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A review of mentoring deaf and hard-of-hearing scholars

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Abstract

Diversification of the scientific workforce usually focuses on recruitment and retention of women and underrepresented racial and ethnic minorities but often overlooks deaf and hard-of hearing (D/HH) persons. Usually classified as a disability group, such persons are often members of their own sociocultural linguistic minority and deserve unique support. For them, access to technical and social information is often hindered by communication- and/or language-centered barriers, but securing and using communication access services is just a start. Critical aspects of training D/HH scientists as part of a diversified workforce necessitates: (a) educating hearing persons in cross-cultural dynamics pertaining to deafness, sign language, and Deaf culture; (b) ensuring access to formal and incidental information to support development of professional soft skills; and (c) understanding that institutional infrastructure change may be necessary to ensure success. Mentorship and training programs that implement these criteria are now creating a new generation of D/HH scientists.

Keywords

American Sign Language; communication accessibility; deaf and hard-of-hearing persons; designated interpreter; faculty and student diversity; workforce diversity

The National Institutes of Health (NIH) Working Group on Diversity in the Biomedical Research Workforce has recognized that achieving diversity in life science disciplines is critical to ensure that the most creative minds have opportunities to contribute to national research and health goals (NIH WGDBRW, 2012). Yet, data from the National Science Foundation show that “women, persons with disabilities, and three racial and ethnic groups – blacks, Hispanics, and American Indians or Alaska Natives – are underrepresented in [science and engineering education and employment]” (NSF NCSSES, 2017, p. 2). Toward this goal, a fundamental shift in the way scientists are trained and mentored must occur to attract and retain individuals from underrepresented communities (NIH WGDBRW, 2012; NSF BPWG, 2014) since diverse teams are more effective at problem solving (Hong & Page, 2004) and improving the quality of research results (Campbell, Mehtani, Dozier, & Rinehart, 2013; Freeman & Huang, 2014). Diversification of the scientific workforce brings together professionals with different backgrounds, knowledge bases, and experiences (DeLisa & Lindenthal, 2012; McKee et al., 2011; Thew, Smith, Chang, & Starr, 2012; Valentine, Lund, & Gammie), leading to the development of innovative discoveries and translations that are broadly relevant and applicable to all populations.

In part due to the increased expectations that the U.S. federal government is placing on recipients of sponsored research awards to include underrepresented persons in grant-funded activities, many colleges and universities have invested resources in developing mentorship programs to improve how such students are trained for research careers (Strayhorn, 2010) as

well as formal training for faculty and peer mentors (Lewis et al., 2017; Lewis et al., 2016). These programs emphasize inclusion of students from underrepresented minority groups (including persons with disabilities) and create pipelines for undergraduate and graduate students who aspire to careers in medicine, biomedical and behavioral research, and other science fields. Some of these programs create experiential learning environments in which faculty members and lab directors become facilitators of student learning (National Research Council, 2006). Studies show that research mentorship programs increase the rates of college completion, entry into graduate-level training, and enrollment in doctoral or professional programs (Gregerman, Lerner, von Hippel, Jonides, & Nagda, 1998; Hathaway, Nagda, & Gregerman, 2002; Junge, Quinones, Kakietek, Teodorescu, & Marsteller, 2010; Lopatto, 2007; Villarejo, Barlow, Kogan, Veazey, & Sweeney, 2008). In training programs, faculty and student diversity enriches the learning environment, advancing intellectual engagement and democratic outcomes (Denson & Chang, 2009; Killpack & Melon, 2016).

Among those who are underrepresented in scientific careers are deaf and hard-of-hearing (D/HH) individuals (McKee, Smith, Barnett, & Pearson, 2013; NSF NCSES, 2017; Listman & Dingus-Eason, 2018). For them, the intersectionality of disability with membership in a sociocultural linguistic minority requires provisioning of effective accommodations for facilitating communication (Moreland, Latimore, Sen, Arato, & Zazove, 2013; Zazove et al., 2016) as well as successful mentored experiences with culturally competent mentors (Lewis et al., 2017; Lewis et al., 2016) to prepare these individuals to become successful scientists.

