

Table 1 — Proposed Attributes, Example Objectives and Potential Metrics for Improving and Assessing Mentoring Relationships

Attributes for effective mentoring relationships	Example of measurable learning objective: <i>Effective mentors can</i>	Example of measurable learning objective: <i>Effective mentees can</i>	Existing metrics*
Research			
Developing disciplinary research skills	Teach mentees to design and carry out a research project; provide opportunities to observe techniques	Develop the skills to design and carry out a research project	[73, 76, 82–84]
Teaching and helping to learn disciplinary knowledge	Identify the knowledge mentees need to be successful in the discipline, and guide them in learning that knowledge	Seek guidance from their mentors to identify the disciplinary knowledge they need, and be receptive to mentor feedback that guides their learning	[73, 83]
Developing technical skills	Provide instruction in core disciplinary research techniques	Commit to learning and gaining proficiency in disciplinary research techniques	[46, 85]
Accurately assessing understanding of disciplinary knowledge and skills	Assess mentee learning of disciplinary knowledge and skills, and provide feedback and guidance to address gaps	Self-assess learning of disciplinary knowledge and skills, and respond to mentor feedback	[73, 75, 84]
Valuing the practice of ethical behavior and responsible conduct of research	Model the ethical conduct of research and actively engage in conversations with their mentees	Actively familiarize themselves with and follow ethical practices in their research	[33, 46]
Developing mentee research self-efficacy	Foster mentees' internalization of their own research success	Effectively manage anxiety associated with independently conducting research	[55, 56]
Interpersonal			
Listening actively	Give their undivided attention and listen to both their mentees' words and the emotion behind the words	Give their undivided attention and listen to their mentors	[75]
Aligning mentor and mentee expectations	Establish and communicate mutual expectations for the mentoring relationship	Establish and communicate mutual expectations for the mentoring relationship	[73, 75, 84]
Building trusting and honest relationships	Offer honest and open feedback on how the relationship is progressing	Offer honest and open feedback on how the relationship is progressing	[73, 83, 86]

Table 1 — Proposed Attributes, Example Objectives and Potential Metrics for Improving and Assessing Mentoring Relationships (continued)

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Psychosocial and career			
Providing motivation and facilitating coping efficacy	Scaffold research work in ways that yield periodic success; celebrate the successes and offer support after failures	Acknowledge that research frequently involves setbacks, and develop strategies to deal with them	[78, 79]
Developing mentee career self-efficacy	Foster and affirm mentees' career aspirations	Seek opportunities to explore and prepare for a career	[87]
Developing science identity	Recognize mentees as scientists	Affirm themselves as scientists	[44, 53, 76, 78, 79, 82]
Developing a sense of belonging	Create a welcoming and inclusive research environment, especially at transition points	Actively engage and establish relationships with research team members	[88]
Culturally responsive/diversity			
Advancing equity and inclusion	Employ strategies for recognizing and addressing issues of equity and inclusion	Identify strategies for recognizing and addressing issues of equity and inclusion	[37, 73, 75]
Being culturally responsive	Effectively negotiate dialogue across diverse dimensions	Effectively negotiate dialogue across diverse dimensions	[42]
Reducing the impact of bias	Consider their unconscious biases and regularly check that they are not negatively impacting their own or their research team's behavior	Recognize unconscious bias, regularly check that it is not negatively impacting their behavior, and address it when they observe it	[89]
Reducing the impact of stereotype threat	Recognize, acknowledge and work to reduce stereotypes that may negatively impact their mentees	Recognize stereotypes associated with their group identity, and address them to reduce potentially negative impacts	[90–92]

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Attributes for effective mentoring relationships	Example of measurable learning objective: <i>Effective mentors can</i>	Example of measurable learning objective: <i>Effective mentees can</i>	Existing metrics*
Sponsorship			
Fostering independence	Continuously assess mentees' development, and design increasingly challenging tasks and projects to advance mentees' independence	Push themselves to increase responsibility for and ownership of their research, while asking for support and guidance as needed	[73, 75, 84]
Promoting professional development	Identify opportunities for mentee professional development, and support their engagement in them	Identify and engage in opportunities to develop the professional skills needed to become a successful scientist	[75, 78, 79]
Establishing and fostering mentee professional networks	Introduce and facilitate relationship building between their network of colleagues and their mentees	Actively identify and seek ways to meet and establish relationships with potential future colleagues in the discipline	[79]
Actively advocating	Promote mentees' work; provide professional support	Report successful outcomes to mentor; seek out and accept advocacy	[79]

* This table includes metrics that have been used to assess the knowledge and skill of mentors and to assess mentoring relationships, as well as metrics that have been used outside the context of studying mentoring relationships but have potential to be adapted for that purpose. The list of metrics is not meant to be exhaustive, but rather to offer starting points for further work.

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For references see <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4995122/>

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Embedded Practices, Succession Planning and Micro-Messages: What We Know Now

Becky Wai-Ling Packard, professor of psychology and education at Mount Holyoke College, also researches mentoring, with an emphasis on how individuals such as first-generation college students, women and persons of color construct mentoring networks as they navigate complex

pathways toward higher education and work. Her presentation focused on some of her research to date and her book, *Successful STEM Mentoring Initiatives for Underrepresented Students*. She emphasized the importance of embedding mentoring in education, which can scale up its impact, and of faculty learning how to apply research that works.