developed on the Principles of Biotechnology, part of the new Academy of Health Sciences

Plans underway to develop additional courses on industry as well as specific sectors of the industry

100Kin10 STEM Initiative

A multi-sector network that responds to the national imperative to train 100,000 excellent science, technology, engineering, and math (STEM) teachers by 2021

Aims to increase the quantity and quality of STEM teachers

Ensures that all students have access to first-rate STEM teaching and learning

Amgen Biotech Experience

Scientific Discovery for the Classroom

- Developed through a special collaboration between Amgen scientists and educators, the first labs were used in 1990 at a local high school next to Amgen's global headquarters
- This uniquely Amgen program opens students' eyes to the world of biotechnology, bringing professional-grade lab equipment and the 'wow' factor to biology classrooms
- Nearly $9 million invested to date has allowed the program to reach **360,000+ students** across Amgen regions, including 60,000 students the past year alone

www.amgenbiotechexperience.com

> ***"The Amgen program is modern, current, and cutting edge. Micropipettes, gel electrophoresis – students love it. This program is incredibly powerful."***
> Mary Simun, Biology Teacher
> Redondo Union High School, California

Current Program Regions

✓ Southern California	✓ Rhode Island
✓ Northern California	✓ Washington, D.C.
✓ Colorado	✓ Washington
✓ Massachusetts	✓ England
✓ Puerto Rico	✓ Ireland

Effective Biomedical Lab Experiences Bring Relevancy, Rigor, and Genuine Engagement to High School Classrooms

Value of the Amgen Biotech Experience

- Provides real-world concepts and work experiences of the biomedical industry
- Promotes student interest in biomedical career possibilities
- Leads to more science course-taking in high school and college
- Strongly addresses hands-on “science and engineering practices” required by NGSS*



Strong, Experienced Partners

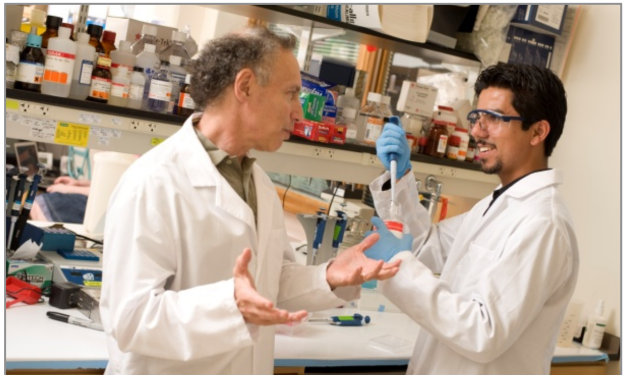
- Partner organizations bring premier national expertise in science education
- **EDC** leads Program Office; **WestEd** increasing formal evidence of effectiveness
- Regional partners include Harvard, UC Berkeley, community colleges, and others

Biomedical Science in High Schools

- Students from all backgrounds can be engaged in solving problems and careers related to helping others
- Thus biomedical sciences has every potential to be a career field that attracts students and helps them to persist in STEM education and careers
- ABE provides an experience that fills a void between many core curricular programs and the need for experiences that demonstrate the applicability of that content to students, and engages them in developing relevant skills
- Student engagement and understanding of the application of content is more likely to lead to further course-taking and retention in STEM programs; thus, **engagement** and **career awareness** is key to building the pipeline in STEM fields

*Next Generation Science Standards

Amgen Scholars Continues to Launch Hundreds of Undergraduates on the Path to a Scientific Career



Access to Incredible Opportunities

Jose Rios of Arizona State University, one of over 2,400 Amgen Scholars to date, spent the summer under MIT Institute Professor Bob Langer, named by Forbes as one of the 25 most important individuals in biotech in the world. Jose was the first in his family to attend college, and is now in graduate school in biomedical engineering at Cornell.

- Now in its 8th year, this premier summer research program at top universities is open to undergraduates across the U.S. and Europe
- Made possible by a $34 million, eight-year commitment, ensuring that all students are able to participate regardless of their financial status
- Unique U.S. and European Symposiums highlight medical biotechnology and engage Amgen executives and staff
- An all-time high of 4,200 students from over 800 colleges and universities applied for this year's 325 slots
- Robust, independent evaluation in place since program launch allows for data-based decision-making, continuous improvement, and ability to track impact over time

California Institute of Technology

Columbia University Barnard College

Karolinska Institute

LMU Munich

Massachusetts Institute of Technology

Stanford University

University of Cambridge

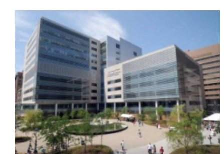
University of California, Berkeley

University of California, Los Angeles

University of California, San Diego

University of California, San Francisco

University of Washington



Washington University in St. Louis

Amgen Scholar Alumni are Pursuing Advanced Scientific Degrees and Careers in Large Numbers

PROGRAM ALUMNI

1,096

Current Status of Alumni
Who Have Completed Undergraduate Degree*

552

Graduate School in Science (Masters and PhDs) **

67 MD/PhD Programs	**139** Science-Based Career
176 Professional School in Science (MD, Other)	**162** Non-Science Grad School or Career / Unknown

* Status as of February 2013. Note that 711 of the 1807 alumni are still pursing their undergraduate degree and have not been included in the chart.

**This number includes the 20 alumni who are currently pursing specialty science programs, or post-bacc fellowships.

ALUMNI PROFILE

Scholar Name
Seychelle Vos
Undergraduate Institution
University of Georgia

Amgen Scholars Program
University of California, Berkeley (2007)

Seychelle's experience as an Amgen Scholar inspired her to return to UC Berkeley for graduate school, where she's just completed her PhD.

Seychelle Vos, Ph.D.
2007 Amgen Scholar

Finding STEM Programs that work: The Power of STEMworks

Scientific Management Review Board, NIH

July 7, 2014

CHANGE THE EQUATION™

Why Design Principles?

Many wanted better guidance

CHANGE THE EQUATION™

Source: "Blind Faith," Lee McLaughlin, Wikimedia Commons

Why Design Principles?

