Workshop on Excellence Empowered by a Diverse Academic Workforce

Chemists, Chemical Engineers, and Materials Scientists With Disabilities

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Contents

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Executive Summary

Disabilities have rarely gotten in the way of excellent science, but people with them are underrepresented in scientific careers, including chemistry, chemical engineering, and materials science, when compared with the general public. The roots of this problem extend into the earliest stages of scientific training, and include disabilities visible (such as sensory or mobility problems) and invisible (such as psychiatric and emotional disorders). To assess the scope of this problem and propose ways to create a more diverse scientific workforce, this Workshop on Excellence Empowered by a Diverse Academic Workforce was convened with representatives of 33 federal agencies and more than 40 science departments. The workshop focused on ways to make careers in the sciences more welcoming to students with disabilities and the ways in which specific departments can help make this happen, with a special emphasis on specific, immediately available steps.

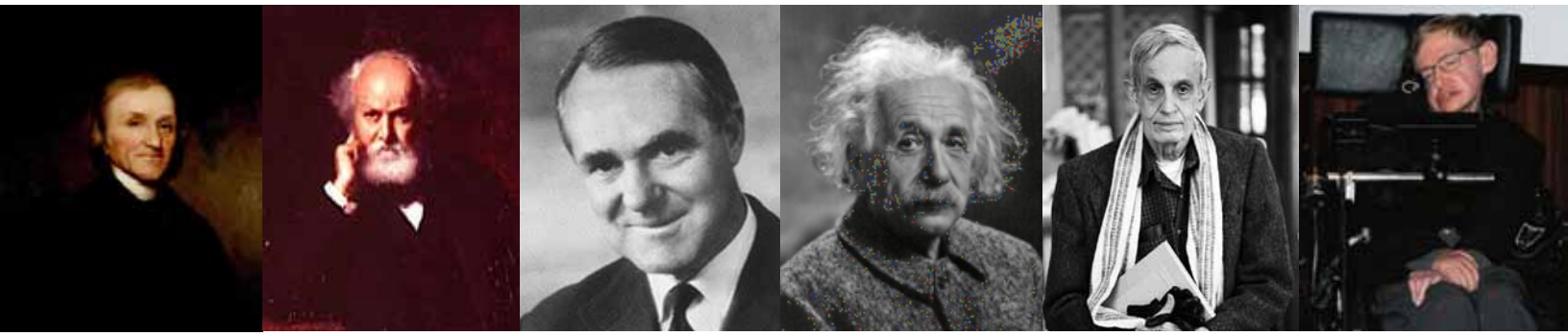
One of the most significant challenges in creating a more diverse academic workforce that includes people with disabilities is a lack of good—or even passable—data on how and why students with disabilities do not advance as far as their peers. Acquiring better data is a first step and will require strong administrative will. Federal regulations provide a basic template for how universities and other institutions should accommodate people with disabilities, but often leave ambiguities and judgment calls in their wake. Communication, within and between universities, is essential for knowledge sharing on the best way to meet federal guidelines on both practical and ethical levels. A variety of accommodations—ranging from universal design principles to specific, targeted interventions—are available, as are budding support systems for students and scientists with disabilities. These opportunities need to be expanded and made more accessible, with support from federal agencies and professional organizations.

The workshop's presentations, including several by scientists with disabilities, were followed by a series of breakout sessions in which the attendees discussed specific problems and developed a series of recommendations for immediate next steps toward making classrooms, labs, and university facilities friendlier to people with disabilities. These recommendations were the results of brainstorming sessions and did not represent a consensus.

Any academic community is only as strong as it is diverse. The ongoing underrepresentation of people with disabilities at the highest level of scientific achievement does a disservice both to students who could excel if given the opportunity and to scientific advancement as a whole. Sometimes the perspective and tenacity that people with disabilities need to succeed can lead to new, original insights. The scientific community would be well served to foster this resource.

Introduction

Great scientists rarely let disabilities stand in their ways. Joseph Priestley (1733–1804) is credited with the discovery of oxygen despite a stammer that made it painful, even impossible, to speak at times. Pierre Janssen (1824–1907) traveled the world observing solar eclipses—discovering helium in the process—despite a childhood accident that left him unable to walk. More recently, University of Sussex chemist John Cornforth (b. 1917), deaf since his teens, shared a Nobel Prize in 1975 for his work on the stereochemistry of enzyme-catalyzed reactions. Einstein, Nash, Hawking—echolalia, schizophrenia, neuromuscular dystrophy. In each of these cases, supposed disabilities may even have provided unique scientific or mathematical perspectives.



Priestley, Janssen, Cornforth, Einstein, Nash, and Hawking are among the notable scientists with disabilities.

Disabilities are clearly no obstacle to fruitful, even revolutionary, careers in chemistry, chemical engineering, and materials science. In fact, a healthy scientific community is a diverse one, one that harnesses the special perspectives, approaches, and tenacity of disabled individuals of all types. Data on the presence, persistence, and success of people with disabilities in the sciences are severely lacking, in part because the population of people with disabilities is super-diverse (encompassing everything from mild learning problems to full paralysis), because certain types of disabilities often go unreported, and because, frankly, no one has invested the time and effort in acquiring them. But it does appear that people with disabilities are underrepresented in the sciences when compared with the general population.

This underrepresentation occurs, in part, because people with disabilities tend to drop out at greater rates as graduate training progresses. The causes and consequences of this problem, and the need for better data, led the National Science Foundation and National Institutes of Health to sponsor a Workshop on Excellence Empowered by a Diverse Academic Workforce focusing on chemists, chemical engineers, and materials scientists with disabilities in February 2009. This report records the discussions and conclusions of this effort to increase the representation of people with disabilities in the scientific world.

Disabilities fall into two general categories—visible and non-visible. Visible disabilities include the full range of physical impairments, from missing or non-functional limbs to blindness or deafness. The non-visible disabilities, which are often undocumented, can run from subtle physical impairments to a variety of emotional and psychological problems, from anxiety and learning disorders to depression and bipolar disorder. Disabilities often fly under the radar in the sciences—rarely discussed in a unified way. In the chemical sciences in particular, there is an unfounded, and

disproved, perception that certain disabilities can pose safety hazards in a laboratory environment, and this misperception might have repercussions—scaring uninformed potential employers away. Disabilities and the reactions to them can also lead to declines in self-worth and confidence. All of these problems are matters of perception, not practice. Overcoming these misguided notions will require the marshalling, education, and galvanization of the scientific community to support disabled members and break down the barriers that retard their progress.

Kathie Olsen speaks to the workshop.

The Workshop on Excellence Empowered by a Diverse Academic Workforce focusing on chemists, chemical engineers, and materials scientists with disabilities is the third in a series of workshops on underrepresented minorities in the sciences (following race- and gender-focused efforts). The organizers of the workshop, including Kristin Bowman-James and David Benson of the University of Kansas and Tom Mallouk of Pennsylvania State University, brought together representatives of 33 federal agencies and more than 40 science department chairs from February 8–10, 2009, in Arlington, Virginia. The attendees included scientists with disabilities, people who work with them, and administrators who have to help accommodate them, among others. These individuals were tasked with a diverse set of goals:

- Raise awareness of the issues facing people with disabilities in the scientific workplace
- Demonstrate the ways in which individuals with disabilities benefit the scientific community as a whole
- Foster sensitivity for people with disabilities
- Educate the attendees of the challenges of studying and accommodating people with disabilities in the sciences
- Provide an overview of applicable federal regulations
- Create strategies for increasing the number of people with disabilities in the sciences
- Present and discuss the latest advances in education and assistive technologies
- Provide tools and tangible steps for everyone in the scientific community

The attendees addressed these goals through a combination of lectures, question-and-answer sessions, and panel discussions. The workshop culminated in breakout sessions geared around eight specific questions. The findings of each group were then presented to the entire workshop. This report on the workshop proceedings is structured thematically. It will address the specifics of the data problem, discuss federal regulations, and present the latest information on accommodation and assistive technologies. Throughout, there are personal accounts of scientists who have thrived because of or despite their disabilities. The report concludes with a summation and synthesis of the workshop's finding and immediate next steps.

Among the talks presented to the group were those of Kathy Olsen, Senior Adviser in the NSF Office of Information and Resource Management, and Joe Francisco, then President-Elect of

the American Chemical Society. Both spoke for all the attendees in emphasizing the importance of diversity in the academic workforce and the need to battle the stereotypes that hamper the growth of young people with disabilities who are interested in the sciences. Olsen, who dealt with dyslexia as a child, pointed out that the minority of people with disabilities is unique because any of us could become a member of this minority at any time. In his keynote address, Francisco, said, "Scientists with disabilities bring unique perspectives to the table. They also bring attributes such as persistence and creativity. Their success attests to the value of their inclusion at the table."

"That's what this workshop is about," said Olsen. "It's important that we look for ways to bring in and take advantage of the diversity—and sometimes special skills—that people with disabilities add to the workplace."

The workshop developed a number of key themes. There is a pressing need for better data on the problem of dropouts. Young scientists with disabilities need more access to mentoring and role models. A multi-university mentoring network and targeted fellowships might help to encourage these students further. And it is important to project a positive attitude to help people with disabilities in the sciences to persist in the face of challenges and harness their individual assets to advance the chemical sciences across the field.

