Socioeconomic Roots of Academic Faculty

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Tenure-track faculty play a special role in society: they train future researchers, and they produce much of the scholarship that drives scientific, technological, and social innovation. However, the professoriate has never been demographically representative of the general population it serves. For example in the United States, Black and Hispanic scholars are underrepresented across the tenure-track, and while women's representation has increased over time, they remain a minority in many academic fields. Here we investigate the representativeness of faculty childhood socioeconomic status and whether it may implicitly limit efforts to diversify the professoriate in terms of race, gender, and geography. Using a survey of 7218 professors in PhD-granting departments in the United States across eight disciplines in STEM, social sciences, and the humanities, we find that the estimated median childhood household income among faculty is 23.7% higher than the general public, and faculty are 25 times more likely to have a parent with a PhD. Moreover, the proportion of faculty with PhD parents nearly doubles at more prestigious universities and is stable across the past 50 years. Our results suggest that the professoriate is, and has remained, accessible mainly to the socioeconomically privileged. This lack of socioeconomic diversity is likely to deeply shape the type of scholarship and scholars that faculty produce and train.

I. INTRODUCTION

Professors play a unique role in the knowledge economy: they both train the next generation of thinkers and generate new scholarship, which informs national policy and advances scientific discoveries. While the diversity of the professoriate has been extensively studied in terms of gender [1, 2] and race or ethnicity [3–5], and the general links between family wealth and educational attainment are well documented [6–8], comparatively little is known about the socioeconomic roots of professors.

From early childhood through college, family wealth shapes educational opportunities and completion. Working class or poor parents are less likely to enroll their children in organized activities or allow their children to question establishments [9, 10]. These tendencies can disadvantage working class or poor children, and many are unable to move into the middle or upper class as adults. The children of the wealthy are substantially more likely than the children of the poor to complete elementary school [11] and high school [12]. Beyond graduating college at higher rates [13], students at elite institutions are more likely to come from the top 1% of the U.S. income distribution than from the bottom 50% [14]. Lower-income students recruited to these elite colleges are more likely to come from privileged high school preparatory programs [15].

The processes by which education, occupation, or income are passed from parents to children is often called intergenerational transmission [7, 16], and studies of this process implicate the attainment of a college degree as a gateway towards greater occupational opportunity and income. As a result, the association between the economic circumstances of parents and their children is less strong (upward social mobility) for children who complete college than for those who do not [17, 18]. In fact, the association between parents' socioeconomic status and their children's grows for post-graduate degree holders [19, 20], and differences in acquiring social capital due to family wealth continue to shape who applies for graduate school [21], as well as their experiences once accepted [22, 23].

The accumulation and consequences of these differences surely limit the socioeconomic diversity of the professoriate. However, the socioeconomic backgrounds of faculty are poorly understood, as are the ways they influence gender, racial, and geographic diversity. Nevertheless, it is known that professors from lower socioeconomic backgrounds report hyper-awareness of how those backgrounds impact their careers [24], and that these different roots make them feel like cultural outsiders in academia [25]. Socioeconomic status may also interact with job placement within academia. Vague definitions of merit or "fit" within faculty hiring may disadvantage the work of marginalized scholars, particularly racial minorities [26] or those from working class or poor backgrounds [27]. Structural barriers on the road to earning a faculty job, as well as difficulties once employed, influence the composition of this workforce. Diversity is beneficial for research [28], and since academia trains the next generation of scholars, its current biases are likely to shape its future [29].

Here, we investigate the childhood socioeconomic status of tenure-track professors across eight disciplines spanning science, technology, engineering, and mathe-

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matics (STEM), the social sciences, and the humanities. We consider how socioeconomic status systematically shapes faculty placement within academia, and how the educational attainment of parents has influenced the likelihood that their children become and survive as faculty. We conclude by investigating how socioeconomic diversity and its historical trends may shape racial, gender, and geographic diversity in the professoriate.

II. DATA & METHODS

To study the early childhood socioeconomic status of faculty we conducted a large representative survey of tenure-track faculty at PhD-granting departments in the United States from eight academic disciplines. This survey was approved by the University of Colorado Boulder Institutional Review Board. Responses include information on the education levels of parents and the ZIP code where faculty grew up. We augment our survey data with national estimates of educational attainment, income, and rural or urban classification by ZIP from the U.S. Census, National Science Foundation (NSF) Survey of Earned Doctorates (SED), Internal Review Service (IRS), U.S. News and World Report (USNWR), and the National Research Council (NRC), which allow us to contrast survey characteristics with patterns in the general U.S. population.

We conducted this online survey on a frame of 46,692 current tenure-track faculty across 1360 PhD-granting departments in Computer Science, Business, History, Psychology, Physics & Astronomy, Sociology, Anthropology, and Biology. These academic disciplines were chosen for their diversity of scholarship and represent a broad sample of tenure-track faculty at research intensive institutions in the United States. In total, 7218 faculty provided information on a parent's level of highest education (90.1% of respondents) and 4807 provided the ZIP code in which they grew up (60.0%). While respondents are generally representative of their fields by institutional prestige and faculty rank, women responded at slightly higher rates than expected in several disciplines (Table S1). This pattern may imply a slight upward bias in our analysis of parents' education: in our sample, women are somewhat more likely to come from highly educated families (one of their parents holds a PhD: 24.8% vs 20.8%; $z = 3.88$, $p < 0.01$).

We asked faculty to reflect on their childhood and report their parents' highest levels of education during this period (SI IV A). We compare each response to the adult educational attainment statistics in the U.S. population in the year the survey respondent was born [30], and to educational attainment of parents of doctoral recipients in the year they graduated [31]. These benchmarks respectively facilitate comparisons of faculty with the general public, and with academics at a career stage just prior to their current one. Comparing faculty to national estimates describes how privileged the upbringings of faculty were relative to the general public, and comparisons to doctoral recipients describes how the roots of faculty differ from the broader set of their doctoral recipient peers.

