

Zugänge, Barrieren und Potentiale für die internationale Mobilität von Wissenschaftlerinnen

Länderbericht USA

Country dossier USA

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1 Introduction

This report is the Country Dossier for the United States in the context of the “Study of the Potential of Internationally Mobile Women Scientists,” which explores the reasons for the low proportion of women among Humboldt Foundation grantees. The question the report seeks to answer is: “How high is the potential of female scientists in the individual country who could be attracted for a research stay in Germany due to their qualification and their willingness to be internationally mobile?” Following the basic module, this report will first undertake a “context analysis of the higher education and research system” and then address “gender participation in tertiary education and academic careers” and the “gender-specific aspects of scientific careers.”

When considering the interest and willingness of U.S.-based women postdocs to apply for research stays in Germany, three key issues are important to consider in the U.S. case: First, the worldwide reputation of some of its top universities and research institutions, such as Harvard, MIT, the University of California at Berkeley, etc., reflects the highly stratified nature of the system of higher education and research in the United States, which funnels resources to these top research locations. These top schools (rather than international locations) have been the most desirable destinations for those who want to pursue an academic career in the United States, because having a degree and/or a postdoc from one of these schools outweighs the status benefits from international research experiences, which in most disciplines are not a requirement, nor are they considered part of excellence.

Second, the United States has been a magnet for (international) students and researchers, reflecting its position in the global competition of knowledge economies more broadly. Since U.S. graduate schools and labs, particularly in STEM fields, recruit both students and postdocs heavily from abroad, enticing U.S.-based PhDs to go to Germany potentially means recruiting both U.S. citizens and third-country nationals. The latter individuals have already been internationally mobile; they left their countries of origin to pursue graduate and/or postdoctoral training in the United States. A research stay in Germany would require many of them to learn one more language and to adapt to a second academic culture, system, language, and country. And finally, third, race and class are intertwined with gender in the United States. For example, women of color are even less represented in STEM fields than white women, while Asian women are overrepresented in some disciplines. Thus, where possible, this report includes information on underrepresented minorities and non-U.S. citizens.

2 Context Analysis of the Higher Education and Research System

2.1 Size and structure of research and development (R&D)

Overall, the size and structure of research and development (R&D) in the United States can be characterized by gross expenditure on R&D (GERD) as a percentage of GDP, which was 2.84 in 2018 (CEWS Template/UIS, Table 1.1.1). More specifically, in 2018, GERD as a

percentage of GDP by sector of performance was: 2.06 by the **business enterprise sector**, 0.29 by the **government sector**, 0.36 by the **higher education sector**, and 0.12 by the **private non-profit sector** (CEWS Template/UIS, Table 1.1.2). Government expenditure on education as a percentage of GDP was 4.96 in 2014, and expenditure on tertiary education as a percentage of total government expenditure on education was 27.5 (CEWS Template/UIS, Table 1.1.3).

2.2 Participation in tertiary education

Participation in tertiary education is high; 19.9 million students were enrolled at U.S. colleges in fall 2019 (National Center for Education Statistics).¹ In 2018, 34.99 percent of the population age 25 years and older had at least a bachelor's or equivalent degree (ISCED 6 or higher). However, only 1.78 percent of tertiary degree holders obtained a doctoral degree (ISCED 8) in 2016. Between 2000 and 2018, the number of doctoral degree holders more than doubled, to 4.5 million; as of 2018, 2 percent of U.S. adults between the ages of 25 and 64 had a PhD.²

2.3 Human resources in science and research

Researchers are employed across various sectors. As of 2017, 71.31 percent of researchers (FTE) were employed in business enterprises; the rest were employed in the other sectors, including government, higher education, non-profit, and others, although no detailed information is available for these sectors.

2.4 Basic Characteristics of the Higher Education and Research System

The stratification of the system is also due to the fact that the United States is a federal republic. As the 50 states have the main authority over education and research, the funding and institutional structure are highly decentralized. Thus, the regulatory role of the federal level is limited, and the U.S. Department of Education mainly provides guidance and some softer regulation. However, federal-level state funding agencies (National Institutes of Health, National Science Foundation, Department of Defense) provide crucial research funding for the military, for science, technology, engineering and mathematics (STEM), as well as for medical fields.