> "We are in violent agreement about the things we need to do. The question is how we are going to implement these things."

Luis Echegoyen, Director of the Division of Chemistry at NSF, made a passionate plea for the attendees to take these themes as immediate action points. "We go to workshops and we go to workshops and we go to workshops," he said. "We are all in violent agreement about the things we need to do. The question is how we are going to implement these things. We'd like something from this group that we can grab onto and do something with."

The workshop attendees appeared to take this point to heart.

The Data Problem

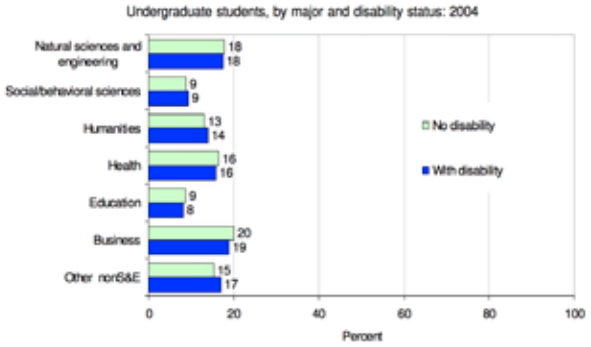
Solid, verifiable data are the cornerstone of every scientist's assessment and problem-solving process. Understanding the status and success rates of people with disabilities in chemistry, chemical engineering, and materials science will require detailed and comprehensive data—both quantitative and qualitative—even to begin to ask the right questions. The attendees of the workshop were in complete agreement that better data will be the foundation of any attempt at a unified policy on disabilities in the sciences or wide acceptance of accommodation measures.

Existing data on the progress of people with disabilities in the sciences can best be described as weak, but they are consistent with a general conclusion: that people with disabilities are indeed underrepresented in scientific careers when compared with the general population. Without better information, how and why this happens are matters of interpretation and speculation. Joan Burelli, a senior analyst in the Science and Engineering Indicators Program at the NSF, spoke to the workshop about current knowledge on chemists, chemical engineers, and materials scientists with disabilities. First, she provided a significant caveat. The data sets that exist are fragmentary, flawed, and unreliable. They come from multiple sources, are incomplete, and often are not possible to compare. But they are, for the moment, all we have.

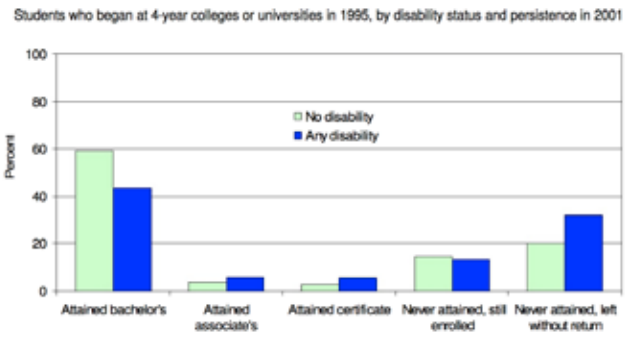
In general, the suggestive data come from the early and late stages of scientific development. College enrollment data show that there are differences between how people with and without disabilities begin their educational careers. Those with disabilities are more likely than their peers to attend two-year colleges and attend part-time, and are less likely to graduate. Of those who begin college, according to a 2003 NSF study, people with disabilities are just as likely as their peers to choose a path in the sciences (18 percent), but are

Joan Burelli presented the suggestive but flawed data below on students with disabilities.

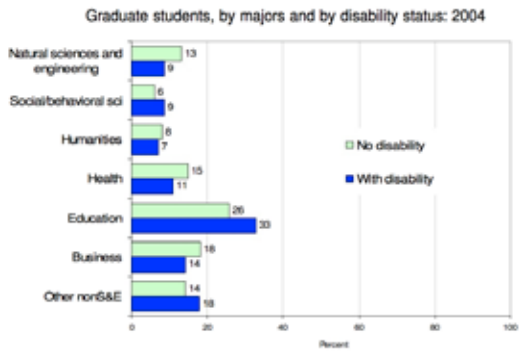
Undergraduate students with disabilities choose S&E majors at about the same rate as students without disabilities



Students with disabilities are less likely than those without to complete a bachelor's degree



Graduate students with disabilities are less likely than those without to major in natural sciences and engineering



less likely to progress in those fields. People with disabilities who go to graduate school are less likely than their peers to do it in the sciences. These data do not provide much detail, but they point toward the conclusion that academic progress of these students is somehow stunted—people with disabilities are simply less likely to advance.

As a result, only 5 percent of people in chemical and materials science careers have reported disabilities, compared with 16 percent of the general population. Among older scientists, this percentage increases—as one might expect, disabilities often emerge or are diagnosed with advancing age—culminating in a disability rate of 10 percent in scientists over 60 years of age.

Among university faculty in the sciences, 7 percent have reported disabilities. Again, the age effect swells this number. The more relevant statistic to this discussion—and one of the most alarming—is that a vanishingly small number of people with existing disabilities advance through graduate school to earn doctorates. So few reach the highest levels of the discipline, Burelli explained, that she needed to pull nearly 20 years of data to obtain meaningful numbers. From 1998 to 2007, she said, just 0.7 percent of people receiving doctorates in the chemistry, chemical engineering, or materials science had a disability. The data, though sparse, show no upward trend over that time, despite the passage of the Americans with Disabilities Act in 1990, which resulted in no discernible bump in the numbers.

These data from either side of the educational process point to the conclusion that people with disabilities simply do not progress as well in the sciences as do their peers. Though they are just as likely to choose to study science, they are much less likely to make it all the way through graduate school. It is impossible to understand fully the causes for this phenomenon because the relevant data have yet to be acquired. "We have a great big black hole in the middle where we don't have any data," Burelli said. "The undergraduate enrollment data are collected every four to six years. And then we don't have any bachelor's or master's degree data. We don't really get them again until they earn a doctorate degree."

This statement makes this community's needs quite clear. More solid data on undergraduate enrollment will be key, but it must be followed by data that track students with disabilities as they pass in and out of the academic community, through their undergraduate careers and into master's and doctorate programs. These data must be both quantitative and qualitative, as it will be important to know both when and why students with disabilities encounter the problems that are hampering their academic success in the sciences.

> "We have a great big black hole in the middle where we don't have any data."

The existing data are flawed for a number of reasons—the same reasons that acquiring these data in the future will be a significant challenge. When compared with women or racial and ethnic minorities, people with disabilities have not long been considered a unified minority. As a result, the data reflecting their place in the sciences are shallow—they date back only to the 1990s, compared with the 1960s and 70s for other significant minorities. Furthermore, particularly in the academic context, the data are inconsistently acquired and applied. Schools and institutions use different metrics and definitions of "disability"—a problem attributable in some sense to the diversity of the group as a whole, which encompasses everything from students with mobility problems to those with psychiatric diagnoses. Perhaps out of concerns about privacy, schools often document disabilities on paper records kept separate from the usual student records—only 13 percent of institutions have unified systems. Some count individuals as disabled based on the need for spe-

cific accommodations, others only count disabilities that have been verified. Still others rely on external proxy reports from people such as parents and teachers, or, often most problematically, self-reporting.

Many disabilities—especially many of the "invisible" ones such as emotional and learning problems—go unreported and in many cases are undiagnosed. As Victor Day, director of the X-Ray Crystallography Laboratory at the University of Kansas, who was diagnosed with bipolar disorder in the 1990s, said at the workshop, "There are a lot of people who have these disabilities and probably aren't even aware of it." The problems of self-reporting may be due in part to the issues of perception already discussed—students may be concerned about the stigma of a disability, want to protect their own privacy, or are too proud to ask for the help they need. In the sciences, self-reporting is even more problematic, as students may be worried about the perception that scientists with disabilities are considered safety or employment risks in the laboratory. As a result, attempting to count and follow students with disabilities can seem an intractable data acquisition problem, like attempting to census undocumented immigrants. Disabled students are a group that, by its very nature, defies assessment, and is generally without great public presence or influence.

Acquiring these data—in a form that can be usefully assessed, verified, and compared across the country—will rely on innovative strategies and, perhaps more importantly, strong administrative will. The attendees of the workshop universally agreed on the criticality of better data from across the academic development of students with disabilities in the sciences. They recommend that the NSF and NIH, as well as professional organizations large and small, such as the American Chemical Society, take the lead in the development of this administrative will on behalf of the disabled community. These institutions, the attendees agreed, must combine efforts to obtain trustworthy, rigorous, consistent data to determine the reasons that people with disabilities do not appear to progress well in the chemical and

David Wohlers

Professor of Chemistry
Truman State University

David Wohlers is blind—he lost sight in one eye at age four and the other at age eight. Among other things, he spoke to the workshop about something few sighted people even think about: reading and writing in Braille, the system of raised dots that correspond to letters. He noted that when Braille is written, it moves from right to left, like Chinese characters, and that the need to move one's hands while reading means that the blind must expend physical energy and invest more time in simple tasks. "So there's a lot more time and energy involved in being blind as opposed to being sighted," he said. He also spoke about Braillers, or devices used to type words in Braille. The Perkins Brailler—his preferred model—is near indestructible. When his old model began to produce barely raised dots that he could hardly feel, he donated it to a school in Africa, where more sensitive young hands might still be able to use it.

material sciences, and to begin to devise solutions to encourage them to succeed.

