

Science & Society

Building Diverse
Mentoring Networks that
Transcend Boundaries
in Cancer Research

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Scientists at all career stages can benefit from building diverse mentoring networks that transcend boundaries and promote inclusion. In this piece, we define mentoring networks, describe examples of how mentoring networks can reinforce scientific identity, and help minority scientists overcome unique challenges to achieve their goals in cancer research.

What is a Mentoring Network?

While supportive mentorship is necessary to enable trainees to accomplish their scientific goals and achieve their career aspirations, mentees often rely solely on one mentor (e.g., thesis advisor) while navigating their career trajectory. As the academic landscape becomes increasingly diverse, a single mentor may be insufficient for diverse scholars, who face unique challenges during their scientific journeys. Furthermore, having exposure to mentors from diverse backgrounds strengthens scientific identity by providing access to scientific role models who provide experience-based emotional, social, and cultural mentoring to promote the retention of scientists [1]. As such, we believe diverse mentoring networks offer a more expansive and productive mechanism for mentees to

grow scientifically, compared to conventionally defined mentoring circuits.

Mentoring networks were originally described in 2001 by the Ontario College of Family Physicians to provide a more well-rounded clinical training environment [2]. Notably, this definition has expanded to encompass collaborative mentoring for basic sciences and medical research, scholarship, and more. We define diverse scientific mentoring networks as expansive groups of connections between a mentee and many mentors (peer or senior mentors) supported by communities (e.g., formal mentoring programs, societies, networking events, and social media) (Figure 1). Mentoring networks can be built from primary mentoring (direct interactions between mentor and mentee) and secondary mentoring (interactions between mentee and a connection of a mentor). While primary mentoring relationships are crucial for fostering the development of mentees, secondary/indirect mentorship for supplemental support can further improve the research, career, and professional development of mentees in cancer research. As Persons Excluded because of Ethnicity or Race (PEER) scientists face unique challenges which advisors may not have the necessary tools to help them navigate [3,4], a mentoring network provides supplemental resources to complement their career trajectory. This increases the range, density, and strength of the network to build communities of PEER scientists where diversity may be lacking.

There is a severe lack of underrepresented minority (URM) scholars in biomedical research, which has been attributed to a lack of retention of URM scientists, suggested to be due to environmental factors [5], for example, microaggressions, cultural exclusion, or lack of acceptance by colleagues. This lack of representation can promote a sense of isolation, which can contribute to PEER researchers leaving science altogether [6–8]. Thus, mentoring networks offer an accessible mechanism

for both PEER and non-PEER mentors to provide mentorship, advisement, and sponsorship to all scholars, which can be particularly helpful for promoting a sense of inclusion for PEER scholars, who may otherwise feel excluded. Furthermore, mentoring networks concentrated with PEER scientists provide the opportunity for informed feedback and advice regarding specific hurdles PEERs often face, as many of the participants may have navigated similar journeys. Herein, we describe how building mentoring networks supportive of one's personal and professional goals is vital for mentees to assume and to establish their scientific identity, which we believe is particularly important for PEER scientists.

How can we Build Mentoring Networks?

As travel restrictions and geographical distance can limit in-person connections, we encourage scientists using virtual platforms to generate a collaborative network that transcends physical boundaries. For example, joining a program that facilitates virtual connections between scientists in common fields can support near-peer mentoring, while formalized grant writing mentorship programs may enable early-career scientists to connect with established investigators for specialized training. These programs allow scientists to extend their networks with limited disruptions to their research productivity or family obligations. Additionally, pre-conference online networks can be used to integrate new cancer researchers into the community prior to attending large meetings, thereby promoting inclusion. We believe these opportunities are essential steps towards learning how to trust others, develop collaborations, and help build back bridges when the science technology engineering mathematics (STEM) field has historically maimed trainees from disadvantaged backgrounds.