Data on the educational attainment of adults are drawn from the American Community Survey of the U.S. Census, and information on family's educational attainment among PhD recipients is drawn from the NSF SED. Prior to 1993, the Census recorded educational attainment as years of schooling, and completion (or not) of high school or bachelor's degree [32]. More recent data recorded educational attainment as highest degree held among adults 25 years and older. In our study, we refer to both. Using the earlier census data, we compare parents' college completion among faculty to college completion rates in the adult U.S. population. When we require information on degree earned, we compare respondents to the census dataset closest to the year faculty were born that records this information.

Our estimates of U.S. adult PhD completion (from 1993 at the earliest) are likely higher than the true PhD completion rate in the year a respondent was born (which was 1967, on average), due to rising educational attainment in the U.S. Thus, our comparisons of faculty parents with the general public may in fact underestimate academia's overrepresentation of highly educated families. Data on the highest degree attained by parents of PhD recipients is available for select years from 1993 to 2018 from the NSF [31]. Details on how many respondents matched with a given year of data are provided in SI IV B.

To estimate early childhood income levels and geographic diversity among current faculty, the ideal data set would be individual-level household income and location during the childhoods of faculty. Because it is difficult for survey respondents' to estimate their parents' income retrospectively, we approximate these quantities using more easily recalled information. We link ZIP code responses to the closest publicly available IRS tax release (1998 to 2018) when faculty were children, and adjust all amounts for inflation to 2020 dollars. This approach, estimating individual socioeconomic status based on aggregate ZIP code level data, is popular [33, 34] but when used for explanatory models, may overlook confounding variables because ZIP codes often span heterogeneous populations [35]. To measure whether faculty come from rural or urban areas, we use U.S. Census data from 1990 to 2010, linked to faculty responses by their year of birth [36], which records how many people live in urban or rural areas in a given ZIP code. We labeled ZIP codes as either rural or urban based on whether the majority of the population in that ZIP code lived in a rural or urban area. As with our estimates of income, this approach may miss confounding variables due to the underlying heterogeneity of a ZIP code.

Finally, in order to assess whether socioeconomic status impacts job placement within academia, we compare the previously described measures with the institutional

	Elementary	Some HS	HS	Some College	College	Masters	PhD
All Professors	2.6	2.9	13.7	9.5	19.5	29.6	22.2
Anthropology Professors	0.8	2.2	15.1	7.0	19.0	32.8	23.0
Biology Professors	3.2	3.3	14.1	11.6	19.5	26.3	21.9
Business Professors	2.3	3.3	14.5	8.4	24.1	30.9	16.6
Computer Science Professors	3.2	3.4	10.8	8.9	21.6	26.1	26.0
History Professors	1.6	1.3	10.5	8.6	17.0	34.3	26.7
Physics / Astronomy Professors	4.1	4.1	12.1	10.2	18.2	27.4	23.9
Psychology Professors	1.6	2.1	17.4	9.9	17.0	31.1	20.7
Sociology Professors	1.8	2.7	17.3	7.1	17.3	34.9	18.9
Survey of Earned Doctorates (NSF)	←	25.2	→	14.0	23.1	26.0	11.8
U.S. Population (Census)	8.7	10.5	35.6	23.1	14.6	6.5	0.9

TABLE I. Percentages of faculty by their parents' highest held degree, compared to the closest available data on educational attainment of the U.S. adult population when faculty were born and the education levels of the parents of doctoral recipients when faculty started their tenure-track job.

prestige of a respondent's faculty appointment. For most of the disciplines considered here, we refer to 2017–2020 college rankings from USNWR, which is provided for most Carnegie-classified R1 and R2 doctoral universities. Because Anthropology departments are not ranked by USNWR, we use their R rank in the 2010 NRC Anthropology rankings. To account for differences in the number of departments across disciplines, we rescale each ranking to the unit interval. Where faculty were employed at institutions not ranked by USNWR or NRC (14.1% of responses), we coded their ranking as missing and excluded them from our analysis of institutional prestige.

III. RESULTS

Faculty tend to come from highly educated families. Across all eight disciplines, over half (51.8%) of faculty have at least one parent with a masters degree or higher (Table I). Nearly a quarter (22.2%) report at least one of their parents holds a PhD, and 3.7% of faculty report both parents hold PhDs. In comparison, among adults in the U.S. aligned to when faculty were born, on average, just 6.5% held a graduate degree of any kind, and less than 1% held a PhD. Hence across all eight fields, we find that faculty are on average 25 times more likely to have a parent with a PhD than the general population, and about twice as likely as other individuals who hold a PhD (Fig. 1).

The distributions of parents' highest education are similar across the disciplines surveyed, suggesting that despite disciplinary differences in scholarship, funding, and culture, having a parent with a PhD is universally advantageous for becoming a professor. The rates at which parents of faculty have a college education or higher have also slightly increased over time, which mirrors broader social trends in the U.S. population (Fig. 2). Women are particularly more likely to have highly educated mothers: 33.1% of women versus 28.0% of men have a mother who holds a graduate degree ($z = 4.57$, $p < 0.01$). Historically, rates of parents' college completion among female faculty is higher than male faculty, but this gap has

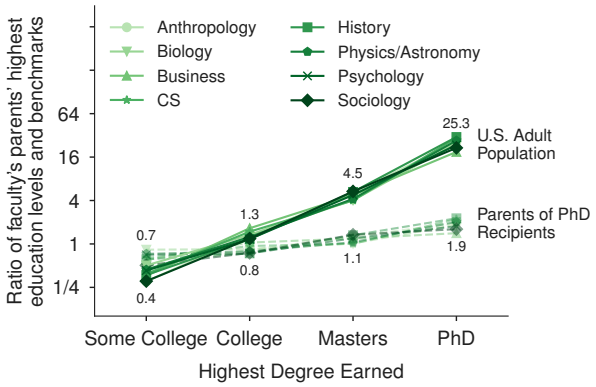

FIG. 1. Faculty members' parents' highest education levels divided by the educational attainment of the U.S. adult population (solid) and parents of PhD recipients (dashed) [30, 31]. Disciplines denoted by symbols.