The greatest asset that the scientific community—as represented by the attendees of the conference—possesses is that it is made up almost entirely of capable administrators and scientists themselves. This population has the skills to acquire data, and certainly has the skills to interpret them and put them to optimal use.

Workshop attendees discuss the significant data challenges they will face.

Federal Regulations

The most significant public step in creating opportunities for people with disabilities was probably the passing of the Americans with Disabilities Act (ADA) in 1990. The ADA has been noted here for its apparent inability to impact the success of students with disabilities in the chemical and materials sciences, but it remains central to any discussion of people with disabilities in the United States. The law provides a federal legal baseline from which administrators

Steve Ramirez explains the challenges of the Americans with Disabilities Act.

and department chairs must work—both specific requirements and the guiding principle that an individual should not be discriminated against based on a disability.

The ADA was supported by an unusual coalition of interests, including disability groups, civil rights proponents, and social justice advocates. Despite strong opposition from religious groups and business organizations—primarily concerned, it seems, about the cost of making churches and places of business accessible to the disabled—it was signed into law by George H. W. Bush on July 26, 1990. The law includes five titles, including provisions for making public entities, transportation, commercial facilities, and telecommunications accessible to the disabled. Its first and perhaps most prominent title provides equal opportunity employment to people with disabilities. The law states that people with disabilities are entitled to work, provided they are qualified and can perform the "essential functions" of a job, and that employers must make "reasonable accommodations" for disabled employees who request them. A 2008 amendment, which went into effect on January 1, 2009, was designed to make the law more inclusive, encourage broad interpretation, and make it easier for people with disabilities to seek its protection.

The federal government does not have an official definition of what comprises a disability, though the General Accounting Office has apparently been working on one for some time. The ADA specifically defines a disability as a physical or mental impairment that substantially limits one or more major life activities, which are listed in the 2008 amendment. The population of people who fall under this rubric changes over time. Today, people with learning disabilities are the largest group of disabled people. People with psychiatric disabilities are the fastest growing subset, probably as a result of expanded definitions and improved diagnosis. Also, veterans must increasingly be accounted for.

Steve Ramirez, equal opportunity specialist at the University of Kansas, spoke to the workshop attendees about the law's purpose and some of the subtleties of its application. According to Ramirez, the law is designed to encourage increased opportunities for people with disabilities, ensure their full participation in society, and protect them from discrimination. In employment, as put forth in Title 1, this means that disabled applicants and employees must have a level playing field with their fellow applicants and

workers—they can expect to be held to the same standards but can request help when necessary. The law also protects confidentiality and privacy—concerns fueled by the stigma and misperception of disabilities. Thus, it is up to the person with a disability to disclose his or her status and request accommodation. A central difficulty of the law in practice is striking a balance between treating people with disabilities like other workers, protecting their privacy, and making requested accommodations available. This leads to some mild absurdities, such as not being able to call a change to an employee's workstation an "accommodation."

This balance is only one of the challenges faced by administrators. The wording and intent of the ADA sets up any number of fine lines and judgment calls. Because of the room the law allows for interpretation, decision-makers must determine the best course of action from a legal perspective, but also must take matters of ethical behavior and practical needs into account in a given situation. What constitutes "substantial" impairment? What are a job's "essential" functions? And what counts as a "reasonable" accommodation? While it is up to people with disabilities to disclose their status and request help, the onus of making the law work is on administrators and department chairs.

"You can probably find as many different definitions of 'reasonable' as there are people in this room," Ramirez told the workshop.

He added that the law must be applied on a case-by-case basis. "You might think that people who have the same disability would require the same accommodation," he said. "But that's not always true."

Attendees at the workshop expressed confusion over some of the basic questions of legality involved in the law—in part because of the wide range of interpretation it allows. Further complicating this are the more delicate situations involving privacy and undisclosed disabilities.

One example of this discussed at the workshop was what to do when an employee shows the effects of an unreported disability—such as regularly showing up late because of a psychiatric or emotional disturbance—on the job. They are, after all, expected to be held to the same standards as other employees. Ramirez recommended an indirect approach that protects the employee's privacy, perhaps by offering help at first and then insisting on it (without mentioning a specific suspected diagnosis) if the behavior does not improve. Ian Shipsey, a physicist at Purdue University, who lost

Discussion of meeting ADA requirements created as many questions as it answered.

his hearing as an adult, favors a proactive approach of reaching out consistently to an employee having a difficult time. But privacy concerns again become a problem. Students with learning disabilities and other problems are entitled to more time on tests, Shipsey said, but many don't take advantage because begin allowed that extra time might "out" a student as disabled. In some cases, even talking about a suspected disability can be problematic from a legal perspective.

"A lot of people simply don't know they have a problem," said Victor Day of the X-Ray Crystallography Laboratory at the University of Kansas.

Though the ADA strives for wide application and ease of protection, it also creates complexities for which there are no simple solutions.

However, the most complicating elements can be identified. According to Tom Mallouk, a chemist at Pennsylvania State University and one of the workshop organizers, these include the overall diversity of people with disabilities, the open definitions of several key terms, and the low rates of self-disclosure among people with invisible disabilities.

The workshop attendees were not discouraged, however, but seized on several concrete steps that people in the chemical and materials sciences can take to honor the letter and, more importantly, the spirit of the law. They made four specific recommendations. First, the NSF should add information to the FastLane front page to make it easier for researchers to request accommodations when they submit grant proposals, and the NIH should take similar steps. Second, department chairs should team with ADA experts to assess the accessibility of buildings and labs, and add at least one universally accessible workstation to teaching labs. Third, department chairs should recommend that university-level strategic plans account for people with disabilities. And finally, correspondence and recruitment literature should include language that encourages people with disabilities to apply for admission or faculty positions.

These steps can help encourage people with disabilities, make it easier for them to request accommodations, and reduce the overall need for specific future accommodations for additional disabled employees or students. In the spirit of the workshop, the goal was to discuss the complexities and then devise intelligent, no-regrets policies and recommendations that will at least move toward an inclusive, healthy, diverse scientific community.

Ian Shipsey

Julian Schwinger Distinguished Professor of Physics
Purdue University

In his presentation, Ian Shipsey told the story of how he first lost his hearing in 1989. Music and the voices of family and friends drifted away from Shipsey that year, as powerful antibiotics—taken to compensate for a depressed immune system following treatment for leukemia—destroyed the hair cells in his cochlea. He was hired shortly before he lost his hearing. "I don't think for one minute that they would have hired me if they had known that two months later I would become deaf," he said. He couldn't work for two years while he learned to read lips, though the skill helped little in large meetings with other physicists. "There were no models for how to treat a deaf faculty member," he said. Shipsey adapted by meeting in smaller groups of ten to twelve and developing a close-knit group of graduate students. In one of the interesting advantages of a disability, Shipsey was able to take on foreign students whose limited English skills had turned off his colleagues. "They were brilliant," he said. He found that his disability made him more accessible to his students and he received the Purdue Physics Professor of the Year award after just his first semester. And, working with a deaf colleague, he helped get cochlear implants covered by the Purdue health plan—an accommodation he encouraged all the attendees to see implemented at their institutions.

Accommodations and Support

Having a disability can be isolating and lonely, especially in a place of work or study that is not supportive and accommodating. Creating an environment that encourages people with disabilities to succeed is a practical, physical, and psychological process that brings together all the other discussions in this report. The attendees of the workshop discussed three of the primary ways to make a scientific workplace or place of study welcoming to people with the full range of disabilities: tailored accommodations, universal design, and targeted support programs.

Tailored Accommodations

One way in which institutions meet the requirements of the ADA is through tailored accommodations. This means altering the workplace, from architecture to software, in ways that allow people with disabilities to function like all other employees. These are the accommodations—noted in the discussion of the ADA—that are determined and implemented by request and on a case-by-case basis. There are as many different specific accommodations and approaches as there are degrees and types of disability. Two primary means of accommodating people with disabilities are through accessibility changes and assistive technology. Accessibility changes can include everything from wheelchair ramps and stair lifts to handicapped bathroom stalls and doors with large, easily gripped handles. Assistive technologies can include workstations designed for blind users or specialized software. While many accommodations fall under these two concepts, there is an almost unlimited range of needs and methods for addressing them.

