

Welcoming Deaf Students into STEM: Recommendations for University Science Education

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ABSTRACT

Scientists are shaped by their unique life experiences and bring these perspectives to their research. Diversity in life and cultural experiences among scientists, therefore, broadens research directions and, ultimately, scientific discoveries. Deaf individuals, for example, have successfully contributed their unique perspectives to scientific inquiry. However, deaf individuals still face challenges in university science education. Most deaf students in science, technology, engineering, and mathematics (STEM) disciplines interact with faculty who have little to no experience working with deaf individuals and who often have preconceptions or simply a lack of knowledge about deaf individuals. In addition to a lack of communication access, deaf students may also feel unwelcome in STEM, as do other underrepresented groups. In this essay, we review evidence from the literature and, where data are lacking, contribute the expert opinions of the authors, most of whom are deaf scientists themselves, to identify strategies to best support deaf students in university STEM education. We describe the journey of a hypothetical deaf student and methods for faculty to create a welcoming environment. We describe and provide recommendations for classroom seating and layout, accommodations, teaching strategies, and research mentoring. We also discuss the importance of including deaf scientists in research about deaf individuals.

Deaf Visiting Student Researcher Nancy Barker Allegedly Denied Services by Disabled Students' Program.

—Headline from the *Daily Californian* (Shrivatsa, 2017)

OVERVIEW

Scientists, like all people, are shaped by their life experiences, and they bring their unique perspectives to their research. Diversity and cultural experiences among scientists broaden research directions and, ultimately, scientific discoveries. For example, genetic diseases among the Ashkenazi Jewish population are well studied, because many prominent geneticists were Jewish themselves and took an interest in their own population (Carmeli, 2004). Women's medical issues were largely ignored until recently, when female investigators became better represented among medical researchers and began researching these issues (Keville, 1994). Likewise, work by teams with deaf scientists regarding American Sign Language (ASL; Stokoe, 1980; Padden *et al.*, 2014) led to a paradigm shift in neurolinguistics (Thompson *et al.*, 2013; Olulade *et al.*, 2014; Williams *et al.*, 2015).

Working to make science, technology, engineering, and mathematics (STEM) inclusive and, ultimately, more diverse improves the quality of scientific research

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(Cole and Zhou, 2013; Lou and Jamieson-Drake, 2013; Roberge, 2013; Singal, 2014; Burke *et al.*, 2015). Diverse teams are more effective at problem solving (Hong and Page, 2004) and decision making (Shachaf *et al.*, 2008), thereby positively impacting the quality of the science produced. Research groups with more diverse compositions are advantageous in that they usually consider a larger and more varied set of solutions; therefore, they ultimately find a more effective approach than do less-diverse groups (Campbell *et al.*, 2013; Freeman and Huang, 2014).

Developing a welcoming, inclusive atmosphere in STEM is critical. Research has shown no differences in the intelligence and academic achievement of students who leave STEM for other fields versus those who persist (Seymour and Hewitt, 1997; President's Council of Advisors on Science and Technology [PCAST], 2012). Students who leave often cite an unwelcoming atmosphere in STEM courses (PCAST, 2012). Students who leave STEM, including deaf students, report feeling a need to work harder than other students to maintain a sense of belonging (Listman, 2013; Archer *et al.*, 2015; Marchut, 2017). This sense of belonging to a STEM community seems to be a key factor for persistence (PCAST, 2012; Brown *et al.*, 2015).

Here, we follow a hypothetical deaf student, Emily, as she navigates her STEM major and describe the challenges that she will most certainly face. We describe classroom and research practices in university STEM education that are inclusive and welcoming to deaf students. We refer to empirical evidence in the published literature when such studies exist. In areas in which the literature is lacking, we offer our consensus expert opinion. Eight of the 10 coauthors of this essay are deaf (D.C.B., A.E.M., C.M.S., M.M., Z.D., R.S.K., J.L., and P.C.H.), and we have a combined 101 years of experience in teaching and mentoring deaf students in higher education.

We hope that these recommendations will promote conditions in which deaf students feel a sense of belonging, encourage aspiring deaf scientists, and encourage hearing scientists to make STEM education welcoming to all.

INTRODUCING EMILY

Our story begins with a hypothetical deaf student, Emily, a new first-year student who plans to major in STEM at her university. Details about Emily are kept intentionally vague: to the reader, she should represent any deaf student.