Mentor-mentee cultural awareness: cross-cultural dynamics pertaining to deafness, sign language, and Deaf culture

The topic of mentoring and its successful implementation is of considerable interest in the literature. Herein, *Deaf*, with a capital D, is used to refer to individuals who not only use a signed language, but who also embrace the cultural values and beliefs of the greater Deaf community; either by choice or by circumstance, not all deaf persons are members of a Deaf community. Although a study by Foster and MacLeod (2004) focused on the role of mentoring relationships in the career development of successful D/HH persons, it also provided a comprehensive summary of the general roles and responsibilities of successful mentors and the characteristics of successful mentor-mentee relationships. This dyad is built on trust and respect (NCSET, 2002), “requires effort, continuity, and consideration for different learning styles [and] demands hard work, discipline, rigueur, creativity, honesty, and integrity” (Centeno, 2002, p. 1214). A mentor provides “guidance, support, and encouragement ... while modeling such skills as communicating effectively, demonstrating empathy and concern for others, and being willing to be open and honest” (Mullen, 2001, p. 17). Mentoring allows “a protégé to perform to their highest potential, leading to career advancement” (Fracaro, 2002, p. 10) and is “an intense caring relationship ... [that promotes] both professional and personal development” (Caffarella, 1992, p. 38).

The navigation of cross-cultural dynamics in a mentor-mentee relationship can be key to the success of the partnership. For example, some female graduate students with male faculty advisors feel dismissed or ignored by them (Schroeder & Mynatt, 1993). Other researchers

have discussed how Native American students and Asian/Pacific Islanders thrive best with frequent interactions with faculty advisors (Lundberg & Schreiner, 2004) and how female African-American graduate students prefer having female African-American mentors (Patton, 2009). As an “agent of socialization” a faculty member must assume the crucial role of helping mentees, especially those from underrepresented groups, to become fluent in the “norms and values of their discipline” through experiences in public speaking, attending professional conferences, and reviewing journal manuscripts (Lechuga, 2011, p. 766). Furthermore, demonstrating cultural awareness and sensitivity is a key contributor to the success of a cross-cultural faculty-graduate student relationship (Lechuga, 2011).

Although ethnicity and gender are often major factors that govern mentoring relationships, disability, language, and culture are other areas that influence a person’s access to cultural and navigational capital (Listman, Rogers, & Hauser, 2011; Listman & Dingus-Eason, 2018). In this vein, it has been noted that “women, minorities, and disabled persons ... have less often experienced and benefited from informal mentoring relationships compared to non-disabled, majority men” and they “may not be as savvy about how to establish and sustain mentoring relationships” (Foster & MacLeod, 2004, p. 444). People with a low-incidence disability such as deafness often have few opportunities to meet others like them and to share experiences and advice for overcoming challenges, especially if they live in rural or otherwise secluded environments (Stumbo et al., 2014). For such persons, emotional support that validates their abilities and recognizes their disability is vital to promoting success (Foster & MacLeod, 2004).

As is the case for other underrepresented individuals, D/HH persons need mentored experiences that are linguistically and culturally accessible and supportive (Braun, Gormally, & Clark, 2017; Braun et al., 2018). As they grow up, they often experience familial, social, and academic interactions differently than hearing people do (Barnett, 1999, 2002; Hauser, O’Hearn, McKee, Steider, & Thew, 2010). When they enter academia, these differences persist, such that cultural and linguistic barriers and misconceptions that some hearing persons have about them can hinder their success in academia (Hauser, Maxwell, Leigh, & Gutman, 2000; Solomon & Campbell, 2006). Yet, positive mentoring relationships, such as those established through undergraduate research opportunities, serve to advance D/HH students in fields where they are underrepresented – not only by providing them with specialized training but also empowering them to shed stereotype threats they may have developed internal to themselves (Pagano, Ross, & Smith, 2015). Establishing a research environment that promotes their success with technical accommodations (such as through the engagement of sign language interpreters) and that also addresses and promotes more general aspects of academic and personal development (such as inclusion, equal treatment, patience, respect, and flexibility) allows a research mentor to build and maintain a successful research team. Gehret et al., (2017) surveyed D/HH undergraduate students involved in bioscience-related research and made recommendations for mentors and peers to promote academic participation and success of this underrepresented group including: (a) implementing flexible communication methods and practices in the lab (e.g., dry-erase boards and texting/messaging services) to accommodate non-signers; (b) planning experiments in advance to reduce or resolve procedural problems; and, (c) matching

undergraduates with peer mentors who are flexible, patient, and empathetic workers and communicators.

