

Maintaining a Neural Network: Transforming Mentorship

R25/T32 Diversity Workshop

April 25-26, 2022

Virtual Meeting

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Acronym Definitions

AI/AN	American Indian and Alaska Native
BEST	Broadening Experiences in Scientific Training
CHOP	Children’s Hospital of Philadelphia
CIMER	Center for the Improvement of Mentored Experiences in Research
ENDURE	Enhancing Neuroscience Diversity through Undergraduate Research Education Experiences
FERPA	Family Educational Rights and Privacy Act
IDDRC	Intellectual and Developmental Disabilities Research Center
LAUNCH	Leading the Advancement of Underrepresented Neuroscientists for Change
LSUHSC	Louisiana State University Health Sciences Center
NASEM	National Academies of Sciences, Engineering, and Medicine
NIA	National Institute on Aging
NIH	National Institutes of Health
NINDS	National Institute of Neurological Disorders and Stroke
OITE	Office of Intramural Training and Education
PI	principal investigator
PROPEL	Post-baccalaureate Research Opportunity to Promote Equity in Learning
SGM	sexual and gender minority
STEMM	science, technology, engineering, mathematics, and medicine
URBrain	Undergraduate Ready for Burgeoning Research for American Indian Neuroscientists
URM	underrepresented minority

Executive Summary

Introduction and Overview

On April 25-26, 2022, the National Institute of Neurological Disorders and Stroke (NINDS) of the National Institutes of Health (NIH) held a workshop during which R25 and T32 program directors and staff discussed strategies to improve mentorship quality of neuroscience program trainees. The workshop began with welcoming remarks from Walter Koroshetz, MD, NINDS Director, who emphasized the importance of quality mentorship in retaining diverse scientific talent in academic research. Following these remarks, Michelle Jones-London, PhD, Chief of the Office of Programs to Enhance Neuroscience Workforce Diversity at NINDS, outlined the workshop goals. The first day of the workshop included a featured lecture from Maria Dahlberg, MS, about the findings described in the National Academies of Sciences, Engineering, and Medicine's (NASEM's) 2019 study report, *The Science of Effective Mentorship in STEMM*. Each panel consisted of presentations and group discussions. The first day of the workshop concluded with a presentation from Sharon Milgram, PhD, Director of the NIH Office of Intramural Training and Education (OITE), about supporting the emotional well-being of trainees. The second day of the workshop involved a Center for the Improvement of Mentored Experiences in Research (CIMER) workshop for program directors to develop individual plans to improve their institutions' training programs.

Key Themes and Highlights

General

- A culture that values mentoring can enhance trainee education and help retain trainees in academic research. A cultural shift requires participation at the institution, department, program, and individual levels.
- After recruitment, institutions, programs, and individual laboratories need to provide sufficient mentorship and support for underrepresented minority (URM) and sexual and gender minority (SGM) trainees.
- Training programs can provide educational workshops and resources to improve mentorship skills and trainee knowledge in specific topic areas.
- Many trainees will pursue career paths outside of academia, and these careers should not be viewed as inferior to academia.
- Mentors play an important role in helping trainees build resilience and maintain mental health and wellness.
- Objective measures for mentorship quality are needed to identify good mentors as well as toxic or abusive mentors. These measures can also be used to assess program progress in improving mentorship culture.

Benefits of a Culture of Mentorship

- A research culture that values mentorship creates a more inclusive atmosphere for all trainees. Quality mentorship can also serve as a protective factor for trainees against mental illness and help trainees progress in their research and careers.

- Support from multiple mentors can help fill gaps in mentorship provided to a trainee by their principal investigator (PI). Trainees benefit from mentoring related to career development and psychosocial support. If a trainee feels their PI is disengaged in the mentoring relationship, other mentors can provide additional support.
- Successful mentoring relationships evolve and adapt to best support trainees at multiple career development stages.

Recruiting, Supporting, and Retaining Diverse Trainees

- High school and undergraduate research opportunities are important strategies for recruiting students into academic research. However, the voluntary nature of many of these programs excludes some URMs who need to earn money to support their education. These research opportunities should be funded to support participants to make these programs more accessible.
- High school and undergraduate research programs should prioritize positive communication about academic research and assign mentors who clearly convey enthusiasm for science.
- Post-baccalaureate research programs provide important research opportunities for students who are interested in pursuing a PhD but may not have previously worked in a laboratory. These students are prepared for and are often accepted into PhD programs after completion of their post-baccalaureate research.
- Individual PIs can promote and foster diversity in their laboratories by avoiding affinity biases and participating in culturally sensitive mentorship training.
- URM and SGM trainees benefit from culturally sensitive mentorship and support in various forms, including participation in affinity groups.
- Discrimination, harassment, and abusive behavior from mentors should be taken seriously and appropriately addressed. The inherent power differential between PI and trainee puts trainees at great risk for retaliation if the trainee chooses to file a complaint.

Promoting Mentor Training

- CIMER and NIH offer mentorship resources and workshops to help people improve their mentoring skills.
- NINDS Landis awardees tailor their mentoring to suit each trainee, which includes assisting them with career development even when their ultimate career goal is outside of academia.

Trainee Support

- Training program activities successfully proceeded virtually during the COVID-19 pandemic.
- Training programs can provide useful trainings and workshops in important topic areas such as statistics, scientific rigor, and presentation skills.

- Training programs can integrate high school, undergraduate, graduate, postdoctoral, and faculty researchers to allow participants to serve as mentors, peer-mentors, and mentees. This promotes a more inclusive and supportive network.
- Postdoctoral training programs can help fellows form multiple mentoring relationships, including those between basic researchers and clinicians.
- Many trainees will seek careers outside of academic research. This requires proactive support from their mentors. Careers outside of academic research should not be viewed as inferior to academic careers.
- Program directors should assist trainees in identifying compatible mentors by encouraging trainees to ask important questions of candidate mentors as well as other current members of their respective laboratories.

Supporting Trainee Mental Health and Wellness

- Program directors and other mentors should promote the use of mental health and wellness resources.
- Mentors have an important role in recognizing trainee mental health issues and encouraging use of mental health and wellness services.
- Positive stress motivates trainees, while negative stress impedes trainee progress.

Incentivization of Quality Mentorship and Accountability for Poor Mentorship

- Quality mentorship should be formally recognized with awards. These awards can be beneficial for tenure, career advancement, and further funding. Awards can also include discretionary funds.
- Abusive mentorship practices often persist because of an inherent power differential between PI and trainee. Trainees fear retaliation in response to either switching laboratories or filing a formal complaint. They would prefer an anonymous system for reporting mentor behavior to shield them from retaliation.
- Trainees often seek advice from program directors pertaining to poor mentoring relationships. Program directors should take note of any PIs who exhibit consistent patterns of discrimination, harassment, or abuse. Program directors can decide to remove PIs from training grants in response to toxic behaviors.
- Program directors can help trainees in difficult mentoring situations by: (1) serving as a neutral mediator for PI and trainee discussions, (2) helping trainees switch laboratories if deemed necessary, and (3) supporting trainees who choose to file formal complaints.
- Faculty and staff should directly address witnessed incidents of discrimination, harassment, and abuse.
- Mentorship quality should be an important factor in PI careers. NIH should consider mentorship quality when reviewing grant applications. Institutions should include mentorship quality as a metric for career advancement opportunities, including tenure.

Meeting Summary

Welcome

Walter Koroshetz, MD, Director, National Institute of Neurological Disorders and Stroke (NINDS)

The future of neuroscience research rests on current research trainees. Technological breakthroughs have led to the development of novel research tools that can be used to answer more complex research questions in neuroscience for the next generation of principal investigators (PIs). Dr. Koroshetz encouraged workshop participants to recall the reasons why they chose to remain in academia; according to a recent survey of NINDS trainees, a major factor in this decision is mentorship received during graduate and postdoctoral training (Ullrich et al., 2021). Science is a community-based activity that requires nurturing communities focused on solving similar research problems.

To incentivize the quality mentorship that is necessary to retain research talent, NINDS created the Landis Award, which recognizes PIs for excellence in mentoring. Because quality mentoring is not limited to a specific career stage, the target career stage (i.e., early-, mid-, and late-stage career) for Landis awardees rotates each year. This award is meant to provide visibility of the traits and actions of excellent mentors.