A very crowded field

Source: Library of Congress, Wikimedia Commons

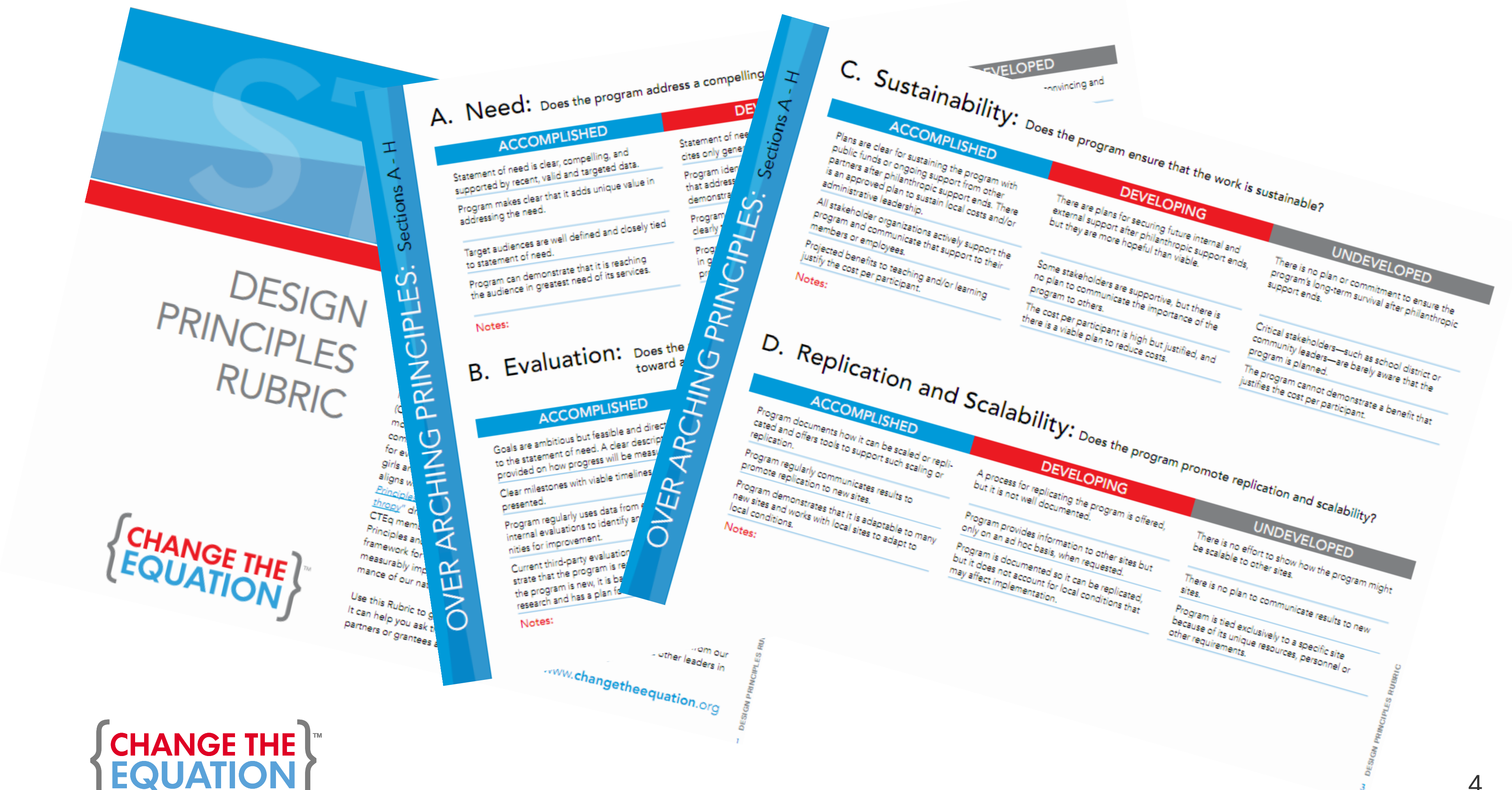
Design Principles Committee

- Accenture
- Carolina Biological
- Chevron
- Cisco
- Causecast
- Dupont
- ExxonMobil
- Freeport-McMoRan
- IBM
- Intel
- Merck
- Nature Publishing
- Oracle
- Procter & Gamble
- Teradata
- Texas Instruments

CHANGE THE EQUATION™

STEM Design Principles

Based in research and deep expertise



CHANGE THE EQUATION

STEM Design Principles

A. NEED

B. EVALUATION

C. SUSTAINABILITY

D. REPLICABILITY

E. PARTNERSHIPS

F. CAPACITY

G. STEM CONTENT

H. STEM PRACTICES

I. STEM INTEREST

J. UNDERREPRESENTED GROUPS

CHANGE THE EQUATION™

STEM Rubric

A. Need: Does the program address a compelling and well-defined need?

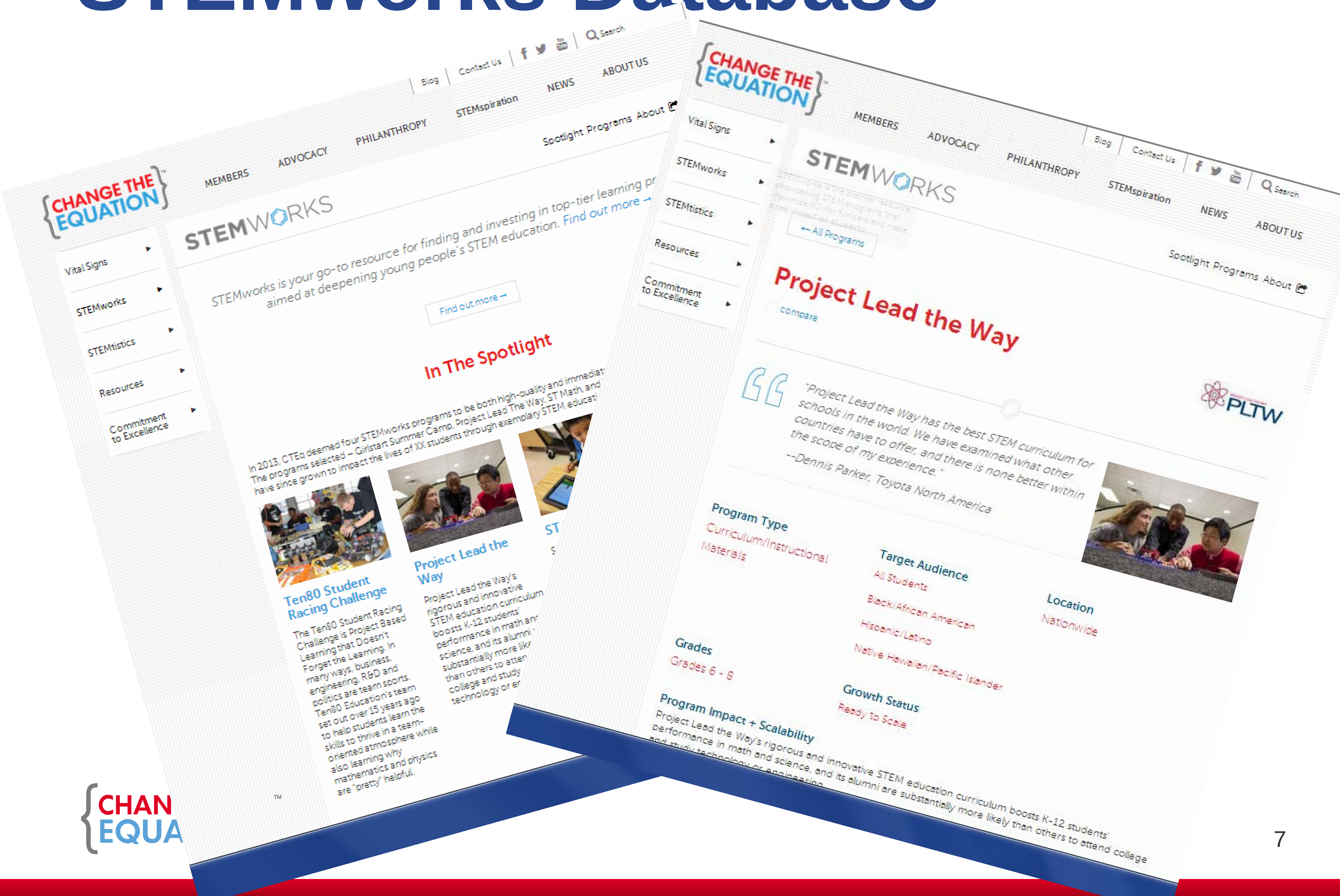
ACCOMPLISHED	DEVELOPING	UNDEVELOPED
Statement of need is clear, compelling, and supported by recent, valid, and targeted data.	Statement of need is clear and compelling but cites only general data.	Description of need is vague or unconvincing and cites little or no data.
Program makes clear that it adds unique value in addressing the need.	Program identifies other past or present programs that address the same need, but does not fully demonstrate how it adds to those programs.	Program makes no attempt to identify or evaluate other past or present programs that address the same need.
Target audiences are well defined and closely tied to statement of need.	Program defines target audiences but does not clearly tie them to statement of need.	Program does not make clear what audiences it is targeting.
Program can demonstrate that it is reaching the target audience.	Program makes clear efforts to reach target audience but cannot demonstrate what proportion of those audiences it is reaching.	Program makes little effort to reach intended audience.

