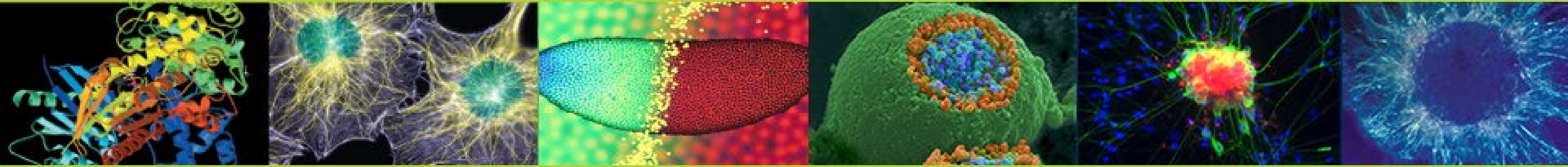
National Institute of
General Medical Sciences

Overview of NIGMS Training, Workforce Development and Diversity Programs

Alison Gammie
Director Training, Workforce Development and Diversity

February 10, 2020



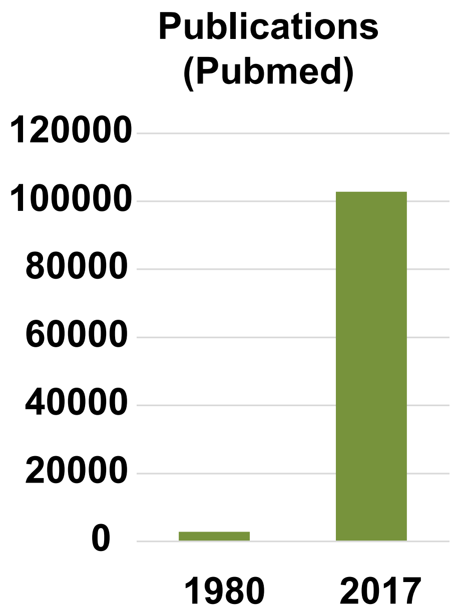
What are some of the major issues in biomedical research workforce training?

Biomedical Research Training: Calls for Change

"Substantial changes in graduate education are recommended—not because the previous approaches were wrong—but because the technological leaders of this century must have skills crafted to meet its demands."

Biomedical science has changed significantly over the past decades – graduate research training needs to keep up

It was easier to “know everything” there was to know about ACTIN in 1980



A Growing Challenge:
Ensuring the Rigor and Reproducibility of Biomedical Research

Vox SCIENCE & HEALTH

Too many mice are sacrificed for seriously flawed studies

Updated by Julia Belluz on July 28, 2016, 10:20 a.m. ET @juliaoftoronto julia.belluz@voxmedia.com

Science has lost its way, at a big cost to humanity

Researchers are rewarded for splashy findings, not for double-checking accuracy. So many scientists looking for cures to diseases have been building on ideas that aren't even true.

October 27, 2013 | Michael Hiltzik

The Economist | World politics | Business & finance | Economics | Science & technology | Culture

Unreliable research

Trouble at the lab

Scientists like to think of science as self-correcting. To an alarming degree, it is not

Oct 19th 2013 | From the print edition

RESEARCH ARTICLE

PSYCHOLOGY

Estimating the reproducibility of psychological science

Open Science Collaboration*†

Beware the creeping cracks of bias

Evidence is mounting that research is riddled with systematic errors. Left unchecked, this could erode public trust, warns Daniel Sarewitz.

Why animal research needs to improve

Many of the studies that use animals to model human diseases are too small and too prone to bias to be trusted, says Malcolm Macleod.

Believe it or not: how much can we rely on published data on potential drug targets?