Emily most likely does not fit neatly into a mold or a preconception of deaf students that faculty and staff who meet her may have. Many people have misconceptions of deaf individuals as a result of having little or no prior experience with deaf people. Often, preconceptions come from depictions of deaf people in books, movies, or TV shows. In reality, deaf students are a heterogeneous group with varying amounts of residual hearing, means of communicating, educational backgrounds, and cultural identities. Some deaf students may call themselves “hard-of-hearing.” Some are able to communicate well in spoken language in one-on-one conversations but miss information in group conversations or noisy environments. Some deaf students have knowledge of ASL and consider themselves “culturally Deaf.” These students are active members of the Deaf community, where Deaf culture is a source of pride,

support, heritage, and networking (Padden and Humphries, 2006; Hauser *et al.*, 2010; Holcomb, 2010; Clark and Daggett, 2015).

Preconceptions about deaf students, when communicated, can have the cumulative effect of making Emily feel unwelcome, perhaps even before her first day of class (see Woodcock *et al.*, 2007). It is important to avoid communicating preconceptions (Table 1 includes a list of examples).

EMILY'S FIRST STOP: DISABILITY SERVICES OFFICE

Before beginning her first class, Emily will work with her university's disability services office or a designated official to request accommodations for classes; her faculty will not be responsible for requesting course accommodations. To obtain equal access compared with her peers, Emily should be able to participate in all opportunities available to her hearing peers: lecture and laboratory sessions, tutoring/group study sessions, department seminars, and informal learning opportunities.

Deaf students vary widely in how they communicate; thus, Emily's accommodations should meet her specific individual needs. Accommodations may include ASL interpreting, real-time captioning, note-taking services, and/or preferential seating in the classroom where the deaf student can better see the instructor (Marchut, 2017).

Our collective experience has been that institutional infrastructure critically impacts the delivery of accommodations to students. University disability services offices appear to be most effective when their funding is centralized. In contrast, they are least effective when the cost of accommodations is passed down to smaller department budgets. When departments shoulder the costs, department staff may approach the deaf student with concerns about costs. This may make the deaf student feel unwelcome and/or as though he or she should forgo some accommodations (Table 1; Solomon *et al.*, 2012, 2013). To our knowledge, the subject of optimal institutional structure for delivering accommodations has not yet been studied.

Students, faculty, staff, and administrators should all be aware that universities are unambiguously required to provide reasonable accommodations. These accommodations are mandated by Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. §701) and the Americans with Disabilities Act of 1990 (42 U.S.C. §12101). Some institutions have been resistant to complying with the law due to the cost and required infrastructure changes. In Table 2, we provide a flowchart for what to do if accommodations are not readily provided.

For more information, we encourage administrators in higher education to review resources such as the Americans with Disabilities Act National Network (<https://adata.org/faq/what-are-public-or-private-college-universitys-responsibilities-students-disabilities>) and practical tips provided by the Higher Education Compliance Alliance (www.higheredcompliance.org/resources/resources/Practical-Tips-Managing-Disability-Related-Issues1.pdf).

EMILY'S STEM CLASSROOM EXPERIENCE

Classroom Seating

On the first day of class, Emily will arrive and get her bearings. Certain aspects of classroom design are important to Emily for communication access: lighting and clear sightlines. Emily must be able to see her information sources: instructor, displays,

TABLE 1. Examples of commonly communicated preconceptions toward deaf students, including real-life examples of communicated preconceptions, explanations about why these preconceptions are problematic, and positive actions that faculty can take to make students feel welcome