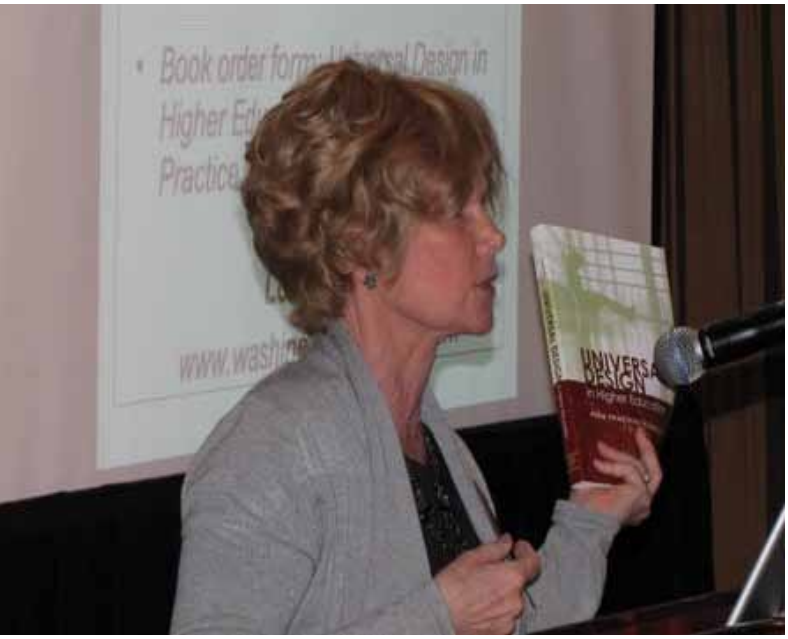
Virginia Reilly, Director of University of ADA Services at Virginia Tech University, spoke to the workshop about specific accommodations for people with cognitive and learning disabilities—a challenge in which the appropriate steps might not be immediately apparent. She discussed specific examples from her university. A person with attention-deficit/hyperactivity disorder, which can make it hard to sit at a computer for long periods of time, was offered a wireless microphone and dictation software. "The more modalities of input he has, the better," she said. She also discussed a faculty member struggling with depression, which resulted in a cluttered office that was difficult to work in. The professor was offered a student assistant, a temporarily reduced workload, assistive technology that enabled online teaching, a delayed tenure clock, and access to a warehouse available for storage on campus. And that is the story of tailored accommodation—a mix of creative thinking and compassion.

Reilly also spoke of proactive steps a university can take, such as advertising for open positions in a wide range of publications (including ones targeted for people with disabilities), providing boilerplate information about disabilities for use in grant requests, and sending information to job applicants early in case it takes them longer to

Virginia Reilly spoke of the proactive steps a university can take to make itself more welcoming to people with disabilties.

process the information.

Tailored accommodations have benefits and drawbacks. On one hand, they are targeted for a specific individual's needs. They can, however, present an administrative burden, create difficult decisions, and cost a lot of money, especially in the case of new workstations and architectural retrofits.



Sheryl Burgstahler explains the principles of universal design.

Universal Design

An alternative to creating new accommodations for people with disabilities on a case-by-case basis is to avoid needing most accommodations at all. Universal design is a design principle that entails creating products and environments that are usable by all people to the greatest extent possible without the need for accommodation or modification. Sheryl Burgstahler, Director of Disabilities, Opportunities, Internetworking, and Technology at the University of Washington, spoke to the workshop about using universal design to craft a place of work or study that is welcoming to all—physically, pedagogically, and psychologically.

According to Burgstahler, the tenets of universal design were first articulated by North Carolina State University architect, designer, educator, and wheelchair user Ronald Mace. The idea is built on the assumption that the full range of humanity represents the potential users of space, technology, instruction, and services at an institution. The principle behind the concept is to be proactive in making a space functional for disabled people, rather than reactive—as responses to ADA requests often are—and to make design decisions that serve the largest number of people. For example, accessibility ramps and curb cuts are simple design features that can help people in wheelchairs or motorized scooters, people pushing strollers, or those who walk with a cane.

There are obvious advantages to employing universal design principles. In addition to avoiding the need for many tailored accommodations and the cost they often entail, universal design conveniently skirts the problem of underreporting—an unreported disability will still have been accounted for. Also, it eliminates the need to be concerned about privacy, as everyone will have access to the same level of accessibility and resources, and no one has to be singled out as needing help. And as a principle, it spans the diversity of disability types.

Burgstahler provided the workshop attendees with a range of examples of universal design ideas. For people with mobility issues, universal design adaptations include ramps, curb cuts, adjustable tables in workspaces, and levers instead of knobs on doors and devices. Universal accommodations for people with sensory disabilities include job postings accessible to the blind with screen readers, video cameras tethered to microscopes to magnify images, publications in a variety of formats (such as videos with captions), easily readable signs, websites that conform to accessibility guidelines, and assessment of students using a wide range of instruments, from written tests to demonstrations or interviews. Certain universal accommodations—designed to create a more accepting environment—apply to people with the

full range of disabilities, including guidelines in job descriptions for requesting further accommodations, inclusion of people with disabilities in policy writing, and images of people with disabilities in publications.

The primary question behind the implementation of universal design practices is when to employ them. They can cost more in the short-term, but may create benefits in the long-term, both in the cost of tailored accommodations and in the creation of a more diverse, inclusive workforce or student body. "My only advice is this," said Burgstahler. "When it's reasonable, do as much as you can on the universal design side, and then it will minimize the accommodations you need to provide and also create a more welcoming and inclusive environment for everyone." Essentially, any relatively low-cost, no-regrets universal design choices should be made, and universal options should be considered when making other accommodation decisions. This policy must be coupled with a system that guarantees timely action on further requests.

Support

Tailored accommodations and universal design choices do not exist in isolation—they must be part of a generally supportive atmosphere. More than physical and pedagogical support, people with disabilities also need philosophical support, or the knowledge that their institutions understand their concerns and challenges and are in a position to provide support in multiple forms. The workshop attendees discussed various NSF, NIH, and other programs designed to encourage people—particularly students—with disabilities.

The Facilitation Awards for Scientists and Engineers (FASEDs) program of the NSF provides specialized equipment and training to further the research of students or faculty with disabilities. The American Association for the Advancement of Science Entry Point! program features paid fellowships for students with disabilities and is structured to offer job assignments, assistive technologies, and on-the-job mentoring. The NSF's Partnerships for Research and Education in Materials (PREM) program creates fellowship opportunities for people at institutions whose enrollment primarily comes from minority groups (African Americans, Hispanic Americans, women, and people with disabilities) so they can work with researchers from other universities on collaborative projects. However, according to Penn State's Tom Mallouk, it has limited effectiveness among people with disabilities, as few of them attend institutions that specialize in their needs. It is hoped, Mallouk said, that research support programs, such as the NSF's Research Experiences for Undergraduates and other fellowship programs might offer more opportunities targeted to students with disabilities.

"Why don't we create prestigious NSF graduate student fellowships targeted at students with disabilities," said Ian Shipsey of Purdue University. "Begin with schools that have track records of embracing students with disability, like Berkeley, Stanford, UCLA, and the University of Illinois at Urbana-Champaign."

There are support programs in place to encourage students with disabilities, but they are perhaps not large or well-publicized enough to have had a clear impact to date. The workshop discussion elaborated on the mechanisms that could be used as part of a support system: consistent encouragement, faculty role models and mentoring, and increased networking opportunities—all attributes of a welcoming, positive academic atmosphere that puts its students and faculty in a position to succeed, regardless of disability status.

In Practice

To whom does the responsibility for creating a welcoming climate and positive attitude for people with disabilities belong? In an academic environment, the workshop attendees largely agreed, department chairs set the tone, have the leverage to act, and possess specialized knowledge of a giv-

en discipline, such as the chemical and materials sciences, to know which actions are necessary and will be most supportive. To that end, department chairs must learn which resources are available and the specific needs of their students and faculty, and then be able to pass that information to others. But department chairs can't and shouldn't act alone.

A team for addressing the needs of students and scientists with disabilities should consist of the department chair, other faculty, ADA experts, legal and accessibility counselors, psychologists, and technical staff, among others. Each of these individuals has specialized knowledge of needs and available resources. Such a team could also work with outside groups, such as state departments and engineers who can design and implement appropriate tools—from architectural modifications to more inclusive publications. Above all, an institution's disability team should also include people—from students to faculty to advisors—with disabilities, who have a specialized knowledge that simply can't be passed on to others.

The team approach was also stressed by Jim Lightbourne, Acting Director of the NSF Office of Equal Opportunity Programs, who spoke about how the NSF coordinates its efforts on behalf of people with disabilities. He noted the importance of confidentiality and the need for a central funding mechanism at each institution for accommodation and universal design choices. This is a key component of the rapid handling of requests and the distribution of the burden of paying for legally and ethically necessary accommodations. Centralized funding cuts off the possibility of purely budget-driven decision-making.

