Online Ethics Center
FOR ENGINEERING AND SCIENCE

Mentoring - Meeting the NSF Requirement

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Description

In 2023, the National Science Foundation added a new requirement for institutions to provide mentoring training and mentorship as part of the responsible and ethical conduct of research education program they provide to students engaged in NSF-sponsored projects. This is a short bibliography of seminal reports, example programs, and mentoring guides for faculty and students for institutions seeking to meet these new requirements.

Body

Mentoring Requirements for Responsible and Ethical Conduct of Research

National Science Foundation PAPPG Requirements on RECR Certification (Effective for proposals submitted after July 31, 2023)23-001

Chapter II.D.1.d, Proposal Certifications Provided by the Organization, was modified to include a new certification by the AOR relating to the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 requiring that senior personnel are made aware of the certification requirements required by the Act. A second new certification regarding Responsible and Ethical Conduct of Research (RECR) was added for proposals submitted on or after July 31, 2023. The certification replaces the existing RECR certification and expands the training requirement to faculty and other senior personnel and mandates that the training cover mentor training and mentorship. A third new certification requires the AOR to certify that any organization proposing to conduct research off-campus or off-site has a plan in place for this proposal regarding safe and inclusive working environments

CHIPS and Science Act of 2022 Sec. 10337

Amends Section 7009 of the America COMPETES Act of 2007 on responsible conduct in research training for postdoctoral researchers, faculty, and senior personnel to address mentor training and mentorship, training to raise awareness of potential research security threats, and federal export control, disclosure, and reporting requirements.

National Academies Reports on Mentoring

Mentoring of Black Graduate and Medical Students, Postdoctoral Scholars, and Early-Career Faculty in Science, Engineering, and Medicine: Proceedings of a Workshop (2022)

Proceedings from a roundtable held in 2020 on how to strengthen mentoring and advising of Black students and professionals in science, engineering, and medicine.

The Science of Effective Mentorship in STEMM (2019)

Report that provides descriptions of successful mentoring programs and practices at the undergraduate and graduate levels. This report and its complementary interactive guide present insights into effective programs and practices that can be adopted and adapted by institutions, departments, and individual faculty members.

Effective Mentoring in STEMM: Practice, Research, and Future Directions (2017)

Report from a 2017 workshop that looked at successful practices and metrics for mentoring students in STEMM career pathways. Includes discussion on identifying the evidence supporting successful mentoring practices for women and students of color across high school and post-secondary education.

Online Resources

A Postdoc's Guide to Mentorship

A guide developed by the National Postdoctoral Association. This short guide includes information about how to find a mentor and mentoring others.

National Research Mentoring Network

Developed through funding by the U.S. National Institutes of Health, the NRMN offers undergraduate, graduate, and postdoctoral students, as well as junior and senior faculty and administrators, online courses, and the ability to find a virtual mentor based on the mentee's goals and interests.

Resource Guide for Postdoctoral Research Development

This resource guide is meant to help support the mentoring and development of postdoctoral researchers and includes 13 modules with thematic content in the areas of career management, personal effectiveness and leadership, work-life integration, fostering creativity, teaching, collaboration, and team science, facilitation, interesting diversity, equity and inclusion, proposal development and management, managing research projects, communicating science to the public, data management, and programming.

The Science of Effective Mentorship in STEMM Online Guide V. 1.0

This online guide, developed as part of a project by the National Academies, provides information on program development and management, mentoring tools, and program assessment strategies for building a strong mentoring program.

The Science of Mentoring Podcast

Developed by the National Academies, this podcast series features the personal mentorship stories of leaders in academia, business, and the media and seeks to help listeners learn how evidence-based mentorship practices can help you develop the skills to engage in t he most effective STEMM mentoring relationships possible.