Sample evidence:

- Program description
- Literature review with cited, research-based data
- Mission/vision or goal statement for program (includes the target population for the program)
- Existing needs assessment data that was used for planning and/or program development
- Logic model
- Evaluation reports that define the need, the target audience, and/or recent data from the research base
- Student/participant demographic data
- Documents that reflect where the program fits into the landscape of existing efforts

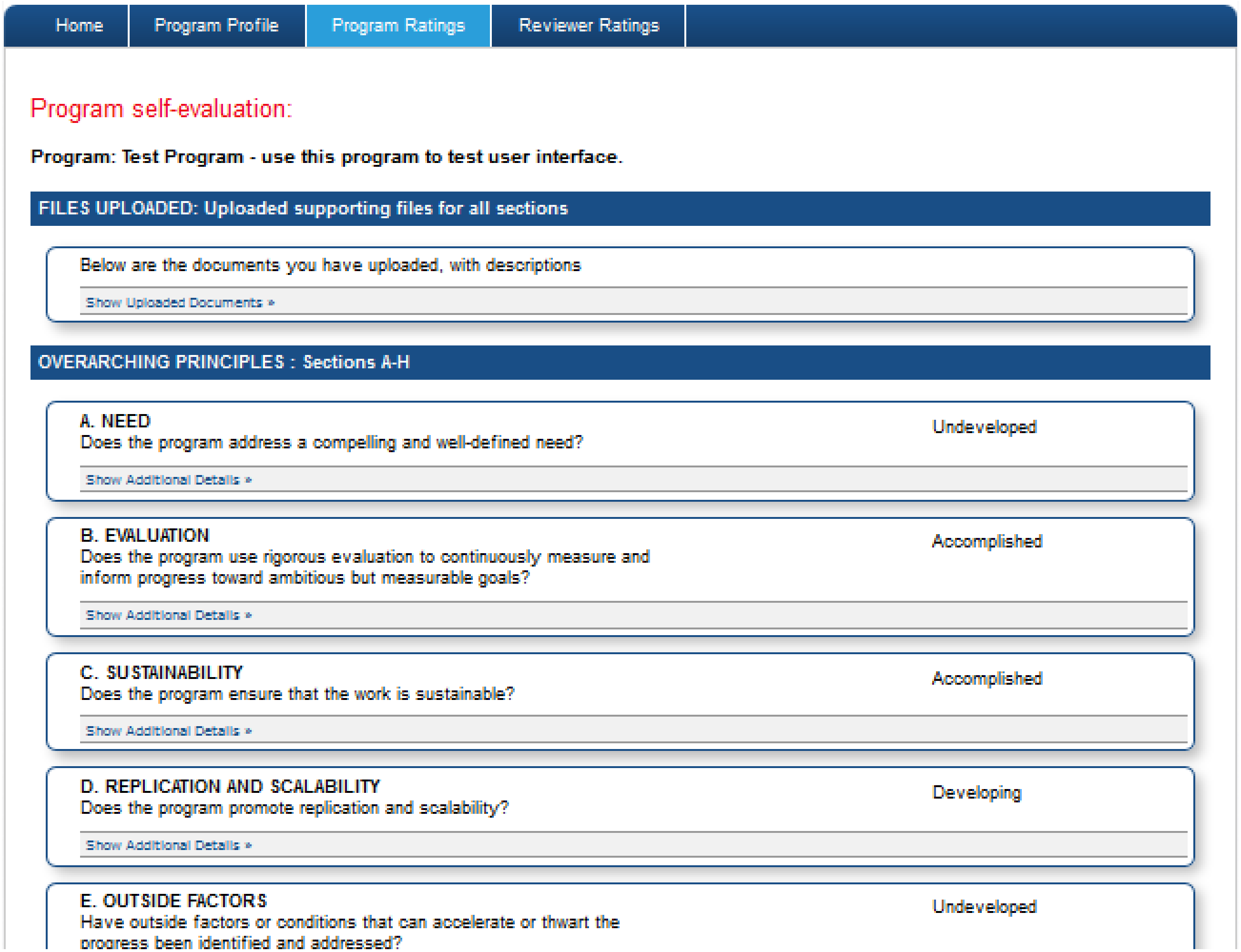
CHANGE THE EQUATION™

STEMworks Database



CHANGE THE EQUATION

Rigorous Application Process



Home | Program Profile | Program Ratings | Reviewer Ratings

Program self-evaluation:

Program: Test Program - use this program to test user interface.

FILES UPLOADED: Uploaded supporting files for all sections

Below are the documents you have uploaded, with descriptions

Show Uploaded Documents »

OVERARCHING PRINCIPLES : Sections A-H

A. NEED
Does the program address a compelling and well-defined need? — Undeveloped

Show Additional Details »

B. EVALUATION
Does the program use rigorous evaluation to continuously measure and inform progress toward ambitious but measurable goals? — Accomplished

Show Additional Details »

C. SUSTAINABILITY
Does the program ensure that the work is sustainable? — Accomplished

Show Additional Details »

D. REPLICATION AND SCALABILITY
Does the program promote replication and scalability? — Developing

Show Additional Details »

E. OUTSIDE FACTORS
Have outside factors or conditions that can accelerate or thwart the progress been identified and addressed? — Undeveloped

CHANGE THE EQUATION™

Rigorous Application Process

Home | Program Profile | Program Ratings | Reviewer Ratings

Program self-evaluation:

Program: Test Program - use this program to test user interface.

FILES UPLOADED: Uploaded supporting files for all sections

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Undeveloped

Show Additional Details »

B. EVALUATION
Does the program use rigorous evaluation to continuously measure and inform progress toward ambitious but measurable goals?

Accomplished

Hide Additional Details »

Your explanation for this rating:

some words need to go here.

Documents that support your rating for this principle:

[view] CTE_Design_Principles.pdf
[view] CTE_Design_Principles_Rubric.pdf

Accomplished	Developing	Undeveloped
Goals are ambitious but feasible and directly linked to the statement of need. A clear description is provided on how progress will be measured.	Program goals are ambitious and feasible but difficult to measure.	Goals are too ambitious for this program alone to fulfill-or too unambitious to be worthwhile.
Clear milestones with viable timelines are presented.	Scope of work is included, but the timeline is vague or nonexistent.	Program lacks clear milestones or timeline.
Program regularly uses data from external or internal evaluations to identify and act on opportunities for improvement.	Program only sporadically uses evaluation data to identify and act on opportunities for improvement.	Program has no plans for using evaluation data to improve itself.
Current -third party evaluation data demonstrate that the program is reaching its goals. If the program is new, it is based on high quality research and has a plan for a	Program is based on research that does not directly apply to the program's circumstances. Program designers conduct their own evaluation in lieu of	There is no research cited or a plan to evaluate the program's progress to meet goals.

CHANGE EQUATI

TM

A High Bar

- Only **29%** of applicants admitted thus far
- Strong commitment to the **TRANSPARENCY** of the process
- **FIREWALL** between Change the Equation and WestEd reviewers

CHANGE THE EQUATION™

Scalable Programs

- Girlstart Summer Camp
- Project Lead the Way
- ST Math
- TEN80 Student Racing Challenge

CHANGE THE EQUATION™

Thank you

Claus von Zastrow

COO/Director of Research

cvonzastrow@changetheequation.org

STEMworks:

CHANGE THE EQUATION™

Scientific Management Review Board (SMRB)-NIH

Gary L. Harris, Ph.D., P.E.
Associate Provost for Research and Graduate Studies
Director of the Howard Nanoscale Science and Engineering Facility (HNF)
co-PI NSF STC Center fo Integrated Quantum Materials

Outline

- Historical Facts about Howard
- Howard’s Research Priorities
- New HuIRB
- Comments of the NIH Review Process

Facts about Research at Howard

- University Charter: March 2, 1867
- 10,500 Students, 13 Schools & Colleges
- Graduate School: 31 programs, 17 STEM area
- 20 Ph.D areas, largest Undergraduate Program in Biology
- NSF Report: largest producer of AA Ph.D.s is STEM
- 32 Million in R&D, 70 million Sponsored Programs