Recommendations

The wide-ranging discussion of accommodation, universal design, and support at the workshop informed a series of tangible recommendations. The attendees agreed that the NSF and NIH should fund additional programs to support the acquisition of research skills by people with disabilities—

Victor Day

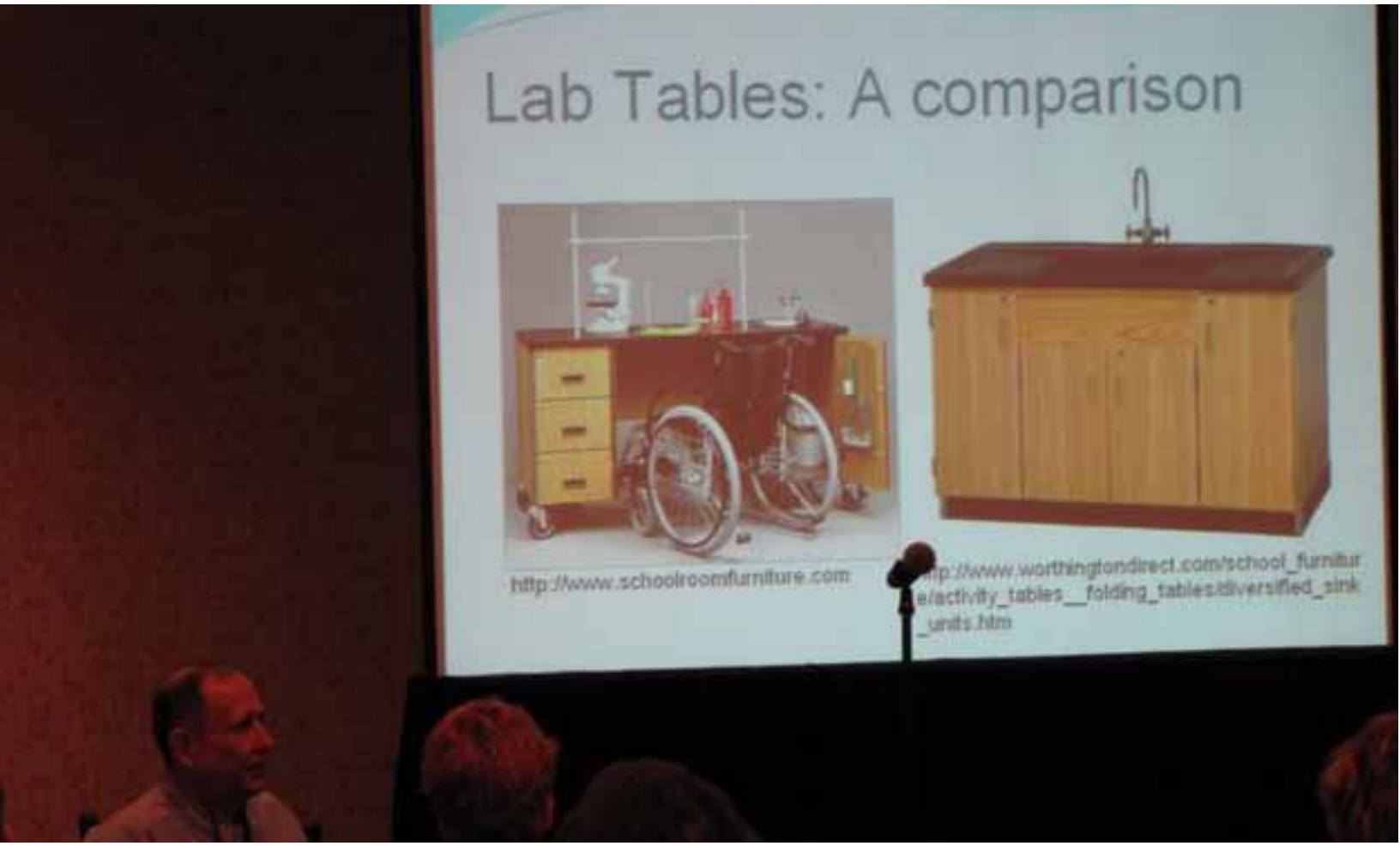
Director, Small Molecule X-ray Crystallography and Protein Structure Laboratories
University of Kansas

Victor Day, unlike the other scientists with disabilities who spoke at the workshop, has one of the so-called "invisible" disabilities—a psychiatric condition called rapid cycling bipolar disorder. After his diagnosis in 1994 (Day has been taking medication for the disorder for 15 years and experienced no serious problems), Day was relieved. "There was a side of me I never understood," he said, and the diagnosis explained why he often acted against his own interests or lost his temper over minor things. He informed his department chair of his diagnosis but never requested an accommodation. "If you have a disability, you shouldn't keep it quiet," he said. Many people have such problems, including bipolar disorder or major depression, but either don't know or don't report it, and therefore never get the help they need.

particularly those who are at the beginning of their scientific careers or contemplating an academic path in the chemical or materials sciences. The workshop organizers also agreed on material steps that can be taken, including but not limited to a discussion of how to create and manage a mentoring network for people with disabilities and the production of a presentation (with the NSF and NIH) for training department chairs to raise awareness about students and faculty with disabilities and the resources available to encourage them and educate their staffs.

"I would urge each of us to go back to our institutions and try to have a positive effect," said Peggy Cebe, a workshop steering committee member from Tufts University. "If each of us impacts our local institutions, the effect would be multiplicative—much farther reaching than the report produced by the committee."

This comment was not made to denigrate the value of this report and its synthesis and overview of the challenges associated with supporting people with disabilities in the chemical and materials sciences, but rather to highlight the importance of each attendee acting locally—at his or her home institution—and thinking globally by following the principles and recommendations outlined here.



Wheelchair-accessible lab tables are among the simple tailored accommodations that can make lab environments safe and friendly for people with mobility problems.

Breakout Sessions

The workshop attendees discuss specific questions in the breakout sessions.

The centerpiece of the workshop on people with disabilities in chemistry, chemical engineering, and materials science was the breakout sessions in which the attendees—including department chairs, scientists with disabilities, and other administrative and academic staff—were divided into eight groups. Each group was tasked with a question or series of questions. They brainstormed recommendations and presented their findings to the rest of the workshop (in addition to the summaries here, the full list of recommendations from each session is available in Appendix B). A common feature of many NSF-sponsored workshops, the breakout sessions allowed each attendee to have a specific voice and brought a wide range of ideas to the table, though the recommendations should be treated with caution as they do not represent a consensus and did not necessarily include all stakeholders. The workshop organizers then used these recommendations to develop the conclusion and broader recommendations of this report. And each of these questions can be used by institutions to structure their own discussions on how they can best serve the needs of students and employees with disabilities of all types.

Question 1: Accessibility

How does a university develop safe, effective access to facilities for people with disabilities? What can be done to improve access to offices, classrooms, laboratories, libraries, and other facilities, and will these recommendations differ by disability? What would the ideal university look like, and what research or technology is needed to achieve this goal?

Recommendations

The discussion of this question stressed the need for university-wide planning and a suite of services for people with disabilities that is flexible, centralized within universities, and standardized across institutions. Strong communication of current and best practices—especially between planners, administrators, and department chairs—is important. Discussions, including those in advance of renovations or other significant changes

that might affect accessibility, should be as inclusive as possible, and include input from faculty, regardless of disability status, and the full range of university departments. To communicate best practices and provide a model for future planning, the practices and facilities of schools that are most welcoming to students with disabilities should be compiled and distributed in a database. A menu of low-cost accommodations or universal design choices, and available subsidies for them, should be compiled.

Question 2: Non-visible disabilities

How does a university develop adequate accommodations for people with non-visible disabilities? What resources and accommodations are available for this population?

Recommendations

The attendees who discussed this question agreed that the NSF and ACS should take responsibility for refining the definition of non-visible disabilities and acquiring statistics on disability by type. Departments should provide a welcoming environment—one in which students and staff are comfortable enough to request accommodations when needed—that considers disability status to be a form of diversity. Faculty should meet to discuss the ADA and to learn from someone, such as an ADA expert or staff support counselor, about the resources and options available to those with non-visible disabilities. Universal design principles should be applied wherever possible.

Question 3: Instructional tools

Are your universities instructional tools accessible or friendly to disabled users? How can access to that information be improved? For faculty members with disabilities, how is technical material and student work made optimally accessible?

Recommendations

Students and faculty with disabilities must accept responsibility for seeking assistive technology—even in the case of visible disabilities. That said, the breakout group also agreed that these options must be presented to students in regular classroom visits from an accessibility counselor and to faculty through liaison with an ADA or support office. Department chairs should encourage the use of a variety of learning modalities, and the NSF should provide funding for basic forms of assistive technology, such as text-to-speech (and vice-versa) software and a funding mechanism for other, more specialized forms.

Question 4: Access to information

What resources are required to ensure appropriate access to information? How are these resources the same or different for classroom or research use?

Recommendations

Universities can recruit and retain faculty with disabilities, the discussants agreed, through research experiences targeted at undergraduates with disabilities (funded and promoted by federal agencies). A national organization or federal agency should build and maintain web resources for community-building and mentoring, both faculty-to-faculty and faculty-to-student, for those with disabilities. Department chairs should seek training about disabilities to improve their abilities to lead in the field and help educate faculty to prevent unconscious bias. Further technology can be used to support distance learning, self-paced learning, and accessible websites and textbooks. And departments should publicize, in their recruitment literature, the existence and capabilities of university offices that support students, faculty, and staff with disabilities.

Question 5: Agencies and professional societies

What new strategies can be employed by federal agencies, professional societies, and other external stakeholders to lower the barriers faced by people with disabilities?