Meeting Goals

Michelle Jones-London, PhD, Chief, Office of Programs to Enhance Neuroscience Workforce Diversity (OPEN-WD), NINDS; Stephen Korn, PhD, Director, Office of Training and Workforce Development, NINDS

This workshop was held to discuss effective mentorship practices and strategies for implementing quality mentorship at an academic program level for the next generation of neuroscientists. Quality mentorship provides essential support to recruit and retain a diverse neuroscience workforce for the future. The workshop is a follow-up to three previous workshops: (1) a 2016 workshop to identify successful approaches to recruit, train, and retain a diverse group of individuals in the neuroscience workforce, (2) a 2017 workshop to discuss the issues, misconceptions, and barriers that currently exist in neuroscience graduate admissions programs with regard to diverse trainees, and (3) a 2019 workshop to discuss institutional approaches to support career transition points and retain a diverse workforce as well as strategies for training programs to implement institutional change for diversity and inclusion. The 2022 workshop goals are as follows:

- Discuss promising mentorship practices and share useful tools and resources for implementing effective mentor training.
- Identify strategies for neuroscience R25 and T32 administrators to improve the quality of mentorship at the individual lab, program, and department levels, as well as across their respective institutions as a whole.
- Provide training to neuroscience R25 and T32 administrators on approaches to support the emotional well-being of trainees.

- Provide training to neuroscience R25 and T32 administrators to develop strategic plans aimed at improving mentorship quality in their programs.

Drs. Jones-London and Korn emphasized that workshop discussions were meant to assist participants in effecting real change in their respective programs and the neuroscience research community. For example, the 2017 workshop included an in-depth discussion of the merits of a post-baccalaureate program. Using information from this discussion, Drs. Jones-London and Korn released a funding opportunity announcement for a doctoral readiness post-baccalaureate program, and applications are currently under review by NINDS.

Featured Lecture: The Science of Effective Mentorship in STEMM

Maria Dahlberg, MS, Study Director, The Science of Effective Mentoring in STEMM

The science of mentorship brings together multiple disciplinary perspectives to provide guidance on effective behaviors, theoretical frameworks, measures and assessment techniques, mentoring tools, mentoring relationship structures, and roles for institutional support. The National Academies of Sciences, Engineering, and Medicine's (NAEM's) 2019 study report defines mentorship as "a professional, working alliance in which individuals work together over time to support the personal and professional growth, development, and success of relational partners through the provision of career and psychosocial support" (*The Science of Effective Mentorship in STEMM*, 2019). In the context of science, technology, engineering, mathematics, and medicine (STEMM) training, effective mentorship is a critical component for the development of STEMM professionals. In a typical research environment, a primary research mentor has formal supervisory and evaluative roles. When a student chooses a research laboratory and advisor, they typically do so based on mutual research interests but sometimes lack important information about an advisor's mentoring style. Although not all trainees and research advisors would define their relationship as mentorship, the development of trust over time can shift a relationship to a mentorship.

Aspects of Effective Mentorship

Effective mentorship requires trust, expectations, self-reflection, and proper education. Trust develops between mentors and mentees as they work together to set expectations for a mutually beneficial relationship. These expectations should be explicitly stated and even recorded in writing. As the mentee develops, this established trust enables those in the mentorship to adjust expectations. During the mentorship process, mentors and mentees should participate in honest self-reflection on their contributions to the mentorship relationship. Because mentorship is a learned skill, formal mentorship education can help improve mentorship strategies and the overall relationship.

Mentorship consists of a series of phases that require changes to expectations and participant needs. During initiation, the potential mentee and mentor determine whether a mentorship relationship is a proper fit. They also set formal expectations for each other. At the cultivation stage, the mentor provides multiple forms of support to the mentee and adjusts their expectations when appropriate. As the mentee develops and achieves increased independence,

the process of separation begins to allow the mentee more freedom in their research pursuits. Lastly, as a mentoring relationship between a faculty member and a trainee concludes, the individuals need to redefine their relationship. This redefinition can include a colleague relationship, friendship, or the conclusion of any relationship between the individuals. Importantly, the termination of a mentoring relationship should not be viewed as a failure.

Common Mentorship Structures

Mentorship structures are not limited to the traditional dyadic setup between a mentor and mentee, and researchers at any level can serve as mentors. In fact, a single mentor cannot meet all of the psychosocial and research mentoring needs of their mentee. Triadic mentorships can consist of two mentors and a mentee or one mentor and two mentees. Fellow mentees can serve as peer mentors to one another in this situation. Larger, more collective mentorship structures involving multiple mentors and mentees offer peer mentorship both among mentors and among mentees, as well as mentorship support from multiple mentors to multiple mentees.

Psychosocial Support in Mentoring Relationships

Culturally responsive mentoring acknowledges and supports mentees' cultural backgrounds and social identities. This style of mentoring requires active listening and learning about trainee backgrounds and experiences as well as understanding how impostor syndrome in trainees can negatively affect mentoring relationships. Mentors who cannot provide a sufficient level of culturally responsive mentoring can encourage trainee participation in affinity-based mentorship groups that can support individuals from underrepresented minority (URM) groups in STEMM. Together, culturally responsive mentoring and affinity-based mentorship groups can help a trainee navigate academia and reinforce the trainee's belief in their ability to be successful in STEMM.

Creating a Culture of Effective Mentorship

Initiatives at the program and institution level can help improve mentorship and as a result improve the development of trainees. However, barriers to implementation of mentorship initiatives include lack of time, resources, and relevant expertise. In addition, some programs and institutions fail to acknowledge and understand the importance of quality mentorship. Institutions and programs can create a culture of effective mentorship by:

- Providing mentorship education
- Promoting mentorship tools
- Using validated measures to evaluate mentorship effectiveness
- Providing data to initiate conversations about mentorship strategies
- Encouraging faculty discussions about challenges and opportunities in mentorship

Supporting the Cultivation of Quality Mentors

To help support the development of effective mentors, authors of NASEM's 2019 report recommend that institutions and programs should:

- Adopt a formal definition of STEMM mentorship
- Base mentorship education on evidence-based approaches
- Establish and use structured feedback systems to track mentorship effectiveness
- Recognize and respond to identities in mentorship
- Prioritize and reward effective mentorship
- Apply strategies to mitigate negative mentorship experiences

Useful Tools for Effective Mentoring

Mentors can use established tools to augment their mentoring strategy. Using and, more importantly, discussing individual development plans can help mentees identify and prepare for careers of interest. Formal mentoring plans and agreements clearly outline the overall approach of mentors and expectations for specific mentoring relationships, respectively. Mentors can also generate mentorship maps to identify additional resources and mentors to fulfill any mentee needs not sufficiently addressed in mentoring plans and agreements. In addition to their 2019 report, NASEM created a guide and a podcast on mentoring in science (*The Science of Effective Mentoring in STEMM*, 2021; *The Science of Effective Mentorship in STEMM: Online Guide V1.0*, 2019).

Discussion

A Cultural Shift: Reframing Mentorship as an Opportunity

Cultural Change at the Individual Principal Investigator Level

While some PIs are passionate about mentoring, others do not view providing quality mentoring as an important part of their career evolution. Those with a passion for mentoring trainees are more likely to attend mentorship workshops and engage in evidence-based mentorship strategies. Those who do not prioritize mentorship need to be convinced of the importance of mentoring for both the future of the field and their own research and career. Mandatory training can help these individuals develop basic mentoring skills and including mentorship quality as part of annual faculty reviews can motivate PIs to improve by using mentorship resources and tools.

Rather than wait until a research scientist is hired as a PI, some workshop participants suggested taking a more proactive approach to increase appreciation for the importance of quality mentorship. Graduate students and postdoctoral fellows can serve as peer mentors and mentors to other students and providing these opportunities can help trainees value and practice quality mentoring. Including mentoring training as part of faculty onboarding can also help send a message to new faculty that the institution, research program, and department value mentorship. The Center for the Improvement of Mentored Experiences in Research (CIMER) provides [mentorship training](#) useful for both junior and senior faculty members, but due to high demand, workshops are not always readily accessible.

Cultural Change at the Program and Institutional Levels

Shifting academic research culture at a larger scale requires buy-in from institutions and trainee programs. Often, institutions value research publications and funding over quality mentorship. PIs who have large research grants but are poor mentors are often favored and retained over PIs with less research funding who provide exceptional mentorship. Program directors are in a unique position to advocate for the importance of quality mentorship and its positive effects on research progress and funding in order to convince institutions to take action to promote a research culture that values quality mentorship. Institutions can create prestigious awards that include discretionary funds for PIs who serve as excellent mentors to their trainees. Training programs can develop mentorship tools and educational resources to improve PI mentorship skills. Faculty tenure reviews should consider not only the number of trainees mentored, but also the quality of mentorship trainees received; however, measuring the quality of mentorship in an objective way is not straightforward. The topic of evaluating mentoring relationships is discussed further on page 17 under [“Incentivizing Quality Mentorship Practices.”](#)

Early Alignment of Mentor and Mentee Expectations

Successful mentoring relationships are predicated on the alignment and mutual understanding of mentor and mentee expectations for the duration of the mentorship. These expectations should include discussions about the mentee’s future career as well as any needs that cannot be met by the PI as a mentor, but this requires self-awareness from both the mentee and mentor. Mentors should encourage their mentees to seek out additional mentors to meet their needs; this can prevent mentee frustration if they need additional or different mentoring from that which their mentor provides.

Navigating the separation and redefinition stages of a mentorship relationship can be especially difficult for younger PIs. Having explicit conversations early and often can ensure the appropriate level of separation and preferred redefinition of professional relationships.