Mentors who have a deaf mentee will therefore need to assume a holistic approach. It is important for a mentor to strive for effective communication with a mentee. It also is critical for a mentor to understand deafness, sign language, and Deaf culture as well as the implications that these attributes have on a deaf person's educational and career progress (Braun et al., 2017; Saur, 2001; Saur & Rasmussen, 2003). In the beginning of a mentor-mentee relationship, mentors should endeavor to learn about Deaf culture and how it intersects with the cultural norms of hearing populations. Further, mentors and deaf mentees should collaborate to identify a mentee's particular strengths and where the mentee needs to improve. For advice on how to proceed, hearing mentors who have no prior experience working with deaf or hard-of-hearing individuals will likely want to consult with a deaf or hard-of-hearing scientist or with a hearing mentor who is familiar with mentoring such persons. In such a situation, bringing on a deaf, hard-of-hearing, or *Deaf-aware* hearing co-mentor may be ideal.

Ensuring access to formal and incidental information to support development of professional soft skills

A critical factor a mentor should understand is the degree of familiarity a deaf person may or may not possess regarding the sociocultural norms of majority hearing populations that differ from those of the Deaf population, especially those inherent to an *academic* environment. For instance, through informal side conversations and overhearing nearby discussions, hearing persons acquire implicit knowledge that is generally inaccessible to deaf persons. This knowledge benefits hearing persons greatly, allowing them to be more informed about how to relate to and put into practice environment-specific attitudes, beliefs, and values: the so-called *soft skills* including professional relationship standards, email and meeting etiquette, conflict resolution strategies, and navigation of workplace politics (Maassen, 1996). Not surprisingly, students who persist in scientific fields are those who can better anticipate, tolerate, and assimilate into the academic atmosphere and institutional culture, a situation that is generally more challenging for underrepresented minorities (McGee & Keller, 2007; Seymour & Hewitt, 1997; T. Y. Smith, 2000). The resulting impacts, including on educational (Task Force on Health Care Careers for the Deaf and Hard-of-Hearing Community, 2012; Traxler, 2000), employment and income (McKee, McKee, Winters, Sutter, & Pearson, 2014), health knowledge and health literacy (McKee et al., 2011; Chin, et al., 2013), mental health (Fellinger, Holzinger, & Pollard, 2012), and physical health (Barnett, McKee, Smith, & Pearson, 2011) outcomes can be wide ranging.

A mentor, therefore, needs to take on the responsibility of working to fill gaps in academic, social, and cultural capital that a mentee may possess. For example, just as hearing mentees have opportunities to learn how to navigate the culture of academia through a mentor's personal stories (B. Smith, 2007), deaf persons benefit from such information as well. Furthermore, qualitative research with deaf professionals shows that hearing colleagues who use sign language with some proficiency and are Deaf-aware (Braun et al., 2017) can

provide deaf persons invaluable information about the various goings-on in the office or laboratory (i.e., the *informal curriculum*). Creating such connections to the prevailing academic and professional culture supports the resilience of D/HH individuals, thereby building confidence for day-to-day interactions and laying the foundation for a successful career (Kavin & Brown-Kurz, 2008; Kurz, Hauser, & Listman, 2016). A mentor can also help a deaf or hard-of-hearing mentee to navigate the complex linguistic environment in scientific disciplines. Explaining field-specific vocabulary and concepts to mentees as well as to an interpreter or captionist will improve the quality of communication in classroom, laboratory, and meeting environments. An interpreter's own assimilation into academic culture as well as into the deaf person's specific discipline requires persistence and investment of time and energy (Hauser & Hauser, 2008).

