Age Dependence of Scientific Resource Allocation Following Ethnic Diversification

ABSTRACT: The benefits of diversity are many, and an array of policies are designed to increase the breadth and vitality of the scientific workforce. Using a hand-collected dataset on U.S. scientists' NIH grant-funding between the years 1985 and 2017, we present a number of findings. First, we demonstrate that an increase in non-white (vs. white) life scientists led to a greater share of funding for that group, but no proportionate increase in non-white scientists in the tenure ranks. As funding for non-whites increased, additional funds accrued to senior scientists, largely bypassing the disadvantaged group's junior members. These results highlight a novel structural impediment to the career advancement of ethnic/racial minorities, without which the full benefits of demographic diversity are unlikely to be realized.

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1. INTRODUCTION

It is now widely recognized that having a diverse workforce yields benefits. Diversity enables the expansion of the scientific talent pool (*1*) and greater variation in the topics addressed by scientists, resulting in positive gains in the rate and direction of science (*2, 3*). Over the past few decades, there has been an encouraging increase in the representation of non-white scientists in the biomedical sciences. For example, the National Science Foundation's Survey of Earned Doctorates (NSF SED) (*4*) shows that the proportion of non-white doctorates in biomedical-related sciences has risen 1.9 fold from 28% in the mid-1980s to 52% in 2020, as visualized in Figure 1.

While there is an agreement regarding the importance of diversity in the scientific labor force, less examined is how the increase in diversity relates to the allocation of financial inputs in scientific research. This oversight is surprising given the central role that sponsored research plays in shaping scientists' success. For most biomedical researchers whose work is largely lab-based, grant funding serves as the lifeblood of their work. Without securing sufficient grants, scientists will face difficulties in running their labs, purchasing equipment and materials, supporting graduate students and postdocs, and hiring technical support staff—all leading to a decrease in productivity and lower career performance. The experience of Katalin Karikó, a 2023 Nobel Prize winner in medicine, underscored how critical funding is in biomedical research—she was demoted by the University of Pennsylvania from the tenure track for lack of funding support, and her research on mRNA almost stopped had it not been for the support from collaborators (*5*).

Additionally, a series of studies have documented possible funding discrepancies *between* different demographic groups. For example, there have been a number of research papers examining the funding gap between men and women scientists. After controlling for factors such as application rates and researcher productivity, some studies suggest equality in funding (*6, 7*) while others indicate persistent gender gaps in funding rate (*8, 9*). Regarding the funding gap among scientists of different race and ethnic backgrounds, Ginther et al. (*10*) found that after controlling for the applicant's educational background, country of origin, training, previous research awards, publication record, and employer characteristics, black applicants for U.S. National Institute of Health (NIH) research grants still lag white by 10 percentage points. Asian and Hispanic scientists also trail white scientists in their findings, though by a lesser degree. In a different paper, Ginther et al. (*11*) found that scientists' publication records can, to some extent, though not fully explain the funding gap across racial and ethnic groups.

In this paper, we turn attention from an examination of diversification's impact *between* demographic groups to its impact *within* demographic groups. Our central question is: *as a research field gained more representation of racially and ethnically diverse scientists, how did funding rates change for different sub-groups of scientists in the field*? Our sub-group of interest is based on scientists' professional age (or career stage), as researchers have increasingly voiced concerns about the funding challenges faced by the younger generations in biomedical sciences (e.g., *12-14*). For the scientific labor force to grow more diverse, it is critical to assess the level of financial support for the younger generation of minority scientists, given the implications of such support for their future career success in science.

To assess this question, we empirically examined the distribution of 2.3 million U.S. NIH grants awarded to biomedical scientists from 1985 to 2017. Our analysis of the changes in the funding distribution patterns in 797 unique NIH funding panels ("study sections", which is the basic unit for funding allocation decisions) revealed that while funding-panel diversity increased the level of funding for non-white groups, greater diversity also increased funding inequality *within* non-white groups, disproportionately benefiting senior non-white scientists, while leaving junior non-white scientists behind. A full description of the data and methods used in this paper is available in the next section and in the *Supplemental Information (SI)*.

2. DATA AND METHODS

*NIH Funding Data***.** NIH is the dominant grant-funding source for biomedical scientists in the U.S. Using the NIH's RePORTER tool, we obtained information on about 2.3 million NIH-funded projects between 1985 and 2017. Among them, we retained only projects led by a single principal investigator (PI), as multi-PI projects accounted for only 3% of all grants. While we used all grant types in our analysis, we have also conducted a separate analysis replicating the models with data restricted to only research project grants (RPG) (see Table S10 for details.).

Our research question requires the construction of concentration measures for grants awarded to subgroups of scientists (e.g., white versus non-white scientists). To reliably construct funding concentration measures, we removed funding panel-year observations in which there were fewer than five scientists in the subgroup of interest. This restriction yields a funding-panel-level analytical sample that includes 797 unique NIH funding panels (study sections) and 14,746 panel-year observations between 1985 and 2017. Descriptive statistics for variables constructed with the NIH grants data are in Table S1 of *SI*.

In our analysis of the consequences of diversification on funding, we primarily used a difference-in-difference analytical design and analyzed the amount of funding received by individual grant recipients before and after a funding panel (study section) had become diversified. This research design required individual grant recipients to have received grant funding for at least two time periods within the observation window before and after a given diversification threshold, allowing for within-individual comparisons that rule out time-invariant differences across individuals (e.g., scientists' field of training). With this restriction, our individual scientist-level analytical sample included 23,393 unique grant-recipient scientists who accounted for a total of 180,230 scientist-year observations (see Table S2 for descriptive statistics). We used this sample to analyze the relationship between the amount of research funding received by an individual scientist of a given demographic subgroup and the level of diversity in the funding panel.

