

Biomedical Workforce Development & Diversity – Data to Policy

Kenneth Gibbs, Jr., Ph.D.

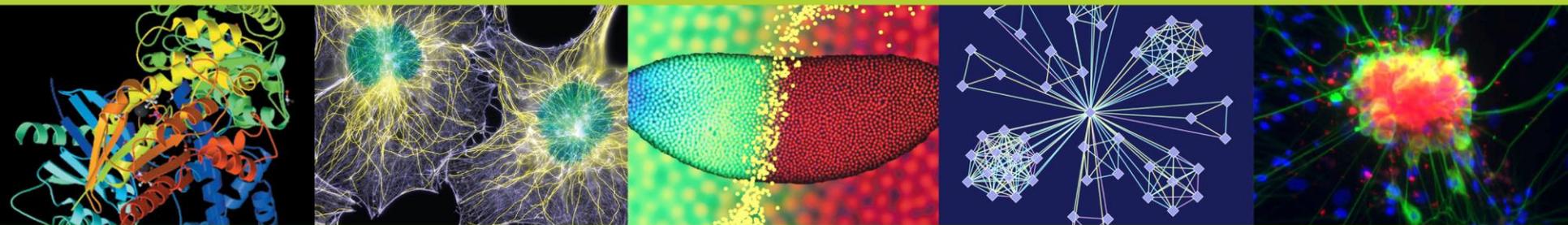
National Institute of General Medical Sciences

Director, Postdoctoral Research Associate Training (PRAT) Program

Program Director

Division of Training, Workforce Development and Diversity

@NIGMSTraining



Scientific Excellence Demands Diversity

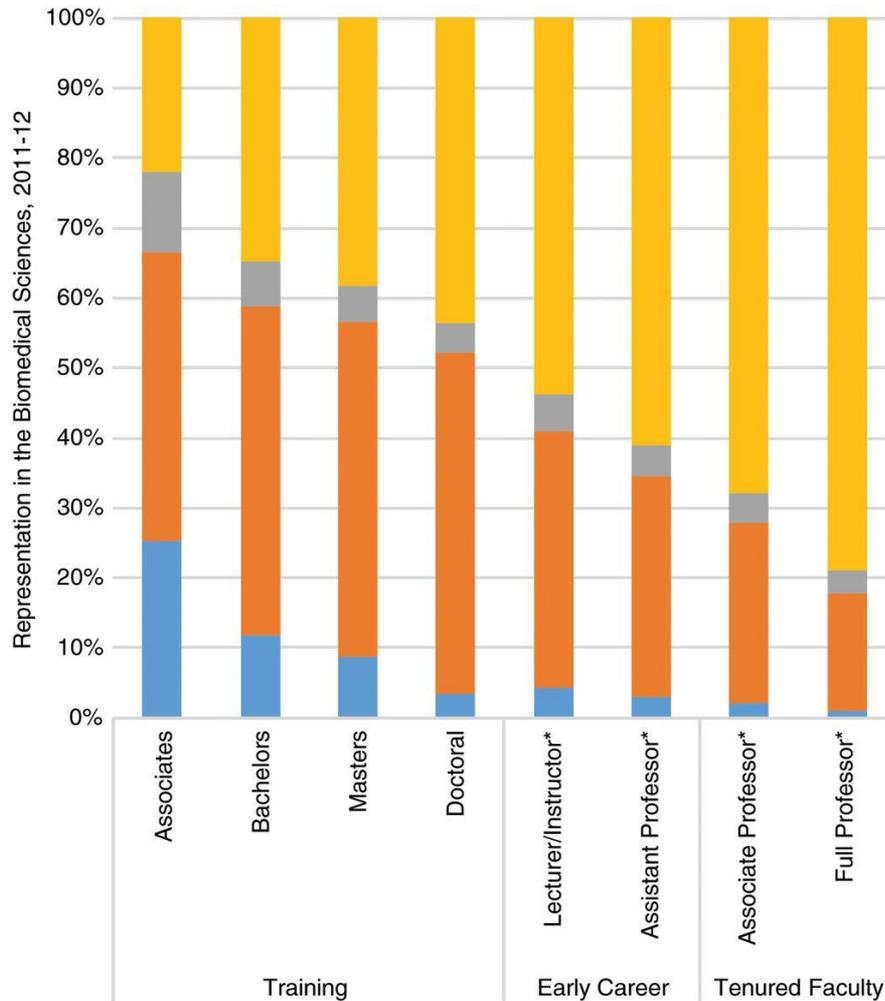
Maximizing the return on taxpayers' investments in fundamental biomedical research

A core principle of both financial investment and biology is that diversity leads to strength. **Diversity at all levels**—from the kinds of science to the regions in which it is conducted to the backgrounds of the people conducting it—**strengthens the institute's research portfolio** and should lead to the best returns on the taxpayers' investments. Lorsch, *Molecular Biology of the Cell*, 2015

National Institutes of Health addresses the science of diversity

Lack of diversity “is limiting the promise of our biomedical enterprise for building knowledge and improving the nation's health...recruiting and retaining a diverse set of minds and approaches is vital to harnessing the complete intellectual capital of the nation.” Valantine & Collins, *PNAS*, 2015

What's the Current Landscape?