Due to unexpected disruptions in work due to natural disasters [volcanic eruptions, earthquakes, hurricanes, flash floods,

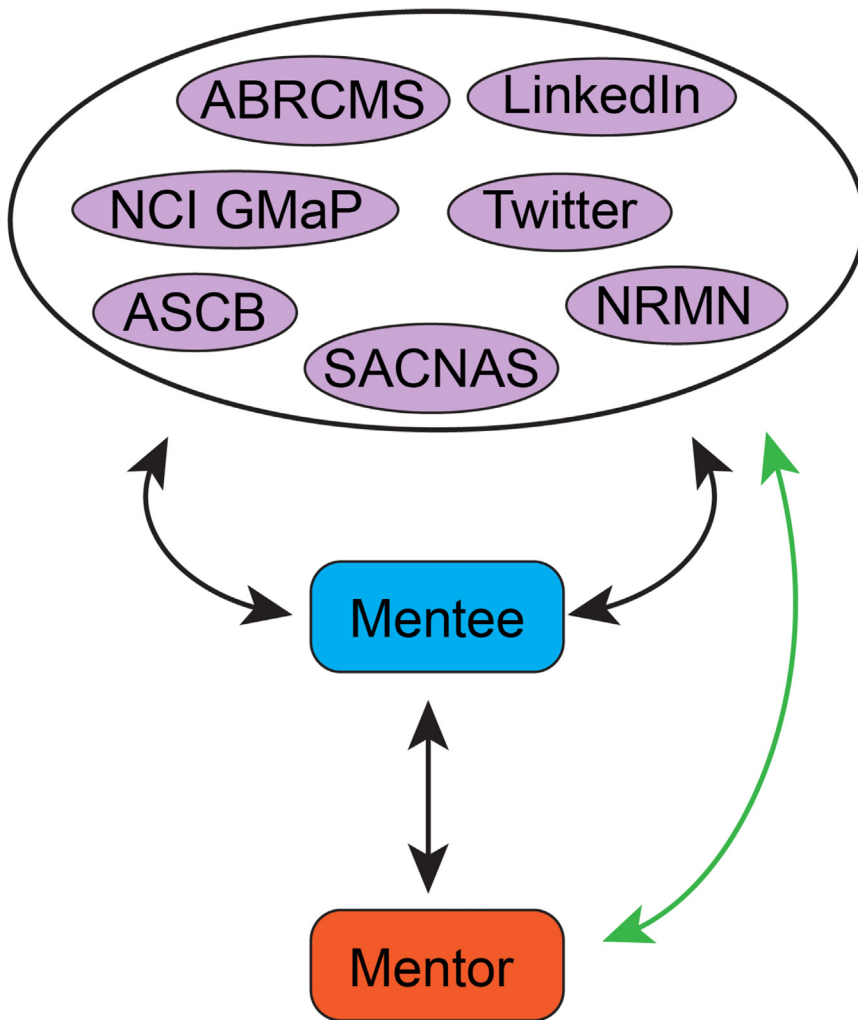


Figure 1. Example of a Mentoring Network. A traditional mentee (blue)–mentor (orange) relationship is shown connected by in-person or digital interactions (double-headed straight black arrow). An example of a mentee’s mentoring network is depicted above, consisting of interactions with scientists from professional societies (SACNAS, ABRCMS, and ASCB), which are strengthened by social media connections (Twitter and LinkedIn). A mentee may also participate in formalized mentoring programs [i.e., ASCB Faculty Research and Educational Development (FRED) Program] to support near-peer mentoring and formalize mentorship of diverse scientists with similar interests. A green arrow connects the mentor to components of a mentoring network, where the mentor (PEER or non-PEER) provides guidance to both PEER and non-PEER mentees. Abbreviations: ABRCMS, Annual Biomedical Research Conference for Minority Students; ASCB, American Society for Cell Biology; NCI GMaP, National Cancer Institute Geographic Management Program; NRMN, National Research Mentoring Network; PEER, Persons Excluded because of Ethnicity or Race; SACNAS, Society for Advancement of Chicanos/Hispanics and Native Americans in Science.

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events. Moreover, sending a simple follow-up email to a seminar speaker could initiate a connection that may develop into a mentoring relationship [9]. Additionally, specialized networking programs hosted by funding agencies, societies, and institutions, exist to enable scientists to build field-specific mentoring networks (Table 1). We believe trainees can leverage these diverse, yet focused networks to support their scientific and professional development throughout all stages in their career.

How can Trainees Draw Upon their Mentoring Network for Allyship, Sponsorship, and Community?