Author-ity Data of U.S. Biomedical Scientists and Medline Publications. We merged the NIH grant funding data with the Author-ity dataset. Torvik and Smalheiser (2009) (*15*) used an array of machine-learning tools on the Medline dataset to generate unique disambiguated author-IDs, allowing us to trace the careers and activities of life scientists over time. The Author-ity dataset has also been used in other social studies of science (e.g., *16*, *17*) as well. Separately, we retrieved all research papers published and tracked by the Medline database between 1985 and 2009, as well as the medical subject heading (MeSH) terms assigned to the papers in Medline. Descriptive statistics for variables constructed with the Author-ity data are in Table S3 of *SI*.

NSF Survey of Doctoral Recipients (SDR). We analyzed NSF's SDR survey data from 1993 to 2017 to assess the probability that a biomedical scientist holds a tenured position in academia. This dataset has been widely used in research on doctoral scientists in the U.S. (e.g., *18-20*). The survey was updated every 2-3 years through 2017, with each wave including doctoral-degree holders from both recent graduates as well as a sample of the older cohorts who have been surveyed in previous waves. Details of SDR sampling frames can be found on the SESTAT homepage (nsf.gov/statistics/srvydoctoratework). We retained observations for scientists who: (i) were located in the U.S., (ii) received a Ph.D. degree in life sciences in or after 1970, (iii) worked in life sciences disciplines in a 4-year college, university, medical school, or university-affiliated research institute, and (iv) worked full time for pay, which is defined as working 35 hours or more in a week and 39 weeks or more in a year and drawing a salary no less than $10,000. Applying the above criteria, we constructed an unbalanced panel of 27,354 scientist-year observations for 13,338 biomedical scientists from doctoral-degree cohorts between

1970 and 2013 who were working full-time in academia. Descriptive statistics for variables constructed with the SDR data are in Table S4 of *SI*.

Identifying race and ethnicity of scientist. Self-reported demographic background would be ideal for our research question. However, NIH's grant funding data do not provide any information on the race and ethnicity identity of PI scientists. For a dataset on scientists spanning over three decades like ours, we were not aware of any publicly available datasets with self-reported information on race and ethnicity. For this reason, most studies with scientists' demographic backgrounds in longitudinal data like ours used third-party tools for determining scientists' race and ethnic background (e.g., *21-23*). We followed this approach as well.

To determine a scientist's ethnicity, we used nationalize.io (http://nationalize.io) and the "Ethnea" dataset that was provided directly by the Author-ity dataset (*15*). We used nationalize.io to predict a scientist's ethnicity, given their first and last names. If both their first and last names have more than a 50% probability of belonging to North America, Europe, and Australia, we categorize them as "white" and the other group as "non-white". Within the non-white group, if either last or first name has identified as South, Southeast, or East Asian (excluding Iran and Afghanistan) in the name database, we categorize them as Asian. Past research reveals that although this name-based ethnicity identification approach generally has relatively high accuracy for individuals with Asian and Hispanic origins, this approach has difficulty in identifying names for blacks (*24-27*). Therefore, for our robustness test, we have also separated out names of African origins such that different ways of categorizing the minority-scientist subsample can be attempted.

We are currently in the process of improving our identification method for race and ethnicity. We will have the new results by the time of the conference.

3. RESULTS

3.1 Diversity and Funding Resources for Non-White Scientists.

Figure 1 reports the upward trends of the share of non-white minorities among all doctorates awarded in the life sciences from 1985 to 2020 based on data from the National Science Foundation's Survey of Earned Doctorates (NSF SED) (*4*). The proportion of non-white doctorates has increased from 28% in the mid-1980s to 52% in 2020. In addition, both the (a) percentage of awardees and the (b) total percentage of funds awarded to non-white minorities have been trending upward, in concert with the increased percentages of non-white doctoral recipients. Between 1985 and 2020, the total

inflation-adjusted grant dollars awarded to non-whites increased from $0.54 to $2.62 billion (i.e., 4.8-fold). In contrast, whites saw an increase from $6.63 to $10.27 billion (i.e., 1.5-fold).

As we are interested in the distributional patterns of funding resources within different racial and ethnic groups, we measured within-group funding resource concentration levels with the Gini-indices, a widely used concentration measure in the social sciences. We constructed Gini indices by demographic groups (white; non-white) within an NIH funding panel over time. In our analysis, we used funding panel fixed effects to rule out alternative explanations, such as idiosyncratic characteristics of the type of science funded by a given panel.

In Fig.2, we present results based on multiple regression models (see Table S5 of *SI*) where we regress the Gini index of grant funding on the percent of non-white awardees (among all awardees) in a panel-year. As panels became more ethnically diversified, the Gini measure of funding concentration increased significantly faster among non-white than among white awardees. In an additional analysis, we replaced the Gini index with the coefficient of variation, another commonly-used measure of resource concentration, and replaced the continuous measure of ethnic diversity with discrete cutoffs (e.g., panels crossing diversity levels of 10%, 15%, 20%, and 25% non-white). These robustness checks all yielded similar results (see Table S6 of *SI*). Taken together, these results suggest that as the proportion of non-white scientists increased in a funding panel, there was an increase in the total amount as well as the concentration of funding (i.e., inequality) within minority populations.