Howard Research Priorities

- Health Disparities
- Nanotechnology/High Performance Materials
- Computational Science/ Cyber Security
- Atmospheres Sciences
- HIV/AIDs
- Stem Cell/Human Genome
- New Media, Electronic/Digital Arts and Gaming
- Educational Disparities
- Green Technologies/Initiatives & Environmental Sustainability

Howard Interdisciplinary Research Building

- $300 million investment in infrastructure
- 80 million facility
- 43,400 sq./ft assignable
- Hearth of DC high Tech Corridor
  - Nanotechnology/Cleanroom
  - Natural Products Research
  - Developmental Biology/Stem Cell
  - Atmospheric Sciences
  - Core Labs

Comments on Review Process

- Turnaround time for review is quite lengthy
- Reviewers seem to be unfamiliar with the details of the RFA
- Bias against minority institutions; assumption that capacity for performing research in inadequate
- News trolling about an institution; using this information in the review
- Study section reviewers are funded; bias towards keeping funding among small set colleagues

Comments on Review Process

- Need for NIH to pay more attention to “collaborations” with minority serving institutions – ensuring that the MSI is not included as only a means to “boost” minority numbers
- Select reviewers based on keywords/concepts to ensure that content matter experts are reviewing
- Less of a focus on individual grants, but rather more collaborations/small partnerships

Comments from recently unfunded proposals

- The leadership for training URM students at Howard has traditionally been a strength, but recent changes at the University appear to have weakened this capability
- …all three faculty are male. Given that many of the students will be female, it would be important to have female faculty be part of the programmatic team.

Recent NSF Science &Technology Center

CIQM Center for Integrated Quantum Materials

- Center for Integrated Quantum Materials (NSF-STC) with Harvard/MIT
- Vision- The discovery of extraordinary new quantum materials with striking 'non-conventional' properties has caused great excitement, and it promises to transform signal processing and computation
- CIQM $ 4.5 M per year (Howard 1M)

NIH Scientific Management Review Board (SMRB) Meeting

Richard D. Hichwa, PhD
University of Iowa
July 7, 2014

NIH Funding

- Iowa Perspective
- Key Problems
- Training Environment
- Rethinking the NIH Grant
- Review and Evaluation Process

University of Iowa Data

NIH Funding by Grant Type	2012	2013	2014	
R01	228	206	205	(.775 M)
R21	26	28	25	
R03	6	11	12	
R13	1	2	1	
P	23	21	24	(1.17 M)
U	14	19	17	
T	30	24	32	
K	36	37	27	
F	17	24	20	
Other	37	37	48	
Total	418	409	411	

The Funding Problem:

Academic Culture vs Federal Sponsored Research

- Capitalistic Academy: Growth is the only way to achieve distinction
- Tenure based on obtaining grant funding
- Increasing # applicants vs decreasing funding pool
- Fund your own position
- Independent investigator vs multidisciplinary team
- PIs with more grants rewarded by institutions
- Sustaining a large lab requires fulltime grant writing
- Pressure to produce can lead to research misconduct

University Medical Schools

- Measures of productivity, distinction and ranking are based almost exclusively on grant funding.
- Schools of Medicine are heavily leveraged and subsidized by NIH funding.
- Translational medicine is considered second rate compared to bench science.
- The demand for laboratory investigation requires growth in research space.

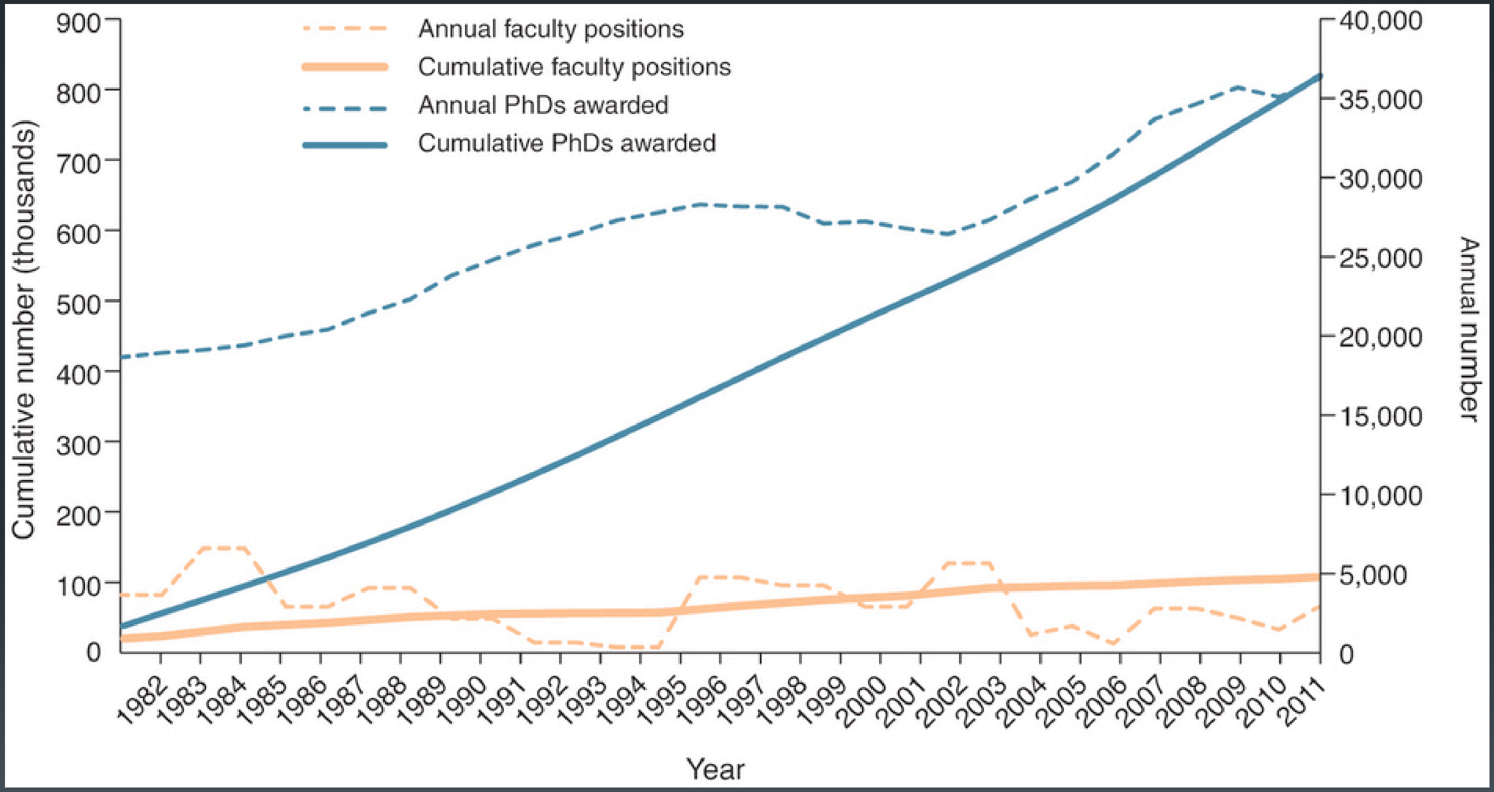
Junior vs Senior Researchers

- How to compete with long standing researchers?
- New ideas vs Incremental research
- Tenure track vs Clinical track
- Protected time vs Accountability for all effort
- Existing lab infrastructure vs Starting-up
- Mentoring and improving competitiveness

The Training Environment

- Trainees vs Employees
- Cloning the faculty
- Predocs vs Postdocs
- Alternative careers
- Developing a career trajectory in a mentored setting
- Infrastructure demands

New Faculty Positions vs New PhDs



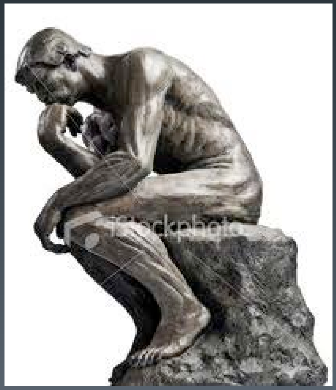
Schillebeeckx, et al. Nature Biotechnology, **31** 938-941 (2013)