Example	Why the example is problematic	Action faculty should take to make students feel welcome
A deaf student was assigned to cleaning glassware while his hearing peers were assigned research projects.	Deaf students may be assigned to lesser tasks so that extended training is not needed. This may stem from disbelief or lack of confidence that sign language can be used to explain step-by-step procedures.	Provide the student with the same opportunities as you would any other student.
Holding up a deaf student as an inspirational model: “You are so brave to apply for an internship at an all-hearing program” (Hauser <i>et al.</i> , 2000).	This sets up deaf students as “exotic” and makes them seem different from other students and in need of special arrangements to succeed.	Treat and speak of the deaf student the same way you would any other student.
“[It] must have been difficult for you to lose your hearing like that” (Hauser <i>et al.</i> , 2000).	This conveys pity and condescension.	Recognize that being deaf is their reality, and they may be proud of who they are.
One of the coauthors of this paper was asked by his future graduate advisor whether he could read and write in English, despite having very high standardized test scores.	Being disabled does not mean that the individual is poorly educated.	Keep an open mind about the student’s abilities, just like for any other student. Deaf students are often ASL–English bilinguals.
“I find it very distracting having an interpreter here” (Hauser <i>et al.</i> , 2000).	This comment may make the student feel unwelcome.	Recognize that interpreters work for the mutual benefit of both parties, not only for the deaf individual.
“What ... laws require us to provide accommodations?” and “Tell me all of the accommodations required during your training, and tell me how much [they will] cost” (Hauser <i>et al.</i> , 2000).	These comments make the candidate feel unwelcome. Deaf and disabled students need to focus on their education and should not be asked to assume responsibility for arranging their own accommodations, including the cost. It is the responsibility of the mentor and the administrator to arrange appropriate and reasonable accommodation.	Potential mentors should research and answer these questions for themselves by reaching out to their university’s disability services office. Let deaf students use their interview time to focus on extolling their skills and the experience that they bring to a position, just like any other candidate would.
“What is the cost of this accommodation?”	Same as above.	Faculty should reflect: one would not bring up the cost of sick leave with an employee who used sick days for chemotherapy or the cost of maternity leave with a pregnant employee.
Hearing faculty and students may assume that ASL is a lesser language than English and that this interferes with science learning.	All languages can be adapted to communicate unusual or new concepts.	Reflect that there are many successful deaf scientists for whom ASL is their primary language.

whiteboards, interpreters, and/or captioning (Mather and Clark, 2012). Emily’s faculty should work to meet her needs, such as seating in a specific location or clear lines of sight (Seal *et al.*, 2002; Marchut, 2017). We encourage faculty to engage with individual deaf students on a case-by-case basis to understand their preferred accommodations and learn which strate-

gies are most useful for them. For example, a faculty member might ask Emily, “How do you want to communicate with me? Is there anything I can do to be helpful? Are you getting the accommodations that you need from the university?”

If the classroom seating is movable, faculty might arrange student desks in a large circle rather than the traditional

TABLE 2. What to do if accommodations are not being provided: a stepwise guide to acquiring accommodations if accommodations are not provided

1. The deaf student should contact the university’s disability services office and complain by describing his or her needs and how they are not being met. A paper trail should be maintained. Faculty can helpfully advocate for the student, because the student may be wary of souring his or her relationship with the university. Faculty should make administrators aware of the problem if it is not readily addressed.
2. The disability services office and the administration should resolve the issue promptly.
3. If the university does not resolve the issue promptly, the student should file an online complaint with the Office of Civil Rights (OCR) in the U.S. Department of Education.
4. The OCR will formally investigate. The OCR will collect information and then meet with university officials, negotiate accommodations for the student, and make recommendations for systemic change that benefits this student and future students. The OCR has the leverage to enforce accommodations.

stadium-style seating. For deaf signers, this arrangement allows for unimpeded sightlines. This arrangement also has universal benefits: past research has indicated that circular arrangements promote social interaction (Rosenfield *et al.*, 1985; Marx *et al.*, 1999). For more information about intentional classroom design that provides universal access, we encourage faculty to read about Deaf Space, an architectural design principle with the goal of universal access (Bauman and Murray, 2009).

Interpreters

If Emily has requested interpreters, she will meet one or two certified interpreters at the beginning of her first class. Interpreters are typically dressed in black or neutral colors, stand near the front of the room, and may approach the instructor before class and introduce themselves. Interpreters may ask faculty to share copies of instructional materials in advance so that they can familiarize themselves with any technical jargon.

The interpreter's role is to facilitate communication between the faculty member, classmates, and Emily by interpreting what is heard in spoken English to ASL and vice versa. Interpreters will also interpret any conversations that they overhear during class and interpret conversations with other students to provide Emily with a more inclusive environment. When interacting with Emily through an interpreter, people should speak directly to and maintain eye contact with Emily, not the interpreter. This promotes a better connection with Emily.

Emily will experience a translation lag time of up to 10 seconds from when the interpreter hears spoken English to when it is conveyed in ASL and understood by her (Cokely, 1986). This lag time can make it difficult for her to interject and ask questions and is discussed in detail in the section *Lag Time*.