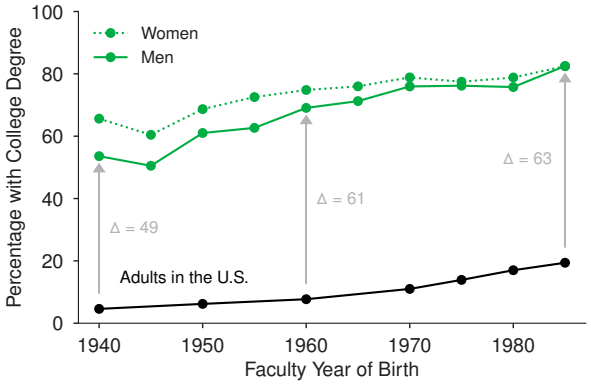

FIG. 2. Fractions of faculty reporting their parents' highest level of education was at least a college degree by faculty year of birth (green), compared with the fraction of U.S. adults earning a college degree or higher in a given year (black).

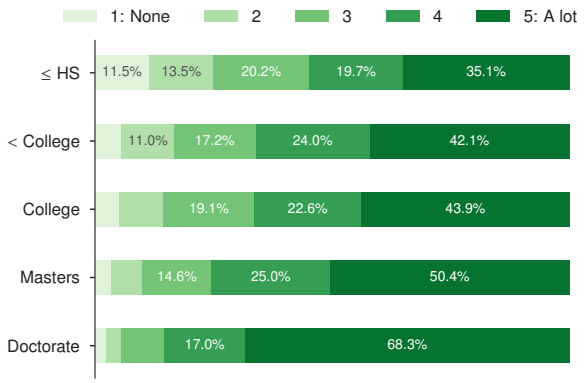

FIG. 3. Amount of support parents provided for academic careers on a scale of 1 (None at all) to 5 (A lot), stratified by faculty members' parents' highest education levels.

steadily closed over time fully reaching parity for faculty born in 1985 (Fig. 2).

We also find that faculty with PhD parents are far more likely to receive support and encouragement for their academic careers from their parents (on a scale of 1 to 5: 4.57 versus 3.90 for less than PhD, $t = 17.2$, $p < 0.01$), which is consistent with prior work [37]. In fact the career support that faculty report receiving from their parents increases with greater parental education (Fig. 3), and does not depend on faculty gender (average of 4.02). This strong correlation between parental education and faculty career support suggests that the family experiences of faculty with highly educated parents are meaningfully different from those without highly educated parents and different in ways that correlate with improving the odds that a person becomes a professor. For example, the amount of family support is known to correlate with both undergraduate and graduate student retention [22, 38]. There may be other mechanisms through which being the child of highly educated parents increases the chances of becoming faculty, such as greater identification with academic ideals, more and earlier experiences in activities valued by academia, or simply closer role models.

Faculty also tend to spend their childhoods in ZIP codes that are wealthier than the general public (Fig. 4). The median estimated household income for surveyed faculty when they were children is 23.7% higher than the median across all ZIP codes ($73K versus $59K, Mann-Whitney U, $\rho = 1.7 \times 10^{11}$, $p < 0.01$). Within our study, household income is correlated with the parents' highest education: faculty who reported that at least one of their parents holds a college degree were associated with higher average household incomes ($74K) than those who said their parents did not hold a college degree ($71K; $\rho = 1.5 \times 10^{4}$, $p < 0.01$). Across disciplines, the median income remains relatively high, ranging from $69K (Sociology) to $78K (History). And, the majority of faculty reported that their parents owned a home during the first 18 years of their life (75.7%; 13.4% said primarily rented, and 10.9% rented and owned equally), higher than one would expect given rates in the U.S. at the time (62% of homes owned by their occupants in 1960 [39]), which indicates relatively stable childhood financial circumstances.

We find that faculty come from more metropolitan areas, but that parents' education level is only weakly predictive of geographic mobility or age at the start of a tenure-track position. Faculty are more likely to have grown up in urban areas compared to the national geographic distribution of the U.S. population close to the average year (1970) faculty were born (89.6% versus 73.6%) [40]. Faculty who reported at least one of their parents holds a PhD traveled about the same distance from home (884 versus 827 miles; Kolmogorov-Smirnov, $D = 0.03$, $p = 0.09$), but are slightly younger at the start of the tenure-track job than those faculty whose parents do not hold a PhD (33.1 versus 33.6 years old; $t = -3.0$, $p < 0.01$).

Because the educational attainment of parents is strongly associated with becoming faculty, we can use data on how many PhDs are granted in a given year to forecast the changing composition of the professoriate. To build a diverse workforce, we need to model how the likelihood of having PhD parents depends on an individual scholar's characteristics.

