



**Testimony of**  
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**Before the**  
**Subcommittee on Consumer Protection and Commerce**

**For the**  
**Committee on Energy and Commerce**  
**United States House of Representatives**

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**Inclusion in Tech: How Diversity Benefits All Americans**  
*“The Critical Role of Higher Education in Preparing a Diverse Science, Technology, and Engineering Workforce for Tomorrow”*

Good afternoon Chairman Pallone, Chairman Schakowsky, Ranking Member Walden, Ranking Member Rodgers, and members of the subcommittee. My name is Joan Ferrini-Mundy and I am the President of the University of Maine and its regional campus, the University of Maine at Machias.

The mission of the University of Maine is to advance learning and discovery through excellence and innovation in undergraduate and graduate academic programs while addressing the complex challenges and opportunities of the 21<sup>st</sup> century through research-based knowledge. Through integrated teaching, research, and outreach, the University of Maine improves the quality of life for people in Maine and around the world, and promotes responsible stewardship of human, natural, and financial resources.

The University’s Diversity Action Plan guides our efforts to achieve seven key goals: communicate clearly and affirmatively the University’s commitment to diversity; make substantial progress on our Affirmative Action goals; retain employees of difference; value diversity as an essential component of the curriculum; increase the percentage of undergraduate and graduate students of color; retain those students through degree completion; and offer programming to sustain a community of respect for differences.

Today I will discuss how diversity and inclusion are central to the successful executing of that mission and those goals, within the context of U.S. higher education and a workplace being dramatically influenced by technology.

**Diversity powering the changing science, technology, engineering, and mathematics (STEM) workplace.** Tomorrow's workplace is changing, and the workplace already features diversity on many dimensions. That workplace requires STEM professionals who are prepared to collaborate with colleagues from multiple disciplines, from diverse backgrounds and from a wide range of experiences. Diversity and inclusiveness in the workplace are central in solving complex problems, learning from and with others as work demands change over their careers, finding competitive solutions to improve efficiency and productivity, and bringing new ideas to market.

The concept of "convergence" already characterizes some of our greatest research advances in STEM, and diversity is foundational to convergence. MIT's Phillip Sharp told American Association for the Advancement of Science members in 2011: "Convergence is a broad rethinking of how all scientific research can be conducted, so that we capitalize on a range of knowledge bases, from microbiology to computer science to engineering design ... It entails collaboration among research groups by, more deeply, the integration of disciplinary approaches that were originally viewed as separate and distinct." (MIT, 2011). The students who are undergraduates in universities across the nation today already are working in labs that do convergence research, and will be the leaders of this convergence future, both as researchers and professionals across the knowledge economy. At the University of Maine, for example, our Graduate School for the Biomedical Sciences and Engineering brings together students from molecular and cellular biology, bioinformatics and genomics, toxicology, neuroscience, and biomedical engineering, in partnership with researchers from several laboratories across Maine. This represents diversity of disciplinary background.

As one of its 10 Big Ideas, The National Science Foundation identified "The Future of Work at the Human Technology Frontier." (NSF, n.d.a). The call for core research proposals (NSF, n.d.b) describes this changing environment: "The landscape of jobs and work is changing at unprecedented speed, enabled by advances in computer and engineering technologies such as artificial intelligence and robotics, deeper understanding of societal and environmental change, advances in the learning sciences, pervasive, intelligent, and autonomous systems, and new conceptions of work and workplaces. This technological and scientific revolution presents a historical opportunity to the Nation and its people, in the creation of new industries and occupations, enhanced productivity and quality of work life, and the potential for more people to participate in the workforce, ultimately yielding sustained innovation and global leadership."

NSF acknowledges the complexity of this changing workplace: "But, as history teaches, such changes also come with risks. Some risks are immediate, such as jobs lost to automation or demand for skills not met by current educational pathways. Other equally important risks include new security threats, algorithmic biases, unanticipated legal consequences including privacy implications, dependence on technology and erosion of human knowledge and skills, inadequate workplace policies and practices, or undesirable impact on the built environment." The students coming through our universities will be those who shape the ways in which these exciting changes are enacted, by capitalizing on collaborations across differences.