Kalichman, Michael, and Dena Plemmons. "Instructor's Guide to Prepare Research Group Leaders as RCR Mentors." Online Ethics Center for Engineering and Science (OEC), 2016.
An excellent guide with readings and exercises lab instructors can use to engage their research groups in meaningful RCR education around a variety of topics.

Program Examples and Guides

Burroughs Wellcome Fund and Howard Hughes Medical Institute. 2004. Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty. 2nd ed. Research Triangle Park, NC, and Chevy Chase, MD: Burroughs Wellcome Fund and Howard Hughes Medical Institute; 2004.
Based on series of workshops, this book is a collection of practical advice and experiences for postdocs and new faculty at the beginning stages of their careers.

California State University, Building Infrastructure Leading to Diversity
Describes an NIH funding program that seeks to help undergraduate students to excel in doctoral programs in health-related careers. Includes the Building Mentor Community, a two-semester program that engages students in weekly online discussions on topics related to effective mentoring and then has participants implement what they learned in research classrooms or laboratories during the second semester.

Culturally Aware Mentoring
A project by the Center for the Improvement of Mentored Experiences in Research at the University of Wisconsin and the National Research Mentoring Network. Includes videos of the developed workshop and upcoming public events.

Entering Mentoring Curricula
Developed by the University of Wisconsin, Center for the Improvement of Mentored Experiences in Research, this database includes discipline-specific mentoring guides.

Northwestern University, Collaborative Learning and Integrated Mentoring (CLIMB)
A program established in 2007 that seeks to guide bioscience PhD students to

develop advanced skills for collaborating, communicating, and conducting research. Resources include material on choosing a mentor, excelling in graduate school, and information on developing oral and written communication skills.

Oak Ridge Institute for Science and Education Mentor Orientation
An online training module for faculty and research staff looking to advise and mentor students.

National Postdoctoral Association Professional Association Mentoring Programs
A list of professional association mentoring programs, including examples of one-to-one mentoring, online mentoring, and mentoring opportunities offered at annual meetings.

Ohio State University, School of Medicine Getting Started in Mentoring
A guide for finding a mentor, establishing expectations, and tips for mentors and mentees.

Racham Graduate School, University of Michigan. Graduate Student Mentoring Guide: A Guide for Students. 2020th ed. Ann Arbor, Michigan: The Regents of the University of Michigan, 2020.
This is an excellent handbook that has been updated on a regular basis that provides students information on working with faculty, finding multiple mentors, developing clear expectations in mentoring relationships, and information about how to handle problems that might arise between advisors, supoervisors, dissertation chairs, and mentors.

Racham Graduate School, University of Michigan. How to Mentor Graduate Students: A Guide for Faculty. 2020th ed. Ann Arbor, Michigan: The Regents of the University of Michigan, 2020.
This is an excellent handbook that has been updated on a regular basis that is a companion volume to the student handbook, and provides excellent advice for mentors, supervisors, advisors and dissertation chairs on how to develop clear expectations for these kinds of relationships with graduate students.

University of Illinois, National Center for Principled Leadership & Research Ethics. Labs that Work for Everyone
A modular leadership/professional development program that consists of modules that center on common ethical dilemmas faced in lab environments. This project is

currently in development but will be available to the public in a few months.

University of Minnesota, Clinical and Translational Sciences Institute. Optimizing the Practice of Mentoring
A training program for faculty investigators who are interested in developing their mentoring skills. UM offers an online course for both UMN faculty, and external users who create a guest account.

Mentoring Tool Examples:

American Association of Medical Colleges, Compact Between Biomedical Graduate Students and their Research Advisors.
Designed to support the development of a positive mentoring relationship between pre-doctoral students and their research advisors, this document offers a broad set of guidelines that can be adapted for different disciplines.

Arizona State University. 2021. CareerWISE Academic Resilience Coach. 2021.
A program from Arizona State University, this site seeks to help women in science, technology, engineer and mathematics programs to find ways to better manage the challenges in their immediate environments and expand their personal skills for thriving in the future. Includes instructional models, how to use the CareerWISE problem solving me thod, and resources on how to communicate more effectively. The site also includes a number of speakers featuring women speaking about their experiences in graduate school around working with advisors, maintaining a work/life balance, and facing delays in their graduation.