Conditioned on having a parent with a PhD, the probability of becoming a faculty member is given by:

$$\Pr\left(\text{faculty}\,\middle|\,\begin{matrix}\text{PhD}\\ \text{Parent}\end{matrix}\right) = \frac{\Pr\left(\begin{matrix}\text{PhD}\\ \text{Parent}\end{matrix}\,\middle|\,\text{faculty}\right)\Pr(\text{faculty})}{\Pr\left(\begin{matrix}\text{PhD}\\ \text{Parent}\end{matrix}\right)}$$

where our estimates of $\Pr(\text{PhD parent}\,|\,\text{faculty})$ and $\Pr(\text{PhD parent})$ are given by the probability of faculty with PhD parents in our survey, and the probability of an adult having a PhD close to the birth year of a professor (22.2% and 0.9% respectively,Table I). To estimate

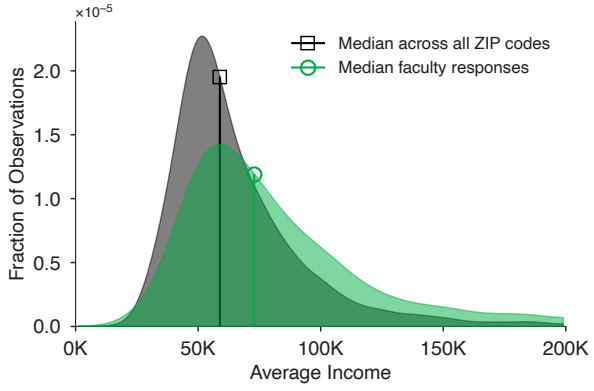

FIG. 4. Average income distribution estimated using faculty members' childhood ZIP codes (green), compared with the income distribution across the 1998 U.S. population (black).

the probability of being tenure-track faculty Pr(faculty), we look to the proportion of the U.S. adult workforce employed in postsecondary education, recorded by the Bureau of Labor Statistics, around the year in which a professor started their job (0.4%) [41]. Because tenure-track faculty are just one kind of employee in postsecondary education, this approach likely overestimates the percentage of the workforce employed as tenure-track faculty. Taken together, we estimate that the probability of becoming a faculty member given that one's parents hold a PhD Pr (faculty | PhD parent) is 9.5% indicating a strong degree of both educational heritability and substantial professional advantage.

It is well known that parental role models and the environments they foster play a critical role in shaping the achievements of children [42]. To the extent that becoming a professor is driven by parents with doctoral degrees, and the corresponding changes in childhood experiences they bring, our results paint a disheartening picture for building a racially diverse pipeline to the professoriate. Broad social and educational inequality within the U.S. indicates that Black and Hispanic adults are less likely to hold graduate degrees of any kind compared to White adults (Fig. 6). Thus, this simple model for the probability of becoming faculty overestimates the production of Black or Hispanic faculty because it fails to account for the lower probability of PhD parents among Black and Hispanic children. That is, it does not account for the racial and ethnic dependence of educational attainment on the factors of socioeconomic status.

In fact, we find evidence of further racial differences within our survey results: White professors are much more likely to have a parent with a PhD (23.4%) compared to Black or Hispanic faculty (17.2% and 16.9% respectively). This difference implies that our model also overestimates the tendency for Black and Hispanic children with PhD parents to become faculty, for the same reason as above. Hence, to the extent that the probability of becoming faculty depends on parental education, and specifically on having PhD parents, this large racial gap in PhD attainment is an intergenerational impediment that limits the proportion of Black and Hispanic scholars who become tenure-track faculty.

The relationship between parents' education and the gender composition of this workforce is complex. Women in our sample are more likely to have PhD parents than are men (24.8% versus 20.8%). Identifying the reasons for this pattern is an interesting direction for future work. We note that gender does not have as long-standing ties to intergenerational wealth as does race, in part because statistically speaking, parents of any level of wealth tend to have male and female children at equal rates. As a result, socioeconomic status does not necessarily impede gender diversity in academia in the same way or to the extent that it does for racial diversity. This fact does not, however, imply that the intersection of race and gender is neutral with respect to the likelihood of becoming faculty. For example, Black women faculty are less likely to have PhD parents than Black men (Table S2).

	Model I	Model II	Model III
Urban neighborhood	-2.069 (1.509)	-2.238 (1.930)	-1.496 (1.940)
Average income (standardized)		-3.719 * (0.798)	-3.556 * (0.799)
Parents highest degree:			
Elementary: 0-8 years			-3.675 (5.754)
High school: 1-3 years			4.059 (5.455)
High school: 4 years			-0.560 (2.592)
College: 4+ years			-1.784 (2.419)
Master's or professional degree			-5.162 * (2.270)
Doctoral degree			-6.492 * (2.356)
Discipline, race, & gender fixed effects	True	True	True
Adjusted R^2	0.019	0.035	0.043

TABLE II. Linear regression of current institutional prestige based on neighborhood, income, and parents' education levels, adjusting for race and gender. Standard errors in parenthesis, and coefficients with $p < 0.01$ are denoted by *.

Academia has undergone many dramatic shifts over the past 100 years, and our survey reveals several interesting and related trends. For instance, we find that the rate of faculty born from 1940–60 reporting that a parent holds a PhD has increased somewhat (Fig. 5A), but then remains stable at above 20% across the next 50 years. This increase from 1940–60's mirrors the increasing college and graduate school enrollment rates within the U.S. over the same period [43, 44], and hence may simply reflect a general broadening of access to higher education. However, the subsequent stability of the rate at which faculty have a PhD parent suggests that the relationship between the educational attainment of faculty parents and the likelihood of becoming faculty has been consistent and strong for nearly half a century.

Parental education appears so fundamental that it also influences where in the academic hierarchy a future professor will land. Across all years, we find that nearly a third of faculty at top ranked universities across all eight fields report that one of their parents holds a PhD, and faculty at these elite departments are 53.6% more likely to have a parent who holds a PhD than are faculty at the least prestigious departments (29.5% versus 19.2%; $t = 5.98$, $p < 0.01$). This concentration among elite departments is consistent with prior research documenting the ways academic hiring tends to devalue faculty of lower socioeconomic standing [26, 27], and overvalue faculty from more privileged backgrounds.