Recommendations

First of all, the breakout group stated, funding agencies should streamline the proposal preparation process in ways that focus on the core of the research. The NSF and NIH should consider designing targeted funding programs for people with disabilities, include people with disabilities in panel reviews, and develop funding programs for the acquisition of assistive technologies. Professional societies should structure benefit packages friendly to people with disabilities, offer reduced membership fees to people who develop disabilities mid-career, and ensure their meetings, conferences, events, publications, and websites are universally accessible. And administrators should examine policies and centralize information on accommodations and institutional resources. Also, departments and universities should work

William McCarthy

Professor of Civil Engineering
New Mexico State University

When he was in high school more than forty years ago, Bill McCarthy was in an automobile accident that cost him the use of his legs, and he was told to give up his dream of becoming an engineer. He persisted and succeeded in spectacular fashion. McCarthy passed away just months after the workshop, in July 2009. But at the workshop, he spoke eloquently about how accommodations for people with paralysis or mobility problems have changed over the years and the best ways to make laboratories friendly and safe for all students. McCarthy explained that accommodations have come a long way since his accident, when the table that was set up for him was considered a fine concession. "Today, we should expect a lot more," he said. Now students have access to a wide range of accommodations, but implementation can often be difficult, particularly when little advance warning is given. He encouraged the attendees to make labs as mistake-proof as possible through a series of simple adaptations. Clear hallways or lanes, particularly those leading to safety stations (that should be accessible to all), as well as plastic containers with no-spill stops, can help keep lab areas safe. Also, trained lab assistants—who are aware of potential dangers but allow students to progress and safely make their own mistakes—are also needed. "Simple concessions can go a long way toward creating an accessible but safe environment," he said. In his career, McCarthy received numerous awards for teaching excellence and served as director for Reaching the Pinnacle, an NSF-funded program for students with disabilities. A computer laboratory for students with disabilities was named the Dr. William C. McCarthy STEM Memorial Laboratory in his honor.

with industry partners to facilitate recruitment of people with disabilities.

Question 6: Internal assessment

How can one assess departmental and institutional attitudes regarding disabilities? And how can a department use such assessments to develop strategic plans to recruit and retain people with disabilities?

Recommendations

The attendees in this group agreed that universities should review their strategic hiring plans, offer departmental incentives with an eye toward including people with disabilities, expand services for students with disabilities to faculty with disabilities, and include sections on accommodation in faculty handbooks. Departments themselves should include clauses about disability in new and renewed contracts, and accommodate disabilities without creating unequal workloads by reassigning responsibilities thoughtfully.

Question 7: Faculty development

How can strategic plans and incentives be developed to attract, recruit, and retain a faculty that includes people with disabilities, both visible and non-visible?

Recommendations

The breakout discussants agreed that if mentors for new faculty with disabilities cannot be found in a home department, then applicable mentors can be drawn from other departments. National organizations such as AAAS and ACS should establish a further mentoring network to match junior and senior faculty members with comparable disability status. And the conference steering committee should create a video supplement to this report that features faculty role models with disabilities.

Question 8: Mid-career disabilities

What are the best practices for accommodating faculty members who develop disabilities mid-career?

Recommendations

A campus ADA coordinator or support staff member should be notified of any change in disability status, the attendees said, and alternate sources of disability insurance should be made available, perhaps through ACS. The faculty member in question should investigate sources of salary support if necessary and devise plans, with a departmental chair, to deal with recurring symptoms that might interfere with job duties. The departmental chairs should encourage communication about disabilities and be alert to changes that might indicate an emerging disability. Finally, the university should allow the tenure clock to be temporarily stopped and grant flexible sabbaticals in the case of short-term disability.

Discussions about ways to encourage diversity in the sciences continued into the evenings.

Conclusion

The attendees of the Workshop on Excellence Empowered by a Diverse Academic Workforce (chemists, chemical engineers, and materials scientists with disabilities) were in full agreement on several points. A healthy scientific community is a diverse one. That diversity must include scientists with disabilities of all types, and those scientists can often bring different perspectives and novel approaches to research questions. For some reason, students with disabilities do not progress as far as their peers, and as a result, people with disabilities are underrepresented at the highest level of scientific achievement. Something must be done to make the scientific world more welcoming to people with disabilities to guarantee its ongoing health. These statements are clear and not in dispute. Less clear—going into the workshop—was what policies can be implemented by agencies, universities, departments, and individuals to work toward this goal in a timely and effective manner.

The wide range of administrative and academic representatives at the workshop engaged in a great deal of information sharing and critical discussion that resulted in some broad recommendations—with related, specific, immediate steps—for each attendee to take back to his or her home institution. These recommendations include making greater attempts to acquire data that can be used to understand why students with disabilities are less likely to complete advanced scientific education. With these data in hand, it will be easier to create and refine the kinds of mentoring programs, targeted fellowships, and support systems that will be needed to encourage students of promise with disabilities, and help develop the careers of scientific faculty members who either have disabilities or develop them later in their careers. To make the office and laboratory environment friendlier to people with disabilities of all types, department chairs and administrators should communicate and interact regularly with both their own university's ADA or counseling offices and with their colleagues at other institutions. Policy-wise, the principles of inclusiveness and universal design should be employed whenever possible and cost-feasible, and every effort should be made to provide useful and creative tailored accommodations for specific disabilities or situations not otherwise addressed.

Perhaps most importantly, the attendees of the workshop met one another and created cross-institutional links that will be essential to a discipline-wide movement toward creating maximally inclusive environments. This report was prepared to capture the spirit of their discussion and continue it beyond that hotel in Arlington. It is hoped it will initiate new rounds of discussion and communication that will further increase the chances of success for people with disabilities in the sciences.

Appendix A: Speakers and Presentations

A variety of leaders and experts in assessing and accommodating disabilities—including several working scientists with disabilities—spoke to the workshop attendees.

Excellence Empowers: Chemists, Chemical Engineers, and Materials Scientists with Disabilities
Kathie L. Olsen
Senior Adviser
Office of Information and Resource Management
National Science Foundation

Inclusion of Individuals with Disabilities: Accommodations and Universal Design
Sheryl Burgstahler
Director of Disabilities, Opportunities, Internetworking, and Technology (DO-IT)
University of Washington

What the Data Show About Chemists, Chemical Engineers, and Materials Scientists with Disabilities
Joan Burelli
Senior Analyst
Science and Engineering Indicators Program
National Science Foundation

Persons with Mobility Disabilities and the Chemistry Laboratory
William McCarthy
Department of Civil Engineering
New Mexico State University

Empowering a Blind Chemistry Professor in a Diverse Academic Workforce
David Wohlers
Department of Chemistry
Truman State University

Deafness and Bionic Hearing: Challenges and Opportunities
Ian Shipsey
Department of Physics
Purdue University

Mental Health (Depression and Anxiety)
Victor Day
Director, X-Ray Crystallography Laboratory
University of Kansas

Diversity and Disabilities: Recruiting and Retaining the Best/Accommodations for Cognitive Disabilities
Virginia J. Reilly
Director of University ADA services
Virginia Tech University

Americans with Disabilities Act
Steve Ramirez
Equal Opportunity Specialist
University of Kansas

Fostering Ability (Keynote Address)
Joe Francisco
President-elect
American Chemical Society

Opportunities and Challenges: Persons with Disabilities as NSF Employees, Panelists, and Advisory Committee Members
Jim Lightbourne
Acting Director, Office of Equal Opportunity Programs
National Science Foundation

Appendix B: Breakout Recommendations

The centerpiece of the workshop was the division of the attendees into a series of breakout sessions in which they discussed specific questions and developed lists of recommendations that were then presented to the full workshop. These recommendations were the results of brainstorming sessions, did not represent a consensus, and did not necessarily include all stakeholders. Summaries of these questions and recommendations appear in this report. What follows is the full text that each breakout group presented to the rest of the attendees.

Question 1
How is safe, effective access to university facilities developed for people with a disability? What recommendations can be made to improve access to office, classroom, laboratory, library, other facilities for work-life balance, and how do these recommendations differ (or are similar) based on disability? What would the ideal university look like, and what new research/technology is needed to achieve that goal?

Recommendations
- University-wide planning is needed.
- Services and policies should be standardized across colleges and universities.
- Campus planners and administrators of services for those with disabilities need to inform department chairs about current practices related to disability.
- When renovations are planned, input should be sought from faculty members regardless of disability status. Discussion of how to solve mobility issues should be broadened to include representatives from many campus disciplines—arts as well as sciences, humanities as well as social sciences.
- The handling of individual cases of disability should be flexible.
- A menu of low cost solutions should be compiled, including subsidies for their implementation.
- The practices and facilities of schools that are models in terms of accommodating all people should be contained within a database.

Question 2
How are adequate accommodations developed for people with a non-visible disability? What resources and accommodations are available, and could be made available, to people with non-visible disabilities?

Recommendations
- The National Science Foundation Division of Science Resource Statistics and the American Chemical Society might consider better defining disability and getting a larger sample size to provide more accurate and detailed statistics on disabilities by type.
- Departments should provide an open and accommodating environment, one that assumes disability is another form of diversity and that focuses on productivity and accomplishment.
- It is essential for department chairs to create an environment where disabilities of various kinds are recognized and addressed in a variety of ways, thereby leading students, faculty and staff to feel comfortable in declaring the need for accommodations related to disability. The implementation of universal design practices will create that environment and, thereby, enhance productivity.
- The Americans with Disabilities Act and its amendments should be discussed at a faculty meeting.
- A representative from an agency within the university knowledgeable about disability—such as an ADA office or a faculty/staff support office—should be invited to address faculty members about non-visible disabilities and inform them about resources and options related to addressing these disabilities as they arise.

Question 3
How friendly are the instructional tools your institution uses to the disabled? What resources are needed to improve access to information? How is technical material prepared for faculty use and how is student work made accessible to the faculty member for assessment?