The power of engaging an experienced *deaf* mentor or team of deaf scholars with hearing mentors who are Deaf-aware is undeniable (Braun et al., 2017). Previous research on underrepresented minorities who are hearing shows that there are clear benefits to having mentors of the same cultural background. Such mentors have direct, personal experience, knowledge, and skills in navigating academia and science that prove invaluable to similarly-situated mentees. They are also better positioned to provide effective psychosocial and career development support given their shared point of cultural reference (Ensher & Murphy, 1997; Koberg, Boss, & Goodman, 1998). D/HH mentors share their own tales of struggle and triumph in navigating academia (Kurz, Hauser, & Listman, 2016), experiences hearing mentors typically lack and thus cannot share. From learning to interact with co-workers to understanding how to arrange for and work with sign language interpreters at conferences, successfully navigating such issues makes training and work environments more productive for D/HH mentees. The results of such collaborations can be quite fruitful. For example, deaf, hard-of-hearing, and hearing scholars have worked together to develop culturally appropriate research designs to study deaf mothers' breastfeeding experiences (Chin et al., 2013) and for cardiovascular perspectives (McKee et al., 2011) among a Deaf community. Additionally, Deaf and hearing researchers are working together to use a community-based participatory research (CBPR) framework for health research with Deaf communities (Barnett et al., 2018) and have collaborated to examine and address the problem of intimate partner violence (Mastrocinque et al., 2017).

Given the degree to which deaf persons are underrepresented in academia in general and in STEM (science, technology, engineering, and math), biomedical, behavioral, and translational science in particular, there are likely few potential deaf mentors in any particular field of study. Whether or not there are *local* deaf mentors, mentees can be introduced to the deaf scientific community via social media and other online resources (Buckley, Smith, DeCaro, Barnett, & Dewhurst, 2017). The Association of Medical Professionals with Hearing Loss (AMPHL) is a particularly valuable resource. Mentees should have opportunities to attend research meetings where they meet other deaf scientists, such as the regular AMPHL meeting or the Deaf-Engaged Academic Forum - Rochester (DEAF-ROC), formerly the Rochester Summer Research Training Institute (RSRTI) for D/HH scientists and their mentors. Some professional societies have committees or working groups that focus on issues that impact students and professionals with disabilities such as the Special Interest Section on Deafness in the American Psychological Association, the

Chemists with Disabilities committee of the American Chemical Society, or the Minority Affairs Committee of the American Society for Biochemistry and Molecular Biology (ASBMB) (Booker, 2013; Rozovsky & Booksh, 2015). These groups arrange work-related and social events within larger professional meetings, thereby allowing for in-person networking to take place, or sponsor training opportunities in STEM for students with disabilities (Rozovsky & Booksh, 2015). Additionally, workshops at national meetings presented by deaf and Deaf-aware (hearing) faculty mentors and D/HH mentees inform hearing mentors and mentees with no or limited experience about best practices for mentoring and collaborating with D/HH individuals.

Effecting institutional change to ensure successful language accommodations

Although taking on a deaf or hard-of-hearing mentee involves many of the same general considerations as does taking on one who is hearing, it also includes the need to assume responsibility for communication effectiveness. It is incumbent upon a mentor and host institution to understand the regulations (Berry et al., 2011; Schwartz, 2012; Zazove et al., 2016) that pertain to the successful securing and deployment of access services such as sign language interpreting, captioning, and notetaking. Although there are laws that mandate the provisioning of access services for D/HH persons, establishing a workplace in which communication diversity is valued, encouraged, and promoted is vital (McKee et al., 2016). Section 504 of the Rehabilitation Act of 1973 (U.S. Department of Justice, 1973) and the Americans with Disabilities Act (ADA) of 1990 (U.S. Department of Justice, 1990) require universities and laboratories to make communication and information accessible to students, trainees, and employees. However, simply securing and implementing a service does not guarantee its effectiveness given that deaf persons have varied communication needs and preferences, degrees and natures of deafness, and other potentially unique characteristics. Of note, deaf or hard-of-hearing individuals may not be in a position to provide sufficient guidance regarding necessary communication accommodations within a given work site until they have actually worked there long enough to comprehend the communication features and challenges that are inherent in the environment. Mentors should therefore be proactive in anticipating the characteristics of a given communication environment and plan for them in advance as best as possible. Above all, improvements made to the accessibility of information benefit everyone, hearing, hard-of-hearing, and deaf.