Adjusting for faculty discipline, ethnicity, and gender, a simple regression model finds that faculty who had parents who attended college tend to be employed at signif-

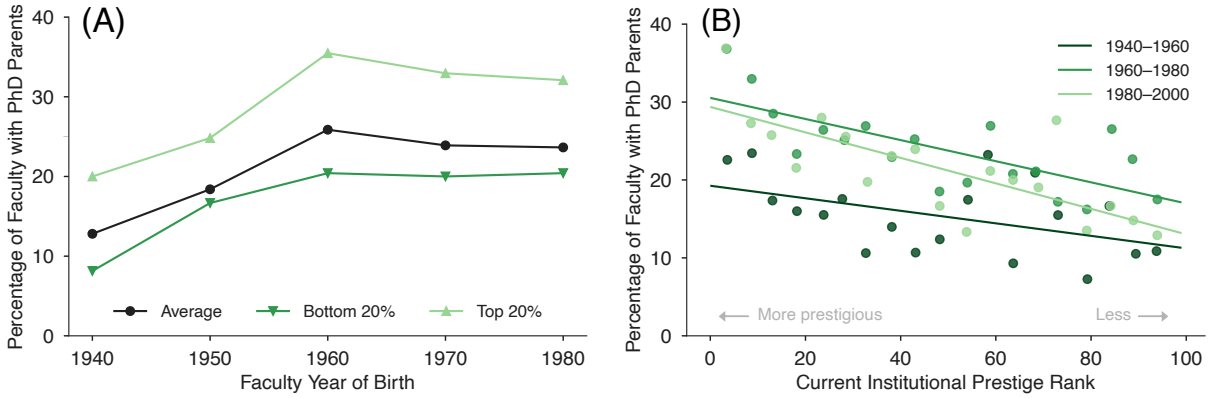

FIG. 5. (A) Percentage of faculty with at least one parent holding a PhD, stratified by prestige of the faculty's current institution. Green upward arrows describe faculty at top 20% of institutions by USNWR or NRC ranking, and downward triangles the bottom 20% of ranked institutions. The black line describes the average proportion of faculty with PhD parents. (B) The relationship between the current institutional ranking of faculty and whether they have a parent with a PhD. Lines show the relationship for faculty born in different time periods.

icantly more prestigious universities than faculty without these childhood socioeconomic advantages (Table II). On average, faculty with a PhD parent move "up" in the institutional rankings by nearly 7 percentile ranks ($t = -2.76$, $p < 0.01$). Faculty who grew up in wealthy neighborhoods also placed at more prestigious institutions. These results have direct implications for efforts to increase the racial and geographic diversity of the professoriate, particularly at the prestige-seeking institutions that train most future professors [45], as Black and Hispanic adults are less likely to hold graduate degrees compared to White adults, and are less likely to have grown up in wealthy neighborhoods. The higher-prestige placement of faculty from wealthier socioeconomic backgrounds also represents a structural barrier to the visibility of the ideas of lower socioeconomic status faculty, because scientific discoveries made at more prestigious universities are more likely to spread throughout academia [46].

Despite the significant correlation between having a parent who holds a PhD and placement in the prestige hierarchy, not all faculty at elite universities (top 20% by USNWR or NRC) have this advantage. For elite faculty without PhD-holding parents, career support from colleagues both within and beyond their institution, their race, and the wealth and urbanicity of their childhood ZIP all become more important factors in explaining their placement at an elite institution. In particular, faculty without PhD parents who are employed at prestigious institutions report slightly higher levels of support from colleagues both within their institution (3.98), compared to those at lower ranked institutions (3.81; $t = 3.55$, $p < 0.01$), and outside their institution (4.03 versus 3.91; $t = 2.54$, $p < 0.01$). Furthermore without PhD parents, faculty at the top institutions are more likely to be White (75.9% versus 70.0%; $t = 3.72$, $p < 0.01$), and to come from urban neighborhoods (92.3% versus 87.4%).

IV. CONCLUSION

> "Talent is equally distributed but opportunity is not." – Leila Janah

Using a large, representative survey of eight academic disciplines spanning STEM, the social sciences, and the humanities, we quantify the extent to which becoming a professor appears to be driven by the factors of socioeconomic status, and in particular is most accessible to the children of doctoral recipients, and those who grew up in wealthy urban neighborhoods.

To summarize, nearly a quarter (22.2%) of faculty reported that one of their parents holds a PhD, and over half (51.8%) had a parent who holds a graduate degree (Table I). Faculty who have parents with PhDs report receiving more support from them for their careers (Fig. 3) and are more likely to be employed at elite institutions. Nearly a third of faculty at top ranked universities report their parent holds a PhD (29.5%), versus a fifth (19.2%) at the bottom. In the context of broader racial inequality in wealth and educational attainment with the U.S., academia's dependence on inherited advantages, i.e., the importance of parental characteristics on a professor's current employment and placement, represents a fundamental limit to its racial diversity (Fig. 6).

Previous studies of the early childhood socioeconomic status of faculty have often been limited in scope, due to relatively small surveys of faculty or a lack of historical data on wealth and education in the broader U.S., both of which were necessary for this study. Given the well-established correlations between household wealth and child educational attainment, the overrepresentation of faculty with PhD parents is perhaps unsurprising. Our results quantify just how large, and how historical, that overrepresentation is. In fact, the importance of having PhD parents is so great that the rate of having them nearly doubles across the transition from completing a

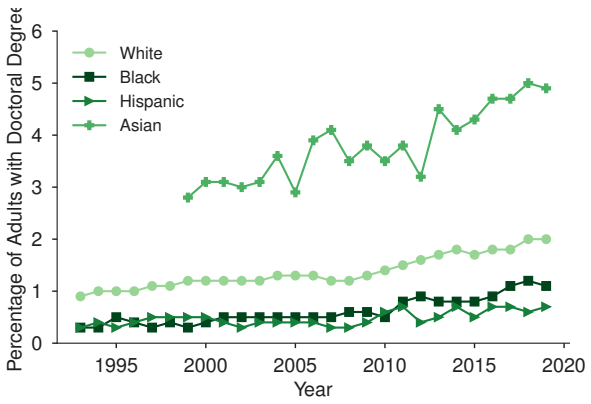

FIG. 6. Percentages of White, Black, Hispanic, and Asian adults (at least 25 years old) in the United States population that hold doctorate degrees [47].