Earth Science Women's Network. 2022. Mentor Mapping – ESWN.
An exercise developed by the Earth Science Women's Network that lists out the types of support every scientist needs and helps users to identify who in their network can provide that kind of support, and identify gaps where more support is needed.

Fuhrmann, C. N., J.A. Hobin, P.S. Lindstaedt, and P.S. Clifford. 2023. " MyIDP, Science Careers." American Association for the Advancement of Science.
An online IDP resource developed by AAAS and a number of participating universities that provides postdoctoral fellows with exercises to help them examine

their skills, interests, and values, tools for setting strategic goals, and articles and resources to guide users through the process of launching their careers.

Indiana University, Leadership in Academic Medicine Program. Individual Development Plan
A model IDP that can be used to help mentees reflect on their goals and progress, and facilitate conversations between mentors and mentees.

National Academies. The Science of Effective Mentorship in STEMM: Mentoring Tools
A list of individual development plans and mentoring compacts for a variety of disciplines for undergraduate, graduate, and postdoctoral students.

University of Wisconsin, Institute for Clinical and Translational Research. Mentorship Compacts/Contract Examples
A collection of five different frameworks to help mentors and mentees customize a mentoring compact that is geared to help launch conversations about mentoring relationships and projects.

See also a spreadsheet of mentor/mentee agreements.

Connecting with Mentors Online

MentorNet
An online mentoring program run by the National Research Mentoring Network that seeks "to provide all STEM students in the United States with access to effective mentorships in a vibrate community committed to student success."

#BLACKandSTEM
An example of an informal e-mentorship program that uses Twitter to connect a community representing a range of STEMM professionals, students, and teachers.

VangardSTEM
An online STEM mentorship community that seeks to provide mentorship experiences for individuals of color, gender nonconforming individuals, and other marginalized populations.

Key Publications on Mentoring

Summary of literature from NSF Reports:

Hernandez, P.R. 2018. Landscape of Assessments of Mentoring Relationship Processes in Postsecondary STEMM Contexts: A Synthesis of Validity Evidence from Mentee, Mentor, Institutional/Programmatic Perspectives 2018. National Academies of Sciences, Engineering, and Medicine. The Science of Effective Mentorship in STEMM. Washington, DC: The National Academies Press. https://doi.org/10.17226/25568.

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McGee, O. 2018. Mentoring Underrepresented Students in STEMM: A Survey and Discussion. National Academies of Sciences, Engineering, and Medicine. 2019. The Science of Effective Mentorship in STEMM. Washington, DC: The National Academies Press. https://doi.org/10.17226/25568.

Montgomery, B. and S. Page. 2019. Mentoring beyond Hierarchies: Multi-Mentor Systems and Models. National Academies of Sciences, Engineering, and Medicine. The Science of Effective Mentorship in STEMM. Washington, DC: The National Academies Press. https://doi.org/10.17226/25568.

Other Publications:

Bird, S.J. 2001. Mentors, advisors, and supervisors: Their role in teaching responsible research conduct. Science and Engineering Ethics 7: 455–468. https://doi.org/10.1007/s11948-001-0002-1

Branchaw, J. L., A. R. Butz, and A. R. Smith. 2019. Entering research: A conceptual framework for research trainee development and customizable curriculum for undergraduate and graduate research trainees, edited by University of Wisconsin–Madison.

Braun, D. C., C. Gormally, and M. D. Clark. 2017. The deaf mentoring survey: A community cultural wealth framework for measuring mentoring effectiveness with underrepresented students. CBE—Life Sciences Education 16(1):ar10.

Brunsma, D. L., D. G. Embrick, and J. H. Shin. 2017. Graduate students of color: Race, racism, and mentoring in the white waters of academia. Sociology of Race and Ethnicity 3(1):1–13.