Florian Prinz, Thomas Schlange and Khusru Asadullah

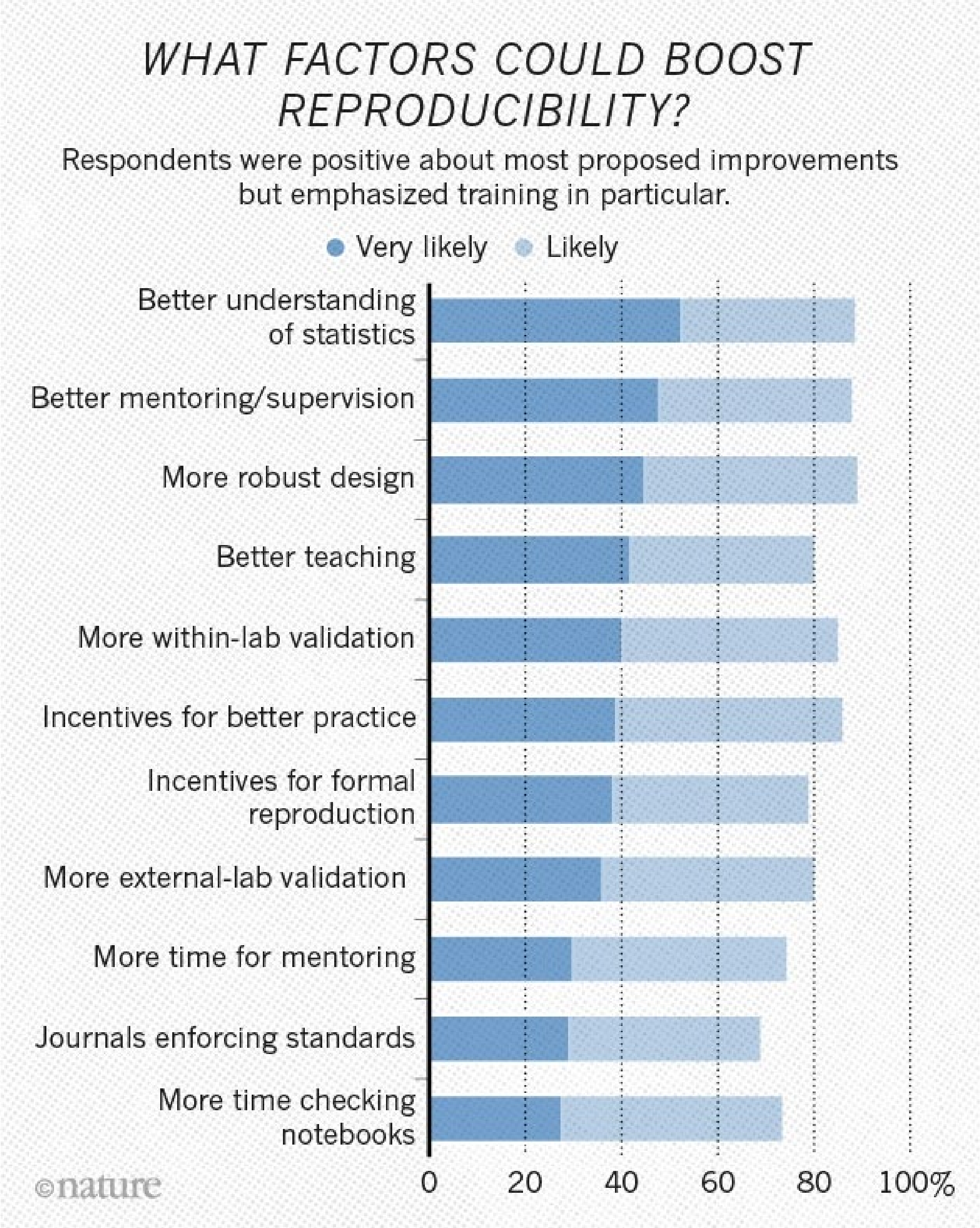
False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant

Raise standards for preclinical cancer research

C. Glenn Begley and Lee M. Ellis propose how methods, publications and incentives must change if patients are to benefit.

Reforming Science: Methodological and Cultural Reforms

Survey Indicates Training Can Play a Role in Enhancing Reproducibility



http://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970

Serious lab accidents occur more often than most people realize

10 years after Sheri Sangji's death, are academic labs any safer?

Chemists discuss their efforts

by Jyllian Kemsley

DECEMBER 28, 2018 | APPEARED IN **VOLUME 97, ISSUE 1**

On Dec. 29, 2008, Sheharbano "Sheri" Sangji was **working on a chemical synthesis** in a lab at the University of California, Los Angeles. One of the reagents she was using was *tert*-butyllithium (*t*-BuLi), which ignites spontaneously in air. It was likely only the second time she had handled such a hazardous substance. She had graduated from college a few months earlier and was working in the lab as a staff scientist while applying to law schools.

Credit: Courtesy of Naveen Sangji

Sheri Sangji

She was transferring a total of 160 mL of *t*-BuLi solution using a 60 mL plastic syringe, **according to her lab notebook**. For unknown reasons, the plunger came out of the syringe barrel and the *t*-BuLi was exposed to the atmosphere. The *t*-BuLi ignited, along with Sangji's clothes. She wore nitrile gloves, no lab coat, and possibly no eye protection. A lab mate attempted to use a lab coat to smother the fire, then started pouring water on Sangji from a nearby sink.

CREDIT: A.MCAVOY/ASSOCIATED PRESS

Report on UH lab explosion reveals deep, systemic safety failures

By Beryl Lieff Benderly | Jul. 7, 2016 , 10:15 AM


SEXUAL COERCION
promising professional rewards in return for sexual favors
threatening professional consequences unless sexual demands are met
UNWANTED SEXUAL ATTENTION
rape
sexual assault
unwanted groping or stroking
PUBLIC CONSCIOUSNESS
GENDER HARASSMENT
relentless pressure for sex
unwanted sexual discussions
nude images posted at work
relentless pressure for dates
sexually humiliating acts
sexual insults
e.g. "for a good time call...", calling someone a whore
offensive sexual teasing
sexist insults
e.g. women don't belong in science
offensive remarks about bodies
obscene gestures
sabotage of women's equipment
vulgar name calling
e.g. "slut," "bitch," "c**t"
gender slurs
e.g. "pu**y"
insults to working mothers
e.g. "you can't do this job with small kids at home"
The National Academies of SCIENCES ENGINEERING MEDICINE

EDUCATION

Graduate School Can Have Terrible Effects on People's Mental Health

Ph.D. candidates suffer from anxiety, depression, and suicidal ideation at astonishingly high rates.