Understanding and securing appropriate access services

The most common kinds of access services provided include sign language interpreters, media captioning, real-time captioning (via Communication Access Real-time Translation (CART) or C-Print), FM loop systems, and notetakers (see Table 1).

Direct consultation with deaf mentees about the most appropriate services for their particular needs is important and may involve further adjustment after initial decisions are made. Just as for the installation and maintenance of other accessibility-related devices such as wheelchair ramps and lifts, the costs for communication access services are borne by the institution. The ADA considers the resources of the entire organization, not those of an

individual academic department, research grant, or disability services office, when deciding whether or not the cost of providing such services constitutes an unreasonable burden. In cases where work is supported by research funding, namely that provided by the federal government, supplemental funds sometimes are available to cover the costs of access services. Securing and delivering communication access services at this level of professional education might be a new experience for some universities such that infrastructure change may be necessary to make successful accommodations possible. A mentor will certainly need to be familiar with not only a deaf mentee's rights but also best practices for ensuring that education and training are accessible (Campbell, Rohan, & Woodcock, 2008; Kushalnagar, & Rashid, 2008).

For D/HH people who use sign language, the provisioning of interpreting services deserves attention. Although some sign language interpreters have specific knowledge and experience appropriate for interpreting in an advanced scientific discipline, many do not (Hauser & Hauser, 2008; Kushalnagar & Rashid, 2008). Developing a successful partnership between a deaf person and an interpreter may involve more than simply identifying and hiring a "generalist" or even a typical post-secondary education interpreter. It might require trying out different interpreters before finding the right match. The term *designated interpreter* (DI) is increasingly used to refer to an individual whose knowledge base and other skills form a strong match with a deaf individual's professional needs and preferences (Hauser & Hauser, 2008). A DI becomes the primary interpreter by learning the necessary vocabulary in English and ASL for the mentee's environment, including discipline-specific terms and lingo, project titles, and persons' names. Importantly, the DI facilitates bidirectional communication not only through the production of sign language for the mentee but also conversion of the mentee's signs to spoken language.

A DI and other team interpreters should have national or state certification in sign language interpreting to ensure minimum competency. However, even with appropriate interpreting certifications, a DI cannot provide full communication access to an academic environment on par with the experiences of a hearing person. Deaf mentees and their mentors should together provide feedback to the DI and other interpreters regarding inter- and intrapersonal, linguistic, and sociocultural preferences that are environment-specific. Mentees and interpreters should negotiate how an interpreter should ask for clarification if information is missed, whether to use American Sign Language (ASL)- or English-based concepts and grammar, and how to prioritize communication flow when multiple hearing participants are talking simultaneously. Development of a communication plan that includes sufficient availability of a DI is vital to ensuring the success of both the mentor, mentee, and the overall research environment.

Without a DI, inconsistencies across multiple interpreters who do not have knowledge specific to the mentor and mentee's scientific field will reduce the mentee's access to both content-specific and incidental information (Campbell et al., 2008; Clark & Finch, 2008; Earhart & Hauser, 2008). Further, the communication flow from the mentee to others can be hindered, causing problems in day-to-day work conversations as well as in more high-stakes situations such as research presentations at conferences, professional networking, and formal interviews. In these situations an interpreter's sign and voice production, if it does not

accurately represent the mentee, can impede the career advancement of a deaf or hard-of-hearing individual.

Ensuring a conducive communication environment

In addition to providing access services to facilitate communication, institutions and mentors should ensure that learning and working environments are designed to promote accessibility. The configuration of furniture, lighting, and general space in offices, classrooms, and labs have a significant impact on the accessibility of classes, meetings, laboratory work, and social events. While it is impossible to provide specific recommendations for every possible area, Table 2 summarizes some of the most important considerations that pertain to the accessibility of D/HH persons in an academic environment.

In general, any improvement to the accessibility of information will benefit everyone: deaf, hard-of-hearing, and hearing. For further discussion and consideration, numerous resources are available from the National Technical Institute for the Deaf at Rochester Institute of Technology, the University of Rochester's National Center for Deaf Health Research, the Deaf Wellness Center, Gallaudet University, the Rochester Bridges to the Doctorate for Deaf and Hard-of-Hearing Students program, the Rochester Postdoc Partnership to Advance Research and Academic Careers in Deaf Scholars IRACDA program, the RIT-Research Initiative for Scientific Enhancement Scientists-In-Training Program for Deaf and Hard-of-Hearing Undergraduates, DEAF-ROC, and AMPHL.