PhD to obtaining a faculty job (11.8% versus 22.2%; Table I). Furthermore, the overrepresentation of faculty with PhD parents at the most prestigious universities (Fig. 5), implies the advantage they confer is not only a pipeline problem. Progress towards broadening participation in science will remain limited if our current definitions of meritocracy within academia implicitly favor individuals with the inherited advantages conferred by wealth and education [26, 27].

The interpretation of our work is limited by the granularity of the IRS and Census data we associate to individual responses, and who is current tenure-track faculty. Several of our comparisons rely on aggregated measures of income or geographic diversity based on respondents' early childhood ZIP code. Additionally many ZIP code boundaries have changed over time, and may span heterogenous populations [48]. Each of these may limit the accuracy of our childhood estimates, especially for older faculty. Better estimates of household income could be obtained from information on respondents' childhood Census blocks, or from de-identified historical tax records [49].

Furthermore, our survey was restricted to current tenure-track faculty at research intensive academic institutions between 2017 and 2020. As a result, we do not observe faculty who left academia prior to our survey date, which may be a population biased toward faculty from lower-income backgrounds [22]. Such a bias would tend to shrink the observed effect sizes or importance of socioeconomic status in our analyses. At the same time, it would highlight the need for further research on how socioeconomic status interacts with both the retention along the tenure-track, and the types of scholarship that faculty pursue.

While this work highlights the advantages socioeconomic status may confer for becoming faculty, it does not speak to the social or professional difficulties that underrepresented individuals may experience stemming from their gender, race, or socioeconomic status once they become faculty. For example, women are less likely to be viewed as competent [50, 51], less likely to be awarded for their research [52], less likely to be invited for talks [53], and less likely to be compensated fairly [54, 55]. Black faculty earn less money despite no measurable differences in productivity [56] and may have their research evaluated less positively [57], all while facing unequal service burdens and racism on and off campus [58]. While research on how socioeconomic status shapes faculty careers is less comprehensive, work generally points to less supportive environments [24, 25] and differences in research or teaching appointments [59]. Individuals may become faculty and still have difficulty finding support within academia.

Future research should consider why the importance of parents' education levels and wealth varies moderately across fields, and whether this conferral of advantage is to be expected given broader trends in intergenerational mobility [16]. In our survey, percentages of PhD parents are lowest among Business and Sociology faculty (17.3%), and highest among Computer Science and History faculty (26.0%, $\chi^2 = 36.6$, $p < 0.01$). Compared to the educational attainment of professors' parents (Table I), a survey of lawyers found about 12% of lawyers were the children of lawyers [60], and among doctors in Sweden, 20.2% of physicians were the children of physicians [61]. Whether or not having a PhD parent provides more of an advantage to academic faculty than one would expect towards other white-collar professions is an important research question we cannot answer here.

Future work should also consider the ramifications of socioeconomic dependence in the academic workforce and, since race and class often intersect in the U.S., the racial impediment it also represents, on scholarly and scientific progress. That is, we should consider what discoveries are not made or what ideas are not developed as a result of academia's historical and current lack of socioeconomic diversity. Making academia more diverse and inclusive will require accounting for the subtle and pervasive ways that socioeconomic status makes standard measures of academic achievement non-meritocratic, which allow greater access to opportunity to be interpreted as a sign of greater merit. Progress in this direction may require developing new notions of merit and achievement, ones that more closely align with the goals of and value the contributions of a diverse academia, and grappling with the generational nature of the socioeconomic roots of academia.

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CITATION DIVERSITY STATEMENT

Recent work in several fields of science has identified a bias in citation practices such that papers from women and other minority scholars are under-cited relative to the number of such papers in the field [62–66]. Here we sought to proactively consider choosing references that reflect the diversity of the field in thought, form of contribution, gender, race, ethnicity, and other factors. First, we obtained the predicted gender of the first and last author of each reference by using databases that store the probability of a first name being carried by a woman [66, 67]. By this measure (and excluding self-citations to the first and last authors of our current paper), our references contain 31.66% woman(first)/woman(last), 10.73% man/woman, 13.12% woman/man, and 44.48% man/-man. This method is limited in that a) names, pronouns, and social media profiles used to construct the databases may not, in every case, be indicative of gender identity and b) it cannot account for intersex, non-binary, or transgender people. Second, we obtained predicted racial/ethnic category of the first and last author of each reference by databases that store the probability of a first and last name being carried by an author of color [68, 69]. By this measure (and excluding self-citations), our references contain 10.91% author of color (first)/author of color(last), 16.99% White author/author of color, 15.23% author of color/White author, and 56.87% White author/White author. This method is limited in that a) the names and Florida Voter Data used to make the predictions may not be indicative of racial/ethnic identity, and b) it cannot account for Indigenous and mixed-race authors, or those who may face differential biases due to the ambiguous racialization or ethnicization of their names. We look forward to future work that could help us to better understand how to support equitable practices in science.