Emily's classroom experience will be affected by the quality of interpreting, which can be impacted by several factors. Interpreters without certification have not been tested by a professional body and are usually not qualified to interpret in an educational setting (Schick, 2005). We therefore recommend that all interpreters have certification, such as from the Registry of Interpreters for the Deaf, which administers exams and has rigorous standards. Second, interpreters should be comfortable with STEM content. Third, the same interpreters should consistently be assigned to every class meeting throughout the semester such that they can learn the technical vocabulary along with the student. This is particularly important, because there is no interpreting certification specific to STEM (Grooms, 2015), and many interpreters do not have experience interpreting STEM (Hauser and Hauser, 2008; Solomon *et al.*, 2012).

If a faculty member has concerns about interpreting services, the faculty member should ask the deaf student about his or her opinion of the quality of the services. Table 2 describes what the deaf student and faculty should do if there are concerns about accommodations. We encourage faculty members to use their influence and institutional knowledge to advocate on the student's behalf. Faculty can be more effective advocates than deaf students, because students may, understandably, be anxious about the consequences of filing a formal complaint.

Real-Time Captioning

Alternatively, Emily might have requested real-time captioning (RTC) services, which are known by other names, including

communication access real-time translation. With RTC, sound is captured through a microphone. A stenographer listens to the conversation and transcribes what is heard into shorthand, which appears as English captions on Emily's display. Emily's display may be her laptop or a tablet. Sometimes the captionist is present in the classroom, but more often, the sound is sent over the phone or Internet to a remote captionist. Faculty should be aware that the transcribed text often contains errors and has a significant lag time of at least 2 to 3 seconds, as discussed in detail in the next section (National Captioning Institute, 2017). Additionally, Emily can look at only one information source at a time; thus, while reading captions, she might miss slides or visual cues.

Special Considerations of Interpreting and RTC

Even with interpreting and/or RTC, Emily will still have less access to information than her hearing counterparts (Hauser and Hauser, 2008; Solomon *et al.*, 2012).

Lag time is a shortcoming of both interpreting and RTC, which makes it more difficult for Emily to interrupt with questions and participate in class discussion. However, this lag does not mean that people should speak more slowly, because translation lag occurs regardless of the rate of speech. Instructors should give Emily equal opportunity to ask questions. Before calling on any student to answer a question, instructors should pause for approximately 10 seconds to give the interpreter or captionist time to catch up and give all students, including Emily, sufficient time to process the question (e.g., see collaborative-learning techniques such as think-pair-share). Lag time might also impact Emily during laboratory class, when faculty may point to the various pieces of laboratory equipment and materials needed to perform an experiment. Due to lag time, Emily may miss this information. The best solution for universal access and clarity is for the faculty to walk to each item to make its location visually explicit (Seal *et al.*, 2002; Marchut, 2017). Likewise, faculty should write laboratory protocols on a whiteboard or distribute handouts.

A second shortcoming of interpreting and RTC are that they often contain errors (Marschark *et al.*, 2005; Marchut, 2017). This adds to Emily's cognitive load. If Emily feels like she may have missed information, she should be encouraged to review the lecture notes and slides within a day or two of the class, and make an appointment to see her instructor. Ideally, Emily's faculty members will proactively check in with her throughout the semester to see whether she is receiving the accommodations she needs and to ask how she is doing with the content.

Finally, Emily is able to look at only one thing at a time and has to constantly move her gaze and adjust her focus between dispersed information sources: the instructor, slides, and the interpreter or captions. Altogether, these add to Emily's cognitive load. Emerging technology will soon address this issue. Tracked captioning projects captions next to an instructor moving around or to an active speaker in a group (Kushalnagar *et al.*, 2016).

Teaching and Learning Strategies

We strongly recommend creating a positive learning environment in which Emily and all students feel welcome (Tanner and Allen, 2007). Creating a welcoming and inclusive classroom

environment is particularly important for deaf students, who are frequently observed as “not able,” thus creating a vicious cycle of low expectations.

Relatedly, Emily may experience being left out of group work (Listman, 2013; Marchut, 2017). Marchut (2017) describes an instance in which a hearing student dominated group work, resulting in missed opportunities and diminishing the self-worth of a deaf classmate. Instructors should watch group dynamics and intervene if necessary with strategies such as assigning tasks to each student and encouraging the group to develop a contract for expectations and deadlines and milestones to meet. A comprehensive flowchart with evidence-based strategies for group work is available online at <https://lse.ascb.org/evidence-based-teaching-guides/group-work>.