Proof of Principle: the Rochester pipeline for D/HH scientists

Because deafness is a relatively low-incidence disability, a robust and statistically powered research study to assess the validity of the practices recommended herein for mentoring and supporting D/HH individuals in mainstream colleges, universities, medical/professional schools, and other employment venues is not feasible. However, several NIH-funded programs have recently been implemented at the National Technical Institute for the Deaf (NTID) at Rochester Institute of Technology (RIT) through a partnership with the University of Rochester (UR) to support D/HH undergraduate and graduate students and post-doctoral fellows in the biomedical and behavioral sciences. These grant-funded efforts are bringing about transformative change in the academic research and didactic learning environments by implementing the strategies discussed herein.

The success of this academic pipeline is evident in a number of ways. As part of this ongoing collaboration, workshops on best practices for diversifying the workforce with D/HH individuals have been presented by Deaf and Deaf-aware faculty to prospective hearing faculty mentors, trainees, program faculty and administrative personnel. Participants report that they feel better prepared to work with D/HH scientists, thereby increasing the likelihood of a successful match of a scholar with a graduate program or lab. In the past four years, the number of D/HH graduate students in PhD programs in the University of Rochester School of Medicine and Dentistry (URSMD) has grown from one to six. Graduates of the Rochester Postdoc Partnership for Deaf Scholars IRACDA program have obtained faculty positions at research-intensive or predominantly undergraduate teaching institutions. At URSMD, the number of faculty with experience teaching, mentoring, or

collaborating with D/HH persons has grown with institutional transformation happening as well. Several key graduate program faculty and master mentors are being tutored one-on-one in ASL and two dedicated administrative positions have been created: an ASL interpreter-manager who oversees scheduling of access services for all D/HH professionals and an ASL-fluent ADA coordinator who works full-time in the Office of Graduate Education and Postdoctoral Affairs at URSMD.

Conclusions

The inclusion of researchers with diverse backgrounds, skills, and interests is critical to the advancement of science, but these findings can certainly be applied to other professional disciplines both academic and non-academic. Striving for the increased participation of traditionally underrepresented persons necessitates bringing D/HH persons into the fold as well. While this population generally benefits from the use of various kinds of communication-related accommodations and practices when interfacing with hearing persons, there are also important sociocultural aspects that must be considered for D/HH individuals to become successfully integrated in and contributors to research programs as scientists in their own right. Having mentors and institutions who are willing to support, develop, and promote the careers of such scholars by implementing a holistic strategy for their inclusion will help to ensure that this goal is achieved. The ongoing success of the Rochester pipeline for training D/HH students at the undergraduate, graduate, and postdoctoral levels demonstrates the viability of these practices in training a new generation of D/HH scientists.

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Table 1.

Various methods of providing communication accessibility to deaf and hard-of-hearing persons.