ALIA WONG NOVEMBER 27, 2018

The Emotional Toll of Graduate School

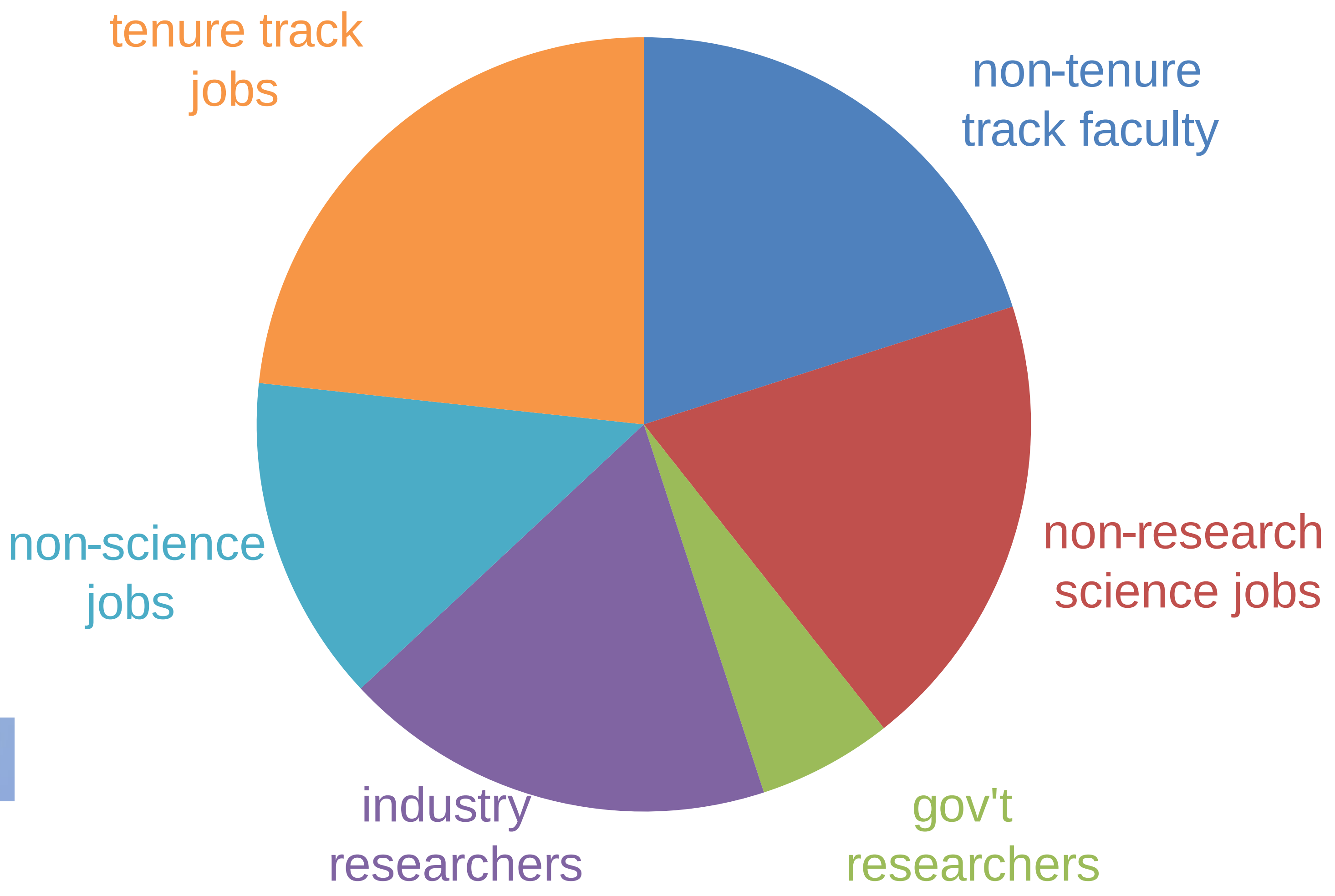
Mental health disorders and depression are far more likely for grad students than they are for the average American