And, as noted in a recent National Academies workshop on the topic of the STEM workforce, “There is often a significant gap between the knowledge, skills, and abilities most often sought by employers (e.g., data analysis skills, problem-solving skills, creativity, and employability skills such as teamwork and interpersonal communication) and the knowledge, skills, and abilities that students bring into the workforce immediately upon graduation. To the extent that employers and colleges/universities can work together to close that gap, and create campus-based and work-based learning experiences for students that enable them to develop those skills, there may be opportunities to better prepare students to thrive in the workplace early in their careers.” (National Academies of Sciences, Engineering, and Medicine, 2016). Recognizing that these workplaces will be diverse and will benefit from diversity is key in the joint planning by universities and employers.

There is much discussion about the need for the continued re-skilling and up-skilling of the STEM workforce, as technologies, processes, and manufacturing change. Higher education already has a substantial role in that activity, particularly at the community and technical college levels, and programs offering stackable credentials and certificates are opening up as a function for higher education. This move toward “work-based learning” is discussed in a recent National Academies Workshop Report (NAS, 2016). For higher education, recognizing that providing inclusive environments for the returning adult learners, who bring a key type of age and experience diversity to campus, will be important if higher education is to be an effective partner in this kind of education. In Maine, 66% of high-wage, in-demand Maine job openings from 2014-2024 will require postsecondary education beyond high school (See Educate Maine, Education Indicators for Maine 2018). Higher education responses will need to incorporate the diversity needs and opportunities that will present themselves in this new sector of the mission.

**Higher education playing a critical role.** Technology increasingly pervades the STEM fields. For instance, a recent Bureau of Labor Statistics report (Riley, 2018) discusses projected growth in the mathematical sciences professions of 29.7% by 2026, and attributes that growth to the need for analytical ability, “particularly as big data becomes more prominent and useful for businesses.” As both science and the workplace change, higher education has a part to play in ensuring that students will thrive in those environments and be the leaders of tomorrow. Central to supporting these changing workplace demands is an inclusive undergraduate and graduate education that provides deep experience in interdisciplinary work and collaborative problem solving. Quality preparation depends on groups that have many kinds of diversity coming together effectively.

U.S. higher education has a fundamental role in preparing the future U.S. science, technology, engineering, and mathematics (STEM) workforce to thrive through diversity in a rapidly changing workplace. According to the National Science Foundation (NSF), “The representation of certain groups of people in science and engineering (S&E) education and employment differs from their representation in the U.S. population. Women, persons with disabilities, and three racial and ethnic groups – blacks, Hispanics, and [Native Americans] or Alaska Natives – are underrepresented in S&E.” (NSF, 2017). At the same time, a recent Pew Center report drawing on data from the U.S. Census Bureau indicates that “nearly half of postmillennials [6- to 21-year-olds] are racial or ethnic minorities” (Fry & Parker, 2018).

which means that U.S. higher education should be expected to fully mirror that diversity over the next two decades.

Institutions of higher education, especially land-grant institutions like the University of Maine, have a responsibility in their states and for the nation to help prepare tomorrow's innovative workforce in STEM. This workforce must be educated to create solutions to complex global problems, to improve quality of life for our people, and drive the economy through innovation. Specifically, the land-grant mission includes a strong outreach tradition, originally around agriculture, such that the new information arising from research would benefit the people of the state, with cooperative extension agents working in the field. That tradition is robust in Maine, in increasingly technologically sophisticated areas of agriculture and aquaculture, and beyond. In addition, our university is preparing leaders in a transforming forest resources industry, in marine sciences, in the health and future of Maine's coasts (all 3,478 miles!), in health care, in biomedical engineering, and other key fields.

Universities are microcosms of the diversities in society, yet for some college students the diverse environments of higher education are their first experience with people different from themselves. Their learning can be greatly enhanced by their interaction with people across the span of various diversity dimensions. For instance, at the University of Maine, 26% of our entering students are first-generation college students. At our Machias campus 54% are first-generation. These are populations that bring critical perspectives to university classrooms and labs, and our institutions need to be skilled in supporting their success.