3.2 Lack of Progress in the Number of Non-White Scientists in the Tenured Ranks

To examine the long-run consequences of diversification, we turn our attention to the NSF's SDR data to determine whether increasing non-white participation translates into their representation at the upper echelons of the profession. Using SDR data, we ran a logit regression analysis of a respondent reporting that they were holding a tenured position conditioning on their ethnic group (i.e., white relative to non-white) and controlling for age, citizenship, marital status, having children (or not), self-reported hours of working, Ph.D. program ranking, and Ph.D. cohort year. We interacted with a scientist's demographic group identity with period indicators to assess whether there is an increasing proportion of tenured non-white scientists over time.

Results based on regressions in Table S9 are illustrated in Figure 3, which shows that for non-whites, there was no discernible progress from the 1990s through the 2010s. For all time periods, non-whites occupied tenured faculty positions at roughly half the rate of whites, and this proportion has

not changed even as non-white scientists have nearly doubled their representation among all earned doctorates over the past several decades.

In summary, as the participation of non-whites in the scientific workforce increased, a greater share of resources (i.e., personnel and funding) is allocated to these minority groups. However, minority scientists do not appear to be entering the senior, tenured ranks of their profession. As tenure affords faculty the stability and freedom necessary to pursue nonorthodox scientific research programs, without tenure, the full benefits of demographic diversity in academic science are unlikely to be fully realized.

3.3 Funding Gain from Diversity Accrued Disproportionally to Senior Researchers in Disadvantaged Groups

Next, we examine resource allocation across the age spectrum among non-white scientists. We are particularly interested in differences between junior and senior scientists because of the recent, steady increase of non-whites within the scientific workforce. Two lines of argument pointed us toward an examination of funding across age groups. First, Alberts et al. (*12*) have suggested that a Malthusian expansion of the modern research enterprise has created demographic-induced constrictions and hyper-competition, especially among junior scientists. Recently, scholars have provided evidence that declining retirement rates have resulted in the aging of the scientific workforce (*13*) as well as decreasing grant-funding success rates for younger PIs (*14*), even as it has been documented that exceptional contributions are more often made by young scientists (*28*). As a consequence, the career outcomes of junior scientists have been compromised.

Second, when the intrinsic quality of an individual is difficult to measure, actors who have already attained a track record of success reap disproportionate rewards over others who occupy (even just marginally) less output (*29*). Importantly, the Matthew Effect is non-linear, implying that the rewards as a consequence of achievement accrue disproportionately to those of higher stature (*30-34*). To summarize, there is significant reason to suspect that younger scientists face a two-fold disadvantage both from increasing cohort competition among (young) peers, as well as decreased attention relative to their (older) high-status incumbent scientists.

To compare the extent to which non-white scientists at junior vs. senior career stages were impacted differently by increasing diversification, we undertook a two-pronged empirical approach. First, we examined changes in an individual scientist's amount of grant-funding as funding pools diversified in a particular NIH funding panel. Second, we examined changes in a scientist's likelihood

of receiving a grant as the individual's field of scientific study diversified. Across the two complementary approaches, we followed the literature in proxying for a scientist's professional age using the time since their first publication. We note that our analysis is not focused on a grant applicant's probability of funding. Rather, our analytical goal is to examine persistent discrepancies in the average level of funding between white and minority scientists (see Fig. S1). As a result, we assess whether the overall increase in resources allocated to minorities as a consequence of increased diversity within the scientific labor force (see Fig 1) is distributed equitably between junior and senior disadvantaged scientists.

We employed a difference-in-difference analytical design. Specifically, we regressed an individual awardee scientist's total grant amount received in a panel-year on the panel's level of diversity in the year, with individual fixed effects incorporated in the models as well as funding panel fixed effects and year fixed effects. We also control for time-varying panel characteristics such as the ratio of competitive grants among all awarded grants, the ratio of research project grants among all awarded grants, and funding panel size (number of awardees). This specification reports more conservative estimates that control for time-invariant individual idiosyncrasies (see Table S7).

We compared the *changes* in funding amount between junior (below the median in professional age) and senior (above the median) scientists as diversity on a funding panel was above (or below) a critical threshold of 20%. The 20% threshold was chosen as our focal point as social scientists have found that the range of 15%-20% (typically) represents a threshold below which members of the disadvantaged groups are often treated as tokens (*35*). For each set of tests, we also used 15% and 25% thresholds or a continuous (i.e., no-threshold) measure of minority representation on the funding panels. In additional tests, we have also run a pooled-sample (with both seniors and juniors in the sample) analysis with three-way interactions of the scientist's demographic group indicator, panel diversity (threshold-based or continuous) and scientist's career stage indicator (junior or senior), and obtained significant results that are consistent with the split-sample analysis we report in Table S7 (see Table S13).

We present the predicted marginal effects of panel diversification in Figure 4A. Senior non-white scientists on a >20% ethnically-diversified funding panel received an 18% *increase* in funding than the baseline group in undiversified panels. Translated, an average senior non-white scientist on a diversified panel received $66K more funding than a senior non-white scientist on a non-diversified panel. By comparison, we observed that junior non-white scientists' average funding level *decreased* as panels became racially/ethnically diversified at a 20% level compared to the baseline in undiversified

panels (even though the junior non-white scientists appeared to be faring better than their junior white peers). This contrasting pattern in how funding amount changes for junior and senior minority scientists with grant-panel racial/ethnical diversification persists when we employ other diversity thresholds or continuous diversity measures (see Table S7). Furthermore, our results are not sensitive to potential errors of wrongly identifying African-American scientists (see robustness tests with African-origin-named scientists excluded from analysis in Table S11A) or Asians (see Table S12A).