By Prateek Puri on January 31, 2019

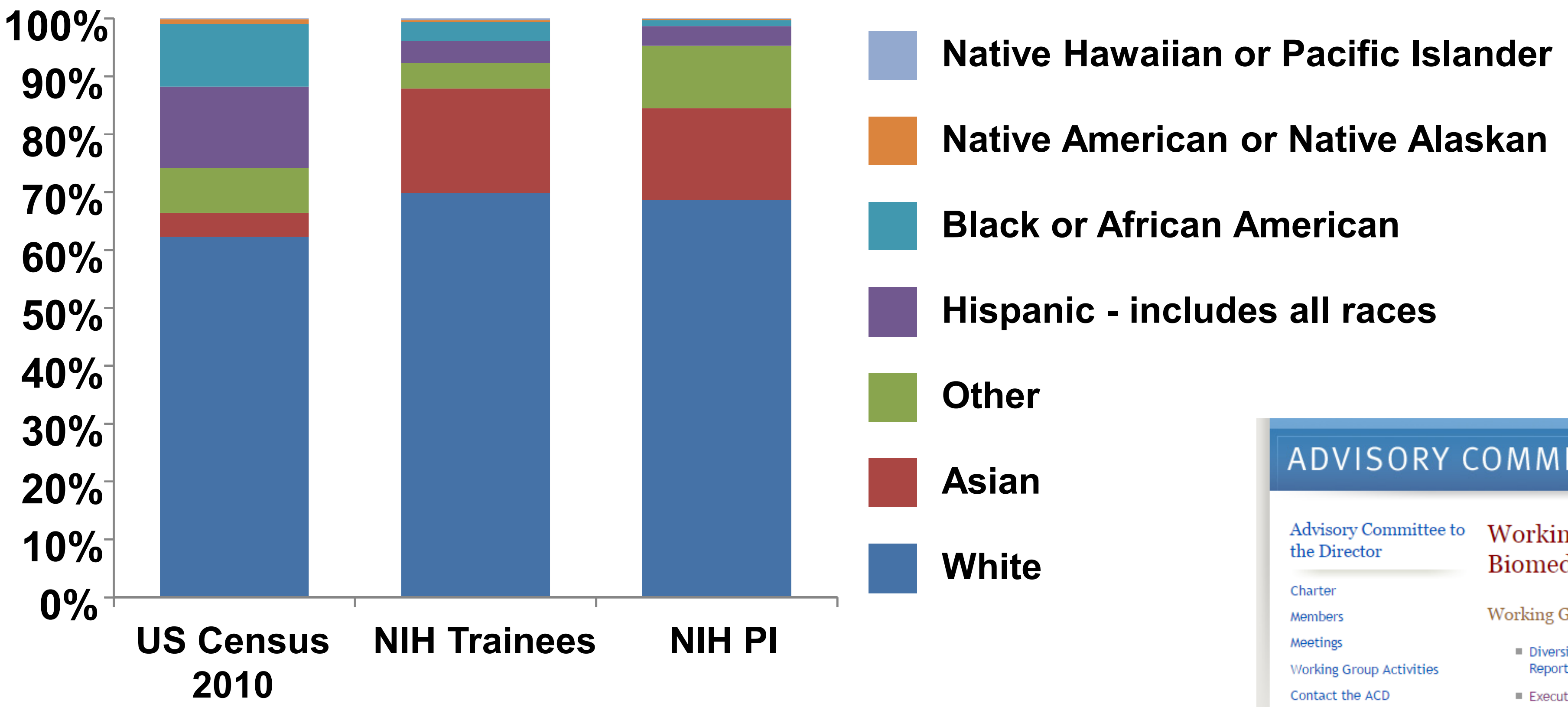
Credit: Getty Images

The research incentive structure is sometimes in conflict with training

The current careers in the biomedical workforce require training beyond academic research



The biomedical research community does not reflect the diversity in this country

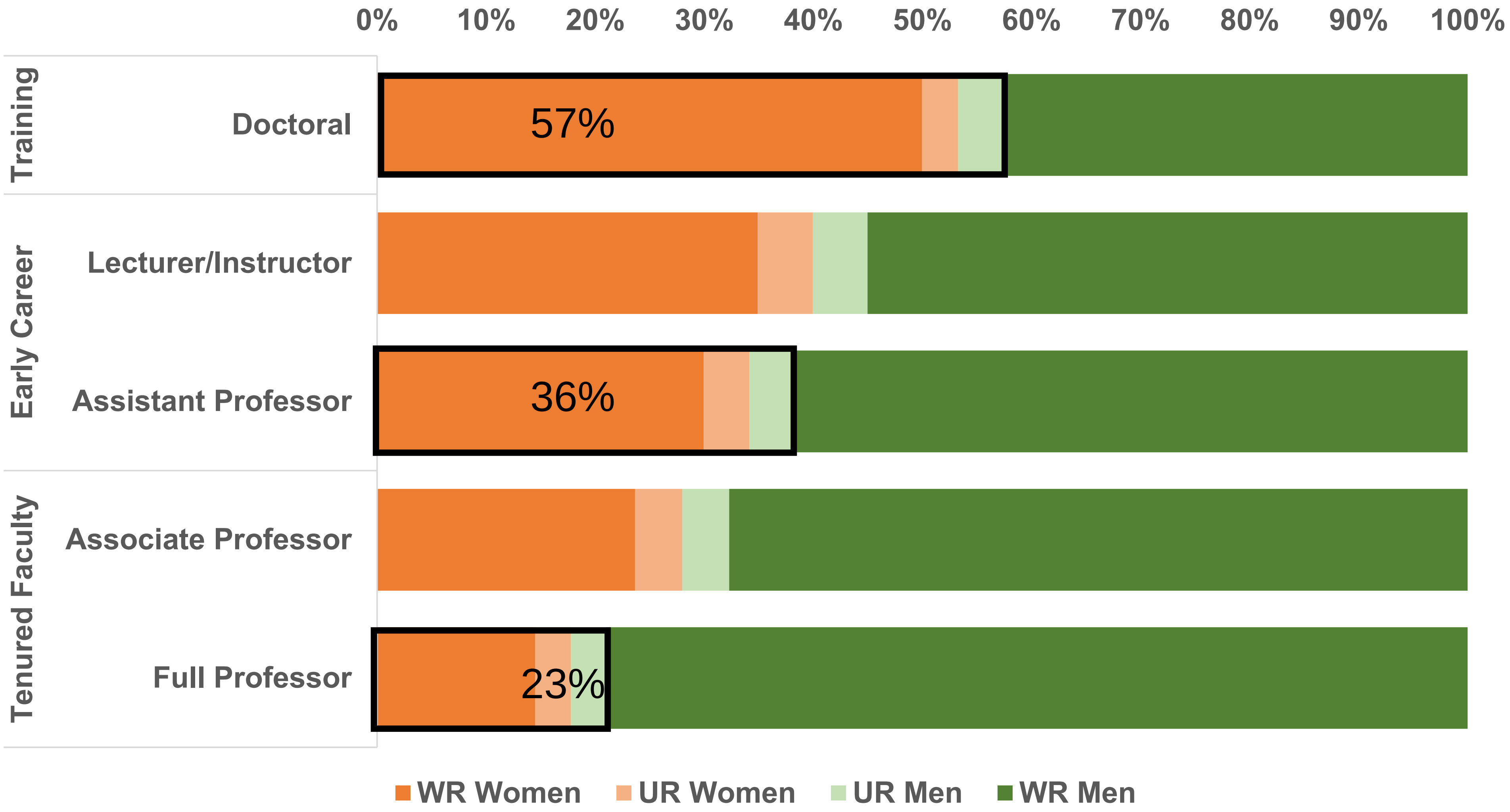


Research: Decoupling of the minority PhD talent pool and assistant professor hiring in medical school basic science departments in the US

Kenneth D Gibbs Jr, Jacob Basson, Imam M Xierali, David A Broniatowski

National Institute of General Medical Sciences, United States; Association of American Medical Colleges, United States; The George Washington University, United States

Participation of Women and Underrepresented Minority Scientists in the Biomedical Professoriate Does Not Reflect Available Talent Pool