Of the 4,298 colleges and universities listed in the U.S. News and World Reports in 2017, 38 percent were public, 39 percent were private non-profit, and 23 percent were private for-profit.³ The Carnegie classification includes a few additional institutions to a total of 4,324. Of these institutions, 418 (or 10 percent) were classified as doctoral universities, as they

¹ <https://nces.ed.gov/blogs/nces/post/back-to-school-by-the-numbers-2019-20-school-year>

² <https://www.census.gov/library/stories/2019/02/number-of-people-with-masters-and-phd-degrees-double-since-2000.html>; https://www.oecd.org/education/education-at-a-glance/EAG2019_CN_USA.pdf

³ <https://www.usnews.com/education/best-colleges/articles/2019-02-15/how-many-universities-are-in-the-us-and-why-that-number-is-changing>

award PhD degrees; they accounted for one-third of overall student enrollment in 2018.⁴ As of 2018, 131 of those universities were classified according to the Carnegie Classification of Institutions of Higher Education as “Doctoral Universities – Very high research activity” (R1); 135 were classified as “Doctoral Universities – High research activity” (R2); and 152 were classified as “Doctoral/Professional Universities (D/PU).⁵

2.5 Funding and significance of the research system

While the federal level provides financial support to individual students (federal aid) and research funding for specific projects, the states are responsible for supporting the general operations of public institutions. The federal research agencies provide funding to cover direct costs for research projects, including staff positions of PhD students and postdoctoral fellows. In addition, universities and research institutions rely increasingly on the indirect costs (overhead) being paid for them through these grants. For example, Harvard University has negotiated an indirect cost rate of 69 percent for on-campus research with the U.S. Department of Health and Human Services.⁶ Overall, however, public funding (both federal and state) provided only about 34 percent of the total revenue of public colleges and universities in 2017.⁷

After decades of severe budget cuts at state level, both public and private universities have increasingly relied on multiple sources of revenue, varying student fees, third-party funding, and overhead for research, as well as alumni donations for the resource-richer institutions. According to the National Center for Educational Statistics, even after adjusting for inflation, the costs for undergraduate students (including tuition, fees, room, and board) at public institutions increased 28 percent and at private nonprofit institutions increased 19 percent between 2008–09 and 2018–19.⁸ The percentage of total revenue that came from student tuition dollars increased from 20.9 percent in 1980 to 46 percent in 2019.⁹

2.6 Important current political decisions in higher education and science policy

The funding situation today varies significantly across states, as the relationship between state- and federal-level funding is being reconfigured. The effects of COVID-19 on the system

⁴ <https://carnegieclassifications.iu.edu/downloads/CCIHE2018-FactsFigures.pdf>

⁵ According to the Carnegie Classification, there were a total of 4,324 degree-granting colleges and universities in the United States as of 2018. The Carnegie Classification includes all accredited, degree-granting colleges and universities in the United States that are represented in the National Center for Education Statistics Integrated Postsecondary Education Data System (IPEDS). (<https://carnegieclassifications.iu.edu/downloads/CCIHE2018-FactsFigures.pdf>)

⁶ <https://research.fas.harvard.edu/indirect-costs-0>

⁷ <https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2019/10/two-decades-of-change-in-federal-and-state-higher-education-funding>

⁸ <https://nces.ed.gov/fastfacts/display.asp?id=76>

⁹ <https://sheeo.org/new-sheeo-report-finds-state-funding-remains-below-historic-levels-as-public-colleges-brace-for-a-recession-and-expected-budget-cuts/>

of higher education and science policy are, at this point, difficult to predict. Universities – which due to waning state support have filled the gaps in their budgets by increasing tuition fees – are facing less predictable student enrollment and increased costs for campus readiness to deal with the pandemic. They are expecting to receive some help through the COVID-19 relief measures. However, even before the pandemic, the overall concern was to provide greater education access to students, and critics have pointed out the looming crisis of increasing student debt.

Regarding science funding, the federal science funding budgets have grown over the past four years, despite repeated threats of cuts by President Trump, who re-mobilized a vocal anti-science movement and anti-immigrant sentiments. Overall, after years of budget cuts due to the recession, many states are attempting to restore higher education funding. However, the levels remain lower than prior to the recession.

Temporary visa holders accounted for more than one-third (36 percent) of doctorate recipients in science and engineering (S&E) fields in 2017.¹⁰ These U.S.-based scientists and scholars, who are non-US citizens, have experienced travel restrictions due to COVID-19. In addition, the precariousness of their legal status in the United States has also been shaped by more restrictive visa regulations overall and by politicized anti-Asian, anti-Muslim, and general anti-foreigner sentiment under President Trump. Their willingness to leave for research stays in Germany is likely to be shaped by these political developments. It is unclear what effect this might have on future mobility. While some individuals might be more interested in choosing Germany as an option, the threat of complications with visa regulations might temper their enthusiasm to seek research opportunities there.