In a second complementary approach, we analyzed the ethnic diversity within a scientist's field of study and the scientist's probability of being funded by NIH. Rather than examining diversity at the grant-funding panel level, we used each scientist's publication record to examine the percentage of disadvantaged scientists actively working within the focal scientist's specific topical area. As each area diversified (or not), we linked this influx of non-white scientists to the probability that a minority scientist received NIH funding.

To enable this approach, we compiled a new dataset centered on data on all U.S.-based biomedical scientists tracked in the "Author-ity" dataset. We characterized each scientist's research field by their publication-associated Medical Subject Heading (MeSH) keywords. For each MeSH field, in a given year, we culled PubMed publication data to compute the percentage of scientists who were non-white to characterize the level of minority representation in the MeSH field-year. We then mean-aggregated across all MeSH fields used by a scientist in the year to indicate the degree of minority diversification of the fields where the scientist performed research. We report the linear probability estimation of a scientist's likelihood of being funded by NIH in Tables S8. All estimations have controlled for scientists' 5-year publication count and coauthor count. Models also included individual-scientist fixed effects to rule out time-invariant idiosyncrasies across scientists and year fixed effects to account for shifting trends in the overall biomedical funding environment.

The marginal effect of ethnic diversification within a scientific field (featured in models 5-6) on scientists' funding level is shown in Figure 4B. Senior (non-white) minority scientists working in research fields that are >20% racial/ethnically diversified experienced a 1.5% *increase* in their likelihood of receiving NIH funding compared to the baseline in undiversified fields. In contrast, junior minority scientists in diversified research fields experienced a 0.7% *decrease* in their funding likelihood (while junior white scientists in the more diversified fields saw a 0.3% increase in funding likelihood). Additional tests with other diversity thresholds or with continuous racial/ethnic diversity measure yield largely consistent results (see Tables S8). Further robustness tests with alternative ways for

defining the minority sample show that our results are not sensitive to potential errors of wrongly identifying African-American scientists (Table S11B) or Asian scientists (Table S12B).

In conclusion, there is strong and consistent evidence that senior members of non-white groups experienced a substantial *increase* from increased diversity in both funding amount and funding likelihood. In contrast, junior members of the disadvantaged groups experienced a significant *decrease* in their funding outcomes with increased diversity levels. At the senior level, differences in funding outcomes (grant amount and funding likelihood) between whites and non-whites are narrowing. Yet there is no evidence that this gap is closing for junior non-white biomedical scientists.

4. Discussion

In this study, we provide new evidence on potential explanations for the failure of non-white minorities to advance through the academic ranks. In contrast to prior studies that examine funding patterns *between* demographic groups, we turn our attention to the career-stage distribution of funding *within* demographic groups of scientists. Our results have significant implications for the field. Most importantly, they not only indicate that there remain substantial structural impediments to the advancement of non-white minorities but that these impediments, occurring at the most vulnerable (i.e., junior) stages of scientific careers, may be obscured by the overall gains of the minority group. Without the erasure of these impediments, the full promise of demographic diversity is unlikely to be fulfilled.

Two additional elements of this study are worthy of comment. First, we note the composite construction of our measure, "non-white minority," which encompassed a broad swath of ethnic minorities, including blacks, Hispanics, and Asians in one. This construction is, first and foremost, dictated by necessity. Underrepresented minorities such as blacks and Hispanics are, by definition, few in number, and it is no surprise that restricting our variable construction to underrepresented minorities weakens the statistical significance of our results, although the core findings remain the same (Table S12). Intriguingly, in supplemental findings where African American scientists are excluded, our results remain robust (Table S11). As such, we believe that one of the most intriguing findings in this paper is the notion of a "bamboo ceiling" whereby Asians (both South and East) face significant structural impediments to career advancement, even if this demographic group is not underrepresented relative to the broader non-scientific population. Second, this paper provides an explanation for failures in career advancement that rest upon changing demographics and the accumulative advantage of incumbent scientists. In doing so, it shifts the burden of career attrition

away from ethnic minorities and their personal choices towards more structural issues within the broader scientific community.

Taken together, our findings suggest that to accelerate progress toward equity, there is a need for not only sustained efforts to recruit and mentor new minority members into the academic community but also to support them throughout the entirety of their career lifecycle (*36*). A focus on the accomplishments of ethnic minorities, without taking into account differential challenges across their career cycles, may lead to suboptimal outcomes for the younger generation of members in the disadvantaged groups and thereby undermine the goal of achieving sustained parity in a diverse and vibrant scientific workforce.