What's Needed at NIH

- More grant opportunities
- Different grant opportunities
- Streamlined review process
- Clearer evaluation criteria
- Better reviewer training
- Investment in higher risk research
- Promotion of translational research/clinical trials
- Lead the culture change in academic medicine

Rethinking the NIH grant

- R01, R21 and P01 or what?
- It is about IMPACT. It's all about IMPACT.
- Is there real and identifiable translation in the application?
- Develop a "rapid idea" grant mechanism to quickly test concepts. Short application with equally short review cycle.
- Limit the effort (inclusive of all combined NIH funding) of PI and Investigators to no more than 30%.
- Develop "term limits" on the number of times a grant can be renewed.
- Deliverables (contract) vs Aims (grant)
- Reward success with limited term "add-on" funding



Today’s Review Process

What’ good:

Bulleted strengths and weaknesses

Availability to read reviewer critiques

Excellent NIH program officers and staff

In-person Study Section review sessions

What’s not so good:

Over emphasis on approach

The Big Picture is lost

Too many critiques per reviewer

Inconsistency between reviewers

Critiques highly variable and often provide minimal feedback

Preliminary data interpreted to mean research nearly completed

Too few submission deadlines

Translational research not valued by study sections

Critiques provide minimal feedback to reviewers

Inconsistent scoring

Tomorrow’s Review Process

- Timing: Continuous review cycle with manuscript like evaluation
- 2-Step process: Develop a short submission application with invitation to proceed to a full application based on ideas and concepts
- Applicant Feedback: Provide almost immediate feedback
- Risk: Truly endorse new ideas and high risk applications
- Reviewer Feedback: Continuously critique reviewers and provide constructive criticism
- Workshops: Mandatory participation by reviewers to improve critiques and feedback to applicants
- Workload: Reduce grant review workload
- Scoring: Better guidance on review criteria

Evaluation Criteria

- Provide more explicit guidance to reviewers
- Provide examples of excellent applications and poor applications
- Develop clear metrics for success as part of RFAs to assist reviewers in evaluating applications
- Improve evaluation guidance with specific criteria to improve consistency of scoring
- Provide weighting criteria for elements of the review to improve uniformity
- Emphasize Impact and the Big Picture
- Stress Innovation that can lead to economic development and commercialization
- Identify Translation aspects of proposal

Summary

- Current process is neither sustainable nor consistent
- Significant changes are needed
- Many good options exist
- Changes can be accomplished quickly and phased in over time
- NIH must take initiative to change the culture

NIH Scientific Management Review Board

Working Group on Pre-college Engagement in Biomedical Science

PRELIMINARY FINDINGS

JULY 7, 2014

ROSTER

Non-Federal Members

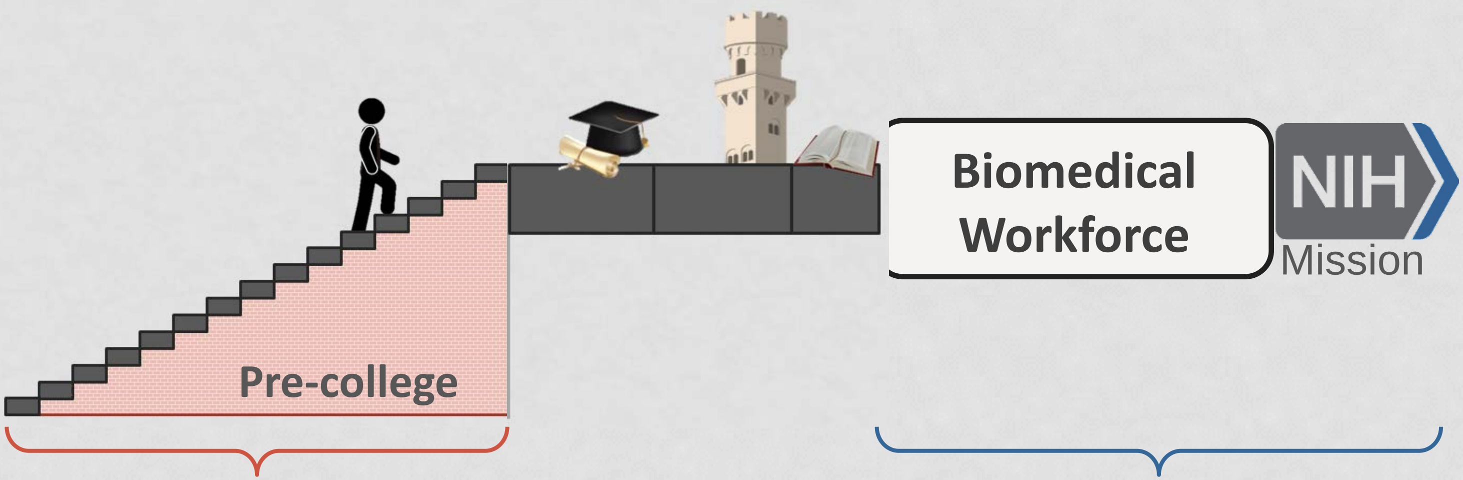
- Clyde W. Yancy, M.D. (Chair)
- Nancy C. Andrews, M.D., Ph.D.
- Norman R. Augustine
- Lee E. Babiss, Ph.D.
- Gilbert S. Omenn, M.D., Ph.D.

Federal Members

- 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)*

Careers	Principal investigator Clinician scientist Veterinarian	Staff scientist X-ray technician Statistician	Postdoctoral researcher	Science policy analyst Pharmaceutical manufacturer Regulatory official Grant manager	Clinician Journal editor Tech transfer officer Clinical trial coordinator Clinical nurse
Challenges	***Long training process*** ***Lack of diversity (especially in leadership)***	***Uncertain promotion and compensation in academic settings***	***Oversupply(?)*** ***Multiple fellowships***	***Career often not counted as a successful outcome (vs R01 grantee)***	***Other***
Careers			Science teacher		
Challenges			***Insufficient training*** ***High turnover***		