2.7 Qualification and Career Structures for Academic Careers

There are six different kinds of degrees: associate degrees, bachelor's degrees, first professional degrees, master's degrees, intermediate graduate qualifications, and research doctorates.¹¹ The typical academic career steps for qualification are a bachelor's degree (3–4 years), a PhD program (5–6 years), followed by one or more post-doctoral positions (2–3 years each). The next step is typically a non-tenured assistant professorship for 5–6 years, then a tenured associate professorship (upon successful review), and promotion to a full professorship.

Mobility across institutions (within the United States, less so abroad, see below) is expected early on for PhD programs, postdoctoral positions, and assistant professor positions. In the science and engineering fields, the median age of all PhD recipients was 31 years in 2016.¹² The time that it takes to achieve a permanent position from the start of a PhD program until tenure as an associate professor can be 10 years without and 15 years with post-doctoral placements.

¹⁰ <https://www.nsf.gov/statistics/2018/nsf18304/static/report/nsf18304-report.pdf>

¹¹ <https://www2.ed.gov/about/offices/list/ous/international/usnei/us/edlite-structure-us.html>

¹² <https://www.nsf.gov/statistics/2018/nsf18304/static/report/nsf18304-report.pdf>

While nearly 80 percent of faculty members had such typical career paths in 1969, roughly three-quarters of non-tenured faculty do not follow these paths today, as universities increasingly rely on non-tenure-track positions to cover teaching and other tasks. These positions include adjunct positions, instructor positions or professor of practice, and teaching professors. They vary greatly in terms of pay, benefits, and predictability of employment.

Postdoctoral positions used to be most common in the life sciences, physical sciences, and earth sciences, but other fields, including mathematics and computer sciences, psychology and social sciences, and engineering now also employ recent doctorate recipients. In 2016, “47% of all S&E doctorate recipients took postdoc positions immediately after graduation, including 63% of graduates in the life sciences.”¹³

Among the doctorate recipients in the S&E fields in 2017 who were U.S. citizens or permanent residents and had definite plans, 44.1 percent planned to stay in the United States and do postdoctoral study. Only 3.9 percent of all S&E doctorate recipients had plans to go abroad. Here, there was a gender gap, as only **3.3 percent of women S&E doctorate recipients** planned to go abroad.¹⁴ The percentage of S&E doctorate recipients with plans to go abroad was highest for those who self-identified as belonging to more than one race (4.3 percent) and for whites (4.1 percent); it was lower for Hispanics or Latinos (3.7 percent), and lowest for Blacks or African Americans (1.8 percent).¹⁵

These low numbers of doctorate recipients who planned to go abroad after their PhD, reflect hiring practices in the academic culture in the United States, which do not include specific expectations for international research stays or collaboration in hiring or promotion practices. Although it is common to consider national and international reputation as one criterion for promotion to full professor at research universities, how to measure such a reputation remains quite vague. For specific fields, it is necessary that research stays be at high profile international research institutions – for example, CERN in the case of particle physics. In contrast, for other fields, research visits in countries other than the United States tend to be viewed more with ambivalence and considered to be more touristic or personal rather than having professional, academic value (Zippel 2017, Chapter 2).

3 Gender Participation in Tertiary Education and Academic Careers

3.1 Academic degrees

The United States witnessed an increase in total degrees earned in the academic year 2017–18, when 1.98 million bachelor’s degrees, 820,102 master’s degrees, and 184,074 doctoral degrees were conferred.¹⁶ Compared with the general population, whites and Asians/Pacific Islanders were overrepresented among recipients of bachelor’s degrees in the academic year

¹³ <https://www.nsf.gov/statistics/2018/nsf18304/static/report/nsf18304-report.pdf>

¹⁴ <https://nces.nsf.gov/pubs/nsf19304/data> Table 8.2.

¹⁵ <https://nces.nsf.gov/pubs/nsf19304/data> Table 8.3.