In a recent administration of the National Survey of Student Engagement at UMaine, our students give us low marks on the opportunities they have here for "discussions with people of a race or ethnicity other than their own" and "institutional emphasis on encouraging contact among students from different backgrounds." We have a robust set of distributed activities in place on campus with more than 50 partner organizations aimed at enabling a highly inclusive campus that uses the great diversity we do have here, on various dimensions, as an asset to our students' experiences, and that endeavors to expand that diversity. For instance, our campus Center on Aging is engaged in promoting and facilitating activities on aging and aging-related education and training programs. Our Center for Community Inclusion and Disability Studies partners with the community to enhance the lives of individuals with disabilities and their families.

Economically disadvantaged students in Maine face challenges in securing higher education. In the 2017-18 school year, 47% of all Maine students in public school were classified as economically disadvantaged. Educate Maine has released goals that are directly related to improving diversity in our state's higher education, (EducateMaine, 2108) and they note the state goal of "60% of Mainers to hold a postsecondary credential of value by 2025." They argue that "we need to increase the number of Mainers with postsecondary credentials of value. ...to provide more academic supports and the price for college needs to be made more affordable..." (pg. 18) In Maine, within one year of high school 50% of economically disadvantaged students are enrolled in college compared to 75% of non-economically disadvantaged. The college completion rate for students who were economically disadvantaged while in high school in Maine is 40%; the rate for non-economically disadvantaged is 62%.

Diversity in socioeconomic status is central for us, and higher education success is tightly linked to college affordability. The University of Maine is addressing this in part by an exciting new first-year student success initiative<sup>1</sup> which is addressing the supports and opportunities needed to draw on diversity and ensure a fully inclusive environment.

Many types of diversity are important for university environments today and workplace environments tomorrow, including diversity of gender, sexual orientation, race, ethnicity, religion, age, disability, personality, socioeconomic status, disciplinary background, and experience. Promising research- and evidence-based practices show we can effectively create learning environments to build on diversities of many types in encouraging learning to occur and in fostering learner success. Indeed, today's college students expect and demand learning in such environments. Interacting with diverse learners can lead to more creativity, better ideas, and stronger motivation and engagement – all important workplace assets. (See Selingo, 2018, Gentile, Brenner, & Stephens, 2017, Chronicle of Higher Education, 2018).

Universities are also becoming quite expert at customizing the educational experience to assure that the needs of diverse learners are met. Innovations to support student success include use of predictive analytics, “intrusive” advising, the reform of gateway courses, adaptive learning, and inclusive teaching practices. There are increasingly widespread efforts to reduce cost and enhance access for a wider range of audiences, including pre-college students, through dual enrollment programs and community college partnerships, adults, place-bound learners, veterans, and other groups.

Universities are creating networks to amplify efforts to improve inclusion and results. For example, the Association of Public and Land Grant Universities (APLU) has launched ASPIRE: The National Alliance for Inclusive & Diverse STEM Faculty, with funding from the NSF INCLUDES program. The program “will pursue three mutually reinforcing strategic goals all focused on faculty. The ultimate aim is attracting more underrepresented students—women, members of minority racial and ethnic groups, persons with disabilities, and those from low socioeconomic backgrounds—into STEM college programs, assist them to stay in these programs, and help them graduate and succeed in a modern STEM workforce.” (York, n.d.). Initiatives such as these will help frame the efforts of universities to sustain and enhance their diversity focus. Our institutions of higher education, as microcosms of the society and the workplace, are ideal for cultivating the abilities and providing the learning environments to use difference as an asset and to collaborate, learn, and solve problems in such environments.

Research indicates that when solutions are derived by diverse teams those solutions are more feasible and effective, and often more profitable. For instance, Cumming and Leung (2018) have studied the role of diversity on corporate boards. They summarize literature on this as providing evidence that diversity in race and expertise “positively affect innovation,” and that diversity in experience and gender affect innovation. Hong and Page (2004) use mathematical modeling to demonstrate that “when selecting a problem-solving team from a

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<sup>1</sup> visit <https://umaine.edu/first-year/>

diverse population of intelligent agents, a team of randomly selected agents outperforms a team comprised of the best-performing agents.” (pg. 16387) Page has made strong claims about the important role of diversity in problem solving, stating that “People from different backgrounds have varying ways of looking at problems ... there’s certainly a lot of evidence that people’s identity groups – ethnic, racial, sexual, age – matter when it comes to diversity in thinking.” (Dreifus, 2008).