Faculty teaching Emily may wonder whether any teaching and learning strategies particularly benefit deaf students and hearing students. Currently, there is little research about STEM teaching and learning strategies for deaf students. We know that both concept mapping and inquiry-based laboratory learning strategies are beneficial for deaf students (Solomon and Rashid, 2017a,b) and that participation in inquiry-based laboratory learning has caused deaf students to develop positive attitudes toward science (Gormally, 2017). More research about learning strategies, particularly deaf students' experiences with group-work dynamics, is needed.

Finally, we encourage faculty to explore DeafTEC: Technological Education Center for Deaf and Hard-of-Hearing Students (www.deaftec.org), which offers global teaching and learning resources to better support deaf students in high school and college STEM education.

Emily's STEM Research Experience

Emily, like other STEM majors, should participate in at least one mentored research experience. Mentored research experiences improve persistence in STEM, particularly among students from underrepresented groups (Nagda *et al.*, 1998; Barlow and Villarejo, 2004; Lopatto, 2004; Thiry *et al.*, 2012). Mentoring is a particularly good intervention for deaf students, because they often feel unwelcome (Woodcock *et al.*, 2007; Wilson *et al.*, 2011; Hauser, 2013). Mentoring creates a sense of belonging and science identity, particularly among women and minorities (Astin, 1977; McGee and Keller, 2007; Eagan *et al.*, 2011; Gasiewski *et al.*, 2012; Eby and Dolan, 2015; Aikens *et al.*, 2016).

Emily may not know of available internship opportunities in STEM, because she does not have the same access to social networking and information (Ovink and Veazey, 2010). Therefore, faculty should take additional initiative to encourage Emily to apply to mentored research opportunities. If she is bilingual (i.e., fluent in ASL and written English), Emily will obtain maximum benefit by joining laboratories that have prior experience working with deaf students, such as those staffed by deaf scientists at Gallaudet University and the National Technical Institute for the Deaf at the Rochester Institute of Technology (Solomon *et al.*, 2012; Listman, 2013; Braun *et al.*, 2017; Majocha *et al.*, 2018). At these institutions, bilingual deaf students can communicate directly with faculty and perform mentored research without needing any accommodations (Listman and Dingus-Eason, 2016).

When Emily begins applying for research opportunities, she is likely to encounter preconceptions and discrimination, particularly in interviews for internships and graduate school (Table 1; Hauser *et al.*, 2000; Woodcock *et al.*, 2007). For example, a deaf doctoral student who had been offered an interview for an internship had the offer retracted once the program learned that he was deaf (Hauser *et al.*, 2000). Universities have also failed or refused to provide legally required accommodations, resulting in deaf individuals leaving doctoral and professional programs (Madhusoodanan, 2016).

If Emily decides to work in a research laboratory, either she or her faculty mentor will need to request accommodations from the disability services office for laboratory events and social functions, such as weekly laboratory meetings. The disability services office might be resistant to providing accommodations, because Emily is not in a credit-bearing course (Gehret *et al.*, 2017). If this is the case, there are three possible options: 1) follow up with the institution's disability services office or administration (see Table 2), because the institution is indisputably required to provide full access; 2) offer Emily course credit for her internship, which may appease the bureaucrats; or 3) obtain external funding to offset the expenses. If the internship program is a National Science Foundation Research Experience for Undergraduates program, additional funding for accommodations can be requested from the program officer; a comparable mechanism exists for National Institutes of Health grants (Solomon *et al.*, 2012). Again, the faculty mentor should advocate for Emily if she has any trouble obtaining accommodations (Table 2).

Recent research has identified four variables that are important for positive mentoring experiences with deaf students: 1) knowledge of or respect for Deaf culture; 2) providing full communication access; 3) teaching self-advocacy; and 4) including a cohort of at least two deaf students in a research program (Braun *et al.*, 2017; Majocha *et al.*, 2018). These findings were used to develop four actionable strategies that faculty can use to best mentor Emily and other deaf students (Table 3). Notably, internship experiences are more likely to promote positive socialization and strengthen connections when they include a cohort of at least two deaf students rather than a single deaf student in isolation (Solomon *et al.*, 2012; Majocha *et al.*, 2018). However, when recruiting a cohort of students, faculty should keep in mind that deaf students are a heterogeneous group, and communication modalities, educational backgrounds, and cultural identities vary widely.