English Captions or Subtitles on Video Media	Although the ADA mandates making educational content available for persons with a disability, the addition of closed captions or subtitles embedded in video data is not uniformly done or regulated. Video media players may have an option in the menu to turn on these captions or subtitles. However, less widely distributed video media, such as those for academic audiences, often do not have captions. Relying on the automatically generated captions provided on a site such as YouTube, especially without reviewing them for accuracy before a video is shown in a class or a meeting, is <i>not</i> advised. Universities often have a mechanism (e.g., through the Office for Disability Services and Support) for faculty members to submit their video media to a captioning service and to receive a captioned version quickly.
Real-Time Captioning Services	Akin to a court reporter, a real-time captionist provides a transcript of a class or a meeting as it is taking place with only a short lag between the spoken word and when it appears on a screen. A captionist typically has a laptop or other device with a keyboard and types words as they are spoken. When generating the transcript, the captionist also indicates whether multiple people are talking, thereby helping the reader to understand the conversational flow. The printed word is displayed on a tablet, laptop, smartphone, or monitor that may only be viewable by a deaf user or projected on a screen to be seen by everyone in the room. A deaf user also can type on the device to have the captionist read his/her statement or question out loud for inclusion in a discussion with hearing people where an interpreter is not present.
Microphone and Loop Systems	Individuals who use hearing aids or cochlear implants with a T-coil switch can benefit from having meetings and classes in rooms equipped with a hearing loop (also called an induction loop). To use a hearing loop, an individual speaks into a microphone connected to the loop; the loop transmits the signal wirelessly to a listener's hearing device. Other systems, such as FM systems and those equipped with Bluetooth, work in a similar fashion. As with all communication, turn-taking is useful to optimize comprehension.
Notetaking Services	The physical and mental task of tracking linguistic and non-linguistic information during meetings and lectures is demanding and exhausting. When taking and reviewing notes during a presentation, a deaf individual must break eye contact with the visual communication (e.g., presenter, interpreter, captions) missing valuable information when doing so. Some universities have staff notetakers who are assigned to different meetings or classes. Other universities sometimes hire experienced student peers to serve as notetakers. Deaf persons might need to "try out" different notetakers before finding one that works for them, as each will have a different notetaking style.
Sign Language Interpreting	Some universities have sign language interpreters on staff while others have contracts with external interpreting agencies. Interpreters who work with deaf students in specialized STEM fields as well as biomedical, behavioral, and translational sciences must be qualified in terms of language skills and discipline-specific content knowledge. Deaf scholars should have at least one interpreter (a designated interpreter, or DI) who is familiar with their research and work environment, working with a small team of interpreters available to support the DI when needed. One interpreter is needed for times when face-to-face communication is periodic but two interpreters are needed for content-intense situations or for any situation where more than one hour of continuous interpreting is needed.

Table 2.

General considerations for seating, lighting, and meeting etiquette for successfully accommodating deaf and hard-of-hearing persons.

Seating	Consideration of seating in laboratories, meetings, classrooms, and other spaces is important to ensure that activities, lectures, and informal conversations are accessible and do not hinder participation. Classrooms, especially large lecture halls with fixed seating, are not optimal. A deaf person who uses sign language interpretation must have an unobstructed view of the interpreter, which means the student and the interpreter will usually be located near the front of the room. However, such an arrangement can make it difficult for a deaf person to determine which audience member is asking a question or making a point and can impede that person's ability to participate in any conversational flow given that the audience is located behind the deaf person. More desirable, is a smaller meeting room with tables arranged in a circle, rectangular, or "U" configuration to allow for easy viewing of the presenter, participants, and interpreter. Conversational turn-taking is more readily accommodated and participants' body language can be seen with such an arrangement. With a deaf presenter in a lecture hall, the sign language interpreter will need to sit in the front row facing the presenter. Amplification will help the interpreter's voice project to the back of the lecture hall. The microphone will need to be with the interpreter, and not attached to the podium at the front of the lecture hall.
Lighting	The lighting in a room should be bright and comfortable and should be configured so that an interpreter, presenter, and other participants all can be easily seen. Backlighting, such as from the sun shining through a window, makes it difficult to see facial expressions as well as hand and lip movements and quickly cause eye fatigue. For projected presentations, the lighting at the front of the room in the vicinity of the screen is often dimmed but doing so can make it difficult to see the interpreter or the presenter. An acceptable balance will need to be reached and time should be allotted to do so.
Meeting Etiquette	Organized turn-taking is crucial for the effective inclusion of deaf or hard-of-hearing persons in meetings. The moderator can ease the flow of communication by requiring participants to be acknowledged before contributing to the conversation. Doing so helps prevent anyone from dominating the discussion. It is vital to understand that there is a lag of several seconds or more from the time a person speaks to when that information is conveyed in sign or in captions. Keeping an eye on the captionist or interpreter to see when that person's movement ceases will indicate when the information has been fully conveyed. Pausing for a few seconds will generally allow for sufficient time to have elapsed, especially if a question is posed with the expectation of a response. Lastly, when projecting information as part of a presentation, allow the audience time to read each slide before discussing it. A person using an ASL interpreter or captionist can only focus on a slide or the access service provider, not both simultaneously.