Strategies for Mitigating Biases as a Mentor

Mentors, just like any other person, bring implicit biases to their relationships, including those with their mentees. Mitigation of these biases can help ensure students receive quality mentorship experiences that consider the mentee as a whole person, not just as a scientist conducting experiments in the laboratory. Culturally sensitive mentorship training can provide mentors with the tools necessary to mitigate their biases. A mentor who is uncomfortable discussing race, gender identity, or sexual orientation should be upfront about this with their mentees as well as connect them with other resources, such as other mentors and affinity-based groups.

Panel Discussion 1: Mentoring Philosophy of Landis Award Winners

Moderator: Stephen Korn, PhD, Director, Office of Training and Workforce Development, NINDS

Panelists: Alexandra Nelson, MD, PhD, Associate Professor, University of California, San Francisco; Robert Froemke, PhD, Professor, New York University; Emily Plowman, PhD, Professor, University of Florida; Matthew Rasband, PhD, Professor, Baylor College of Medicine

The NINDS Landis Award for Outstanding Mentorship recognizes up to five NINDS investigators each year who demonstrate dedication to providing quality mentorship to their trainees. Investigators are nominated by current and former trainees. After nomination, investigators provide their written philosophy of mentoring and up to 10 recommendation letters from current and former trainees along with trainee career outcomes. Because outstanding mentors exist across career stages, requests for nomination rotate annually for junior, mid-career, and senior faculty.

Mentoring Philosophies of Landis Awardees

Dr. Nelson

Dr. Nelson's overall goal for mentoring trainees is to share with them the joy of science and to train them to the highest level of rigor possible. Specific strategies to accomplish this depend on the mentee and their individual strengths and weaknesses. Upfront conversations about strengths and weaknesses between mentor and mentee can help shape the future of the mentoring relationship. When screening individuals interested in working in her lab, Dr. Nelson tries to ascertain whether they have an open and honest communication style and gauge their passion and curiosity for learning. She acknowledged this is likely an affinity bias she has, so she does try to involve other lab members in the interview process to balance that bias. For example, when interviewing an international postdoctoral candidate, she solicited the help of an international postdoctoral fellow from a collaborating laboratory.

During her time as a mentor, Dr. Nelson learned to individualize her communication style to the particular trainee. She once had a mentee who was very talented scientifically and the two of them had several common interests. However, Dr. Nelson noticed that frequent misunderstandings of conversations were impeding her ability to provide effective mentorship. She adjusted her communication style for this trainee, and their subsequent conversations were more productive.

Dr. Froemke

Dr. Froemke frames his mentorship strategy by helping trainees truly understand, manage, and value the level of uncertainty and failure inherent in academic research. He maintains different expectations for each trainee dependent on their previous research experience. He instructs undergraduates and high school students in his laboratory to play the role of an anthropologist and study what it means to be a scientist and whether scientific research is a career of interest. Dr. Froemke adjusts his expectations for PhD students and postdoctoral fellows based on conversations related to desired experiences and career trajectory.

Dr. Froemke tries to convey to his PhD students and postdoctoral fellows that his commitment to their mentorship relationship is not predicated on them remaining in academic science. When a trainee identifies a preferred career path, he supports them by helping in their job search.

Dr. Plowman

Dr. Plowman's mentorship strategy is rooted in the Greek origins of the word "mentor." Because trust is bestowed upon her by mentees, she appreciates the ethical responsibility to adjust her mentoring strategy to meet the individualized needs of each mentee. The overall goal is for the mentee to surpass their mentor and advance their respective field. Dr. Plowman assesses a potential mentorship relationship by understanding the mentee's goals, learning style, communication style, and preferred mentoring style to ensure the relationship is a proper fit. Every semester, she holds meetings with individual mentees to exchange feedback to ensure both parties' needs are still being met. As the relationship progresses, Dr. Plowman adjusts the experiences and expectations of the mentee to prepare them for success in the next step of their career.

Part of the Plowman laboratory's mission statement is to further diversify its membership. To combat affinity bias, Dr. Plowman enlists all laboratory members to interview a potential trainee. Laboratory members complete candidate rating sheets as an additional method to reduce implicit biases. Dr. Plowman actively recruits members of URM communities to create a more diverse laboratory environment where all members can learn from each other's past experiences.

Dr. Plowman considers trainees finding a career they are truly passionate about a successful outcome of the mentoring relationship.

Dr. Rasband

Dr. Rasband described his mentorship style by likening his role as a mentor to that of a mountain guide. He ensures trainees have access to the correct path and tools for success helps trainees maintain a sustainable pace. He points out the truly interesting aspects of the overall experience and shields trainees from dangerous experiences. Dr. Rasband knows the mentoring relationship is successful when the trainee begins to guide and teach him. If Dr. Rasband notices a trainee struggling to progress, he tries to find them a new path. Dr. Rasband intentionally models the appropriate behaviors that he requires from his trainees (e.g., work ethic). Ultimately, open communication is critical to maintaining a positive mentoring relationship and assuring a trainee that their PI is invested in the trainee's personal success, regardless of career trajectory.

Dr. Rasband shared a story about one of his former mentees who was a fantastic scientist but ultimately chose to leave academic research. He indicated that this student planned to pursue a postdoctoral fellowship, but she realized she wanted to become a high school teacher instead. Dr. Rasband supported this choice and helped her access training to develop skills that would help her obtain a high school teaching position. This mentoring relationship was successful, according to Dr. Rasband, because his trainee discovered her true passion.

Dr. Rasband also explained a situation in which a trainee in his laboratory was unhappy. Dr. Rasband worked with this trainee to try different research projects, but ultimately, the trainee was unhappy in the laboratory itself. After additional laboratory rotations, the trainee joined another laboratory that offered a better fit. Dr. Rasband explained that sometimes trainees will

not be happy in a particular laboratory, and that mentors must accept that and support trainee decisions to change laboratories without taking the situation personally.

Discussion

Contributing to an Inclusive Environment

The panel of Landis awardees discussed recruitment and interview strategies that contribute to an overall inclusive environment. For example, how potential trainees from other cultures express passion for research may differ from what a PI might expect. Panelists remarked that when interviewing, they try to value inclusivity and welcome differences while still valuing a candidate's ability to perform collaborative research. In doing so, interviewers need to avoid affinity biases.

URM PhD students are sometimes attracted to laboratories of URM PIs due to increased comfort level, regardless of research interests. URM PIs can help these students navigate the search for PIs with relevant research interests and compatible personalities; this can help URM PhD students formulate questions to assess the overall fit of prospective mentors and level of inclusivity of laboratories. However, this involvement adds an extra burden to the already scarce number of URM PIs.

Supporting Non-Academic Career Paths

Many attendees noted an ongoing tension between supporting non-academic career paths for students and T32 programs being penalized during review for students not remaining in academic career paths. Universities should be obligated to help students find their unique career paths, but because the National Institutes of Health (NIH) disperses funds with the intent of advancing science, they prioritize keeping T32 program students in academic science. However, as some attendees explained, NIH must know that not every PhD holder will receive R01 grants to support academic research and PhD holders can support scientific advancement outside of becoming an academic faculty member; some even become NIH staff members themselves. Some attendees also noted that T32 programs are penalized for students who leave programs early even though an individual student may have left the program to pursue their preferred career. Dr. Korn explained that NIH officially instructs program reviewers not to penalize programs for trainees leaving academia after completing the program. However, many program reviewers nonetheless maintain a mindset of defining success solely as remaining in academic science. Within NINDS training grant reviews, reviewers are not invited back if they are intent on penalizing programs based on graduates pursuing non-academic careers.

Overall, a culture shift is needed to broaden the definition of success for PhD trainees. Part of the mission of the NIH Broadening Experiences in Scientific Training (BEST) program, which was active from 2014-2019, was to help academic faculty members understand and accept that there are no first- and second-class careers for their trainees. However, a tension remains for PIs in balancing their support of a mentee's career goals with making research progress, as some career goals do not necessarily value research milestones, such as research publications.

Creating a culture that values alternative careers may also help recruit undergraduate students to PhD programs. One attendee noted that many URM undergraduates want to pursue an MD and even experience pressure from their families to do so. Educating these undergraduates about the breadth of professional opportunities for PhD holders can help them make an important decision between entering an MD or a PhD program. Career panels through which PhDs share information about their diverse careers can also help with this education, and post-baccalaureate programs can help individuals determine whether to choose a PhD path.

Some attendees cautioned against too readily encouraging trainees to leave academia. A trainee may express desire to leave academia simply due to transient feelings or impostor syndrome and need support and reassurance from their mentor. Program directors should pay close attention to trends among students who choose alternative career paths or leave a PhD program early to determine whether a training program may be unwelcoming to certain groups of students. In addition, despite a passion for academic research, many trainees, especially URM trainees, express a fear of career insecurity in academia as the sole reason for choosing an alternative career path. Increased career security may help these trainees continue their desired career path in academia.