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SUPPLEMENTARY MATERIALS

A. Survey Details

Our survey was conducted over three years, from Summer 2017 to Fall 2020. Each individual received one email reminder. All participants were included in a drawing for a cash lottery. To reduce the burden on participants, our survey was divided into two parts. The first part took 1-2 minutes to complete and asked the most important questions of interest for our study, including participants' year of birth, childhood ZIP code, and information on their parents' education and employment. After completing the first part, participants were told that they can continue to the second part, which asked about parental support for their careers, if they wished. Our study was approved by the University of Colorado Boulder Institutional Review Board.

In total, 8009 faculty gave their consent to participate in our survey (out of 46 692 surveyed; 17.4%). Of those, 7218 faculty provided information on a parent's level of highest education (90.1% of consenting) and 4807 provided the ZIP code in which they grew up (60.0%). Overall our response rate mirrors other online surveys with email invitations conducted in the context of academia [70, 71]. Faculty that provided some of the primary variables for our analysis are generally representative with respect to their populations. Women responded at slightly higher rates than expected (Table S1), which may imply a slight upward bias on our results on parents education. In our sample, women are somewhat more likely to come from highly educated families (one of their parents holds a PhD: 24.8% vs 20.7%; $z = 4.01$, $p < 0.01$). Respondents came from 2763 unique ZIP codes across the U.S. (Fig. S1). Most respondents were the only response for a given ZIP code (74.4%).

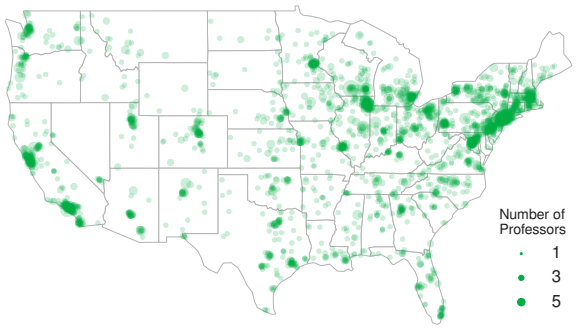

FIG. S1. Geographic plot of respondents by childhood ZIP code. Dot size scales with the number of faculty responses.

Survey Questions

- "In what year were you born?" Drop down of years from 1916 to 1996.
- "During the first 18 years of your life, did your family rent the home in which you lived, or did your family own it (even if supported by a mortgage)?" Options were "We rented a home during all or most of the first 18 years of my life," "We rented and owned a home about equally often," "We owned a home during all or most of the first 18 years of my life," or "Don't know"
- "Where did you live during the first 18 years of your life? If you lived in the U.S., please let us know in which ZIP code you live the longest." Open text box.
- "Now please think of your parents or legal guardians during the first 18 years of your life, and answer the following questions about them. If you grew up with just one parent or legal guardian, please select 'Not applicable' for 'Parent 2'."
  - "What are their genders?" Options were "Male," "Female," or "Other identity."
  - "What is their highest level of education?" Options were "Elementary: 0-4 years," "Elementary: 5-8 years," "High school: 1-3 years," "High school: 4 years," "College: 1-3 years," "College: 4 or more years," "Master's or professional degree," "Doctoral degree," "Don't know," or "Not applicable / Rather not say."
  - "What best describes their employment status during all or most of the first 18 years of your life?" Options were "Employed," "Not employed: stay-at-home parent," "Not employed: could not find job," "Not employed: other reason (e.g. retired, illness, ...)," "Don't know or something else," or "Not applicable / Rather not say."
- "What is your gender?" Options were "Male," "Female," "Other identity," or "Prefer not to say."
- "What is your race or origin? Please select one or more responses." Options were "White," "Hispanic, Latino, or Spanish origin," "Black or African American," "Asian," "American Indian or Alaska Native," "Native Hawaiian or other Pacific Islander," "Some other race or origin," or "Prefer not to say."
- "Please rate support and encouragement you received for your academic career from people below, on a scale from 1 (none at all) to 5 (a lot). If some of those people were not present in your life, please choose Not applicable." Category analyzed was "your parents" with options 1–5 and "Not Applicable."

Field		Men	Women	Nonbinary	Undisclosed	Assistant	Associate	Full	Prestige	N
Anthropology	Respondents	49.0	49.9	0.6	0.6	17.4	30.6	52.1	27.1 (21.6) *	357
	Population	50.8	49.2	–	–	21.1	32.1	46.7	22.6 (19.4)	1994
Biology	Respondents	65.1 *	34.4 *	0.1	0.4	12.7 *	29.7 *	57.6 *	84.6 (61.9)	1548
	Population	70.1	29.9	–	–	23.1	27.6	49.3	83.2 (64.5)	10145
Business	Respondents	66.7 *	32.4 *	0.1	0.8	30.8	25.7	43.5	41.8 (27.2)	1293
	Population	76.5	23.5	–	–	30.4	27.9	41.7	43.4 (28.7)	9573
Computer Science	Respondents	78.7 *	20.3 *	0.1	0.9	33.5 *	22.6 *	43.8 *	65.4 (47.2)	1001
	Population	85.5	14.5	–	–	22.9	26.8	50.3	65.7 (48.5)	5792
History	Respondents	53.0 *	46.5 *	0.2	0.2	16.8	39.3	43.9	56.4 (39.5) *	992
	Population	62.7	37.3	–	–	16.4	38.3	45.3	51.9 (38.2)	4336
Physics/Astronomy	Respondents	79.1	19.7	0.2	1.0	17.4	18.7	63.9	53.4 (40.0) *	935
	Population	85.7	14.3	–	–	18.1	19.7	62.2	51.5 (41.7)	5874
Psychology	Respondents	46.3 *	53.3 *	0.2	0.2	20.9	30.4	48.7	85.1 (60.0)	983
	Population	54.4	45.6	–	–	23.1	28.7	48.2	88.2 (60.5)	6507
Sociology	Respondents	45.5	53.6	0.2	0.7	17.1	32.0	50.9	38.7 (25.9)	440
	Population	50.0	50.0	–	–	22.1	29.7	48.2	40.0 (27.3)	2471

TABLE S1. Demographic attributes of faculty in each discipline who provided either of the most important variables to this study, as proportions for gender and faculty rank, and as means and standard deviations (in parentheses) for departmental prestige. Significant differences (χ^2 tests for gender and rank, Kolmogorov-Smirnov tests for prestige) are marked with $*$, indicating $p < 0.01$.