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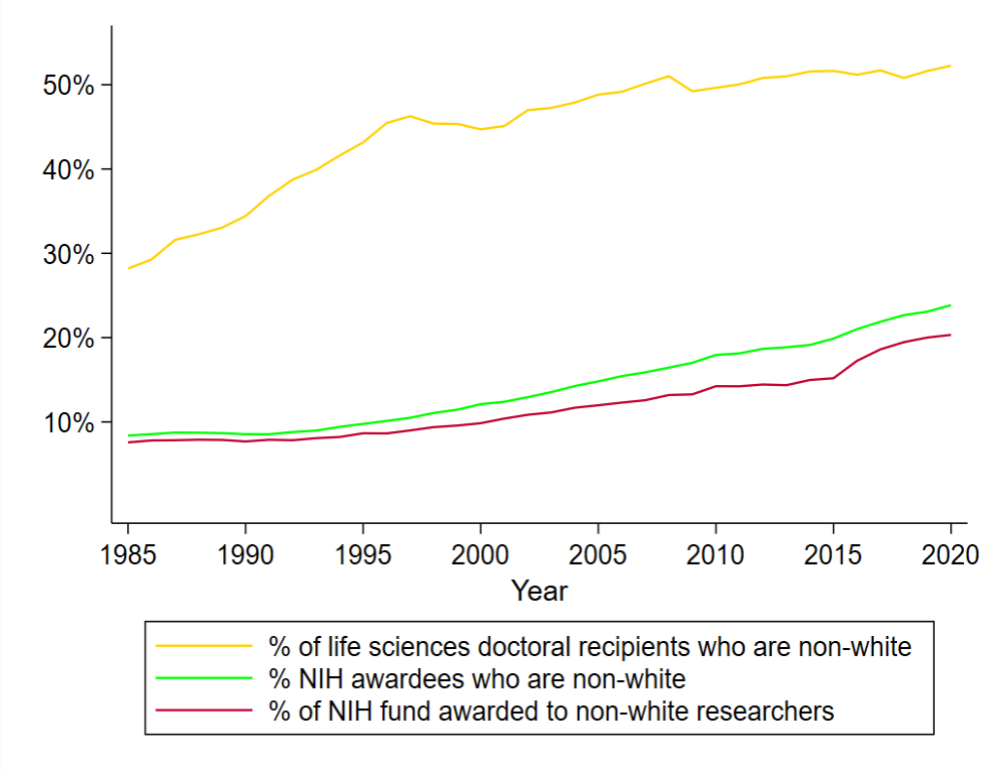


Fig. 1 Proportion of Non-white Life Sciences Doctorates and NIH Grant Recipients (1985-2020). The percentage of non-white life sciences doctorates is based on data from NSF's Survey of Earned Doctorates (https://ncsesdata.nsf.gov/home). Life sciences include the fields of agricultural sciences and natural resources, biological and biomedical sciences, and health sciences. The percentage of NIH awardees who are non-white and the percentage of NIH funds awarded to non-white researchers (the lime-green and red lines) are based on NIH funding data retrieved from the RePORTER website (https://reporter.nih.gov/).

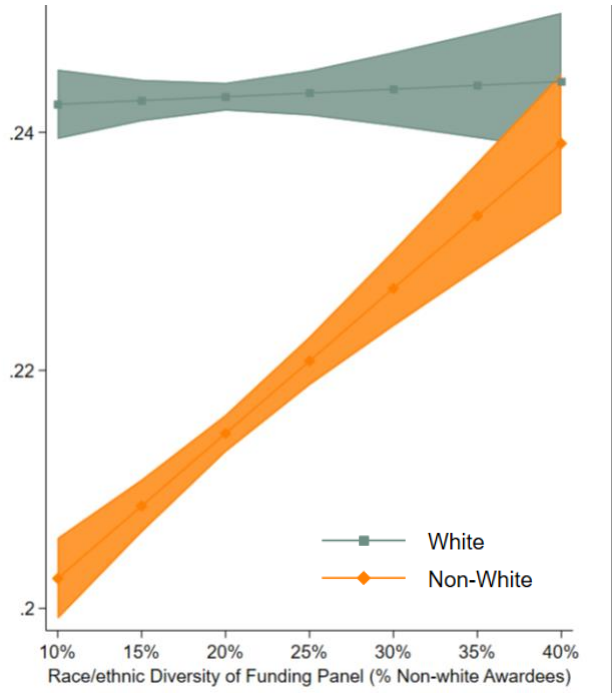


Fig. 2 Reports the predicted Gini index of funding concentration among white scientists (green line) and among non-white scientists (orange line) in NIH funding panels as racial/ethnic diversification increases in the panels, based on model 2 of Table S5.

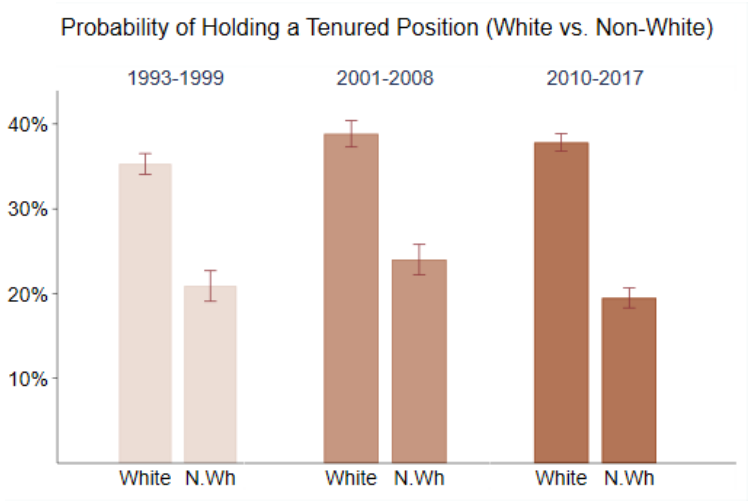


Fig. 3 Reports the predicted probability that a (white vs. non-white) respondent who is working full-time in academia in the 1993-2017 Surveys of Doctoral Recipients (SDR) held a tenured position, broken out by survey periods. Estimates are based on logit regression models that have controlled for scientists' age and age-squared, citizenship, marital status, having children or not, spousal working status, Ph.D. degree program ranking, number of hours working in a typical week, and Ph.D.-degree cohort year. Regression results are in Table S9.