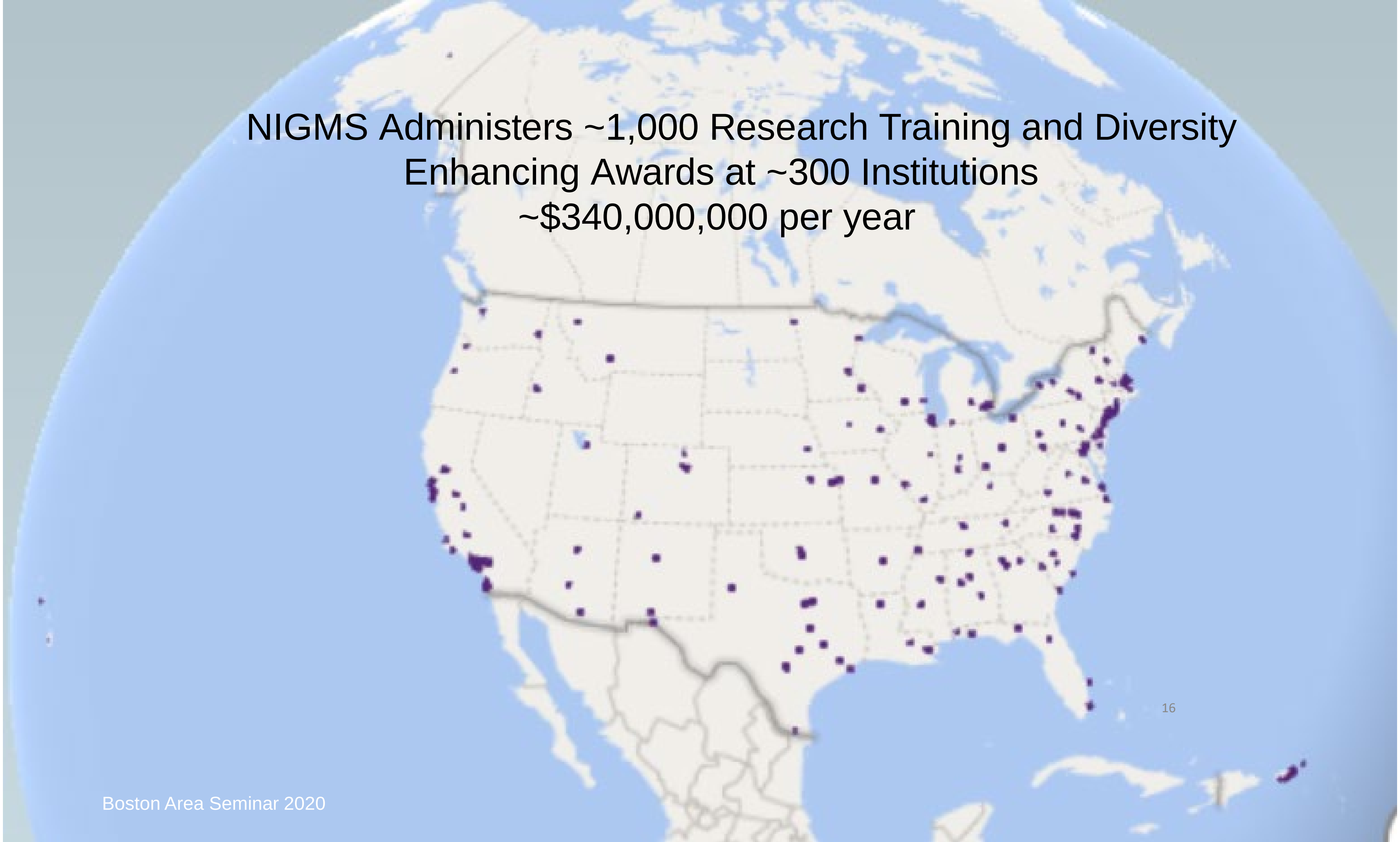


UR, underrepresented: Hispanic/Latinx, African American/Black, Native American/Alaska Native
WR, well represented: White, Asian

Valantine, Lund & Gammie
CBE Life Sciences Education (2016)

What is NIGMS doing to address these issues in training?

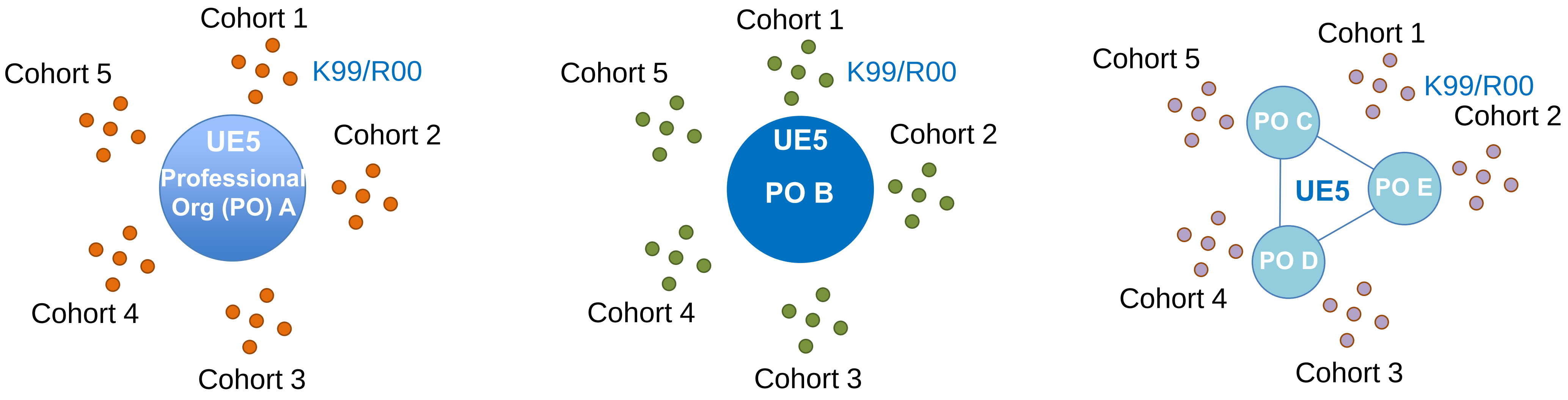
NIGMS Administers ~1,000 Research Training and Diversity Enhancing Awards at ~300 Institutions
~$340,000,000 per year



Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC)

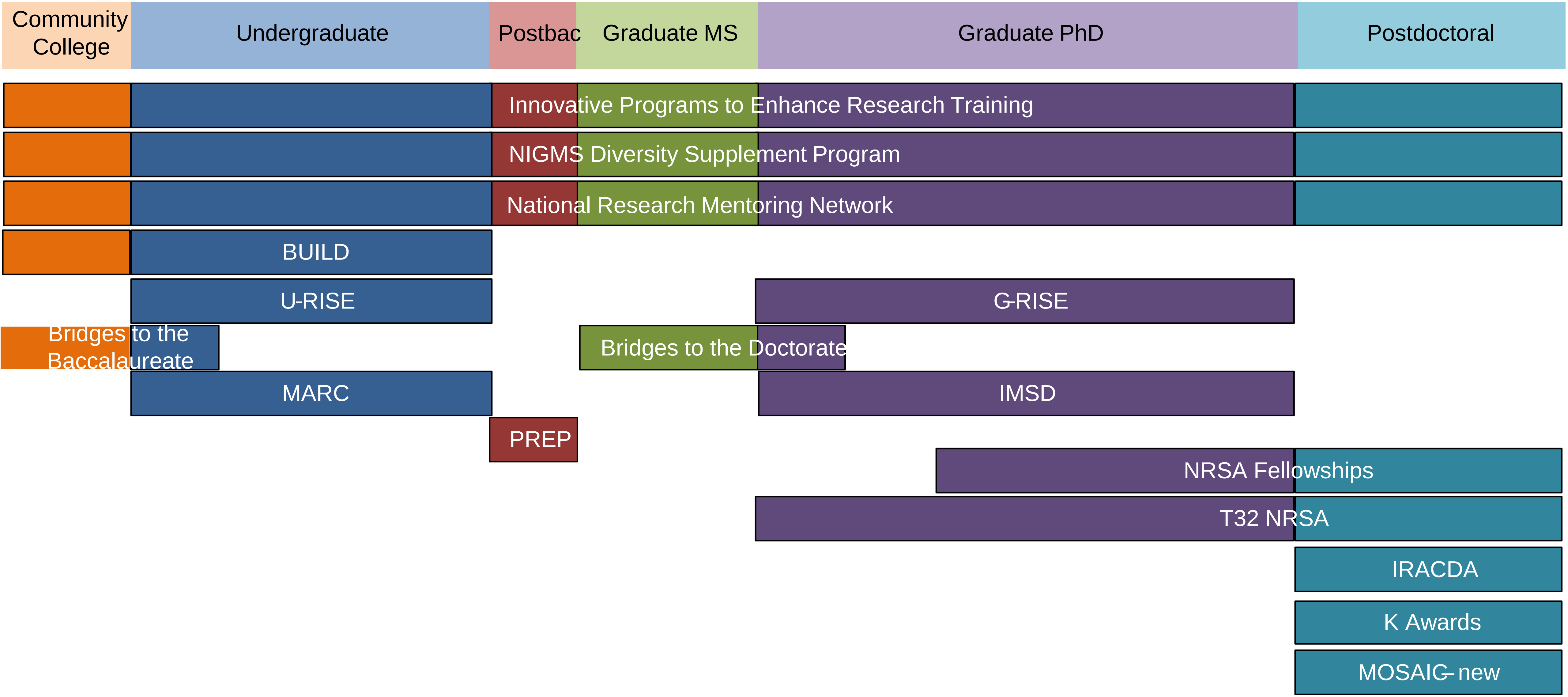
Postdoctoral Career Transition Award to Promote Diversity (K99/R00)
Institutionally Focused Research Education Cooperative Agreement to Promote Diversity (UE5)

- Step 1: NIH Award UE5's to neutral organization such as scientific societies
- Step 2: NIH Administers Competition for K99/R00
- Step 3: Cohorts of MOSAIC scholars organized by scientific areas within the mission of participating ICs



- Expect to grow to ~25 scholars per UE5 in steady-state by year five
- UE5 provide MOSAIC K99/R00 scholars additional mentorship, networking, career development, and institutional responsibility

TWD Administered Programs



All NIGMS Training Programs Should -

- Focus on technical, operational and professional skills development
- Promote rigor and reproducibility in research
- Teach the responsible and safe conduct of research
- Promote diversity, equity and inclusion
- Encourage inclusive, safe, and supportive research environments
- Use evidence-based educational and mentoring practices
- Employ cohort-building activities and interventions that enhance the trainees' science identity and self-efficacy
- Provide individualized mentoring and oversight throughout
- Introduce trainees to a variety of scientific research areas and careers
- Collect and disseminate data on the success/failure of educational aims; make career outcomes publicly available