¹⁶ https://nces.ed.gov/programs/digest/d19/tables/dt19_318.30.asp

2017–18 (63.2 percent and 8 percent, respectively), while Blacks, Hispanics, and American Indians/Alaska Natives were underrepresented (10.4 percent, 14.2 percent, and 0.5 percent, respectively).¹⁷

Women constitute the majority of tertiary graduates, with 57.2 percent of bachelor's or equivalent degrees (ISCED 6) and 58.5 percent of master's or equivalent degrees (ISCED 7) in 2016; there was little change in the percentage between 2012 and 2016 (CEWS Template/UIS, Table 2.1.1). Across racial and ethnic groups, female students earned higher shares of degrees than men: "For example, the shares of bachelor's degrees earned by female students were 64 percent for Black students, 61 percent for American Indian/Alaska Native students, 60 percent for Hispanic students, 59 percent for students of two or more races, 56 percent for White students, and 54 percent for Asian/Pacific Islander students."¹⁸

In 2016, almost one-quarter of women who earned tertiary degrees did so in programs focused on health and welfare, followed by 20.20 percent in arts and humanities, 13.43 percent in social science, journalism, and Information, and less than 1 percent in agriculture, forestry, fisheries, and veterinary.

Women are still underrepresented in S&E degrees: In 2016, they received 50% of bachelor's degrees, 44% of master's degrees, and 41% of doctoral degrees, with huge variation across and within broad fields of study. For example, women's highest degree shares in 2016 were in psychology and biosciences; their lowest shares were in computer sciences and engineering.¹⁹

The Gender Parity Index (GPI) is calculated by dividing the value for females by the value for males for the given level of education. The GPI in tertiary education attainment (at least bachelor's or equivalent – ISCED 6 or higher) grew from 0.98 in 2013 to 1.02 in 2018 in the population age 25 and over, while women's tertiary educational attainment grew from 31.39 percent in 2013 to 35.21 percent in 2018 (CEWS Template/UIS, Table 2.1.3).

3.2 Doctoral degrees

Women's share of doctoral degrees (ISCED 8) decreased from 53.47 percent in 2012 to 49.94 percent in 2016. Similar to bachelor's degrees, the proportion of women varies widely by discipline. As of 2019, women constituted "more than half of doctorate recipients in life sciences, psychology and social sciences, education, humanities and arts, and other non-science and engineering (non-S&E) fields. However, they constitute about a third of those in physical sciences and earth sciences and a quarter of those in engineering and in mathematics and computer sciences."²⁰

In terms of race, the overrepresentation of whites and Asians/Pacific Islanders among doctorate recipients compared to the general population in the academic year 2017–18 was

¹⁷ https://nces.ed.gov/programs/digest/d19/tables/dt19_322.20.asp

¹⁸ <https://nces.ed.gov/fastfacts/display.asp?id=72>

¹⁹ <https://nces.nsf.gov/pubs/nsf19304/digest/field-of-degree-women>

²⁰ <https://nces.nsf.gov/pubs/nsf21308/report/executive-summary>

even more pronounced than at bachelor’s level: Whites and Asians/Pacific Islanders earned 66.8 percent and 12.9 percent of the doctoral degrees, respectively, while Blacks, Hispanics, American Indians/Alaska Natives earned only 8.9 percent, 8.2 percent, and 0.4 percent of the degrees at this level, respectively.²¹

3.3 Scientific staff

Turning to academic staff, the percentage of women teachers in higher education in the United States was 49.57 in 2017. No information is available on the percentage of women researchers by sector of employment. Data on the percentage of women by rank within universities show that the higher the rank the fewer the women. While women constituted 56.55 percent of the instructors in 2018, they accounted for only 33.48 percent of the full professors (see Table 1).

Table 1. Percentage of Women Across Academic Career Steps

	Total Number of Women by Rank	Percentage of Women
Professors (Grade A)	62,189	33.48
Associate professors (Grade B)	73,053	45.91
Assistant professors (Grade C)	94,746	52.28
Instructors	55,875	56.55
Lecturers	25,078	55.77
Other faculty	77,589	47.83

Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Spring 2016 through Spring 2019 Human Resources component, Fall Staff section. (This table was prepared in November 2019.)