Recruiting and Supporting Diverse Trainees

Recruitment efforts at the high school level can help inspire a love for science in students prior to attending college. Some universities do offer opportunities for high school students to conduct research, but these are mostly volunteer opportunities that exclude individuals who cannot afford to work for free. Attendees agreed that high school students should be paid to participate in these research opportunities, and that paying students can help attract URMs to academic science.

Diverse co-mentoring situations that involve URM faculty can help support URM trainees. However, as some attendees noted, academic departments often include few URM faculty, and those faculty cannot take on those additional responsibilities.

Managing Conflict in Mentorships

Depending on the severity of the conflict within a mentoring relationship, different remedies are available to resolve problems that arise between mentor and mentee. To detect mentoring conflicts early, program leadership can hold private, one-on-one meetings with each trainee to assess mentoring relationships while ensuring confidentiality. Some universities provide third-party mediators, or ombudspersons, to facilitate productive conversations to resolve issues between mentor and mentee. If a conflict is severe or remains unresolved, a student may need to either seek out additional mentoring from other sources, switch laboratories, or report particularly severe problems to the program and institution.

Seeking Additional Mentorship

PhD students form thesis committees made up of faculty who can serve as additional mentors. Thesis committees can help the student and PI navigate scientific disagreements. However,

postdoctoral trainees do not have a formal committee, so finding additional mentorship may require additional effort by networking with PIs.

Sometimes, problems in mentoring relationships may arise, but trainees are reluctant to formally complain due to fear of retaliation. These trainees benefit from additional mentorship, advice, and support from program leadership and other department members to navigate difficult mentoring situations. Program leaders can also facilitate discussions between the PI and trainee to help mend the relationship.

Switching Laboratories

Sometimes, due to mentorship style mismatches, trainees need to switch laboratories to successfully complete their PhD or postdoctoral fellowship. While this switch may not be the fault of either the PI or trainee, the PI may blame themselves or blame the trainee for the dissolution of the mentoring relationship. Trainees wanting to switch laboratories benefit from other PIs' willingness to accept them into the laboratory as well as additional guidance from program leadership on navigating the switch. T32 funds can be provided to support trainees rotating and eventually switching laboratories, ensuring the continued payment of their stipends.

A trainee may also choose to switch laboratories rather than formally reporting the PI for abusive or toxic behavior. Ideally, trainees would feel comfortable switching laboratories without fear of retaliation; then, poor mentors would simply not have any trainees in their laboratory.

Reporting Behavior to Program or Institution

Sometimes, behaviors displayed by some PIs, such as discrimination, harassment, and abuse, require reporting to the program director, research integrity office, or institution leadership. Trainees experiencing these behaviors are reluctant to report these issues for fear of retaliation. Many URM trainees drop out of their respective programs due to toxic mentor behavior. A PI may bar a trainee from graduating or publishing their research with little resistance, unless other research faculty advocate on the trainee's behalf. Even in the absence of immediate retaliation, a PI could decide to write a negative recommendation letter for the trainee. A trainee may opt not to ask their PI for a recommendation letter to avoid this situation, but the lack of a PI recommendation letter for academic positions is highly frowned upon. Both the absence of a PI recommendation letter and a negative PI recommendation letter impede former trainee job advancement. Because of these potential negative outcomes, trainees often express interest in a system for anonymous reporting of poor mentoring behaviors. However, if a PI has few trainees, they can easily deduce who reported their poor mentoring behaviors. Therefore, trainees are very reluctant to formally report their PI.

If a student wants to file a formal complaint, program leaders can and should provide support and serve as student advocates. The student who files a formal complaint is often very vulnerable and puts themselves at great risk for retaliation. However, discussions among PIs

about mentoring require tact in order to avoid straining lifelong colleague relationships. In addition, PIs with large amounts of grant funding are not easily induced to adopt better mentoring practices.

Holding Toxic Mentors Accountable

Ensuring accountability for poor mentoring behaviors requires objective measures of mentor quality. However, mentoring relationships are inherently subjective and based on opinions and perspectives of individuals who may not always be in agreement. One suggested way of assessing mentorship quality is to solicit opinions from former mentees during grant, tenure, and promotion reviews through reference letters and structured interviews. This could be costly and require guidance from the university's legal department.

Panel Discussion 2: Novel Forms of Mentorship for Undergraduates and Graduate Students

Moderator: Marguerite Matthews, PhD, NINDS

Inspiring Diversity to Explore the Brain in the 21st Century: The NIH/NINDS-LSUHSC-New Orleans Undergraduate Diversity in Neuroscience Research Experiences

Allison C. Augustus-Wallace, PhD, Louisiana State University Health Sciences Center

Dr. Augustus-Wallace presented about the Louisiana State University Health Sciences Center (LSUHSC) mentorship pipeline that supports both undergraduate and graduate students. The Enhancing Neuroscience Diversity through Undergraduate Research Education Experiences (ENDURE) program provides opportunities in neuroscience research for URM students (*Endure: Diversity in Neuroscience*, 2022). For up to two summers, ENDURE scholars conduct research in laboratories on the LSUHSC New Orleans campus and receive additional mentorship and training at their home institutions throughout the academic year. In addition to gaining hands-on research experience, ENDURE scholars attend journal clubs to learn how to read and write scientific manuscripts. ENDURE scholars are also given multiple opportunities to engage with other summer research program students as well as students in the LSUHSC New Orleans Postbaccalaureate Research Education Program and T32 program PhD students. These interactions create opportunities of near-peer mentoring. Dr. Augustus-Wallace emphasized that these programs provide mentorship to participating mentors in part by having difficult conversations with mentors about explicit and implicit bias.

Interdisciplinary Training in Movement Disorders and Neurorestoration

Dawn Bowers, PhD, University of Florida

Dr. Bowers presented on the University of Florida Interdisciplinary Training in Movement Disorders and Neurorestoration T32 program, which provides interdisciplinary training to six predoctoral students per year from five different academic departments. T32 students attend monthly meetings during which students gain experience presenting and discussing their research. These students also have access to clinical shadowing opportunities as well as lunch

meetings with visiting scientists. The program also sponsors an annual research symposium and a rigor and reproducibility seminar series. An additional component of the T32 program involves students conducting projects in pairs to develop and test hypotheses using various databases.

Dr. Bowers noted that one T32 PI uses a Birkman questionnaire to facilitate productive conversations about mentorship styles with trainees (*The Birkman Method*, 2022). In addition, Dr. Bowers is considering implementing a program similar to a wellness process program for undergraduates to attend small group discussions moderated by psychiatry residents in order to talk about various wellness topics.

Neural Injury and Plasticity Training Program

Kathy Maguire-Zeiss, PhD, Georgetown University

Dr. Maguire-Zeiss presented on Georgetown University's Neural Injury and Plasticity T32 program. Twenty faculty members out of a total of 55 neuroscience faculty participate under this T32, which currently supports 48 predoctoral students. This T32 program encourages students to seek multiple formal and nonformal mentors as well as near-peer mentors. This T32 program offers monthly workshops that cover writing and statistics skills as well as career exploration. In addition, trainees and their mentors participate in weekly journal clubs that focus on statistical literacy, rigor, and experimental design. T32 students also lead or invite experts to lead discussions on research ethics, equity, diversity, and inclusion. The T32 grant requires monthly one-on-one meetings between trainees and their mentors, and the T32 program holds annual, individualized feedback sessions between program leadership and trainees; these feedback sessions help T32 program leadership identify any gaps in a trainee's mentorship and enables leadership to assist those trainees in obtaining additional mentorship and resources.

Mentoring Enthusiasm

Robert Meisel, PhD, University of Minnesota

Dr. Meisel administers a summer R25 that introduces freshmen and sophomores to science research as a career. In the 10 years of this program, all students have been either URM or from economically disadvantaged backgrounds. Dr. Meisel chooses R25 mentors who take a positive and enthusiastic approach to ignite excitement about science at the undergraduate level. He noted that negativity and complaints from PIs can provide an unintentional impression that a career in academic research is not an exciting or rewarding career; this can influence trainees to leave the academic research track prematurely.

Discussion

Management of T32/R25 Programs During and After the COVID-19 Pandemic

During the COVID-19 pandemic, T32 and R25 program directors implemented strategies to facilitate learning at a distance, including virtual meetings. All of the panelists in Session 2 agreed that as COVID-19 cases wane and official guidance allows, they will move most meetings

to an in-person format. Depending on official guidance, larger meetings may still need to be hybrid. Dr. Maguire-Zeiss did explain that while meeting in person is preferred, virtual meetings do allow attendees to see participants' faces while in-person meetings with masking requirements do not.

Promotion of a Positive Outlook on Academic Careers

The academic research community often views extreme levels of busyness as a badge of honor. However, PIs should be aware that discussions of this nature can have a negative impact on how students perceive academic research careers. Students need to hear about how much PIs enjoy their careers. Overall attitudes of PIs can have a significant impact on student recruitment and retention.