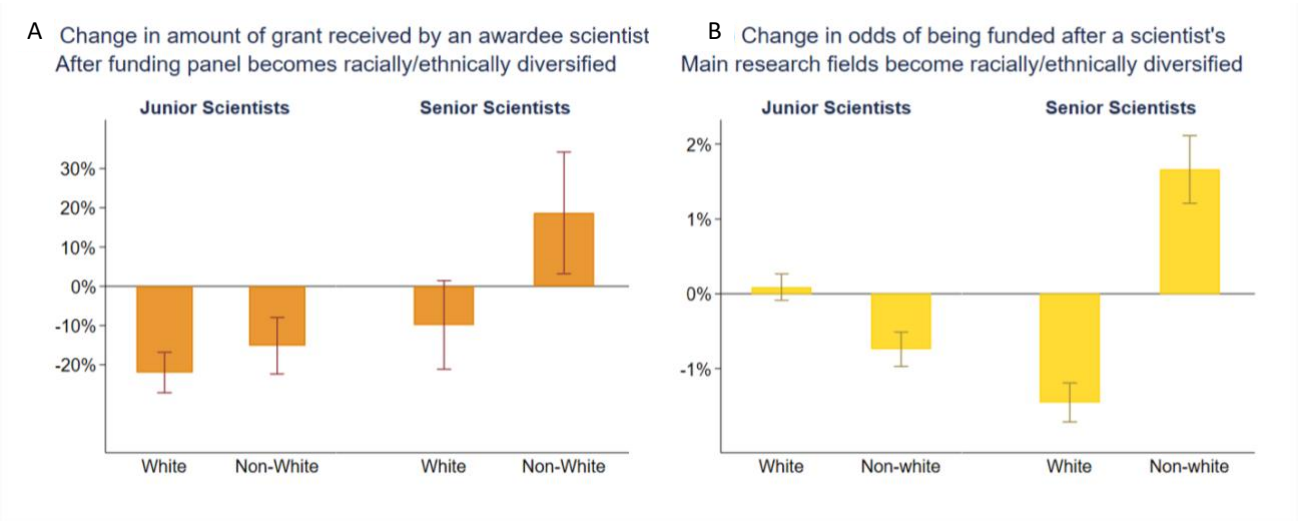


Fig. 4 Panel (A) reports % change in the NIH grant amount received by an individual awardee scientist as a scientist's funding-panel (study section) becomes racial/ethnically diversified at the 20% level, broken out by seniority, based on models 5-6 of Table S7. Senior scientists are those whose professional age is above the median, and junior scientists are below the median. Panel (B) reports a percentage change in the odds of being funded by NIH as a scientist's research fields became racially/ethnically diversified at the 20% level, broken out by seniority, based on models 5-6 of Table S8.

Supplemental Information (SI)

Table S1 reports summary statistics of variables used in the analysis of NIH grant funding data at the panel-year level and used in the analysis of changes in funding concentration before and after a change in funding panel diversity level. These variables are used in the analysis reported in Tables S5 and S6.

Table S2 reports summary statistics of variables from the NIH grant award data that are structured at the individual-year level and used in the analysis of changes in the amount of grants received by NIH awardee scientists before and after a change in funding panel diversity level. These variables are used in the analysis reported in Table S7.

Table S3 reports summary statistics of variables from the Author-ity data of U.S.-based biomedical scientists (with NIH funding information merged in). These variables are used in the analysis of a scientist's probability of being funded by NIH reported in Table S8.

Table S4 reports summary statistics of variables from the full-time-working, academic biomedical scientists in the U.S. in the 1993-2017 NSF Survey of Doctoral Recipients (SDR) data. These variables are used in the analysis of the probability of a scientist holding a tenured position reported in Table S9.

Tables S5 and S6 report analysis of the relationship between funding panel diversity and the level of grant concentration (inequality) among awardee scientists of a given demographic group.

In **Table S5**, we first regress, in models 1-2, the Gini index of the grant funding distribution on the percentage of non-white awardees (among all awardees) in a panel-year. Results in model 1 suggested an overall trend of more funding resource inequality as panels gained in non-white scientist representation. However, model 2 suggests that the pattern of changes in funding resource concentration differed between whites and non-whites. As a funding panel became more racial/ethnically diversified, the non-white-awardee subgroup saw a faster increase in the level of resource concentration. This pattern was replicated when we tested with an alternative dependent variable, the coefficient of variation (CV) of grant funding, in models 3-4 of the table. Results from model 2 are presented in **Figure 2** of the main text.

In **Table S6**, we replaced the continuous non-white representation measure in Table S5 with a series of dichotomous measures. Specifically, we tested whether the extent of funding concentration increased more for the non-white subgroup than for the white subgroup when a panel was diversified at the level of having 10% or more (models 1-2), 15% or more (models 3-4), 20% or more (models 5-6), or 25% or more (models 7-8) non-whites. The results in Table S5 using these diversification threshold cutoffs suggested a similar pattern as we have observed in Table S5 and in Figure 2—as panels became more racial-ethnically diversified, funding resource distribution among non-whites became more concentrated. As such, ethnic/racial diversification was associated with a faster growth of inequality of funding for non-white than for white biomedical scientists.