Byars-Winston, A., P. Leverett, R. Benbow, C. Pfund, N. Thayer-Hart, and J. Branchaw. Race and ethnicity in biology research mentoring relationships. Journal of Diversity in Higher Education (forthcoming).

Cropps, T. A., and L. T. Esters. 2018. Sisters, other-mothers and aunties: The importance of informal mentors for black women graduate students at predominantly white institutions. Diverse: Issues in Higher Education. https://diverseeducation.com/article/119653/. (August 16, 2019).

Dennehy, T. C., and N. Dasgupta. 2017. Female peer mentors early in college increase women's positive academic experiences and retention in engineering. Proceedings of the National Academy of Sciences of the United States of America 114(23):5964–5969.

Estrada, M., P. R. Hernandez, P. W. Schultz, and J. Herrera. 2018. A longitudinal study of how quality mentorship and research experience integrate underrepresented minorities into STEM careers. CBE—Life Sciences Education 17(1):ar9.

Fleming, M., S. House, V. Shewakramani, L. Yu, J. Garbutt, R. McGee, K. Kroenke, Z. Abedin, and D. M. Rubio. 2013. The mentoring competency assessment: Validation of a new instrument to evaluate skills of research mentors. Academic Medicine 88(7):1002–1008.

Gullan. R.L., K. Bauer, P. Korfiatis, J. DeOliveira K. Blong, and M. Docherty. 2016. Development of a quantitative measure of the mentorship experience in college students. Journal of College Student Development 57(8): 1049-1055. https://muse.jhu.edu/ (accessed September 19, 2019).

Handelsman, J., C. Pfund, S. M. Lauffer, and C. M. Pribbenow. 2015. Entering mentoring: A seminar to train a new generation of scientists. Madison, WI: University of Wisconsin Press.

Lee, Adrian, Carina Dennis, and Philip Campbell. “Nature ’s Guide for Mentors.” Nature 447, no. 7146 (June 2007): 791–97. https://doi.org/10.1038/447791a.

Lisberg, A., and B. Woods. 2018. Mentorship, mindset and learning strategies: An integrative approach to increasing underrepresented minority student retention in a STEM undergraduate program. Journal of STEM Education 19(3).

National Academies of Science, Engineering and Medicine.. 2018. The next generation of biomedical and behavioral sciences researchers: Breaking through. Edited by R. Daniels and L. Beninson. Washington, DC: The National Academies Press.

NASEM. 2018. An American crisis: The growing absence of black men in medicine and science: Proceedings of a joint workshop. Edited by C. T. Laurencin. Washington, DC: The National Academies Press.

NAS-NAE-IOM. 1997. Adviser, teacher, role model, friend: On being a mentor to students in science and engineering. Washington, DC: The National Academies Press.

Pfund, C. 2016. Studying the role and impact of mentoring on undergraduate research experiences. Paper commissioned for the Committee on Strengthening Research Experiences for Undergraduate STEM Students, Board on Science Education. Washington, DC: National Academies of Sciences, Engineering, and Medicine. https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_177288 .

Rasheem, S., A.-S. Alleman, D. Mushonga, D. Anderson, and H. F. Ofahengaue Vakalahi. 2018. Mentor-shape: Exploring the mentoring relationships of black women in doctoral programs. Mentoring & Tutoring: Partnership in Learning 26(1):50–69.

Revelo, R.A. and M.C. Loui. 2016. A developmental model of research mentoring. College Teaching. 64(3) 119-129. https://doi.org/10.1080/87567555.2015.1125839

For more references see:

National Academies. (2019) “Developing a Culture of Mentoring: References.” The Science of Effective Mentoring in STEM: Online Guide.

Contributor(s)

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Bibliography

Parent Collection

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Topics

Mentors and Trainees

Discipline(s)

Research Ethics