Well Represented Groups (WR):

White, Asian, Non-Resident

Underrepresented Minority

(URM): Black, Hispanic/Latin@, American Indian, or Alaska Native

WR Men

URM Men

WR Women

URM Women

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

Won't this all work out as demographics change?

Article

What Do I Want to Be with My PhD? The Roles of Personal Values and Structural Dynamics in Shaping the Career Interests of Recent Biomedical Science PhD Graduates

Kenneth D. Gibbs, Jr.,^{*†‡} and Kimberly A. Griffin^{†§}



RESEARCH ARTICLE

Biomedical Science Ph.D. Career Interest Patterns by Race/Ethnicity and Gender

Kenneth D. Gibbs Jr.^{1,2*}, John McGready³, Jessica C. Bennett⁴, Kimberly Griffin^{4*}

Article

Career Development among American Biomedical Postdocs

Kenneth D. Gibbs, Jr.,^{*†‡} John McGready,[§] and Kimberly Griffin^{†¶}

Mixed-methods approach

Study population: US citizen/permanent resident biomedical Ph.D. graduates (2007-2012)

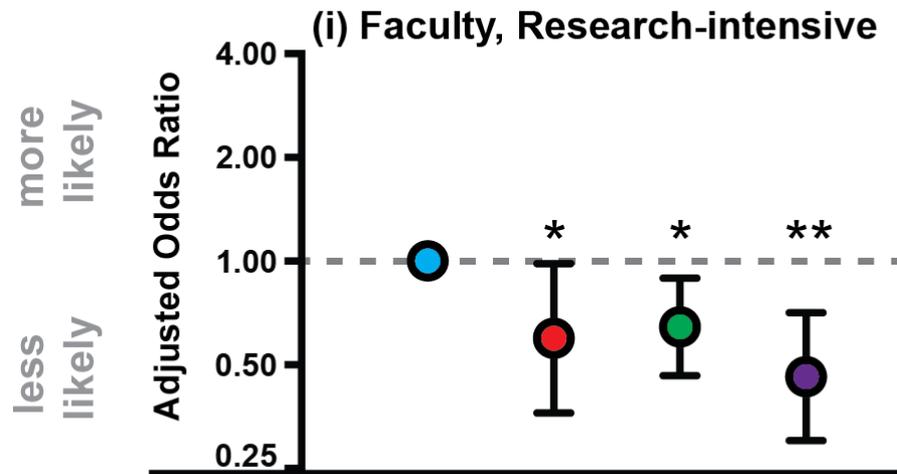
- Focus group (n=38)
- Survey (n=1500)
- In-depth interviews (n=70)

Career goals and knowledge, training experiences, career interests

Faculty (research-intensive), faculty-teaching intensive, research outside of academia, non-research career

Disparate Career Interests at Ph.D. Completion

(A) Likelihood of high interest in career path at Ph.D. completion



Controls

- Career interests at Ph.D. entry(+)
- Advisor relationship (+)
- Publication record (+)
- Ph.D. at “Top 50” university (-)
- Time-to-degree
- H-index
- Research self-efficacy (+)
- Departmental support for career development (+)
- Sense of belonging

WR Men (n=375) URM Men (n=87)

WR Women (n=808) URM Women (n=189)



RESEARCH

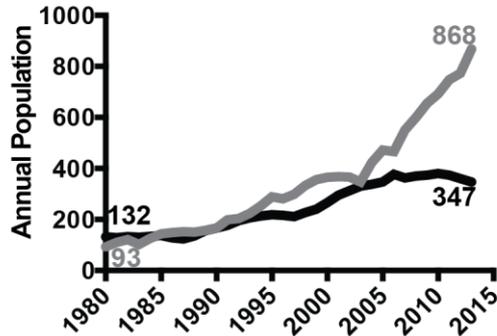
Decoupling of the minority PhD talent pool and assistant professor hiring in medical school basic science departments in the US

- System analysis: 1980-2014
 - NSF Survey of Earned Doctorates (FASEB)
 - AAMC Faculty Roster (Table 20) – assistant professors in basic science departments

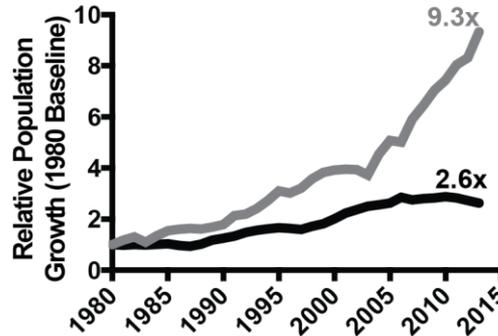
Temporal Trends in Representation

(A) Under Represented Minority (URM) Participation: 1980-2013

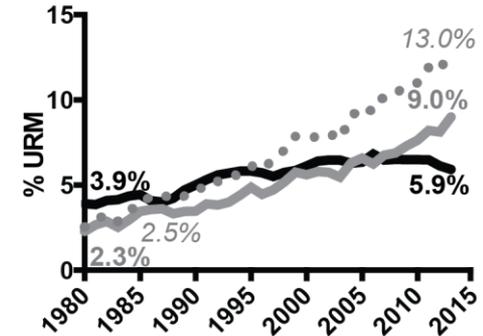
(i) Annual Population



(ii) Population Growth (Relative to 1980)