Post-Baccalaureate Training to Increase PhD Application Diversity

Attendees discussed the value of post-baccalaureate training in increasing the diversity of PhD applicants. PhD applicants from underrepresented backgrounds may not have as much of an opportunity to work in laboratories, either because their undergraduate institutions did not offer research opportunities or because students could not afford to work for free in a laboratory. University of California, San Francisco established the Post-baccalaureate Research Opportunity to Promote Equity in Learning (PROPEL) program that matches students with PIs and funds their work as laboratory technicians through diversity supplement awards. These students also receive ongoing training, access to mentors, journal club experiences, and enrollment in a programming course. The PROPEL program helps students apply and be accepted into PhD programs, and PROPEL leadership is now trying to secure stable NIH R25 funding for this program.

Promotion of Academic Research to High School Students

Attendees noted the importance of exposing high school students to academic research as another recruitment strategy. Dr. Bowers explained that high school students have opportunities to conduct research over the summer, but because it is self-funded, the research cohorts lack diversity. For more equal access to research opportunities for high school students, programs should provide a competitive salary to students working in a laboratory over the summer. Ideally, various R25 programs could help fund high school students with an interest in working in the laboratory.

Some attendees who manage high school programs have noticed that students interested in neuroscience opt to pursue a degree in biomedical engineering rather than neuroscience, possibly in part because they view an engineering career as more financially stable. Exposing high school students to the different career opportunities available to PhD holders can shed light on the benefits of a career in academic research.

Panel Discussion 3: Successful Practices for Mentoring Postdoctoral Fellows and Faculty

Moderator: Michelle Jones-London, PhD, Chief, OPEN-WD, NINDS

Center for Innovation in Brain Science

Kathleen Rodgers, PhD, University of Arizona

Dr. Rodgers presented on the various mentorship programs at the University of Arizona's Center for Innovation in Brain Science. Because mentorship programs support undergraduate and graduate students as well as junior faculty, many opportunities exist for cross-program mentoring. For example, graduate students help facilitate undergraduate training programs, and junior faculty help develop training program curriculum.

The Undergraduate Readying for Burgeoning Research for American Indian Neuroscientists (URBrain) R25 program in partnership with Diné College provides research laboratory experience to American Indian and Alaska Native (AI/AN) undergraduate students. The R25 program pairs students with mentors during the academic year prior to their summer research. Mentors provide support and scientific articles to boost scientific literacy ahead of the summer program. Throughout the academic year R25 students virtually attend professional trainings, weekly journal clubs, and ethics training sessions. Over winter break, R25 students stay at the University of Arizona to meet program leadership as well as graduate students and postdoctoral fellows who help the R25 students become more familiar with the research and activities they will participate in during the 10-week summer research program.

Due to the COVID-19 pandemic, the first year of the URBrain program occurred virtually. Rather than conduct research on-site, R25 students conducted computational research and received a certification in data science. Undergraduate students were each paired with an MD/PhD student, a PhD student, and a physician to support their computational research. The success of this program led to additional supplemental funding to support a very similar medical certificate program for six AI/AN undergraduates. Similarly, a National Institute of General Medical Sciences Native American Research Centers for Health training grant currently supports a medical informatics MS certificate program for AI/AN PhD students.

Additional training programs at the Center for Innovation in Brain Science support graduate students and junior faculty. A National Institute on Aging (NIA) T32 supports graduate students in translational research focused on Alzheimer's disease, and this includes a capstone and ethics course. A P30 NIA Alzheimer's Disease Research Centers Research Education Component grant trains junior faculty to develop an interdisciplinary Alzheimer's disease research project.

Complementary Programs Focused on Neurosciences/Intellectual and Developmental Disabilities

Michael Robinson, PhD, University of Pennsylvania

Dr. Robinson manages a NINDS T32 program at the University of Pennsylvania in neurodevelopmental disabilities for postdoctoral fellows, including PhDs, MDs, and MD/PhDs. This T32 provides 3 years of support, which Dr. Robinson indicated was enough time for trainees to establish a research plan and network. Funding for clinical stipend supplements from the Children's Hospital of Philadelphia (CHOP) are provided to clinical fellows to ensure they have sufficient time away from the clinic to work in the laboratory. T32 activities include: (1) neuroscience chalk talks, (2) grant writing club, (3) workshops on critical analysis of techniques, (4) workshops on quantitative skills, and (5) Intellectual and Developmental Disabilities Research Center (IDDRC) seminar series. Dr. Robinson also manages a New Program Development program that was originally funded by the National Institute of Child Health and Human Development and the IDDRC but is now funded by CHOP. This program supports assistant professors who are then added as T32 PIs.

Dr. Robinson emphasized the importance of programs that encourage interactions across the career stage continuum as well as between PhDs and clinical fellows. He also tracks outcomes of the T32 program through descriptive analyses and is working on a pathway for diversification of mentoring and increased inclusion of underrepresented groups.

Postdoctoral Training T32: Developmental Neurology

Tom Schwarz, PhD, Boston Children's Hospital and Harvard Medical School

Dr. Schwarz manages a postdoctoral T32 developmental neurology program at Harvard Medical School aimed at training postdoctoral fellows in both basic and translational research. This program emphasizes the importance of postdoctoral fellows having multiple mentors outside of their own laboratories, including those who can provide career support, statisticians, and clinician scientists. These additional mentors not only serve as extremely valuable resources, but also as multiple sources for recommendation letters necessary for career advancement. Training activities supported by this T32 program include: MatLab bootcamp, practical statistics workshops, training sessions in quantification and scientific rigor, and job application assistance and interview support.

T32 PIs undergo obligatory trainings and are required to participate in various training activities. These PIs are required to undergo CIMER mentor training and to attend monthly mentor meetings. The program and university also offer training sessions on the topics of mentoring, having difficult conversations, and communicating effectively.

UC San Diego – Leading the Advancement of Underrepresented Neuroscientists for Change (LAUNCH) Program

Joann Trejo, PhD, University of California, San Diego

Dr. Trejo manages the Leading the Advancement of Underrepresented Neuroscientists for Change (LAUNCH) Program, which supports seven to eight junior faculty members from across the United States for 1 year to support their research development and grant writing efforts. The previous cohorts consisted of all URMs and/or women and included one to two University of California, San Diego (UCSD) junior faculty members. Junior faculty members visit UCSD during each summer of their membership in the program, along with a mid-year meeting for development training activities with topics that include: (1) effective mentorship training, (2) personnel management, (3) forming and maintaining collaborations, (4) manuscript writing, (5) seminar participation, (6) grant writing, and (7) research ethics. Grant writing activities include participation in mock grant study sections where junior faculty grants are reviewed by faculty directors and peers. Junior faculty members also create a research career advancement plan meant to help guide their own professional development and career advancement.

Junior faculty participants each have a structured network of mentors including LAUNCH directors, junior and senior UCSD faculty members, a home institution mentor, and a near-peer mentor from other junior faculty support programs. Additional support for LAUNCH comes from the Office of Faculty Affairs at UCSD, as well as through cross-campus engagement with faculty and leadership in other national Summer Institute Programs, which helps create a strong professional network.

Discussion: Assisting Trainees in their Mentoring Relationships

Identifying Quality Mentors and Establishing Healthy Mentoring Relationships

New trainees often seek advice about potential thesis laboratories from other trainees as well as program directors. Trainees should be encouraged to speak with other members of potential thesis laboratories, and current members should feel free to provide honest information about their laboratory's environment. Program directors can assist trainees in identifying candidate PIs who have a compatible mentoring style while steering them away from PIs with a history of poor mentoring and even abuse. Importantly, a single complaint from one trainee may be indicative of poor mentoring style compatibility and not a reflection of the PI as a mentor overall. Maintaining solid relationships with trainees in graduate programs is essential for directors to gain a true sense of consensus issues with specific PIs.

When formalizing a PI-trainee, mentor-mentee relationship, both parties should have honest and open conversations about expectations. The PI should clearly lay out responsibilities for trainees in their laboratory, and the trainee should articulate which types of support they predict they may need during their training. These conversations should remain ongoing throughout the duration of the relationship, as needs and expectations may change.

Handling Disengaged Mentors

Sometimes, trainees can feel that their PI has become disengaged and their current training needs are not being met. This can even include a PI refusing to publish a trainee's research. Fortunately, graduate student trainees can utilize thesis committee members as supplemental mentors. Postdoctoral fellows and junior faculty members no longer have that kind of structured support, but this gap can be filled by postdoctoral and junior faculty training programs and other senior faculty members.

Mitigating Discrimination

The creation of a more inclusive academic environment requires direct actions to mitigate discrimination, including instances of microaggressions. Notably, just because a PI may treat others with respect does not negate the possibility of discriminatory behavior towards URM and sexual and gender minority (SGM) trainees. University staff and faculty members have an obligation to address witnessed incidents of discrimination. Failure to do so continues to perpetuate the leaky pipeline of URMs leaving academia.