Table S7 reports fixed-effect OLS estimates of the relationship between a change in NIH funding panel (study section) racial/ethnic diversification and changes in the amount of grant awards

received by a scientist in the panel. Data on all NIH grant awards are used and structured at the recipient scientist-year level (we also run robustness tests with data restricted to research grant awards only; see below). The models follow a difference-in-difference (DiD) setup in which we retain awardee scientists who have experienced a change of racial/ethnic diversification level from below a threshold (e.g., 20% of non-white representation) to above the threshold. A funding panel is considered to have crossed a diversity threshold when racial/ethnic representation has exceeded a given threshold (e.g., 15%, 20%, or 25%) two times and remained so. We separately analyzed the scientists by seniority. Junior scientists are those whose professional ages (defined as the gap between the current year and the first year of research publication in PubMed) are below the sample median (about 20 years), and senior scientists are those whose professional ages are above the sample median. Models 1-2 use continuous racial/ethnic diversification measure and models 3-8 use threshold-based dichotomous diversification measures (valued at 1 if non-white representation in the panel has exceeded 15%, 20% and 25% levels, respectively, and 0 otherwise). Results of models 5-6 are rendered in the margin plot of **Panel A of Figure 4** of the main text.

Our tests in this table of the differential marginal return of racial/ethnic diversification for white and non-white minority scientists in funding panels show an improvement in funding level for senior non-white scientists (in at least three of the four models in the table), while senior white scientists in at least two models experienced a decrease in funding level. For the junior non-white scientists, while model 1 (which uses a continuous racial/ethnic diversity measure) and model 5 (which uses 20% diversification threshold) suggest they also gain from panel racial/ethnic diversification, the pattern does not hold in other models with different diversification thresholds (15% in model 3 and 25% in model 7). Taking stock across model specifications, our interpretation is that even though there are signs of gain for junior non-white scientists after a panel has become racially/ethnically diversified, the pattern of gain in funding is much clearer and stronger for the senior non-white scientists—that is, senior minority scientists experienced a stronger improvement in funding than junior minority scientists did as funding panels became racially/ethnically diversified.

Models in Table S7 rely on split-sample 2-way interaction model estimations. Each set of the split-sample estimation has also been robust tested with 3-way interaction model. See Table S13 for details.

Table S8 reports fixed-effect linear probability model estimating the probability that a U.S.-based biomedical scientist (tracked in the Author-ity data) is funded by NIH given changes in racial/ethnic diversification of their research fields. We merged the Author-ity data with NIH grant data and structured the dataset as scientist-year panels. The dependent variable is coded as 1 if a scientist has received any NIH funding in a year, and 0 otherwise.

Racial/ethnic diversification of a scientist's research fields was computed in the following way. We first computed, for each MeSH term in Medline data, the percentage of non-white scientists in the MeSH term area each year. We then merged the MeSH-year-level racial/ethnic diversity measure into our scientist-year-level dataset, in which we culled a list of MeSH terms that a given scientist was publishing in a given year. We then mean-aggregated across all MeSH terms used by this scientist in a given year to obtain a scientist-year-level measure that described the level of racial/ethnic diversity of their research fields.

The overall pattern revealed that for senior non-white scientists, an increase in the level of racial/ethnic diversity of their research fields was associated with a significant (about 2-3%) increase in the likelihood of their getting funded by NIH, while no such gain was consistently observed for white senior scientists. For junior non-white scientists, in contrast, an increase in racial/ethnic diversification of their fields is associated with a decrease in their likelihood of getting NIH funding, while junior white scientists saw an improvement in funding likelihood in most of the models. Results of models 5-6 of the table are rendered in the margin plot of **Panel B of Figure 4** in the main text.

Table S9 reports analysis of the probability that a full-time-working, academically-affiliated U.S. biomedical scientist holds a tenured position. This analysis uses NSF's 1993-2017 Survey of Doctoral Recipients (SDR) data. Progress stalled after 2000 in narrowing the racial/ethnic gap in holding a tenured position, as indicated by the non-significant coefficient between non-white and the period indicators in model 4. In fact, the comparison between white and (non-white) minority scientists suggests that the gap between white and minority biomedical scientists in the probability of holding a tenured position has even widened in the most recent decade. These results are rendered in **Figure 3** of the main text.

Table S10 reports robustness tests that replicate Table S7 by restricting data to only research project grants (RPG) grants. We follow previous research (e.g., *1, 2*) and retained the first-period observation of all RPG awards in NIH data as the first-period awards result from a competitive process. RPG include grant categories R00, R01, R03, R15, R21-R23, R29, R33-R37, R50, R55, R56, R61, RC1-RC4, RF1, RL1, RL2, RL9, P01, P42, PM1, PN1, RM1, UA5, UC1-UC4, UC7, UF1, UG3, UH2, UH3, UH5, UM1, UM2, U01, U19, U34, DP1-DP5, based on NIH categorization scheme (https://grants.nih.gov/grants/glossary.htm#ResearchProjectGrant(RPG). All other measures are computed the same way as reported for the main results. As such, this sample is smaller than that used in the main analysis in Table S7, but it is more focused on research grants. Results are smaller in effect magnitude compared to the main Table S7 but nonetheless follow the same pattern.

Tables S11a and **S11b** report robustness tests which replicate Tables S7 and S8 but drop all observations of scientists with African origin names (due to the known difficulty of accurately identifying African American scientists). Results show that the main patterns we observed in Tables S7 and S8 are not affected in a meaningful way if we excluded scientists with African American names.