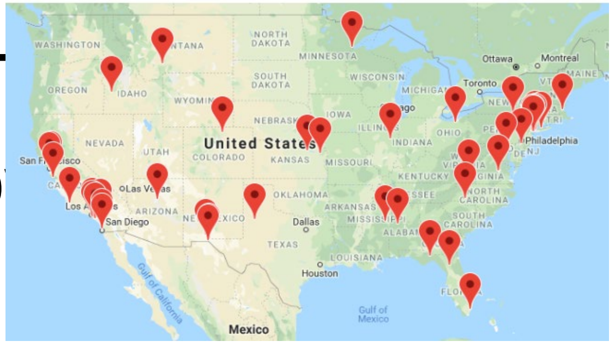
All NIGMS Training Programs Should -

- Have strong institutional support
- Develop Program Director/Principal Investigator teams to broaden program leadership and provide complementary expertise
- Build a diverse faculty cohort with a strong commitment to training and mentoring
- Display coordinated interactions and synergies with other NIGMS-funded training programs at the institution

Programs with Partnerships

Bridges to the Baccalaureat

Contacts: Mercedes Rubio, Patrick Bro



4-year Undergraduate | Postbac | Graduate M.S. | Graduate Ph.D. | Postdoctoral

Community College

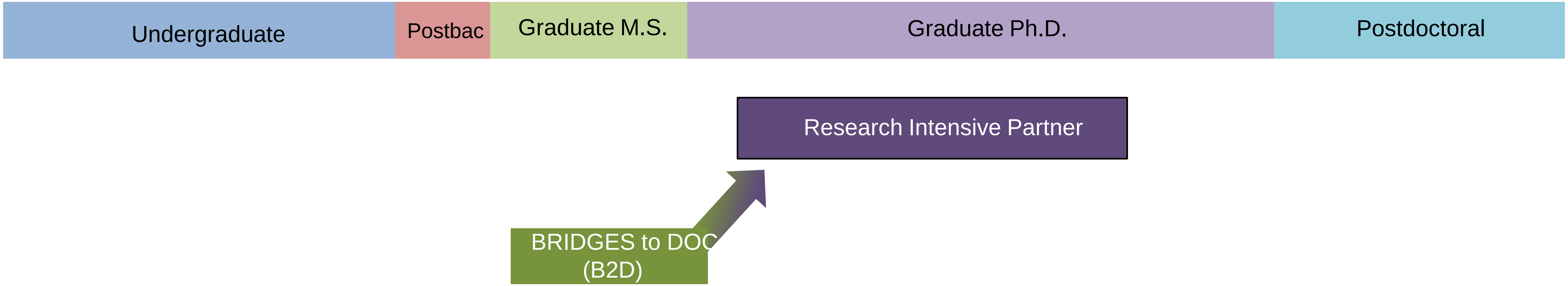
4-year Partner

Bridges to Bac (B2B)

- Diversity enhancing research training program
- Emphasizes the development of a diverse pool of undergraduates that bridge from two-year to four-year institutions, and subsequently earn their baccalaureate degree in the biomedical sciences
- Encourages a strong partnership that offers a well-integrated set of activities both pre- and post-bridging (e.g., trainees conduct research both prior to and after bridging)
- Encourages articulation agreements to reduce the time-to-degree

Bridges to the Doctorate Partnerships

Contacts: Patrick Brown and Mercedes Rubio



- Encourage a strong partnership that offers a well-integrated set of activities both pre- and post-bridging
- Reduce the time to Ph.D. degree (e.g., with effective skill-building activities and course credit articulation agreements)
- Enhance the research efforts of the faculty at the master’s degree granting institution through inter-institutional efforts
- Ensure the research activities of the programs align with NIGMS research priorities

Institutional Research and Academic Career Development Award (IRACDA) (

Contacts: Mercedes Rubio, Desirée Salazar

IRACDA supports postdoctoral training to prepare for independent research and teaching careers in academia, and stren
and modernize science educational offerings at partner institutions

Undergraduate	Postbac	Graduate MS	Graduate PhD	Postdoctoral

Teaching Intensive Partner

IRACDA

TWD administered programs for undergraduates and postbacs

Maximizing Access to Research Careers MARC (T34)
Undergraduate Research Training Initiative for Student Enhancement (U-RISE)

Undergraduate	Postbac	Graduate MS	Graduate PhD	Postdoctoral

MARC

H ¨ óXõ million research project grants (RPG)

U-RISE

< $7.5 million research project grants (RPG)

- **Undergraduate diversity enhancing research training program**
- **Cohorts of research-oriented trainees**
- **Support for 1-3 years**

MARC
Sailaja Koduri

U-RISE
Anissa Brown

Postbaccalaureate Research Education Program (PREP) (R25)

Contact: Kenneth Gibbs or Michele McGuirl

To increase the number of baccalaureates from underrepresented groups who go on to Ph.D. degree programs. Grants made to domestic, private and public universities or research institutions with strong Ph.D. degree programs in the biomedical sciences.