Incentivizing Quality Mentorship Practices

In order to properly incentivize quality mentorship, the scientific community needs to prioritize mentorship for career advancement and develop a strategy for objectively measuring mentorship quality. The current measures that exist, such as simply counting the number of trainees a PI has trained, are not equivalent to quality mentorship. In addition, trainees can succeed in spite of a bad mentor. Chapter 6 of NASEM's 2019 report details evaluation methods that measure mentorship relationships. By using evaluations on a regular basis, programs and institutions can determine whether their mentorship education has improved the quality of mentoring received by trainees.

Providing discretionary funds and formal recognition for quality mentoring practices can help incentivize mentorship skill improvement. Training programs can incentivize quality mentorship by providing discretionary funds to PIs who participate in program-sponsored activities. Providing formal certificates after completing different mentorship education opportunities can also attract PIs interested in developing their curriculum vitae for funding opportunities, tenure, and other career advancement opportunities. Departments, training programs, and institutions can also establish annual awards for PIs who display excellence in trainee mentorship, with both formal award recognition and additional discretionary funds.

Accountability for Poor Mentorship Practices

While excellent mentorship should be rewarded, mentors who display toxic or abusive behavior should be held accountable to further promote an academic environment that values quality mentorship and mutual respect. There is currently no mechanism through which a PI risks losing research funding as a result of inappropriate mentorship behavior. Program directors do not have objective methods for identifying mentors with poor mentorship practices; they rely on information from program trainees. If there is a consistent pattern of complaints about a particular PI, a program director can exert some leverage by warning the PI of possibly being removed from the training program, meaning the PI will no longer receive funded trainees.

Program directors can also emphasize to PIs that while bullying practices may accelerate progress in the short term, in the long term, these practices can lead to the loss of trainees. In addition, the scientific findings generated under such an abusive and toxic environment may not be reproducible.

A focus group of NINDS trainees expressed interest in an anonymous reporting avenue that minimizes the potential for retaliation. In this proposed system, a trainee can file an anonymous complaint about their PI that remains sealed at that time. Once a certain threshold is reached (e.g., a PI has five complaints on file), the NIH, training program, department, and/or institution would then further investigate those complaints. Accumulating complaints over time would better preserve anonymity, allowing trainees to feel safer when filing a complaint.

Training Session: Supporting Emotional Well-Being for Trainees

Facilitator: Sharon Milgram, PhD, Director, NIH Office of Intramural Training and Education (OITE)

In academia, both trainees and faculty struggle with burnout and mental health issues (Clark & Hurd, 2020; Flaherty, 2018; Nagy et al., 2019; Sample, 2020). Prior to the COVID-19 pandemic, graduate students reported a six-fold higher rate of anxiety and depression compared to their non-student counterparts (Evans et al., 2018). Dr. Milgram recalled the highly distorted negative stories postdoctoral fellows shared about themselves during a wellness seminar. The goals of this training session were to:

- Appreciate the link between resilience, stress management, and wellness with success in school, career, and life (NIH OITE, 2021c)
- Understand how to help trainees through acute stressors with minimal disruption to academic and research progress
- Prepare to deal with more serious mental health concerns that impact some members of the research community

Dr. Milgram explained that achieving these goals requires:

- Framing this as a wellness issue, not an illness, by being proactive rather than reactive
- Personal and cultural change at all levels of academic research
- Collaboration between PIs, staff, trainees, and others

Protective Factors for Mental Health

Certain skills and resources can help protect the mental health of trainees, and program leadership and PIs play a major role in helping trainees to: (1) develop and use positive coping styles to face adversities, (2) manage interpersonal support, (3) maintain work-life balance, and (4) access quality mentorship.

The sense of financial stability can also be protective for trainees. Although training programs and PIs do not usually have direct control over trainee stipends, they can advocate or create programs for financial assistance for trainees in need.

Working Within the Zone of Tolerance

People work best when their stress level is situated within their zone of tolerance. In this zone, trainees respond productively to stress, display high-quality problem-solving skills, address interpersonal issues respectfully, and acknowledge mistakes. When stress is too high, trainees can become more reactive to seemingly minimal disruptions, while too low of stress can lead to a trainee simply giving up.

Maintaining a personal window of tolerance requires holistic self-care, which includes physical, mental, emotional, and spiritual well-being. Wellness assessments can help trainees understand their current approach to self-care and wellness (NIH OITE, 2021d). Notably, some trainees express that they have strong spirituality or religiosity but feel like there is no space for that part of their identity in biomedical research.

Stress Management

Stress, the feeling of being overwhelmed by or unable to cope due to a situation, pressure, or change, can exert positive and negative effects on trainee mental health. Positive stress, also called eustress, motivates and helps focus energy, while negative stress, also called distress, causes anxiety and concern and can lead to mental and physical health problems. Eustress can improve research performance, while distress can decrease research performance.

Common signs of distress, whether due to mental illness or not, can be expressed verbally or detected by changes in cognition, emotion, and physical health, which are summarized below.

Verbal Expressions	<ul style="list-style-type: none"> Talking about issue directly Minimizing the issue Denial of actual problems 	<ul style="list-style-type: none"> Excessive blame directed at self or others Speech that is incoherent or abnormally rapid or slow
Cognitive Signs	<ul style="list-style-type: none"> Confused thinking Difficulty concentrating Excessive worrying 	
Emotional Signs	<ul style="list-style-type: none"> Changes in affect Emotional flooding Extreme mood changes 	<ul style="list-style-type: none"> Helplessness and hopelessness Significant irritability Hyperenergetic expression
Physical Signs	<ul style="list-style-type: none"> Excessive fatigue Restlessness Changes in hygiene Weight gain or loss Somatic complaints Changes in sleep patterns 	<ul style="list-style-type: none"> Changes in eating habits Hyperventilation Sweating Dizziness Self-medication Self-injury

Extreme or sustained levels of stress can impact work performance and overall health. Trainees may either miss work or work excessively while making careless mistakes. They may be unable to deal with normal responsibilities and deadlines and experience difficulties navigating group discussions and dynamics. Eventually, high stress levels can lead to trainee isolation and withdrawal and can sometimes lead to tragic consequences.

Developing Resilience in Trainees

Building resilience in trainees early in their careers can help protect them from the fallout of stress and allow them to persevere even in response to failure. Resilience is the ability to: (1) adapt and grow through adversity, (2) navigate difficult challenges, and (3) find constructive approaches during difficult times (*Resilience*, 2022).

While resilience may be, in part, innate, trainees can learn resilience through education, self-reflection, and practice. This learning requires a culture shift in academia toward valuing self-care. Due to life experiences, many trainees have experienced trauma that negatively impacted their resilience and may impede its development.

Trainees can preemptively build a stress management toolkit to help bolster their resilience during times of high stress. Resilience includes people, process, and preparation components. A resilience toolkit should include community support within and outside of the academic research environment. Attending wellness workshops can help trainees understand the concept of distorted self-talk, how to identify such self-talk, and how it undermines progress and confidence. Developing a growth mindset can help trainees view failure as an opportunity to improve themselves.

Promoting Student Wellness

Promoting overall student wellness requires active development of wellness and mental health programs, affinity groups, and support for URMs, as well as diverse career development.

Establishing and Improving Programs

By prioritizing wellness, mentors can improve trainee access to and use of wellness resources. Often, trainees are unaware of the various wellness activities sponsored at the program, departmental, and institutional levels. Sharing information about wellness and mental health resources can increase awareness of specific resources. Mentors can also dedicate time during retreats to discuss wellness as well as plan wellness activities (not including happy hours). By attending wellness workshops as a group with trainees, mentors can improve workshop attendance and help foster a culture that values overall wellness. Importantly, mentors should normalize taking breaks from work and vacation time to allow trainees to recharge.

Supporting Underrepresented Minorities

Support for URM and SGM trainees requires training for PIs and staff as well as access to supportive affinity groups for trainees. SGM and URM trainees can experience discrimination in academia and are more vulnerable to harassment and bullying. A more inclusive research environment would be beneficial and more supportive for all trainees; a recent survey conducted by the United Kingdom Wellcome Trust found that more than half of survey respondents experienced bullying or harassment within the past year (Shift Learning, 2020). Diversity, equity, inclusion, and accessibility programs should provide trainings in the areas of allyship, civility, diversity, and bystander action for trainees, faculty, and staff. Promotion of an anti-bullying, anti-discrimination, and anti-harassment environment can help create sustained cultural change at the institutional level and in the broader scientific community.

Supporting Diverse Career Paths

Successful career development for trainees requires support for diverse career paths. Shame is still present in many programs and departments around exploration of non-academic careers. Trainees with interest in non-academic careers may begin to feel isolated in the absence of support for their futures. Mentors should proactively promote and participate in career development for trainees and explicitly support diverse career outcomes to combat any shame associated with pursuance of non-academic careers.