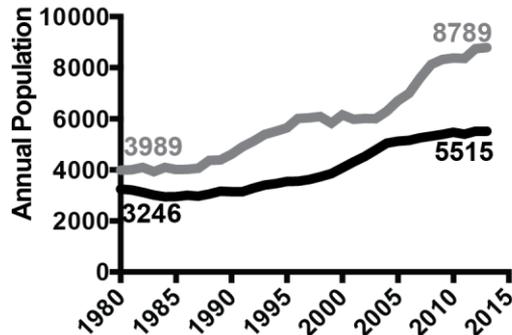


(iii) Percentage Representation

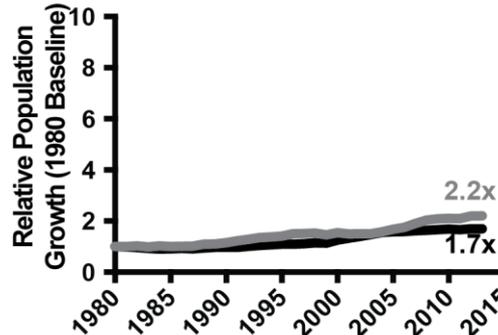


(B) Well-Represented (WR) Participation: 1980-2013

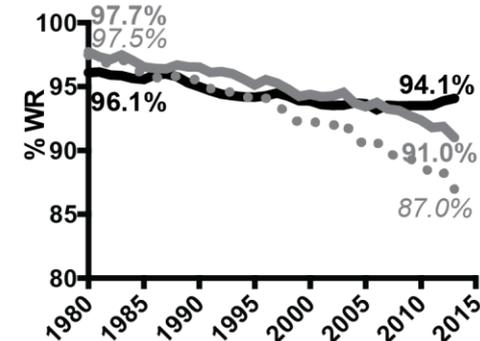
(i) Annual Population



(ii) Population Growth (Relative to 1980)



(iii) Percentage Representation



— Ph.D. Graduates

— Assistant Professors

••• % Ph.D. Graduates
(US Citizens & Permanent Resident Only)

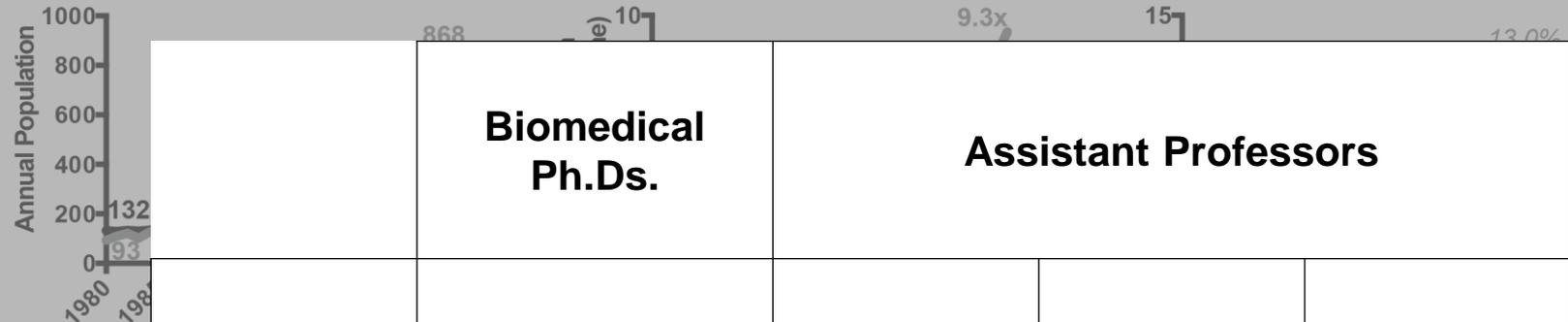
Temporal Trends in Representation

(A) Under Represented Minority (URM) Participation: 1980-2013

(i) Annual Population

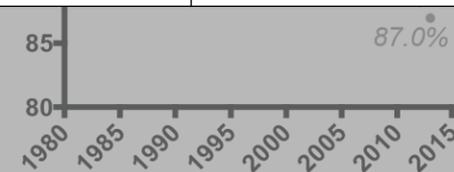
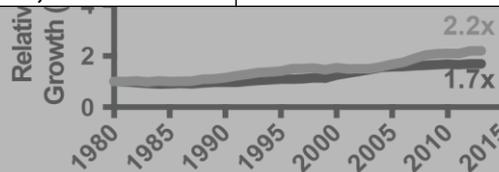
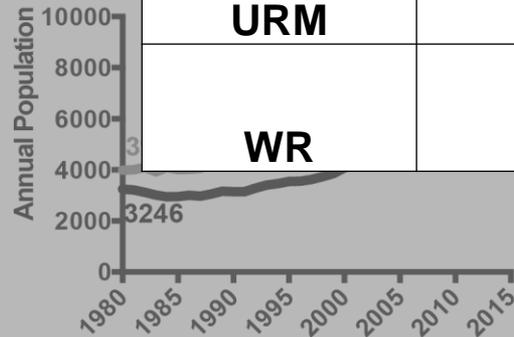
(ii) Population Growth
(Relative to 1980)