	Elementary	Some HS	HS	Some College	College	Masters	PhD
White Women Professors	0.9	1.7	12.1	7.3	19.5	32.9	25.5
Black Women Professors	4.9	0.0	17.5	14.6	11.7	36.9	14.6
Hispanic Women Professors	2.3	2.3	13.7	15.3	15.3	31.3	19.8
Asian Women Professors	2.4	4.4	7.3	12.5	19.4	30.2	23.8
American Indian / Native Women Professors	0.0	5.3	21.1	10.5	10.5	36.8	15.8
White Men Professors	2.4	2.5	15.2	9.6	19.2	29.1	22.0
Black Men Professors	7.4	8.4	15.8	12.6	9.5	26.3	20.0
Hispanic Men Professors	6.9	6.4	17.0	9.6	18.1	27.1	14.9
Asian Men Professors	7.3	8.4	7.5	12.4	25.3	23.4	15.7
American Indian / Native Men Professors	0.0	3.4	17.2	10.3	20.7	37.9	10.3

TABLE S2. Percentages of faculty by race and gender with their parents' highest held degree.

B. Matching to Census, IRS, and NSF Data

Comparing the education and income of the parents of faculty with the overall United States populations involves linking responses to publicly available education and income data. Responses were matched either by the year faculty were born or the year they began their first tenure-track job, to the appropriate year of data release.

Year of NSF SED	Avg.	Min.	Max.	N
1993	1985	1956	1995	2292
1998	1998	1996	2000	846
2003	2003	2001	2005	965
2008	2008	2006	2010	975
2013	2013	2011	2015	1294
2018	2017	2016	2020	636

TABLE S3. Number of responses (N) linked to each release of NSF SED [31], which contains the educational attainment of the parents of doctoral recipients. The average, minimum, and maximum tenure track start year across linked responses.

Year of US Census	Avg.	Min.	Max.	N
1990	1960	1916	1974	4890
2000	1979	1975	1984	1943
2010	1987	1985	1999	377

TABLE S4. Number of responses (N) linked to each release of the U.S. Census [36] describing the percentage of the urban and rural population per ZIP code. The average, minimum, and maximum year faculty were born across linked responses.

For example, the National Science Foundation's Survey of Earned Doctorates (NSF SED) provides information on the educational attainment of the parents of doctoral recipients every five years from 1993 to 2018 (Table IV B). Survey responses were matched to the closest available data. In many cases (32.6% of responses) this was 1993, the earliest year available from the NSF.

Data on the urban or rural classifications of ZIP codes was obtained from the decennial U.S. Census presented by the Integrated Public Use Microdata Series (IPUMS) National Historical Geographic Informa-

tion System (NHGIS) [36] (Table IV B). Responses were linked by the closest year to when faculty were 21 years old, to represent the ZIP code's characteristics close to when the faculty was growing up. The majority of responses (67.9%) were matched to the earliest data release (1990).

The American Community Survey provides estimates of the highest educational level attained by all adults (25 years or older) in the United States [47] (Table IV B). This data is available on a yearly basis starting in 1993 [30]. We link this data to responses by the birth year of faculty to compare the parents of faculty with the U.S. adult population at the time of their birth. Almost all responses are linked to the earliest release available.

Year of ACS	Avg.	Min.	Max.	N
1993	1967	1916	1992	7207
1996	1998	1996	1999	3

TABLE S5. Number of responses (N) linked to the American Community Survey [30, 47], which reports the educational attainment of adults (25 years and older) in the United States. The average, minimum, and maximum year faculty were born across linked responses.

Lastly, it is generally difficult to estimate income distributions for geographic locales, especially without a direct connection to census tract. Our approach using ZIP codes is common, in part because people can recall their ZIP code more readily than street address or census tract. The U.S. Internal Revenue Service (Table IV B) reports the total income and number of returns for each ZIP code in the United States from 1998 to 2018. Responses were linked by the closest year to when faculty were 21 years old, to approximate the wealth of a ZIP code during the person's childhood. Most responses (79.0%) were linked to the earliest release since the average year the faculty we surveyed were born was 1967. The IRS provides earlier data on the county level (from 1989 on; [72]), and state levels (from 1954 on; [73]). Because ZIP codes are based on the mail distribution needs of USPS, they only roughly correspond to other geographic locales [48]. For example, they change shape over time, and can span states or counties. Altogether, this means linking ZIP codes to historical income on the country and state level is difficult and requires the boundaries of ZIP codes and counties, and population estimates for each over time.

Year of IRS	Avg.	Min.	Max.	N
1998	1963	1916	1978	5695
2001	1980	1979	1980	384
2002	1981	1981	1982	413
2004	1983	1983	1983	174
2005	1984	1984	1984	167
2006	1985	1985	1985	118
2007	1986	1986	1986	111
2008	1987	1987	1987	60
2009	1988	1988	1988	44
2010	1989	1989	1989	25
2011	1990	1990	1990	11
2012	1991	1991	1991	4
2013	1992	1992	1992	1
2017	1996	1996	1996	1
2019	1999	1999	1999	2

TABLE S6. Number of responses (N) linked to IRS data releases [74], which reports the total income and number of returns reported per ZIP code. The average, minimum, and maximum year faculty were born across linked responses.