Recognizing and Addressing Trainee Mental Illness

Training programs should take a proactive approach by promoting overall wellness rather than simply reacting to signs of mental illness as they arise. However, many trainees do experience mental illness. The severity of mental illness can vary and change over time; many trainees may exhibit some symptoms without qualifying for a diagnosis of a mental health condition. Some trainees may even have dual diagnoses and suffer from more than one mental illness. Efforts to cope with mental illness can lead to maladaptive behaviors and can impact trainee success.

Certain identity groups experience higher rates of mental illness. Those who report being multiracial or SGM also report a higher rate of mental illness compared to all adults (*Mental Health By the Numbers, 2022*). In addition, many trainees have experienced trauma in the past that may or may not have caused post-traumatic stress disorder (PTSD). PTSD has a 4 percent national prevalence, and trauma overall can impact learning. Community and a sense of belonging are essential to handling trauma; thus, fostering an inclusive and welcoming environment can also prove beneficial for trainees with a history of trauma.

Barriers to Seeking Mental Health Resources***Lack of Resource Accessibility and Awareness***

The overall culture of research departments and groups may exacerbate existing barriers to mental health resources. Without a culture that values wellness, trainees may not understand the benefits of wellness and resilience, and they may not be aware of available mental health resources. Unfortunately, student health services at many institutions are overwhelmed and not equipped to meet trainee demand for mental health services. Trainees who seek mental health resources outside of student health services are burdened with extra costs due to mental health benefits typically being out-of-network. URM and SGM trainees are even less likely to find a professional mental health practitioner with specific expertise who is also covered by their insurance. These accessibility challenges make it even more difficult for a trainee experiencing mental illness to access the resources they need.

Persistent Stigma

Despite societal efforts to the contrary, a stigma around mental illness still exists that can prevent some trainees from accessing mental health resources. The culture and pressure of academic research emphasizes high workloads and intensity that can deprioritize the importance of wellness and mental health. One way to combat this stigma is to provide trainees

with exemplars in academic research who have struggled with their mental health and wellness. For example, Dr. Milgram recalled interviewing former NIH Director Dr. Francis Collins, who discussed a time when he broke down crying in the bathroom during his postdoctoral fellowship. Sharing experiences of this kind normalizes mental health struggles and helps combat feelings of loneliness and isolation experienced by trainees who are struggling with their mental health.

Program Staff and Mentors Can Help Remove Barriers to Mental Health Resources

Mentors and program directors can play a critical role in helping trainees access mental health resources. They can proactively encourage the use of mental health and wellness resources early on during mentoring relationships. Societal influences may have taught trainees that using mental health resources is a sign of weakness; therefore, the use of these resources needs to be actively encouraged and normalized. In doing so, mentors can help their trainees build a mental health and wellness toolkit preemptively. In addition, by remaining observant, mentors and program staff can detect indicators of distress or mental illness in trainees and recommend the use of available resources to help prevent more urgent mental health crises (NIH OITE, 2021a).

However, mentors and program staff should remain in their appropriate roles and maintain necessary boundaries. They should notice signs of distress but not over-interpret trainee behaviors. Mentors should not serve as a counselor, parent, or friend. Mentors should model behaviors and attitudes that promote wellness and provide appropriate support to trainees who are suffering from distress or mental illness.

Discussing Mental Health Concerns with Trainees

Dr. Milgram presented a model of discussing resilience and mental health with trainees, which includes four steps: (1) opening, (2) information gathering, (3) resource sharing, and (4) closing. This model is not rigid, and mentors may need to adjust its structure in cases of life-threatening concerns or if the topic arises during discussions about work.

Opening

When a mentor schedules and initiates a meeting with a trainee, the trainee often assumes they are in trouble; mentors should always address this immediately and explicitly state that the trainee is not in trouble and that the conversation will be about their well-being and not their research. This action, along with active listening, can help establish a connection and sense of trust necessary for a conversation about mental health concerns.

Information Gathering

To ascertain which resources may be useful for supporting the trainee, a mentor should listen actively and ask curious questions (*Want To Communicate Effectively? Do This*, 2020). The mentor should react appropriately to the trainee's emotional responses. However, boundaries between mentor and trainee exist, and the mentor should indicate when a trainee is providing too many personal details.

Resource Sharing

Based on the information gathered, the mentor should strongly encourage the use of specific mental health and wellness resources. Proactively gathering basic information about these resources can ensure the mentor is fully prepared for conversations about mental health. Mentors can perform warm hand-offs, which involve sending a follow-up email introducing the trainee to an individual who manages or provides mental health or wellness resources; this can improve the chances of a trainee accessing necessary resources. The mentor should also stress that the trainee's well-being comes first and before their research progress.

Closing

At the end of the conversation, the mentor should summarize the next steps that were discussed for the trainee and establish ongoing availability for mental health and wellness follow-up meetings. Mentors should also send a warm follow-up email to further normalize the conversation that occurred as well as any promised warm hand-off emails to available resources.

Actions to Avoid

Mentors need to take care not to engage in conversation that could worsen a trainee's mental health situation. Mentors should not: (1) offer a diagnosis, (2) discuss in-depth a diagnosis they share, (3) belittle their situation or say, "It will be okay," (4) over- or under-interpret the conversation, (5) insist the trainee power through adversity, (6) threaten consequences for underperformance, or (6) breach confidentiality by sharing information with others. Dr. Milgram cautioned mentors against discussing their own experiences with mental health beyond a simple mention of any experience with a mental health condition.

Addressing Immediate Crises

Sometimes, mentors may encounter an urgent situation that requires further action beyond scheduling a conversation about mental health. Urgent crises can include: (1) trainee absence from work and not responding to emails, (2) emotional breakdown, (3) manic or other extreme behavior, and (4) openly discussing suicide. Mentors should proactively compile a list of resources and relevant contact information to quickly manage the situation. Mentors should also generate or seek out specific standard operating procedures for wellness checks and dealing with suicidal ideations in trainees to prevent a tragic outcome (NIH OITE, 2020).

Mentors may receive a report of a trainee mental health concern from a third party. The reporting party requires wellness support, and the mentor needs to address the trainee's mental health concern either directly or by encouraging the third party to help the trainee seek out the appropriate resources. The third party's identity should remain confidential.

Common Outcomes

After a mentor provides mental health resources to a trainee, the trainee may: (1) seek support with little disruption to their research, (2) take a short leave of absence to set up a medical plan, or (3) take a more substantial leave of absence. Mentors should explicitly express support for time away from the laboratory for therapy appointments and wellness activities. Trainees taking a short leave of absence can return to the laboratory but providing stipend support during this time is key for this positive outcome. Many trainees who take a longer leave of absence eventually return to the laboratory and thrive.

Additional Resources: The “Becoming a Resilient Scientist” Series

The OITE’s “Becoming a Resilient Scientist” series consists of five seminars and drop-in small-group discussions. These webinars and discussions are meant to help trainees understand the interplay between thoughts, emotions, and behaviors. In addition, trainees will learn about cognitive distortions and how to identify them, as well as how to deal with impostor syndrome. Workshop attendees reported more confidence in being assertive and managing conflict. While workshop attendance has a positive effect on resiliency, URM trainees reported a more positive change than non-URM trainees.

The OITE offers “Becoming a Resilient Scientist” facilitator training for mentors and program staff to hold their own series at their respective campuses. Pre-recorded presentations are available, and facilitators can manage small group discussions (NIH OITE, 2021b).

Discussion

Reintegration After an Acute Crisis

After an acute mental health crisis, a PI and other mentors can help their trainee reintegrate into the laboratory research environment. Mentors should seek out additional resources to learn how they can help support the trainee. The trainee may require mental health resources to help with executive function, cognitive distortions, and emotional regulation.

Legal Issues When Addressing Mental Health with Trainees

Although a mentor would ideally directly address legitimate concerns about mental health with trainees, the Family Educational Rights and Privacy Act (FERPA) may limit mentor involvement to simply suggesting wellness resources. NIH legal counsel has granted mentors at NIH the freedom to be direct with trainees and to perform warm handoffs to critical resources. At some graduate schools, a wellness program may be separate from student health services; in this situation, a mentor could recommend and introduce a trainee to a wellness program to properly adhere to FERPA rules. Dr. Milgram suggested that program directors contact their respective university’s legal counsel as well as their mental health task force, if available.

Common Student Wellness Resources

Workshop participants shared various resources that have proven successful in their programs and at their institutions. Trainees and mentors are more receptive to wellness sessions and workshops with small time commitments. Graduate students have reacted positively to student

health services that include counselors with specific experience counseling graduate students. In addition, university and program resources to assist trainees with financial difficulties are helpful but require expansion.