(iii) Percentage
Representation



(B) Well-Represented (WR) vs. Under Represented Minority (URM)

Timeframe	2005-2014	2005	2014	% Change
URM	6,633	347	341	-1.70%
WR	81,002	5122	5562	+8.60%



— Ph.D. Graduates

— Assistant Professors

••• % Ph.D. Graduates

(US Citizens & Permanent Resident Only)

Enhancing Faculty Diversity

- Created system dynamics model of assistant professor hiring from 1980-2080 ($R^2=0.79$)
- Modeled impact of increasing
 - URM talent pool
 - Number of assistant professor positions
 - Transitions onto faculty job market and hiring
- Assume exponential URM population growth and no bias in hiring

% URM professors

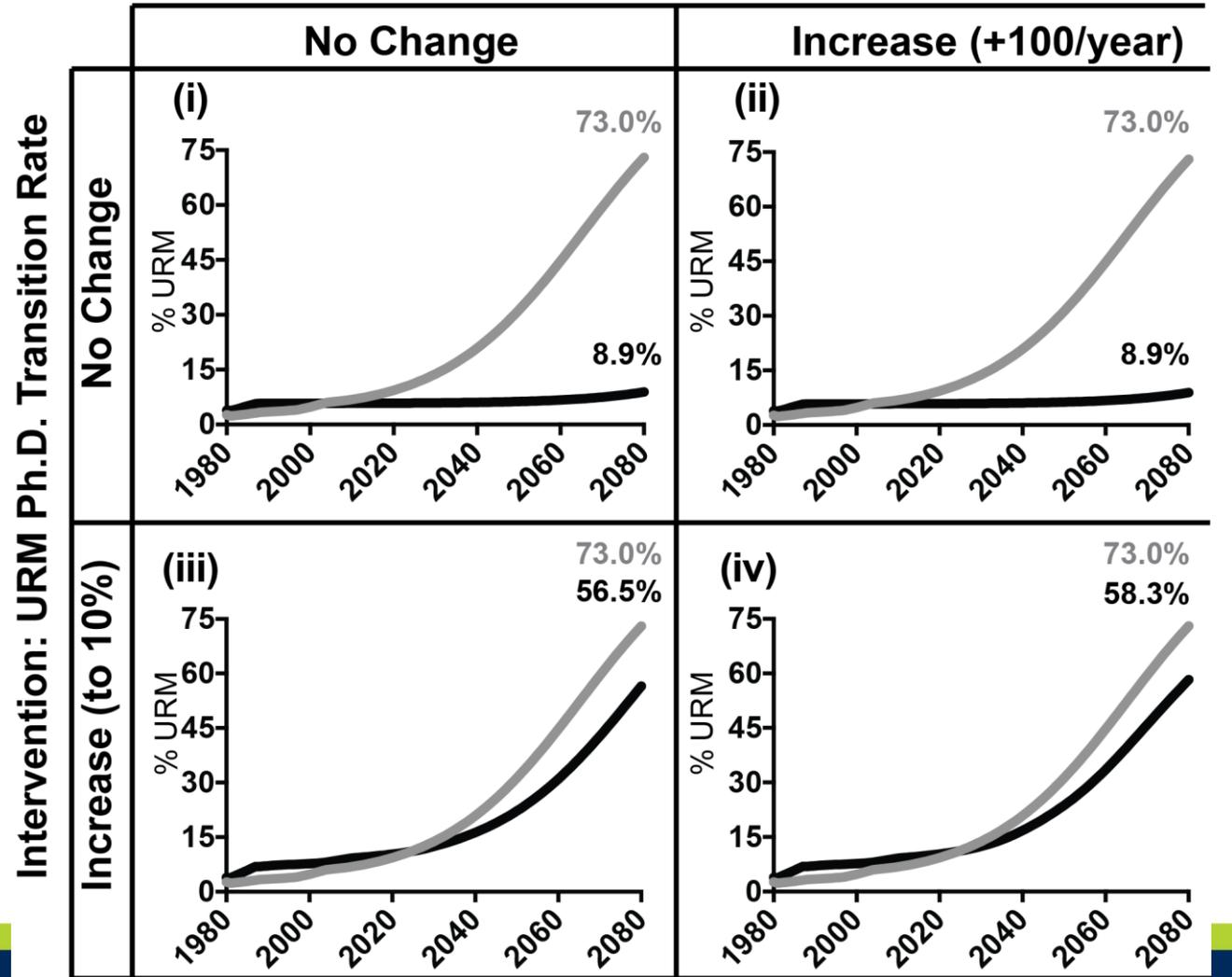
A: < 25%

B: 25 – 50%

C: 50 – 75%

D: > 75%

Intervention: Number of Assistant Professor Positions



— Ph.D. Graduates — Assistant Professor

OCTOBER 19, 2017

New NIGMS Institutional Predoctoral Training Grant Funding Opportunity Announcement

BY DR. ALISON GAMMIE, DR. KENNETH GIBBS, AND DR. SHIVA SINGH

We've just released a new training [funding opportunity announcement](#) (FOA) specifically tailored for predoctoral graduate programs in the [basic biomedical sciences](#). Through this FOA, we intend to encourage changes in biomedical graduate training that allow it to keep pace with [the rapid evolution](#) of the research enterprise, which is increasingly complex, quantitative, interdisciplinary, and collaborative.