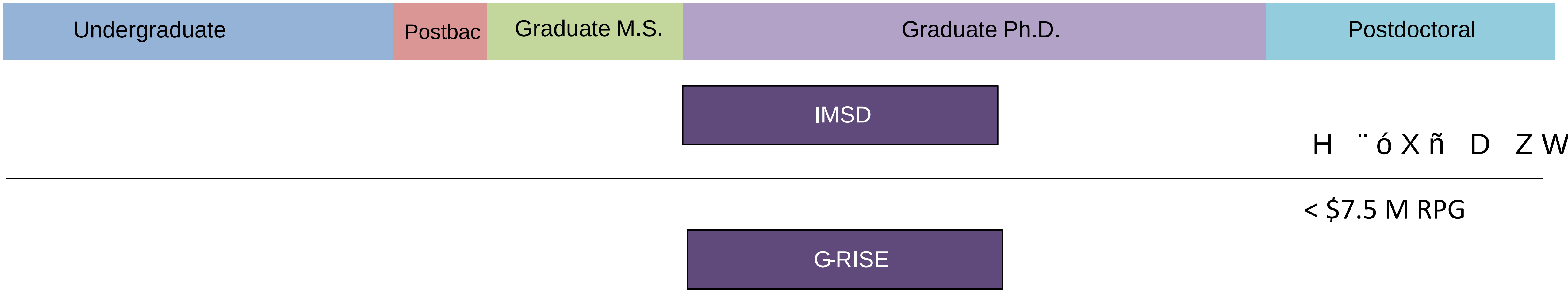
NIGMS Biomedical Graduate Training

While preserving the best elements, NIGMS would like to catalyze changes in biomedical graduate training to keep pace with the rapid evolution of biomedical research

Medical Science Training Program

- Similar objectives to the Ph.D. T32 FOA
- Longitudinal mentoring with exposure to the spectrum of physician-scientist research areas
- Encourage career trajectories that utilize the dual degree

Diversity Enhancing Graduate Diversity Training Programs



- Emphasize the development of a diverse pool of scientists earning a Ph.D., who have the skills to successfully transition into careers in the biomedical research workforce.
- Support for 2-3 years (typically early years)
- Employ cohort-building activities and interventions that enhance the trainees' science identity and self-efficacy
- Provide individualized mentoring and oversight throughout the trainees' undergraduate or graduate career

Individual Predoctoral National Research Service Award (NRSA) Fellowships

Donna Krasnewich (F30) Ph.D. and M.D.-Ph.D. or other dual-degree students not at MSTP institutions

Anissa J. Brown; Patrick Brown (F31 Diversity)

NIGMS predoctoral fellowships promote fundamental, interdisciplinary and innovative research training and career development leading to independent scientists who are well prepared to address the nation's biomedical research needs.

Educator-Initiated Innovations

- **Training modules to enhance data reproducibility (R25)**

NIH Rigor and Reproducibility Training Modules

Coming soon – data science

Introduction to the Modules [PDF, 110KB]

Module 1: Lack of Transparency

In order to reproduce someone else's findings adequately, the experimental methods, rationale and other pertinent information must be accessible and understandable. This module highlights the need to include all relevant details in publications to ensure that other studies are able to build upon the research appropriately and accurately.

Lack of Transparency Discussion Material [PDF, 97.2KB]

- **Administrative supplements T32 predoctoral grants**
  - Rigor & Reproducibility
  - Career Development
  - Skills Development – technical, operational, professional
  - Safety in the Research Environment

Postdoctoral Training

Individual Postdoctoral National Research Service Award (NRSA) (F32)

Contact: Mike Sesma

Postdoctoral fellowships support advanced and specialized training in basic and/or clinical research through an intensive, mentored research project experience that encourages the development of independence, innovation and creativity in a highly productive research setting.

Career Development Awards

K08, K23, K25

Contact: Michael Sesma

The K08 Mentored Clinical Scientist and the K23 Mentored Patient-Oriented Research awards support individuals with M.D. degrees through mentored research career development experiences in anesthesiology, clinical pharmacology, trauma and burn injury or wound healing.

The K25 Mentored Quantitative Research Development Award supports investigators from quantitative science and engineering disciplines who seek to focus on questions of health and disease.

Pathway to Independence Award (K99/R00)

Contacts: Oleg Barski, Paula Flicker; Michael Sesma; Dan Janes

The goal of this program is to shorten and facilitate the transition from a postdoctoral researcher to an independent investigator capable of leading a research team. The strategy is to support highly promising postdoctoral researchers in 2-year mentored research positions followed by 3 years of independent research support when the grantee obtains an independent position.

Institutional Postdoctoral National Research Service Award (NRSA) (T32)

Contact: Martha Garcia; Zuzana Justinova; Rochelle Long; Darren Sledjeski;

Institutional training programs support research training for clinician-scientists in four clinically relevant research areas within the mission of NIGMS: anesthesiology; clinical pharmacology; medical genetics; and injury and critical illness. Trainees receive at least 2 years of research training in basic, clinical and/or translational science areas and engage in activities to promote research career development.

TWD administered programs that span the pathway

Undergraduate	Postbac	Graduate MS	Graduate PhD	Postdoctoral

Research Supplements to Promote Diversity in Health-Related Research (Admin Supp) | PA-18-586; Desirée Salazar

This program employs the research project grant as the platform for intensive mentored research experiences within the scope of the grant during the continuum from high school to the postdoctoral level. The goal is to increase the nation's pool of students from underrepresented groups by preparing them to continue their training in biomedical research.

Undergraduate	Postbac	Graduate MS	Graduate PhD	Postdoctoral

Research to Understand and Inform Interventions that Promote the Research Careers of Individuals in the Biomedical Sciences (R01)

NIGMS intends to enhance the evidence base for effective, high-impact, scalable interventions, and to improve our understanding of the factors contributing to success, including the social and behavioral factors involved in the advancement of individuals pursuing independent academic biomedical research careers.

- Interventions must be practical, realistic, scalable and sustainable across a range of institutions
- Will fund robust experiments (e.g., randomized control trials, case controls, matched pair design)

http://understanding-interventions.org/lead-consortium/

Potential areas for investigation:

- Training Program Related
- Psychosocial Factors (must be linked to outcomes)
- Navigation of Critical Transition Points
- Institutional Factors

Contact:
Mercedes Rubio

PAR-19-295