Mentorship Training: Enhancing the Mentor-Mentee Relationship

CIMER Facilitators: Janet Branchaw, PhD, University of Wisconsin, Madison; Christine Pfund, PhD, University of Wisconsin, Madison

Drs. Branchaw and Pfund facilitated a new mentorship workshop from CIMER that consists of parts of previous CIMER workshops. The goals for each of the attendees of this workshop included:

- Describe their current mentorship ecosystem
- Learn what it means to create a culture of mentorship
- Identify strengths and weaknesses in their training program's mentorship ecosystem
- Learn about resources and strategies to advance a culture of mentorship
- Develop an action plan to address training program weaknesses
- Collaborate with and learn from fellow training program directors

Ultimately, workshop attendees developed individual plans to improve their respective institutions' training programs with strategies to address gaps and weaknesses (Wiggins & McTighe, 1998).

Discussion

Workshop attendees indicated that the demand for CIMER workshops currently outweighs the supply of CIMER representatives. CIMER is expanding and building local capacities at different institutions to address this demand.

Concluding Remarks

Dr. Jones-London thanked workshop attendees for their participation in productive, active discussions; she also thanked CIMER trainers. She explained that NINDS will send a survey to workshop attendees to collect feedback about the meeting, and NINDS will use this feedback to inform planning for the next workshop. Dr. Jones-London encouraged attendees to provide ideas of strategies to identify and manage poor mentors as well as objective measures to quantify mentorship quality through either the NINDS survey or through email to her and Dr. Korn.

Appendix 1: Participant List

Juan Marcos Alarcon, PhD, Downstate Health Sciences University
Janet Alder, PhD, Rutgers University
Cashen Almstead, Society for Neuroscience
Alfonso Araque, PhD, University of Minnesota
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Allison C. Augustus-Wallace, PhD, Louisiana State University Health Sciences Center
Peter Baas, PhD, Drexel University
Tallie Z. Baram, MD, PhD, UCI
Carrie Bearden, PhD, University of California, Los Angeles
Morris Benveniste, PhD, Morehouse School of Medicine
Madison Berl, PhD, Children's National Hospital
Mark Bevan, PhD, Northwestern University
Brenda Bloodgood, PhD, University of California, San Diego
Dawn Bowers, PhD, University of Florida
Janet Branchaw, PhD, University of Wisconsin, Madison
Todd Braver, PhD, Washington University, St. Louis
Lisa Briand, PhD, Temple University
Amanda Brown, PhD, Johns Hopkins University School of Medicine
Marion Buckwalter, MD, PhD, Stanford University School of Medicine
Robert Burgess, PhD, The Jackson Laboratory
Jessica Cardin, PhD, Yale University
Brian Carpenter, PhD, Washington University, St. Louis
Michael Cascio, PhD, Duquesne University
Moses Chao, PhD, New York University Langone Medical Center
Gregory Cole, PhD, North Carolina Central University
Devani Cordero, Massachusetts General Hospital
Constanza Cortes, PhD, University of Alabama at Birmingham
Lori Corzine, Washington University, St. Louis
Paula Croxson, PhD, Columbia University
Maria Dahlberg, MS, National Academies of Sciences, Engineering, and Medicine
Marlene De la Cruz, PhD, University of California, Irvine
John Detre, MD, University of Pennsylvania
Peter Donovan, PhD, University of California, Irvine
Eleazar Eskin, PhD, University of California, Los Angeles
Mary Farach-Carson, PhD, University of Texas Health Science Center
Bruce Fischl, PhD, Massachusetts General Hospital/Harvard Medical School/Massachusetts Institute of Technology
Victoria Flores, PhD, University of Chicago
Paul Forlano, PhD, City University of New York, Brooklyn College
Michael Fox, PhD, Virginia Polytechnic Institute and State University
Robert Froemke, PhD, New York University Grossman School of Medicine

Natalie Galucia, MSW, Washington University, St. Louis
Erendira “Ren” Garcia Pallares, Massachusetts General Hospital
Jose Garcia-Arraras, PhD, University of Puerto Rico, Rio Piedras
Cristin Gavin, PhD, University of Alabama at Birmingham
Aryn Gittis, PhD, Carnegie Mellon University
Bruce Gluckman, PhD, Pennsylvania State University
Jonathan Godbout, PhD, Ohio State University
Nace Golding, PhD, University of Texas, Austin
Miriam Goodman, PhD, Stanford University
Michelle Gray, PhD, University of Alabama at Birmingham
Wendy Grillo, PhD, North Carolina Central University
Wes Grueber, PhD, Columbia University
Yian Gu, MD, PhD, Columbia University
Melina Hale, PhD, University of Chicago
Gillian Hamilton, PhD, Houston Methodist Research Institute
Melissa Harrington, PhD, Delaware State University
Tajie Harris, PhD, University of Virginia
Tarik Haydar, PhD, Children’s National
Ulrich Hengst, PhD, Columbia University
Erik Herzog, PhD, Washington University, St. Louis
Philip Horner, PhD, Houston Methodist Research Institute
Claire Horner-Devine, PhD, University of Washington
Rebecca Ihrie, PhD, Vanderbilt University
Dezhe Jin, PhD, Pennsylvania State University
Matthew Johnson, PhD, University of Minnesota
Ashley Juavinett, PhD, University of California, San Diego
Kristen Keefe, PhD, University of Utah
Jim Lauderdale, PhD, University of Georgia
Amy Lee, PhD, University of Texas, Austin
Gina Leininger, PhD, Michigan State University
Andrea Leiseca, University of Miami Miller School of Medicine
Laura Lillien, PhD, University of Pittsburgh
Farah Lubin, PhD, University of Alabama at Birmingham
Kathy Maguire-Zeiss, PhD, Georgetown University School of Medicine
Carmen Maldonado-Vlaar, PhD, University of Puerto Rico, Rio Piedras
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Paul Mermelstein, PhD, University of Minnesota
Rita Mihailescu, PhD, Duquesne University
Carol Milligan, PhD, Wake Forest School of Medicine
Sheri Mizumori, PhD, University of Washington
Italo Mocchetti, PhD, Georgetown University Medical Center

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Matthew Rasband, PhD, Baylor College of Medicine
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Sharon Milgram, PhD

Appendix 2: Workshop Agenda

Day 1: April 25, 2022

- 12:00 – 12:10 PM **Welcome Message**
Walter Koroshetz, MD, Director, National Institute of Neurological Disorders and Stroke
- 12:10 – 12:20 PM **Meeting Goals Overview**
Michelle Jones-London, PhD, Director, Office of Programs to Enhance Neuroscience Workforce Diversity, NINDS
Stephen Korn, PhD, Director, Office of Training and Workforce Development, NINDS
- 12:20 – 1:00 PM **Featured Lecture: The Science of Effective Mentorship in STEMM**
Maria Dahlberg, MS, Study Director, The Science of Effective Mentoring in STEMM
- 1:00 – 2:00 PM **Panel Discussion 1: Mentoring Philosophy of Landis Award Winners**
Moderator: Stephen Korn, PhD, Director, Office of Training and Workforce Development, NINDS
- Panelists:*
Alexandra Nelson, MD, PhD, Associate Professor, University of California, San Francisco
Robert Froemke, PhD, Professor, New York University
Emily Plowman, PhD, Professor, University of Florida
Matthew Rasband, PhD, Professor, Baylor College of Medicine
- 2:00 – 2:30 PM **Lunch Break**
- 2:30 – 3:15 PM **Panel Discussion 2: Novel Forms of Mentorship for Undergraduates and Graduate Students**
Moderator: Marguerite Matthews, PhD, NINDS
- Panelists:*
Allison Augustus-Wallace, PhD, Associate Professor, Louisiana State University Health Sciences Center
Robert Meisel, PhD, Professor, University of Minnesota
Dawn Bowers, PhD, Professor, University of Florida
Kathleen Maguire-Zeiss, PhD, Professor, Georgetown University
- 3:15 – 4:00 PM **Panel Discussion 3: Successful Practices for Mentoring Postdoctoral Fellows and Faculty**

*Moderator: **Michelle Jones-London, PhD**, Director, Office of Programs to Enhance Neuroscience Workforce Diversity, NINDS*

Panelists:

***JoAnn Trejo, PhD**, Professor, University of California, San Diego*

***Kathleen Rodgers, PhD**, Professor, University of Arizona*

***Michael Robinson, PhD**, Professor, University of Pennsylvania*

***Thomas Schwarz, PhD**, Professor, Harvard Medical School*

4:00 – 4:15 PM

Break

4:15 – 5:15 PM

Training Session: Supporting Emotional Well-being for Trainees

*Facilitator: **Sharon Milgram, PhD**, Director, NIH Office of Intramural Training and Education (OITE)*

5:15 – 5:30 PM

Report Out/Wrap-Up/Adjourn Day 1

Day 2: April 26, 2022

1:00 – 4:45 PM

Mentorship Training: Enhancing the Mentor-Mentee Relationship

*Facilitator: **Janet Branchaw, PhD**, CIMER Faculty Leader*

4:45 – 5:00 PM

Wrap-Up/Concluding Remarks/Adjourn Day

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