The overarching objective of this new predoctoral [T32 training program](#) is to develop a diverse pool of well-trained scientists who have the following:

- A broad understanding across biomedical disciplines, and the skills to independently acquire the knowledge needed to advance their chosen field.
- The ability to think critically, independently, and to identify important biomedical research questions and approaches that push forward the boundaries of their areas of study.
- A strong foundation in scientific reasoning, rigorous research design, experimental methods, quantitative and computational approaches, as well as data analysis and interpretation.
- A commitment to approaching and conducting biomedical research responsibly and with integrity.
- Experience initiating, conducting, interpreting, and presenting rigorous and reproducible biomedical research with increasing self-direction.
- The ability to work effectively in teams with colleagues from a variety of cultural and scientific backgrounds, and to promote inclusive and supportive scientific research environments.
- The skills to teach and communicate scientific research methodologies and findings to a wide variety of audiences (e.g., discipline-specific, across disciplines, and the public).
- The knowledge, professional skills, and experiences required to identify and transition into careers in the biomedical research workforce (i.e., the breadth of careers that sustain biomedical research in areas that are relevant to the NIH mission).

FOLLOW US ON...



SUBSCRIBE

Individual Posts

Digest of Recent Posts

AUTHOR INFO



[Dr. Alison Gammie](#)

Alison directs the NIGMS division that supports a variety of research training, career development and diversity-building activities at the undergraduate through faculty levels.



[Dr. Kenneth Gibbs](#)

Kenny directs the Postdoctoral Research Associate Training (PRAT) program and manages the Postbaccalaureate Research Education Program (PREP), T32 biostatistics grants, and Predoctoral MD/PhD or Other Dual-Doctoral Degree Fellowships for

Graduate Education

[PAR-17-341](#)

Goal is to equip trainees with the **technical** (e.g., appropriate methods, technologies, and quantitative/computational approaches), **operational** (e.g., independent knowledge acquisition, rigorous experimental design, and interpretation of data) and **professional** (e.g. management, leadership, communication, and teamwork) **skills** required for careers in the biomedical research workforce

OCTOBER 19, 2017

New NIGMS Institutional Predoctoral Training Grant Funding Opportunity Announcement

BY DR. ALISON GAMMIE, DR. KENNETH GIBBS, AND DR. SHIVA SINGH

We've just released a new training [funding opportunity announcement](#) (FOA) specifically tailored for predoctoral graduate programs in the [basic biomedical sciences](#). Through this FOA, we intend to encourage changes in biomedical graduate training that allow it to keep pace with [the rapid evolution](#) of the research enterprise, which is increasingly complex, quantitative, interdisciplinary, and collaborative.

The overarching objective of this new predoctoral [T32 training program](#) is to develop a diverse pool of well-trained scientists who have the following:

- A broad understanding across biomedical disciplines, and the skills to independently acquire the knowledge needed to advance their chosen field.
- The ability to think critically, independently, and to identify important biomedical research questions and approaches that push forward the boundaries of their areas of study.
- A strong foundation in scientific reasoning, rigorous research design, experimental methods, quantitative and computational approaches, as well as data analysis and interpretation.
- A commitment to approaching and conducting biomedical research responsibly and with integrity.
- Experience initiating, conducting, interpreting, and presenting rigorous and reproducible biomedical research with increasing self-direction.
- The ability to work effectively in teams with colleagues from a variety of cultural and scientific backgrounds, and to promote inclusive and supportive scientific research environments.
- The skills to teach and communicate scientific research methodologies and findings to a wide variety of audiences (e.g., discipline-specific, across disciplines, and the public).
- The knowledge, professional skills, and experiences required to identify and transition into careers in the biomedical research workforce (i.e., the breadth of careers that sustain biomedical research in areas that are relevant to the NIH mission).

FOLLOW US ON...



SUBSCRIBE

Individual Posts

Digest of Recent Posts

AUTHOR INFO



[Dr. Alison Gammie](#)

Alison directs the NIGMS division that supports a variety of research training, career development and diversity-building activities at the undergraduate through faculty levels.



[Dr. Kenneth Gibbs](#)

Kenny directs the Postdoctoral Research Associate Training (PRAT) program and manages the Postbaccalaureate Research Education Program (PREP), T32 biostatistics grants, and Predoctoral MD/PhD or Other Dual-Doctoral Degree Fellowships for

[PAR-17-341](#)

- **Strong disciplinary training**
- **Rigor & research integrity**
- The ability to work effectively in **teams** with colleagues from a variety of cultural and scientific backgrounds, and to promote inclusive and supportive scientific research environments;
- The skills to teach and **communicate** scientific research methodologies and findings to a wide variety of audiences (e.g., discipline-specific, across disciplines, and the public); and
- The knowledge, professional skills and experiences required to identify and transition into **careers** in the biomedical research workforce (i.e., the breadth of careers that sustain biomedical research in areas that are relevant to the NIH mission)

OCTOBER 19, 2017

New NIGMS Institutional Predoctoral Training Grant Funding Opportunity Announcement

BY DR. ALISON GAMMIE, DR. KENNETH GIBBS, AND DR. SHIVA SINGH

We've just released a new training [funding opportunity announcement](#) (FOA) specifically tailored for predoctoral graduate programs in the [basic biomedical sciences](#). Through this FOA, we intend to encourage changes in biomedical graduate training that allow it to keep pace with [the rapid evolution](#) of the research enterprise, which is increasingly complex, quantitative, interdisciplinary, and collaborative.