**The University of Maine is Committed to Diversity and Inclusion:** Maine is an aging state, above the national average for persons 65 years of age and over (US census.gov). Our population is 94.7% White, 1.6% Black or African American, and 1.6% Hispanic or Latino. Maine is considered a rural state, with population per square mile about half of the US average. (43 compared to 87). Maine is the oldest state (median age of 44.7) and the most rural, with more than 60% of Mainers living outside a metropolitan region. (PPH, 2018).

I have been the president of the University of Maine and its regional campus the University of Maine at Machias since July 2018, and am learning about how excellence and inclusion are fully central to our three core strategic values: fostering learner success, creating and innovating for Maine and beyond, and growing and stewarding partnerships.

On our campus of 9,365 undergraduates and 2,039 graduate students in Orono, Maine, we score above the national average in gender diversity (51% percent of our student body is women) and geographic diversity, and below the national average in ethnic diversity, according to College Factual. White students comprise 82% of our student body, while Black or African American, Hispanic/Latino, and all groups other than those of unknown ethnicity comprise about 12% of our student body. In the faculty and staff, 76% are white, 7% report as nonwhite, and 19% are unknown.

I wish to provide examples of University of Maine / University of Maine System initiatives that illustrate the place of diversity. The first is a project funded by the NSF INCLUDES program. NSF INCLUDES was cited recently in the Administration’s 2019 Science and Technology Highlights (The White House, 2018) as an effort to make a “lasting impact in diversifying the STEM workforce of the future through partnerships and collaborations at scale.” In 2017 a group of principal investigators at UMaine led by anthropologist Dr. Darren Ranco received funding to develop and assess the *Wabanaki Youth in Science Program to Bridge Inclusion in Post-Secondary education Through the Sciences*. Part of the project is the development of a course that brings together Traditional Ecological Knowledge and Western Science for undergraduates.” (Ranco, Daigle, & Crandall, 2017). This kind of instructional innovation overtly focuses on bringing diversity by race and ethnicity into the undergraduate and graduate university curriculum. The success of this ongoing effort will depend upon diversity and student engagement with ideas that are unfamiliar, via experts with experiences that span a range.

Funded by the NSF Research Traineeship (NRT) program funding, Dr. Sandra De Urioste-Stone leads another project that places diversity at the center. The project is developing “an interdisciplinary curriculum based on active learning models, professional development, and collaborative research that integrates biophysical and social sciences. The curriculum

consists of four diverse learning experiences: (1) integrated courses that provide theoretical and research foundations in socio-ecological resilience and science communication; (2) an internship with a conservation management, policy or science organization to master STEM professional skills; (3) an interdisciplinary research project; and (4) a mentoring program to ensure trainee success. Training will include close interactions with key conservation partners from state and local agencies, the National Park Service, non-governmental organizations, and community partners. NRT Trainees will learn to promote a systems approach to conservation through a wide range of biophysical and social science models and methods. (De Urioste-Stone, Calhoun, Nelson, Silka, & Weiskittel, 2018). Here, the students will learn how to interact with a range of diverse groups that have different stakes, motivations, and objectives.

The University of Maine partners with Educate Maine, a business-led education advocacy organization. One of Educate Maine's programs, Project>Login, focuses on growing a diverse tech workforce in Maine. The program facilitates employer events at five of the campuses to match students with internships and full time jobs in computing occupations. By partnering with career staff members, student organizations, and individual departments, Project>Login assists underrepresented minorities, women, and rural students to pursue a variety of experiential learning opportunities in technology.

Finally, the work of Dr. Brian Beal at the University of Maine at Machias centers on building marine research infrastructure with its partner, the Downeast Institute. Faculty, students, community members, and fishermen engage together to examine factors affecting the hatchery, nursery, and grow phases of shellfish cultures. This work brings together diversity of expertise and experience, is cross-generational, and is addressing meaningful challenges for the region as a part of the university experience.

**Conclusion.** Our nation's diversity is a resource— for learning and for solving the most complex problems of our times. As technologies and advances lead to changes in our workplaces, new generations of STEM professionals will bring their collective diversity to bear on improvements and innovations. U.S. higher education has a role to play in ensuring that those professionals are ready to make a difference.

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