The evolution of scientific mentorship comes with reenergizing an often-neglected scientific skillset, allyship [10,11]. Allyship is the long-lasting process in which established scientists foster empathy towards the challenges of marginalized groups (e.g., PEER, LGBTQIA+, women, first-generation, disabled scientists, socioeconomically disadvantaged, rural communities, and ethnic/religious minorities). The goal of allyship is to increase inclusivity displayed in public (e.g., speaking up for PEERs at conferences or publicly defending minority trainees) or private (e.g., signing onto initiatives to promote diversity in society activities or actively pursuing grants to fund inclusive training initiatives). An ally is someone who supports the social identity of marginalized groups and fights injustices against mentees (e.g., a senior investigator who empathizes with the #BlackLivesMatter movement) and is willing to look beyond the initial stages of allyship to foster long lasting mentoring that becomes sponsorship [12,13].

or the coronavirus disease 2019 (COVID-19) pandemic], alternative methods of communication are critical to maintaining mentoring networks. While in-person interactions at conferences, seminars, and workshops can initiate a connection, online

interactions via digital platforms can be used to strengthen a sense of belonging (-Table 1). For example, Twitter and LinkedIn can be used to compile and organize digital connections with scientists you may interact with at conferences or other professional

Sponsorship is the process in which scientists commit time and resources to develop a mentee’s potential. The word ‘sponsor’ is derived from ‘*spondere*’ which means ‘to make a promise’. A sponsor (also termed advocate) is someone who leverages their privilege to advance a mentee’s career. For example,

Table 1. Resources for Building Mentoring Networks

Resource	Examples
American Association for Cancer Research (AACR)	Minorities in Cancer Research (MICR) Membership Group, Women in Cancer Research (WICR)
American Society for Cell Biology (ASCB)	Online mentoring communities, Mentor Match, Minority Affairs Committee (MAC) Travel Awards, Faculty Research and Education Development Program, and Women in Cell Biology (WICB)
American Society of Clinical Oncology (ASCO)	Virtual Mentoring Program, Diversity Mentoring Program
Annual Biomedical Research Conference for Minority Students (ABRCMS)	Annual meeting activities
Burroughs Wellcome Fund	Postdoctoral Enrichment Program, awardee's retreat, Collaborative Research Travel Grants
Cancer Research Institute (CRI)	Cancer Immunotherapy Consortium
Damon Runyon Cancer Research Foundation	Damon Runyon Fellowship, fellows' retreat and networking events
Endocrine Society	Future Leaders in Endocrinology (FLARE)
Fred Hutchinson Cancer Center	Dr. Eddie Méndez Scholars Symposium
Keystone Symposia Fellows Program	Diversity Fellows Program
National Cancer Institute (NCI)	Geographic Management of Cancer Health Disparities Program, Career Mentoring Advantage Program
National Heart, Lung, and Blood Institute (NHLBI)	Programs to Increase Diversity Among Individuals Engaged in Health-Related Research (PRIDE)
National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)	Network of Minority Health Research Investigators (NMRI)
National Institute of General Medical Sciences (NIGMS)	Hispanic Alliance for Clinical and Translational Research (The Alliance) – UCC-SOM, UPR-MSU, and PHSU
National Institute of General Medical Sciences (NIGMS)	Preparing Future Faculty: RISEing to the Challenge – UCC-SOM
National Institute on Minority Health and Health Disparities (NIMHD)	The Research Centers in Minority Institutions Translational Research Network
National Research Mentoring Network	MyNRMN and MyMentor features
U.S. Department of Education – UPR-MSU and UCC-SOM Title V Cooperative Team	Research Education Toward Opportunities (RETO)-Mentorship Offering Training Opportunities for Research (MOTOR) and Clinical Translational Mentored Teams (CTMT) which facilitate Intensive Development and Experiences in Advancement of Research and Increased Opportunities (IDEARIO)
Utah Advanced Course on Mentorship and Leadership on Cancer-Related Health Disparities	NCI Awardee Skills Development Consortium
Twitter	@BlackinCancer, @BlackandSTEM, @BlackinCMBio, @BlackinChem, @LatinxinSTEM, @LatinXChem, @cietificolatin, @NativesInSTEM, @DisabledStem, @500QueerSci, @CienciaPR, @LGBTSTEM, and @500womensci

sponsors may nominate mentees for speaking engagements, research awards, advisory committees, or provide access to resources (e.g., equipment, materials, and funding). Mentees who receive sponsorship from members of their mentoring networks gain a sense of belonging and acceptance in their scientific research fields.