Recommendations

- Students and faculty with visible and invisible disabilities must accept responsibility for seeking help in securing and using assistive technology. Staff, faculty and administration cannot presume a need for assistance when a disability is visible nor can they identify all that might benefit from assistance, especially when a disability is invisible.
- Accessibility counselors should be invited to visit classrooms to help students connect with the services they require. Such visits should be routine and not made only when disabilities are visible.
- Departments, schools or college should appoint a contact person to be a liaison with campus offices knowledgeable about access issues and solutions.
- Department chairs should encourage faculty to teach, and to permit students to learn, in many modes, including visual, auditory and kinetic (writing).
- The NSF should provide funding for the addition of voice-to-print and print-to-voice capability in course management software, or, alternatively, universities should strongly encourage manufacturers to add this capability to their standard course management software packages.
- The NSF and/or universities should develop a funding mechanism that allows academic units to acquire assistive technology.
- New assistant professors should be trained in the concepts, behaviors, technologies and design concepts necessary to make departments accessible to persons with disabilities.

Question 4
What resources are required to permit access to information? Pay particular attention in the breakout session to similarities and differences associated with obtaining material for classroom use and research use as separate topics. How is technical material prepared for faculty use and how is student work made accessible to the faculty member for assessment?

Recommendations
- Universities should develop research experiences and other similarly structured programs targeted at undergraduate students with disabilities in order to increase the number of qualified candidates with disabilities for faculty positions.
- Federal agencies need to fund these programs and universities to develop a structure to raise awareness about them and ease access to them.
- A national organization, such as the American Association for the Advancement of Science, or a federally funded program, such as the NSF AccessSTEM project, should build and maintain Web resources for faculty and students with disabilities to encourage virtual and real communities and promote mentoring, both faculty-to-faculty and faculty-to-student.
- Professors should deploy technology developed to support distance learning. They might, for example, film chemical demonstrations in advance and put them on the Web. Questions could be asked before or after class, without requiring a real-time response, thereby serving the needs of some students with disabilities for self- paced learning.
- Acoustics of auditoriums should be improved for people with and without hearing disabilities.
- Chairs should be trained about disability in order to increase their confidence in raising disability-related issues.
- Faculty should be educated about disability so they do not engage in unconscious bias against students and colleagues with disabilities.
- Leadership in facilitating the participation of people with disabilities in a department or discipline should be an acknowledged form of service.
- Chairs, faculty, and Web builders, designers, and content creators should construct Web sites that meet accessibility standards, perhaps with assistance from a campus standards organization.
- Publishing companies should be urged by faculty to deliver the content of textbooks in multiple formats, including, for example, audio and MP3 formats.
- Departments should make efforts to discover and publicize, on Web sites and in recruitment literature, the existence and capabilities of offices and agencies within the university that are charged with the recruitment, retention and protection of faculty, staff and students with disabilities. This could be done by standard equal- employment opportunity announcements on Web sites, but a more prominent notice also would be warranted, such as a paragraph in recruiting brochures, for example, or a freestanding Web page.
- Faculty and building design/planning committees should pay more attention, at an earlier stage, during decision-making processes related to construction or remodeling projects, to physical access issues. Consideration should be given to exceeding ADA requirements as well as planning for emergencies with persons with disabilities more clearly in mind.

Question 5
In order to support and develop a diverse scientific workforce, what new strategies can be adopted by agencies, professional societies and other stakeholders to lower the barriers that people with disabilities face?

Recommendations

- In the spirit of the concept of universal design, funding agencies should streamline the proposal preparation process. They should de-emphasize formatting, supporting materials requirements and other process considerations, and focus, instead, on the value of a proposal's research core.
- NSF and NIH should design targeted funding programs focusing on PIs with disabilities who have expertise in specific disciplines.
- NSF and NIH should include persons with disabilities in panel reviews. The agencies should work with organizations that advocate for persons with disabilities to identify qualified reviewers.
- NSF and NIH should develop funding programs that allow institutions to acquire assistive technology and develop other accommodations before an opportunity arises to hire a person with a disability or before a request is made by someone at the institution for an accommodation.
- Administrators, chairs and faculty should regularly examine university and department policies and operating procedures to see where universal design principles can be implemented to minimize the need for individual accommodations.
- Administrators should centralize information on accommodations and institutional resources. Attendance should be required at periodic mandatory briefings designed to disseminate the information. Specific individuals or offices should be charged with processing accommodation requests.
- State and federal vocational/rehabilitation/employment agencies should be engaged to provide services and accommodations for qualified individuals.
- The ACS and other large professional organizations should facilitate community building among individuals with disabilities.
- Professional societies and employers should structure benefits packages so that they don't exclude persons with disabilities or place persons with disabilities at a disadvantage in securing various forms of insurance.
- Professional societies should consider offering reduced membership fees to individuals who acquire disabilities in mid-career.
- Professional societies should to ensure that their meetings, conferences and events are held in accessible venues and that the related websites and publications are fully accessible. Events should be announced well in advance so attendees may request accommodations. Sites and services should be scrutinized in advance to confirm accessibility.
- Departments and schools should work with industrial partners to facilitate recruitment of qualified applicants with disabilities and reduce discrimination. Job fairs and related events should be accessible to all.
- In interviews, the focus should be the exchange of information rather than the format or setting of that exchange.

Question 6

How can one assess departmental and institutional attitudes and perception regarding disability? Guided by such assessments, how does a department/institution develop a strategic plan to attract, recruit, and retain a diverse faculty inclusive of persons with disabilities, both visible and invisible?

Recommendations

- Universities should review their strategic hiring plans to assure that persons with disabilities are included as a protected class.
- Universities should offer schools and departments incentives, financial and otherwise, for hiring faculty with disabilities.
- Universities should expand services for students with disabilities to include faculty with disabilities, for the purpose of leveraging existing infrastructure.
- Departments should include in the initial faculty contract, and in contract renewals, a clause about accommodation of disability.
- The faculty handbook should include a section on accommodation of disabilities.
- Department leaders should accommodate disability without creating unequal work loads but by reassigning responsibilities, keeping in mind the need to optimize student satisfaction.

Question 7

How can a departmental/institutional strategic plan be developed to attract, recruit and retain a diverse faculty that includes persons with disabilities, including invisible disabilities? Consider the current practice at your institution, detailing what is effective and what requires improvement. What new department/institutional incentives can be developed?

Recommendations

- If mentors for a new faculty member with a disability are not available in the home department, the department chair should seek mentors in other departments to provide the new hire with assistance in proposal preparation and postdoc recruitment, by sharing lecture notes and evaluating classroom teaching, and with other tasks.
- The ACS or AAAS should establish a mentoring network that goes beyond the university, matching senior faculty with a disability with junior faculty. In the case of non-visible disabilities this could be done confidentially.
- The conference steering committee should oversee development of a video supplement to this report that features role model faculty with disabilities describing some of the needs and challenges that may arise for professors with certain kinds of disabilities working in university STEM departments. Seemingly aimed at professors with disabilities, it would also serve to inform many others.

Question 8
What are the best practices for accommodating faculty members who develop disabilities during their careers?

Recommendations
- The campus ADA coordinator, or other responsible campus agency, should be informed, with permission of the disabled person, as soon as a disability becomes apparent.
- Alternate sources of disability insurance should be made available, perhaps through the ACS, for faculty with disabilities expected to be short-term who want to continue their research.
- The faculty member should investigate sources of agency salary support if the disability impacts teaching but not research capability.
- Chairs should encourage communication about disabilities within the department, with the goal of maximizing productivity.
- Chairs should be alert to changes in behavior or activity that may indicate an emerging problem and communicate with faculty about those changes and their effect on fulfillment of job duties.
- The faculty member, in consultation with the chair, should devise plans to deal with recurring symptoms that occasionally prevent fulfillment of duties.
- The institution should allow for the tenure clock to be stopped if a disability emerges before a tenure decision.
- The institution should allow flexible use of sabbaticals in cases where a disability is projected to be short-term.

Appendix C: Funding and Federal Resources

Federal Resources and Funding Opportunities
National Council on Disability (NCD)
www.ncd.gov
Recommendations regarding public policies that affect people with disabilities

National Institute on Disability & Rehabilitation Research (NIDRR)
www.ed.gov/about/offices/list/osers/nidrr
Research and publications regarding individuals with disabilities

National Science Foundation
www.nsf.gov
Reports, data, and funding opportunities

NSF Research in Disabilities Education
www.nsf.gov/funding/pgm_summ.jsp?pims_id=5482

Office of Disability Employment Policy
www.dol.gov/odep
Employment data and issues

Office of Special Education and Rehabilitative Services
www2.ed.gov/about/offices/list/osers/index.html
Leadership in and funding for achieving equal opportunities for people with disabilities

U.S. Department of Education Grants
www2.ed.gov/fund/landing.jhtml
Funding opportunities

U.S. Department of Labor Find Grants
www.doleta.gov/grants/find_grants.cfm
Funding opportunities

Other Funding Opportunities
There are many private foundations that might fund projects related to increasing the participation of students with disabilities in chemistry. The list below offers examples of the types of funding available from these private sources.