- 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

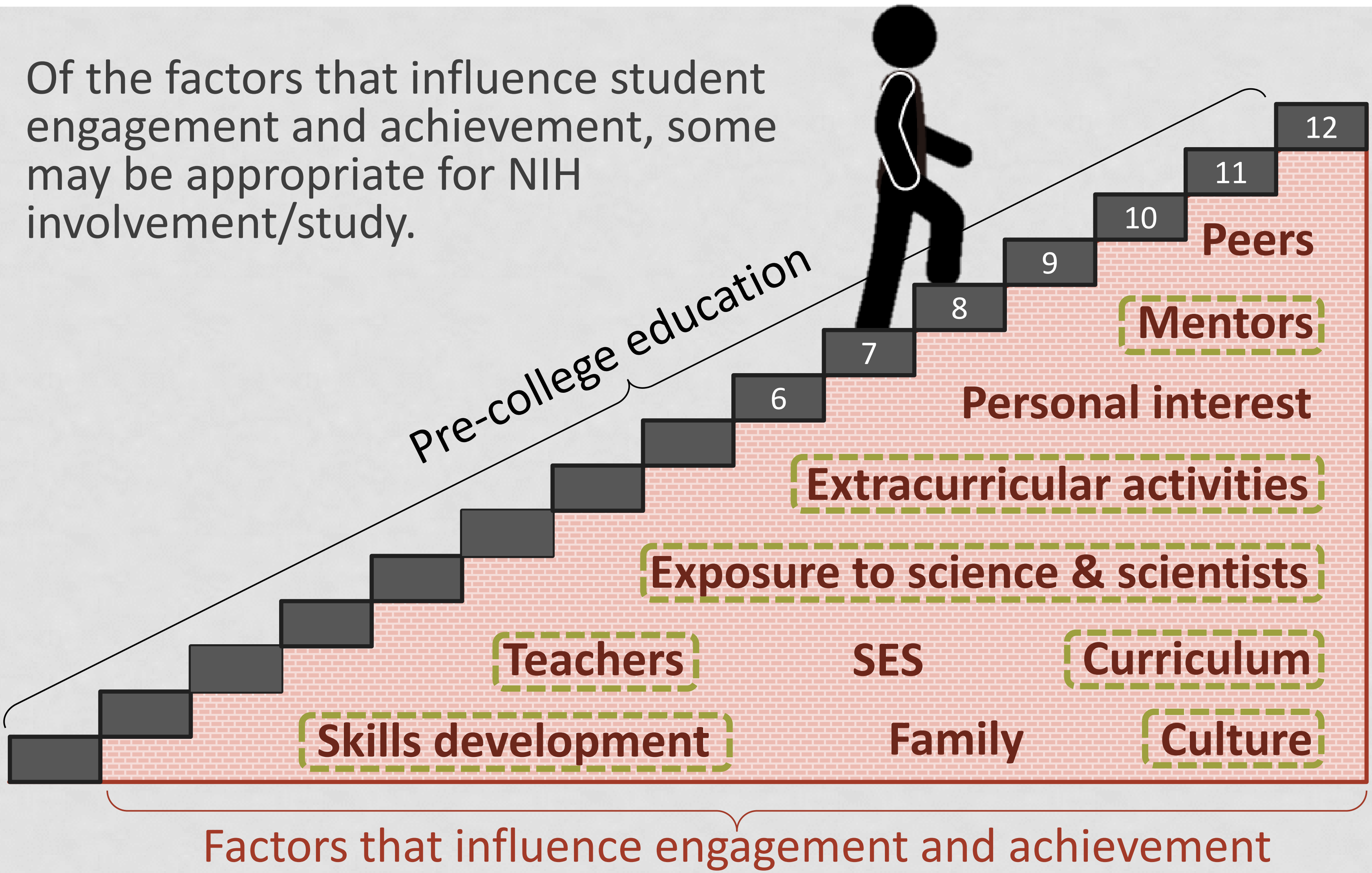
"Identify those points in the pre-college biomedical workforce pipeline where NIH's efforts could be applied most effectively, given finite resources."

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

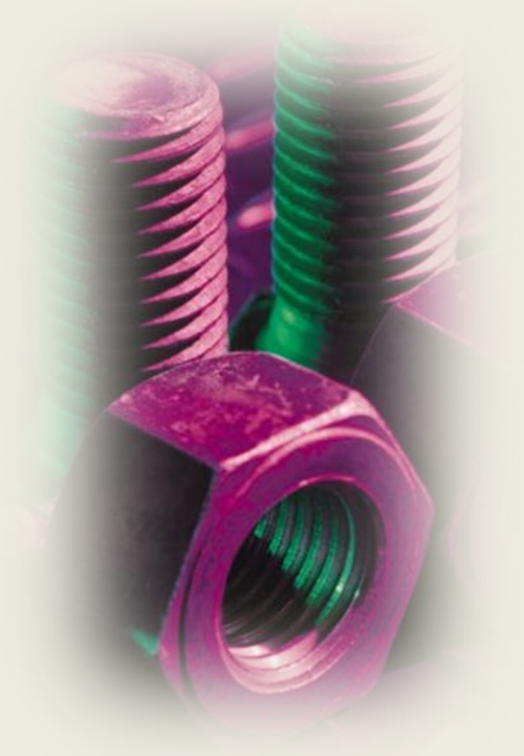
- **Optimizing NIH Efforts to Engage Pre-college Students in Biomedical Science**
  - **James M. Anderson**, M.D., Ph.D., Director, Division of Program Coordination, Planning, and Strategic Initiatives, National Institutes of Health
- **Panel I: Perspective of Science Teachers**
  - **Steven Ahn**, High 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 Riegle-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

The Nuts and Bolts of the NIH Grants Process



Sally J. Rockey, PhD

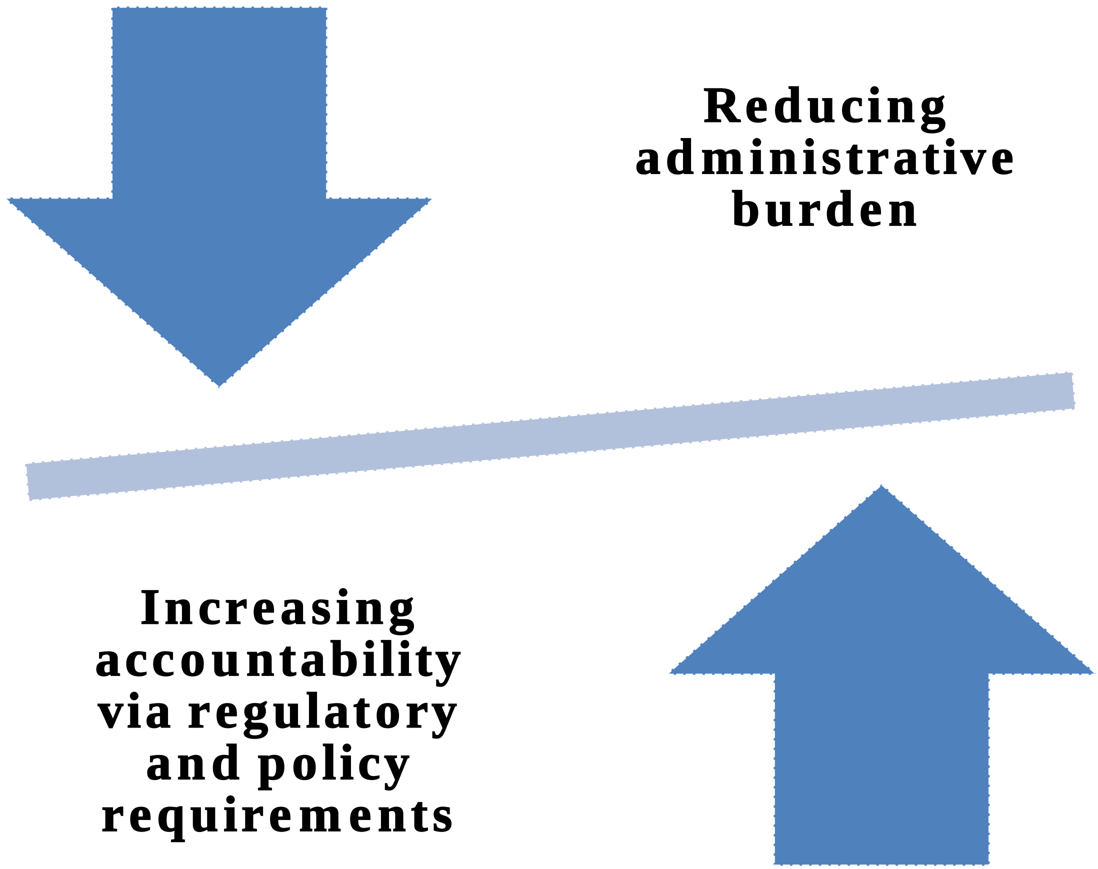
Deputy Director for Extramural Research

National Institutes of Health

Grants Process Overview

Planning, Writing, & Submitting	• Applicant often begins writing application several months prior to application due date • Applicant organization submits most applications to NIH through the Federal portal, Grants.gov
Receipt & Referral (Months 1-3)	• Applications compliant with NIH policies are assigned for review by the Division of Receipt and Referral in the Center of Scientific Review • CSR assigns application to an NIH Institute/Center (IC) and a Scientific Review Group (SRG)
Peer Review (Months 4-8)	• Initial level of review by SRG members for scientific merit • Impact scores & summary statement available to Principal Investigator on eRA Commons • Second level of review by advisory council/board
Award (Months 9-10)	• Pre-award process: IC grants management staff conducts final administrative review and negotiates award • NIH IC director makes funding decision. IC staff issues and sends Notice of award to applicant institution/organization
Post-Award Management (ongoing)	• Conduct of research • Administrative and fiscal monitoring, reporting, and compliance.