Deaf Scientist Leadership in Research about ASL and the Deaf Community

Emily and other deaf students are impacted by findings from research studies on deaf individuals and the Deaf community. These research projects should include deaf scientists in leadership or, at a minimum, collaborative roles, because they bring the necessary cultural and linguistic knowledge that may otherwise be missing (Wolsey *et al.*, 2017). For example, imagine a research team that studies women's reproductive health issues but does not include any female scientists. The researchers' perspectives will be limited, because the research team lacks the lived perspectives of women. This lacking, but critical, perspective will

TABLE 3. Strategies for STEM research mentoring

Actionable strategy	Why this strategy is useful
When working with culturally Deaf students, faculty mentors should develop a working knowledge and awareness of Deaf culture and ASL (Braun <i>et al.</i> , 2017; Majocha <i>et al.</i> , 2018).	Mentoring for various minority groups is more effective when the faculty mentor is familiar with the mentee's minority culture (Haeger and Fresquez, 2016; Braun <i>et al.</i> , 2017; Majocha <i>et al.</i> , 2018). Deaf mentees benefit greatly when paired with deaf faculty mentors (Listman and Dingus-Eason, 2016; Braun <i>et al.</i> , 2017; Majocha <i>et al.</i> , 2018). Hearing faculty mentors who are knowledgeable or willing to learn about deaf students and Deaf culture are nearly as effective as deaf faculty mentors (Braun <i>et al.</i> , 2017; Majocha <i>et al.</i> , 2018). Faculty can reach out to research programs that have served deaf students to learn from their experiences. Faculty can also reach out to successful deaf scientists to learn from their lived experiences (Listman, 2013; Listman and Dingus-Eason, 2016).
Faculty mentors should provide full communication access and advocate for the communication needs of their deaf mentees (Braun <i>et al.</i> , 2017; Majocha <i>et al.</i> , 2018).	The faculty mentor is more powerful than the student within the university's structure.
Faculty mentors should teach self-advocacy to their deaf mentees (Braun <i>et al.</i> , 2017; Majocha <i>et al.</i> , 2018).	Teaching deaf mentees how to request interpreters and obtain accommodations will assist them in becoming successful as scientists (Listman and Dingus-Eason, 2016; Braun <i>et al.</i> , 2017).
Include a cohort of at least two deaf students rather than a single deaf student in isolation (Braun <i>et al.</i> , 2017; Majocha <i>et al.</i> , 2018).	Internship experiences are more likely to promote positive socialization and strengthen connections when they include a cohort of at least two deaf students rather than a single deaf student in isolation (Solomon <i>et al.</i> , 2012; Majocha <i>et al.</i> , 2018).

likely impact the research design and methodology, profoundly affect the interpretation of the data, and ultimately diminish the usefulness of the research.

This is particularly true for research regarding ASL and Deaf culture (Wolsey *et al.*, 2017). Translation from ASL to English is difficult, because idiomatic expressions require native fluency and intimate cultural knowledge in ASL. Therefore, researchers who are not natively fluent in ASL or native to Deaf culture would not be effective at documenting and characterizing the culture, interpreting videotapes, or even assessing the skill level of the interpreters that they hire to transcribe those tapes. Researchers who submit grant proposals to study sign language or the deaf community should include a community advisory board, deaf collaborators, deaf consultants, and funds to hire deaf students, staff, or fellows.

CONCLUSIONS

Deaf individuals have made many contributions to science and technology throughout history. The present generation of young deaf students, like Emily, will be no exception. We should continue our commitment to making this generation feel welcome and enable them to become successful, because the unique perspective that they will eventually bring to science as principal investigators will determine the research questions that will be asked and, therefore, the discoveries that will ultimately be made.

From our experience as deaf scientists and professors who work closely with deaf students, we know that deaf students like Emily often feel unwelcome in the hearing STEM community and often have to work harder than their hearing peers to achieve similar opportunities. Deaf students need culturally sensitive faculty who are willing to advocate on their behalf for accommodations and who will provide them with networking opportunities and research experiences. We encourage you to consider these recommendations and become such a mentor. We believe that by doing so, you will not only

empower deaf students but also be enriched yourself by the experience.

With the recommendations presented in this essay, the narrative of Emily hopefully ends with her successful graduation from college, fully prepared to seek whichever career she chooses. We hope that Emily felt welcome enough that she will choose to persist in STEM if she so desires.

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