3M Foundation
solutions.3m.com/wps/portal/3M/en_US/CommunityAffairs/CommunityGiving/

Abbott Fund
www.abbottfund.org/sections/apply.html

American Honda Grant
corporate.honda.com/america/philanthropy.aspx?id=ahf

Arcus Foundation
www.grant-applications.org/michigan-grants/arcus-foundation

AT&T Foundation Grants
www.att.com/gen/corporate-citizenship?pid=7737

Bank of New York Mellon Foundation
www.bnymellon.com/about/communityinvolvement

Barnes and Noble
www.barnesandnobleinc.com/our_company/sponsorship/Sponsorship_main.htmlnational.html

Bill & Melinda Gates Foundation
www.gatesfoundation.org/about/Pages/overview.aspx

Braitmayer Foundation Grant
www.braitmayerfoundation.org/recip.cfm

Bridgestone/Firestone Trust Fund
www.bridgestone-firestone.com/trustfund.asp

Carls Foundation
www.carlsfdn.org

Carnegie Corporation
carnegie.org/grants/grantseekers/submitting-a-letter-of-inquiry/

Charles & Helen Schwab Foundation
www.schwabfoundation.org/Priorities/Guidelines.aspx

Charles Lafitte Foundation
charleslafitte.org/grants/overview/

Christopher Reeve Foundation Quality of Life Grants
www.christopherreeve.org/site/c.ddJFKRNoFiG/b.4426017/k.95FA/How_to_Apply.htm

Comcast Foundation
www.comcast.com/Corporate/About/InTheCommunity/Foundation/FAQ.html

Community State Street
www.statestreet.com/wps/portal/internet/corporate/home/aboutstatestreet/corporatecitizenship/

ConocoPhillips
www.conocophillips.com/EN/susdev/communities/community_investment/volunteerism/Pages/index.aspx

Mazda Foundation
www.mazdafoundation.org/grantguidelines.html

Motorola Foundation Innovation Generation Collaborative Grants
responsibility.motorolasolutions.com/index.php/society/comminvest/education/igg/

Nordstrom Community Giving
shop.nordstrom.com/c/nordstrom-cares-community-giving

RGK Foundation
www.rgkfoundation.org/public/guidelines

Ruddie Memorial Youth Foundation
www.rmyf.org/content.cfm?u=faq

Sociological Initiatives Foundation
www.sifoundation.org/?p=44

State Farm Youth Advisory Board
www.statefarmyab.com/apply/national-grants/

Union Pacific Foundation
www.up.com/found/grants.shtml

Verizon Foundation
www.verizonfoundation.org/grant/guidelines.shtml

Westinghouse Electric Co.
www.dhs.state.il.us/page.aspx?item=24330

William T. Grant Scholars Program
www.wtgrantfoundation.org/funding_opportunities

Appendix D: Informational Resources

The Access Board
www.access-board.gov
Guidelines and standards for accessible design

Access2Science
www.access2science.com
Articles and links on accessibility of STEM for people with print disabilities

AccessSTEM Knowledge Base
www.washington.edu/doit/Stem/kb.html
Q&As, case studies, and promising practices with links to websites, videos, and publications that share how to make STEM accessible to individuals with disabilities

American Association for the Advancement of Science EntryPoint!
ehrweb.aaas.org/entrypoint/
Internship opportunities for postsecondary students with disabilities

Association on Higher Education and Disability (AHEAD)
www.ahead.org
Organization of higher education disability service providers that share information about research, accommodations, and legislation

Center for Applied Special Technology (CAST)
www.cast.org
How to apply universal design for learning principles

Center for Universal Design in Education (CUDE)
www.uw.edu/doit/CUDE
Applications of universal design to instruction, services, physical spaces, and technology in educational settings

Disabilities, Opportunities, Internetworking, and Technology (DO-IT), University of Washington
www.washington.edu/doit/

Disabled Student Services in Higher Education listserv
dsshe-l@listserv.buffalo.edu

Educational Equity Center
www.edequity.org
Bias-free learning practices that reduce inequalities based on gender, race/ethnicity, disability, and family income

Educational Testing Services Office of Disability Policy
www.ets.org/disabilities
Guidelines for documentation of physical and psychiatric disabilities, learning disabilities, and attention deficit/hyperactivity disorder in adolescents and adults

Equity and Excellence in Higher Education: Universal Course Design
www.eeonline.org
Improving he educational outcomes of postsecondary students with disabilities

HEATH
www.heath.gwu.edu
Promoting success in postsecondary education for individuals with disabilities

Job Accommodation Network (JAN)
askjan.org
Reasonable accommodations for people with disabilities in employment settings

Mobility International
www.miusa.org

National Center for Accessible Media
ncam.wgbh.org
Accessible media

National Center for the Dissemination of Disability Research
www.ncddr.org
Disability-related research

National Center on Secondary Education and Transition (NCSET)
www.ncset.org
Promotes successful transition to postsecondary education and employment for students with disabilities

National Organization on Disability (NOD)
www.nod.org
Promotes the full participation of Americans with disabilities in all aspects of community life

Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)
www.resna.org
Assistive technology

RDE Collaborative Dissemination
www.washington.edu/doit/RDE
Resources for making STEM accessible to individuals with disabilities

Science Access Project
dots.physics.orst.edu
Enhancing the ability of people with print disabilities to read, write, and manipulate information, with a focus on math and science content

SciTrain
www.catea.gatech.edu/scitrain
Training information to help high school math and science teachers teach students with disabilities

Tactile Access to Education for Visually Impaired Students
www.taevisonline.purdue.edu

View Plus Technologies Inc. Tiger Advantage Personal Tactile Graphics and Braille Embosser
www.viewplustech.com

Web Accessibility Initiative (WAI)
www.w3.org/WAI
Web accessibility guidelines, tools, and research

World Institute on Disability
www.wid.org
Reducing barriers and increasing opportunities

Appendix E: ADA and Legal Resources

The Department of Justice offers technical assistance on ADA Standards for Accessible Design and other ADA provisions applying to businesses, nonprofit service agencies, and state and local government programs. It also provides information on how to file ADA complaints. The ADA information line for publications, questions and referrals is (800) 514-0301 (voice) or (800) 514-0383 (TTY). www.usdoj.gov/crt/ada/adahom1.htm

The Equal Employment Opportunity Commission offers technical assistance on the ADA provisions applying to employment. It also provides information on how to file ADA complaints. Employment questions: (800) 669-4000 (voice) or (800) 669-6820 (TTY). Employment publications: (800) 669-3362 (voice) or (800) 669-3302 (TTY). www.eeoc.gov

The Office of Civil Rights enforces Title II of the ADA and can be reached at (800) 421-3481 (voice) or (877) 521-2172 (TDD). www.ed.gov/about/offices/list/ocr/index.html

The Department of Transportation, Federal Transit Administration ADA Assistance Line for information and complaints is (866) 377-8642 (voice). www.fta.dot.gov/civilrights/civil_rights_2360.html

The Federal Communications Commission offers technical assistance on ADA telephone relay service requirements and FCC regulations. For Telecommunications Relay Service (TRS) publications and questions, the numbers are (888) 225-5322 (voice) or (888) 835-5322 (TTY). www.fcc.gov/cib/dro

The Office of Compliance offers technical assistance on accessibility laws applying to congressional offices and services, and can be reached at (202) 724-9250 (voice); (202) 426-1912 (TTY). www.compliance.gov

The Access Board offers technical assistance on the ADA Accessibility Guidelines. For publications and questions, call (800) 872-2253 (voice) or (800) 993-2822 (TTY). www.access-board.gov

Guidelines for Telecommunications Act Accessibility can be found at www.access-board.gov/telecomm

The Internal Revenue Service provides information about tax code provisions, including tax credits (Section 44) and deductions (Section 190), that can help businesses comply with the ADA. Tax code information: (800) 829-1040 (voice) or 800-829-4059 (TTY). Tax code legal questions: (202) 622-3110 (voice) or TTY (use relay service). To order publications: (800) 829-3676 (voice) or 800-829-4059 (TTY). www.irs.gov

The Department of Education funds ten regional centers to provide technical assistance on the ADA.

The Job Accommodation Network (JAN) is funded by the Department of Labor to provide suggestions on accommodating employees with disabilities. Call JAN at (800) 526-7234 (voice/TTY). www.jan.wvu.edu

The Disability Rights Education and Defense Fund (DREDF) ADA Hotline is funded by the Department of Justice to provide technical assistance on the ADA. Call (800) 466-4232 (voice/TTY). www.dredf.org

Project ACTION is funded by the Department of Transportation to provide ADA information and publications on making transportation accessible. For transportation information and publications, call (800) 659-6428 (voice or TTY, use relay). www.projectaction.org

The Fair Housing Act Query the Department of Housing and Urban Development can be reached at (202) 708-2333 (voice) or (202) 401-1247(TTY). For publications, call (800) 767-7468 (voice or TTY, use relay). www.hud.gov/offices/fheo/ FHLaws

Air Carrier Access Act Query the Aviation Consumer Protection Division can be reached at (202) 366-2220 (voice) or (202) 755-7687 (TTY). www.disabilitytravel.com/airlines/air_carrier_act.htm

Appendix F: Workshop Participants

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