As such, we suggest mentees strategically draw upon the strengths and connections of established scientists within their networks, who have the resources to advance their careers in cancer research.

One straightforward mechanism to secure allyship and sponsorship is through mentee

participation in activities hosted by professional societies (Table 1). The infrastructure of professional societies incorporates the needs of members of all levels ranging from early-career trainees to established investigators, while connecting a diverse set of scientists with common interests. Participation in activities carried out by these societies (e.g., annual meetings, grant writing, or mentoring workshops) provides opportunities for mentees to establish and nurture interactions with diverse scientists with the goal of generating productive networks. At the same time, this setting also provides established scientists opportunities to engage with mentees and provide support, often resulting in a symbiotic relationship with bidirectional gain for both parties. In this scenario the established scientist might evolve into a mentor, ally, sponsor, or even a collaborator, which is particularly valuable to ensure scientists from marginalized groups feel valued, supported, heard, and ultimately, included. Thus, we highly endorse using mentoring networks to garner a sense of community and belonging, which can combat inequities in the scientific landscape [6–8].

Furthermore, we believe the engagement of mentors in mentoring networks must be shared between PEER scientists and non-PEER scientists, to uphold the core values of scientific institutions regarding diversity, equity, and inclusion (DE&I). It is well documented that PEER scientists experience increased service burdens regarding DE&I work [14], and thus, we believe it is necessary for non-PEER scientists to take on some of this responsibility to promote a more equitable environment. Through participation in these mentoring networks, non-PEER scientists can gain a deeper understanding of specific considerations for mentoring PEER scientists, which will benefit both mentors and mentees. These experiences better prepare mentors to provide an environment where PEER mentees can achieve maximal productivity. As such, sharing this responsibility between PEER

and non-PEER mentors will benefit the scientific enterprise by enabling the next generations of scientists to thrive.

Additionally, non-PEER mentor participation in mentoring networks, particularly those designed to support PEER scientists, will benefit mentors directly. For example, mentors may gain collaborators, colleagues, or new partnerships with institutions outside of their realm. Moreover, as institutions are beginning to assess DE&I efforts as a part of tenure/promotion evaluations, non-PEER mentors will gain valuable experience working with PEER scientists, which they may not normally have the opportunity to pursue.

How can Mentoring Networks Reinforce Scientific Identity to Enable PEER Scientists to Overcome Unique Challenges?

Mentoring networks can reinforce scientific identity to enable trainees to overcome unique challenges by providing guidance, opportunities, and consistent feedback from afar [15]. For example, mentees may connect with mentoring networks that span multiple institutions, countries, and continents through virtual and face-to-face methods, to foster organizational cultures supporting quality mentorship in medical research. Additionally, mentoring networks can generate a sense of community for PEER scientists who may not have access to similar support at their own institutions.

Mentoring networking can generate a friendly environment amongst peers built from the fundamental and cultural values at the forefront of the minority scientist experience. We believe this will ultimately improve the scientific enterprise by increasing cancer-related discovery and health equity. Thus, we envision this level of team building will empower PEER scientists to tackle common barriers because a network exists to enable informal discussions regarding similar challenges. For example, a PEER

scientist may be the only PEER within their department, which can dampen their sense of scientific identity and even lead to conformity. In our experience, mentoring networks highlighting PEER scientists have helped to reinforce our scientific identities, by validating our existence in a space infrequently occupied by PEERs. By developing one's scientific identity, scientists are better prepared to tackle these hurdles by leaning on the supportive network of PEERs and mentors within one's mentoring network.

Concluding Remarks

The process of scientific development becomes easier and more accessible with the assistance of mentoring networks, which we believe can promote a more diverse academic setting. Building diverse mentoring networks that transcend boundaries provides mentees with respect and acceptance in spaces from which PEERs are often excluded. Notably, the acknowledgment and appreciation for the mentees' work creates a culture of collegial and considerate decorum, which results in increased productivity, global politeness, and ultimately equality and inclusion.

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Declaration of Interests

There are no interests to declare.

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