The overarching objective of this new predoctoral [T32 training program](#) is to develop a diverse pool of well-trained scientists who have the following:

- A broad understanding across biomedical disciplines, and the skills to independently acquire the knowledge needed to advance their chosen field.
- The ability to think critically, independently, and to identify important biomedical research questions and approaches that push forward the boundaries of their areas of study.
- A strong foundation in scientific reasoning, rigorous research design, experimental methods, quantitative and computational approaches, as well as data analysis and interpretation.
- A commitment to approaching and conducting biomedical research responsibly and with integrity.
- Experience initiating, conducting, interpreting, and presenting rigorous and reproducible biomedical research with increasing self-direction.
- The ability to work effectively in teams with colleagues from a variety of cultural and scientific backgrounds, and to promote inclusive and supportive scientific research environments.
- The skills to teach and communicate scientific research methodologies and findings to a wide variety of audiences (e.g., discipline-specific, across disciplines, and the public).
- The knowledge, professional skills, and experiences required to identify and transition into careers in the biomedical research workforce (i.e., the breadth of careers that sustain biomedical research in areas that are relevant to the NIH mission).

FOLLOW US ON...



SUBSCRIBE

Individual Posts

Digest of Recent Posts

AUTHOR INFO



[Dr. Alison Gammie](#)

Alison directs the NIGMS division that supports a variety of research training, career development and diversity-building activities at the undergraduate through faculty levels.



[Dr. Kenneth Gibbs](#)

Kenny directs the Postdoctoral Research Associate Training (PRAT) program and manages the Postbaccalaureate Research Education Program (PREP), T32 biostatistics grants, and Predoctoral MD/PhD or Other Dual-Doctoral Degree Fellowships for

[PAR-17-341](#)

Because **diversity at all levels is integral to research and training excellence**, this FOA is intended to support outstanding research training environments that focus on all trainees and enhance diversity in the biomedical enterprise by paying particular attention to groups [underrepresented in the biomedical sciences](#)

Describe how applicants and trainees will be provided with information about the career outcomes of graduates of the program (including on publicly accessible websites) and about the overall biomedical research workforce employment landscape

Faculty Diversity

MARCH 4, 2019

Early Notice: Concept Clearance for the Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC) Program (UE5 and K99/R00) to Promote Diversity in the Biomedical Research Workforce

BY DR. ALISON GAMMIE, DR. KENNETH GIBBS, AND DR. MICHAEL SESMA

At the recent **NIGMS Advisory Council** meeting, the Division of Training, Workforce Development, and Diversity received approval to write two new funding opportunity announcements as part of our efforts to **enhance postdoctoral career transitions to promote faculty diversity** in the biomedical research workforce.

The Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC)

program is designed to facilitate the transition of talented postdoctoral researchers from diverse backgrounds into independent faculty careers in research-intensive institutions. The program has two components: an institutionally-focused research education cooperative agreement (UE5) and postdoctoral career transition award (K99/R00) to enhance diversity.



MOSAIC Institutionally-Focused Research Education Cooperative Agreement (UE5) NOT-GM-19-019

This program will support awards to independent organizations (e.g., scientific societies) with a membership of scientists conducting research within the NIGMS mission, an established record of providing professional development and networking activities for the next generation of biomedical researchers, and a demonstrated commitment to enhancing the diversity of the biomedical research workforce.

FOLLOW US ON...



SUBSCRIBE

Individual Posts

Digest of Recent Posts

AUTHOR INFO



Dr. Alison Gammie

Alison directs the NIGMS division that supports a variety of research training, career development and diversity-building activities at the undergraduate through faculty levels.



Dr. Kenneth Gibbs

Kenny directs the Postdoctoral Research Associate Training (PRAT) program and

[NOT-GM-19-019](#) & [NOT-GM-19-020](#)

Maximizing Opportunities for Scientific & Academic Independent Careers (MOSAIC) program is designed to facilitate the transition of talented postdoctoral researchers from diverse backgrounds, for example individuals from groups underrepresented in the biomedical research workforce at the faculty level (see [NIH's Interest in Diversity](#)), into independent faculty careers in research-intensive institutions.

Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC)



K99/R00 to enhance diversity (15 per year – 75 at steady state in 5 years)

- Independent funding & path to professoriate (5 years of funding in 2 phases)
 - Mentored research experience as postdoctoral fellow (K99) 1-2 years
 - Independent research support as faculty (R00) (up to 3 years)
- Research focus – within the mission of NIGMS
- US citizens/permanent residents
- Enhance the diversity of the biomedical research professoriate (e.g., individuals from underrepresented groups – certain racial/ethnic groups, women, persons with disabilities, institutionally defined, see [NOT-OD-18-210](#))
- Commitment to enhancing diversity, equity and inclusion

Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC)



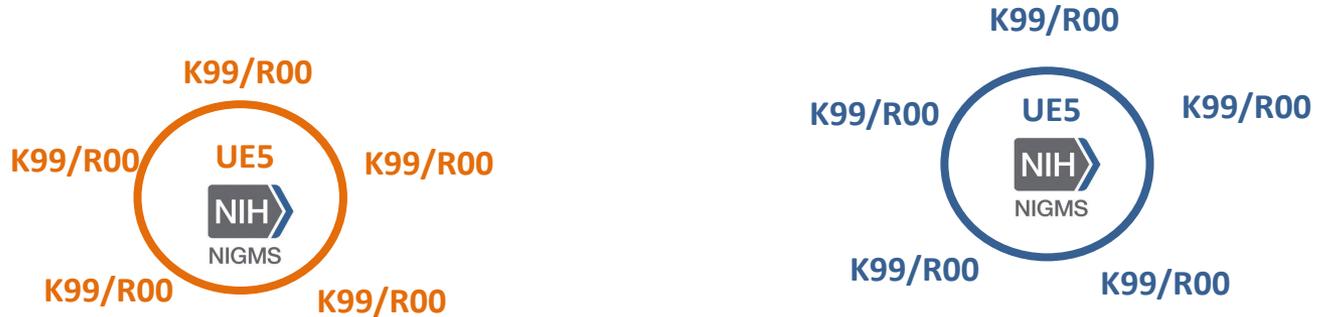
For the MOSAIC UE5, NIGMS intends to fund independent organizations other than institutions of higher education (e.g., scientific societies) with:

- A membership of scientists conducting research within the mission of NIGMS
- Experience serving as a centralized entity to enhance scientific communication and networking among scientists conducting research within the mission of NIGMS
- Established record of providing professional development and networking activities for the next generation of biomedical researchers.
- A demonstrated commitment to enhancing the diversity of the biomedical research workforce.

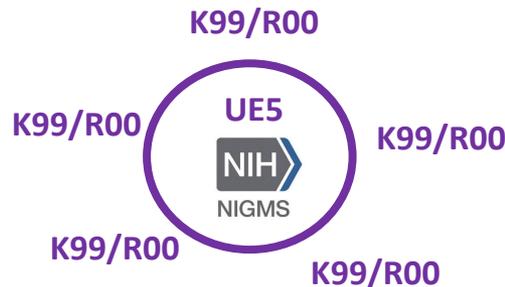


**Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC):
Postdoctoral Career Transition Award to Promote Diversity (K99/R00)
Institutionally Focused Research Education Cooperative Agreement to Promote Diversity (UE5)**