A delicate balance….



Planning, Writing, & Submitting

The investigator, in collaboration with his/her institution:

- Develops a research idea
  - Should be important (have high impact)
  - Needs to align with an IC mission
- Identifies a funding opportunity
  - FOA may be specific to a research area or a “parent” announcement.
- Talks with NIH staff about the idea and where it fits
- Writes a strong proposal that addresses review criteria

Planning, Writing, & Submitting

Institution registration requirements:

- **Data Universal Numbering System (DUNS)**: an identifier that government vendors need to register their organization in the System for Award Management (SAM) so they can apply for a federal grant.
- **SAM**: consolidates Federal procurement systems and the Catalog of Federal Domestic Assistance. SAM registration is necessary to submit applications to Grants.gov.
- **Grants.gov**: a centralized location for grant seekers to find and apply for federal funding opportunities.
- **eRA Commons**: provides applicants, grantees and federal staff the tools necessary for electronic processing of grants.

Planning, Writing, & Submitting

Electronic Research Administration

eRA Commons

Sponsored by National Institutes of Health

- Investigators should work with their institution's office of sponsored research to be sure they are registered and their account is affiliated with their institution BEFORE they apply.
- 2 weeks lead time – PI registration in eRA Commons
- 6-8 weeks – All institutional registrations and renewals

<u>Progress</u>
Modular grants
ASSIST
SciENcv

www.grants.gov

Fed-wide portal for finding grant opportunities

FOR APPLICANTS

- Find Grant Opportunities
- Get Registered
- Apply for Grants
- Track Your Application
- Applicant Resources
- Search FAQs, User Guides and Site Information

APPLICANT SYSTEM-TO-SYSTEM

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SITE MAP

Find. Apply. Succeed.

Grants.gov is your source to FIND and APPLY for federal government grants. The U.S. Department of Health and Human Services is proud to be the managing partner for Grants.gov, an initiative that is having an unparalleled impact on the grant community. Learn more about Grants.gov and determine if you are eligible for grant opportunities offered on this site.

Grants.gov does not provide personal financial assistance. To learn where you may find personal help, check **Government Benefits**, **Student Loans** and **Small Business Start-up Loans**.

What's New This Week at Grants.gov

New Opportunities This Week

April 15, 2009: Grants.gov Stakeholder Webcast

Recovery Act Opportunities on Grants.gov

Notices and System Information
(Login Issues, Error Messages, Adobe Reader)

Guidelines to Combat Grant Fraud

Verify if Your Adobe Reader Version is Compatible with Grants.gov

Sign-up for our "Succeed" Quarterly Newsletter

Quick Links

Latest News!
Grants.gov Blog

FOR APPLICANTS

- Grant Search
- Grant Email Alerts
- Get Registered
- Applicant Login
- E-Biz POC Login

FOR GRANTORS

- Grantor Login
- New Agency Users
- Resources

Funding Opportunities

- Advertised through
  - Grants.gov
  - NIH Guide for Grants and Contracts
- Issued by
  - Each IC
  - “Parent” announcements span the breadth of the NIH mission, include many ICs

Types of Funding Opportunity Announcements (FOA)

Type of FOA	Description
Program Announcements (PA, PAR, PAS)	• Highlights areas of focus • Usually ongoing (3 yrs) • Often use standard receipt dates
Requests for Applications (RFA)	• Narrowly defined scope • Usually single receipt date • Set aside funds • IC usually convenes review panel
Parent Announcements	• Type of program announcement • Generally span the breadth of NIH mission • By activity code (R01, R03, etc) • For "investigator initiated" or "unsolicited" research ideas

Application Due Dates

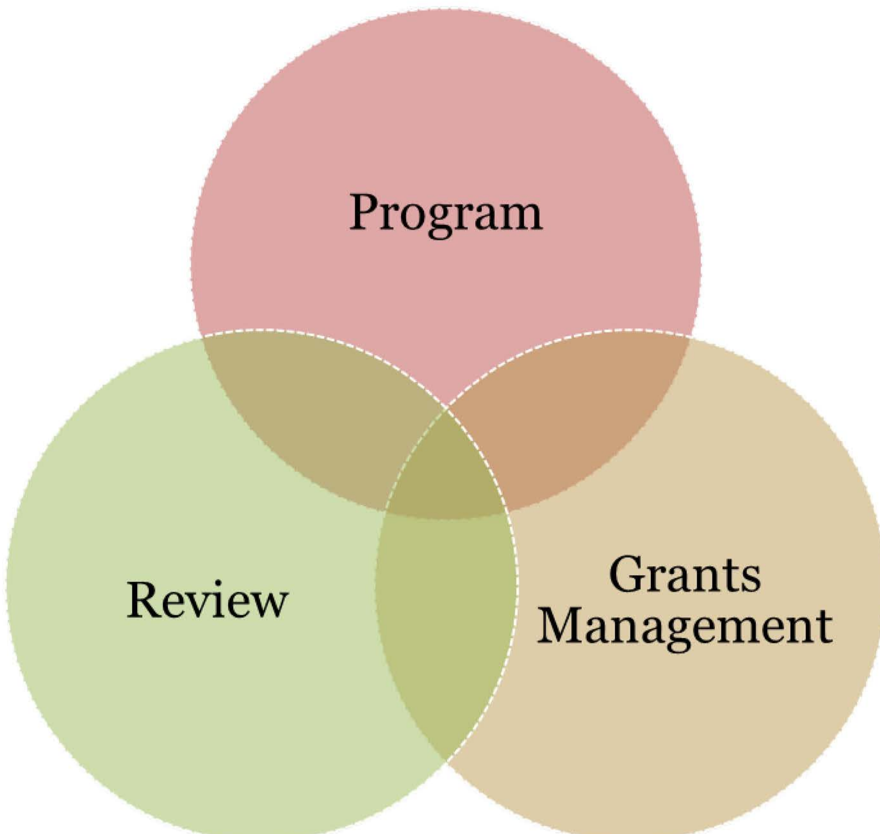
3 standard receipt dates a year.

Activity Codes	Program Description	Application Form	Cycle I Due Date	Cycle II Due Date	Cycle III Due Date
P Series *All - new, renewal, resubmission, revision*	**Program Project Grants and Center Grants** cycles. Transition to SF424 (R&R): On Hold	PHS 398	January 25	May 25	September 25
R18/U18 R25 *All - new, renewal, resubmission, revision*	**Research Demonstration Education Projects**	SF424 (R&R)	January 25	May 25	September 25
T Series D Series *All - new, renewal, resubmission, revision*	***Institutional* National Research Service Awards** **Other Training Grants** NOTE: Applicants sho Institute or Center (IC series applications for cycles. Applicants sho Contacts for information for each IC's scientific/ esearch contact for the NRSA T32 program.	SF424 (R&R)	January 25	May 25	September 25

Standard receipt dates for each type of grant

Scroll further on page for timelines for each "round"

Understanding the NIH Extramural Team



Program Official

- Responsible for the programmatic, scientific, and/or technical aspects of a grant
- Provides scientific guidance to investigators pre- and post-award
- Develops initiatives
- Provides post-award oversight

Scientific Review Officer

- Responsible for scientific and technical review
  - Ensures fair and unbiased evaluation of scientific and technical merit
  - Provides a summary of the evaluation
  - Reviews applications for completeness and conformance with application requirements
- Point of contact for applicants during the review process