The GSS survey provides the most equivalent information on postdoctoral researchers in academia (R2 or Grade C), but only for the science, engineering, and health fields.²² As of 2018, women accounted for only 40.3 percent of these 64,783 postdoctoral researchers, and temporary visa holders accounted for more than half, (54.3 percent). Among U.S. citizens and permanent residents, 58.2 percent were white, 20.3 percent were Asian, 6.3 percent were Hispanic or Latino, 3.7 percent were Black, and in 9.3 percent of cases ethnicity was not reported.²³

²¹ https://nces.ed.gov/programs/digest/d19/tables/dt19_324.20.asp

²² Arbeit C, Yamaner MI; National Center for Science and Engineering Statistics (NCSES). 2021. Trends for Graduate Student Enrollment and Postdoctoral Appointments in Science, Engineering, and Health Fields at U.S. Academic Institutions between 2017 and 2019. NSF 21-317. Alexandria, VA: National Science Foundation. Available at <https://nces.nsf.gov/pubs/nsf21317/>

²³ <https://nces.nsf.gov/pubs/nsf21317> Table 2

3.4 Gender-Specific Aspects of Scientific Careers

Women's employment overall, and their achievements in academia more broadly, has increasingly been taken for granted in U.S. society. Yet, progress seems stalled, and fundamental gender inequalities remain. For example, the COVID-19 pandemic seems to have created highly variable faculty outcomes when universities moved to online teaching and research in March 2020. Whereas faculty with high teaching loads and caregiving responsibilities for children and elderly, sick, and disabled people have raised the alarm that burnout is immanent, submissions of manuscripts by single persons and by men in senior positions have risen. These persistent inequalities also highlight potential barriers for women in academia to engage in international mobility and participate in international research cooperation. I call these institutional and structural factors "glass fences" (Zippel 2017; Uhly, Visser, and Zippel 2016).

For example, because of the gender-specific division of labor both at home and at universities, women who are caregivers rely heavily on childcare service structures. In the United States, childcare is heavily privatized, with high costs, uneven quality for parents, and cultural expectations. Ideologies like intensive mothering put an extra burden on women. For longer-term academic endeavors, Germany could thus be a highly attractive place, given its better public childcare system. However, researchers will need support from the German universities to help find childcare places and to navigate the school system.

Research shows that women with children participate less in international conferences, as they have higher "costs" to travel. However, in the past, conference attendance was crucial to expand academic networks and find new collaborators for specific projects. With travel restrictions due to COVID-19, it is desirable for funding agencies to encourage innovative networking opportunities in the future. Challenges to creating inclusive informal spaces for junior researchers, PhD students, and postdocs alike to present their work to international audiences remain. The move online, and broader acceptance of hybrid forms, could increase the opportunities for those who are less mobile to participate at international level, and German collaborators should be encouraged/enticed into participating in such fora in order to get to know potential Humboldtians.

In general, scholars involved in research are more likely to seek mobility to engage in research collaboration with partners abroad. In the United States, the educational and research system's high stratification aligns with teaching-oriented colleges versus resource-rich, research-intensive universities (R1 in the Carnegie Classification). These institutional differences create horizontal segregation for women and minoritized groups in academia. Women and faculty of color, in particular, are more likely than men or white people to be employed at institutions with fewer resources for research and to have less time for research, as they spend more time on teaching and "care" for students, as well as on administration.

Finally, vertical segregation arises from the different positions that women and faculty of color hold in the university hierarchies. For example, types of employment shape opportunities for international mobility. Prior to tenure, assistant professors in the United States are often encouraged to stay close to their department rather than go abroad. And faculty in

adjunct positions compared to tenured positions will be less likely to seek international mobility if they have no guarantee of a position upon their return. Women are overrepresented among both groups, thus illustrating these institutional and structural barriers.

Overall, U.S. academia might enjoy a reputation of being women-friendly. However, women are still underrepresented both among those employed as postdocs and in academic leadership positions. Moreover, progress across fields and institutions has been quite uneven. For example, while the life sciences have seen strong increases in women, computer science has seen declines, and physics and engineering have remained lower, particularly in terms of PhD degrees. This variation points also to disciplinary cultures. The overall low percentage of individuals who plan to go abroad after their PhD, and the pronounced gender and racial gaps in this group, warrant further consideration. One interpretation is that those who feel less secure overall in their career path will stay closer to the perceived expectations of success, and for the U.S. academic labor market, this does not include international research experiences in general (Zippel 2017).

Therefore, in order to attract more U.S.-based women researchers to Germany, it might be useful to coordinate field-specific information campaigns focused on interdisciplinary themes or particular disciplines in which white women and women from racial/ethnic minority groups had higher representation in the fields that Germany has been known for. For example, for chemists, a postdoctoral fellowship in Germany is still considered highly valuable. To recruit white women and women from racial/ethnic minorities, the **academic benefit and value** of a research stay in the postdoctoral phase in Germany needs to be communicated clearly and strongly, and with most flexibility in terms of timing. Given the high percentage of international graduate students and postdoctoral researchers at U.S. institutions, recruiting strategies and programs might consider their situation with particular attention.

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