- Award UE5's to “neutral” organization such as scientific societies

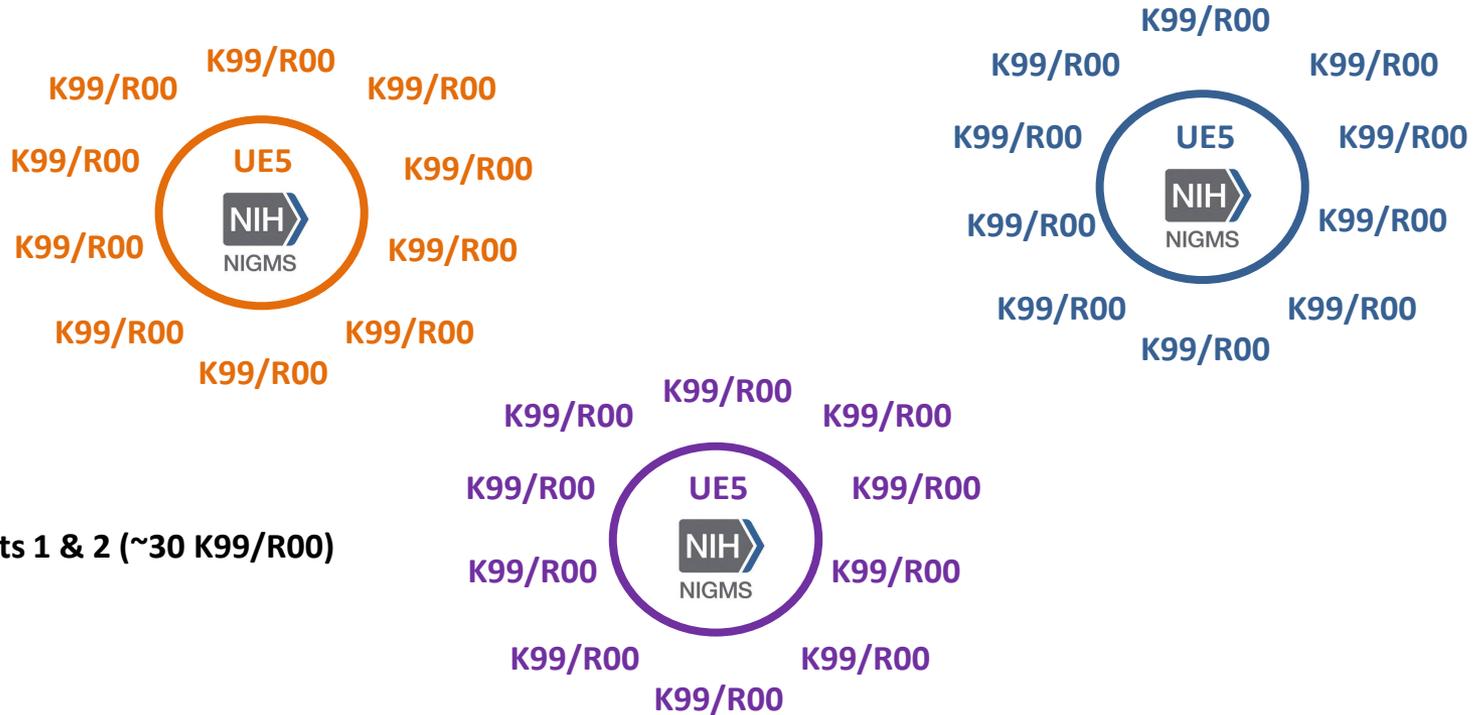


- Competition for K99/R00
- Cohort 1 assembles (~15 K99/R00) organized by scientific areas within the mission of NIGMS





MOSAIC Overview Cohorts 1 and 2



Cohorts 1 & 2 (~30 K99/R00)

Maximizing Opportunities for Scientific and Academic Independent Careers (MOSAIC)

UE5 – Research Education Cooperative Agreement (up to 3 awards). Fund independent scientific organizations composed of NIGMS scientists (e.g. scientific societies) to:

- Assemble **cohorts** of MOSAIC K99/R00 fellows based on scientific areas
- Facilitate the development of **strengths-based individual development plans** for MOSAIC fellows that will allow them to progress toward academic and research independence
- Provide courses for **skills development** around topics such as job search strategies, proposal preparation, scientific publishing, enhancing laboratory management, budgeting, hiring, managing career challenges and expectations, academic advancement, and balancing teaching, research, and service.
- Enhance the **scientific and professional networks** of MOSAIC fellows beyond their local institutions
- Identify and **connect fellows with additional mentors** who can facilitate appropriate career advancement
- **Convene regular meetings with appropriate leaders** at the institutions where MOSAIC fellows conduct research (e.g., postdoctoral research advisors during the mentored phase; department chairs, deans, or provosts during the independent phase) to exchange ideas, and employ evidence-based approaches to **mitigate bias and enhance equity**
- Enhance **institutional accountability** for the fellows' career advancement
- **Track and publicize outcomes** (e.g. publicly available websites)

Summary

- The pool of Ph.D. trained scientists from URM groups is growing
- Disconnect between URM talent pool and faculty hiring; disparate career interests & institutional/systemic factors
- NIGMS initiatives to enhance biomedical training (T32; PAR-17-341) and workforce diversity (MOSAIC; forthcoming) responsive to evidence

Parting Thoughts

- The scientific workforce represents a system (not pipeline)—intervention must consider system architecture
- Increasing the number of URM Ph.Ds. will only affect faculty diversity to the extent that these scientists enter the job market as candidates (are hired and retained)
- Thought experiment
 - AAMC institutions hire ~1000 assistant professors per year
 - To get to 10% URM representation = 100 URM faculty
 - There are ~150 institutions
 - If 2/3rd of AAMC institutions, hired (and retained) **one** URM faculty member per year for six-years, there would be parity in the assistant professor pool in one tenure cycle

References

- Gibbs KD Jr., Griffin K.A. “What Do I Want to Be With My Ph.D.? The Roles of Personal Values and Structural Dynamics in Shaping the Career Interests of Recent Biomedical Science Ph.D. Graduates.” *CBE Life Sciences Education*. 2013 Winter; 12(4): 711-23
- Gibbs KD Jr. et al, “Biomedical Ph.D. Career Interest Patterns by Race/Ethnicity & Gender.” *PLOS ONE*. 2014 Dec 10; 9(12):e114736
- Griffin KA, Gibbs KD Jr., et al, “Respect me for my science’: A Bourdieuan analysis of women scientists’ interactions with faculty and socialization into science.” *Journal of Women and Minorities in Science and Engineering* 2015; 21 (2): 159
- Gibbs KD Jr., Griffin KA. “Career Development Among American Biomedical Postdocs,” *CBE Life Sciences Education*. 2015 Winter; 14(4):ar44
- Gibbs KD Jr., Basson JJ, Xierali I, Broniatowski DA. “Decoupling of the Minority Ph.D. Talent Pool & Assistant Professor Hiring in Basic Science Departments.” *eLife* 2016 Nov 17;5. pii: e21393
- Gibbs KD Jr., Marsteller P. “Broadening Participation in the Life Sciences: Current Landscape and Future Directions.” *CBE Life Sciences Education*. 2016 Fall; 15:ed1
- NIGMS Feedback Loop: <https://loop.nigms.nih.gov/>
[E: kenneth.gibbs@nih.gov](mailto:kenneth.gibbs@nih.gov) @NIGMSTraining

If you have students interested in postdocing at the NIH

NIGMS Postdoctoral Research Associate
Training (PRAT) program:

[https://www.nigms.nih.gov/Training/Pages/
PRAT.aspx](https://www.nigms.nih.gov/Training/Pages/PRAT.aspx)

Next application deadline ~October 2019 to
start ~September 2020

Thanks for listening!
Kenneth.gibbs@nih.gov