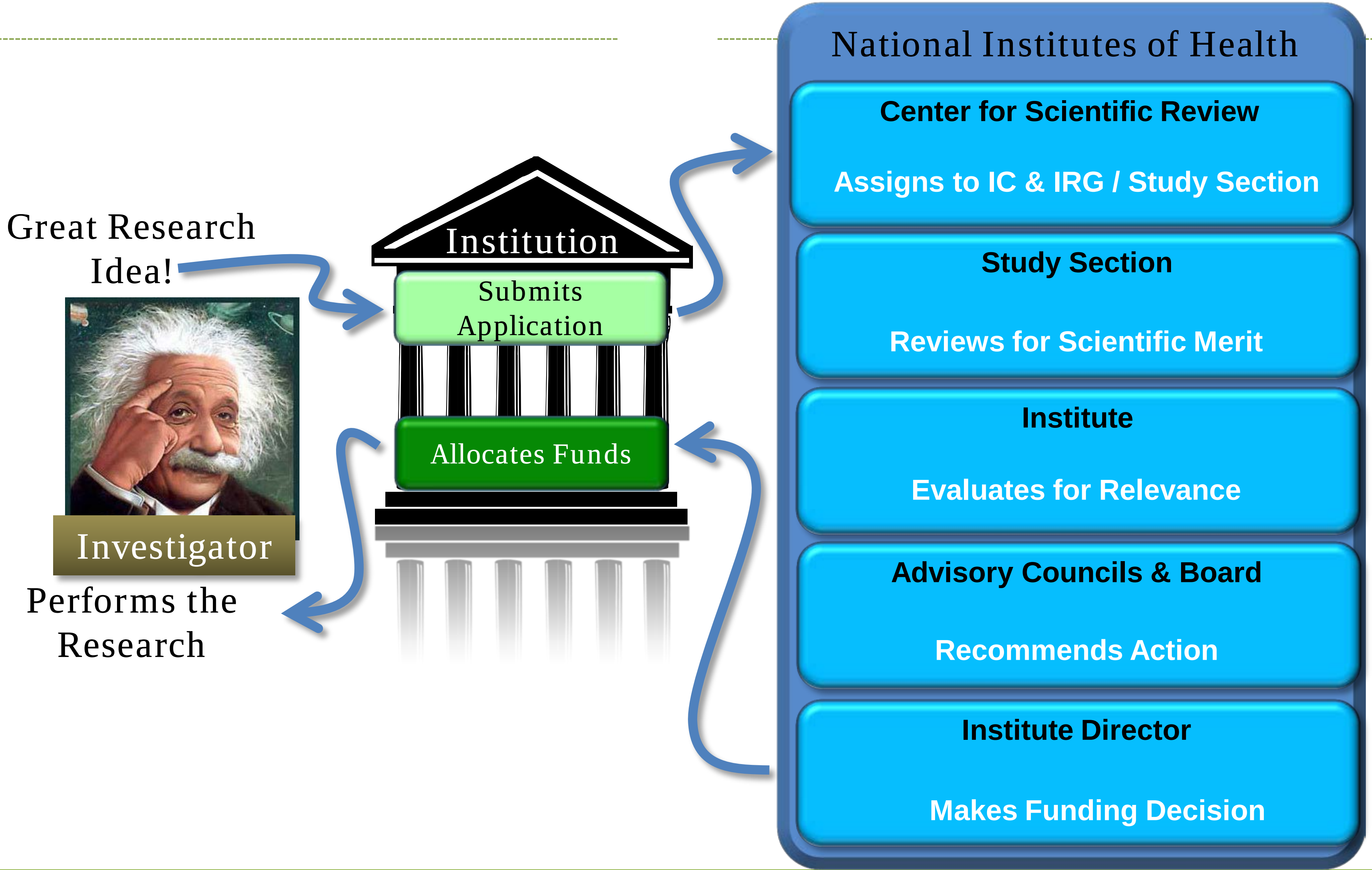
Grants Management Officer

Responsible for completion of business management requirements

- Evaluates applications for administrative content and compliance with policy
- Negotiates Awards
- Interprets grants administration policies

How Long Does It Take to Get Funded?

How does a grant get funded?



Review dates and earliest start date by submission round

Review and Award Cycles

	Cycle I	Cycle II	Cycle III
Scientific Merit Review	June - July	October - November	February - March
Advisory Council Round	August or October *	January	May
Earliest Project Start Date	September or December *	April	July

grants.nih.gov/grants/funding/submissionschedule

Award Process

- All pre-award issues must be resolved
  - Program and grants management review for scientific or budgetary overlap
  - Budget negotiation
  - Determination of Facilities and Administrative (F&A) Costs
  - Certification of education on human subjects
  - Animals & human subject protection issues
  - Other support documentation
- Application to award takes ~9-10 months

<u>Progress</u>
Just-in-time
Streamlined terms & conditions

What Can Delay the Award Process?

- Late submission of the progress report
- Inadequate description of progress
- Missing information for Key Personnel
- Out-of-date IRB/IACUC approvals
- Lack of population data for clinical trials
- Budgets with inadequate justification
- Other Support for an individual that exceeds 12 CM (100%)

Notice of Award (NoA)

- Legally binding document
  - Award data and fiscal information
  - Grant payment info
  - Terms and conditions of award

- Grantee accepts terms and conditions of award when drawing down funds from the Payment Management System

Accessing the Funds

- Generally centralized through the Payment Management System (http://www.dpm.psc.gov/)
- Applicant organizations are required to have financial systems in place to monitor their grant expenditures.
- The Grants Management Specialist reviews grantee cash expenditure reports to determine whether they indicate a pattern of accelerated or delayed expenditures.

Post Award Management

- Annual progress reporting
- Annual federal financial reporting
- Invention reporting
- Yearly audits (as applicable)
- Closeout reporting

<u>Progress</u>
RPPR
Easier effort reporting
SNAP
Automatic no cost extensions

Annual Progress Reports

- Progress reports are required at least annually as part of the non-competing continuation award process.
  - RPPR Required for: SNAP, Fellowship, Multi-Year Funded (ex. R15)
  - All others have the option of paper-submission utilizing the PHS 2590…for now
    - Anticipated to be required for all non-SNAP progress reports by October 2014
  - Further information: http://grants.nih.gov/grants/rppr/

Financial Reporting

- Federal Financial Report (FFR): Annual FFR due 90 days after the end of calendar quarter in which the budget period end date falls
- Final FFRs - due 90 days after the project period end date
- Annual and Final FFRs reporting expenditure data must be submitted via the eRA Commons
- Impact on future awards – delinquent submission of the required FFR will most likely result in the holding of any future awards to support the particular project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Grants Process At-A-Glance

grants.nih.gov/grants/grants_process.htm

Any successful project requires plannin[...]s no
The Grants Process At-A-Glance Chart[...]nnin
submission through award and close out. Look to the related resources on each page for special guidance from NIH experts that can help ma
understanding of the grants process and help you submit a successful grant application.

Planning, *Writing*, *Submitting*

Planning: Applicant should start early, collect preliminary data, and determine internal deadlines. →	**Writing**: Applicant often begins writing application several months prior to application due date. →	**Submitting**: Applicant organization submits most applications to NIH through Federal portal, Grants.gov.

Receipt and Referral

Months 1-3

Months 1-3

Applications compliant with NIH policies are assigned for review by the Division of Receipt and Referral in the Center of Scientific Review (CSR). →	CSR assigns application to an NIH Institute/Center (IC) and a Scientific Review Group (SRG). →	Scientific Review Officer (SRO assigns applications to reviewe and readers.

Peer Review

Months 4-8

Initial Level of Review: SRG members review and evaluate applications for scientific merit. →	**Impact Scores**: Available to Principal Investigator on eRA Commons. →	**Summary Statement**: Available to Principal Investigator on eRA Commons. →	**Second Level of Review**: Advisory council/board reviews applications.

Award

Months 9-10

Pre-Award Process: IC grants management staff conducts final administrative review and negotiates award.* →	**Notification of Award:** NIH Institute/Center (IC) director makes funding decision. IC staff issues and sends Notice of Award (NoA) to applicant institution/organization. →	**Congratulations!** Project period officially begi

Questions?