Tables S12a and **S12b** report robustness tests which replicate Tables S7 and S8 but drop all observations of scientists with names of Asian origin. We conduct this robustness test because it remains a question whether Asian Americans should be analyzed in the category of minority, given the level of their relative representation in biomedical sciences. We thus re-tested models in Tables S7 and S8 with only non-Asian minority groups. The racial/ethnic diversity thresholds chosen for models 3-10 have been adjusted from those used in Tables S7 and S8 given the smaller fraction of non-Asian minority groups in the biomedical sciences. The sample mean for the variable "percent non-Asian minority" is about 9%, so we tested with thresholds around 9% and with the continuous

non-Asian representation measure as well. Results are consistent with those reported in Tables S7 and S8.

Table S13 reports three-way interaction models corresponding to the median-split-sample 2-way interaction models in Table S7. Correspondence details are noted in the tables.

References

1. L.A. Hechtman, N.P. Moore, C.E. Schulkey, A.C. Miklos, A. M. Calcagno, R. Aragon, J.H. Greenberg, NIH funding longevity by gender. *Proceedings of the National Academy of Sciences*, ***115*** (31), 7943-7948 (2018).
2. K. Myers, The elasticity of science. *American Economic Journal: Applied Economics,* ***12*** (4), 103-134 (2020).

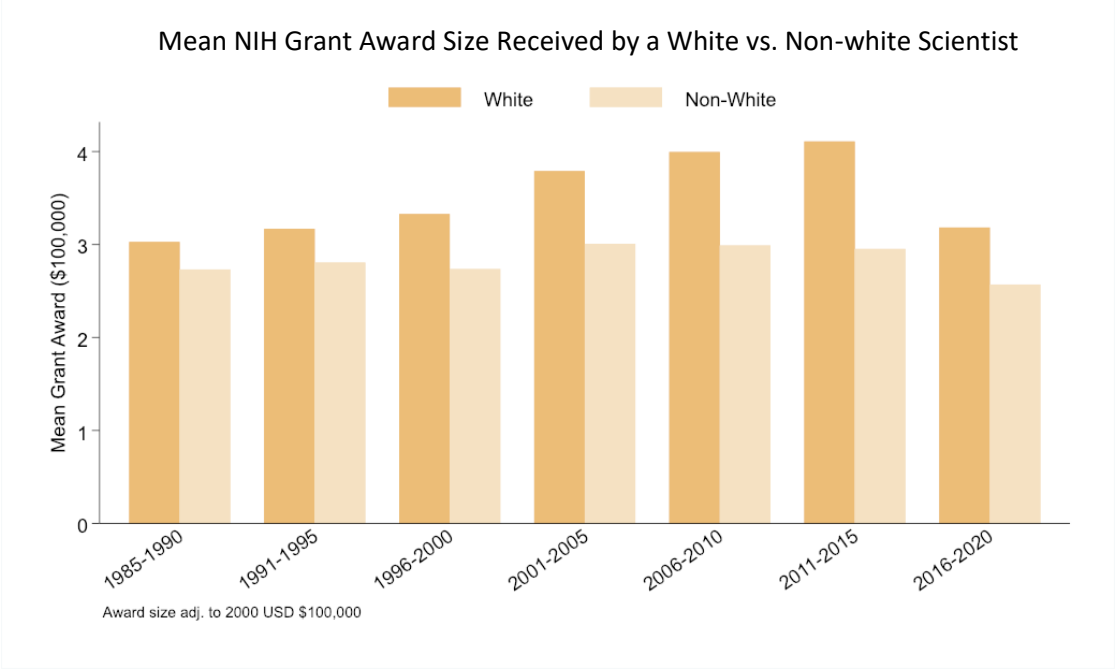


Fig.S1 reports the mean level of NIH funding received by individual scientists in NIH's recipient pool, separately for white and non-white based on NIH grant awards data from RePORTER. See *Data and Methods* in main text for description.

Table S1 Summary Statistics of NIH Funding Data, at Funding Panel-Year Level

	Mean	Std. dev.	Min.	Max.
Sample for analyzing within-race/ethnicity funding inequality in grant award panels (for analysis reported in Tables S5-S6)				
Gini	0.228	0.111	3.3e-07	0.773
Coefficient of variance	0.480	0.304	1.2e-06	3.614
% non-white awardees in funding panel	0.199	0.102	0.029	0.706
Calendar year	2006	9.713	1985	2020
Number of awardees	113.3	131.8	10	1719
Total grant amount awarded	16.73	1.016	10.31	20.52
% of competitive grant among all awarded	0.305	0.165	0	1
Number of panel-year observations 14,746				
Number of unique panels 797				

Table S2 Descriptive Statistics of NIH Funding Data, at Individual Grant Recipient-Year Level

	Mean	Std. dev.	Min.	Max.
Sample for analyzing amt of grant awarded to scientist as panel racially/ethnically diversified at 20% level (for analysis reported in Table S7)				
Grant amount (100,000 USD, normalized to year 2000)	3.536	5.935	0	534.8
Non-white grant recipient (Yes=1)	0.205	0.404	0	1
% of non-white awardees in funding panel	0.203	0.071	0	1
Panel is racially/ethnically-diversified (with ≥20% non-white)	0.472	0.499	0	1
Professional age (= Year – first year of publication)	20.40	10.70	0	40
Calendar year	2008	7.67	1985	2020
% of competitive grants among all awarded grants	0.296	0.433	0	1
% of research project grants among all awarded grants	0.771	0.417	0	1
Funding panel size (# of awardees)	374.6	453.4	5	2019
Number of individual recipient-year observations 180,230				
Number of unique grant recipient scientists 23,393				

Table S3 Descriptive Statistics for U.S.-based Biomedical Scientists in the Author-ity Data

(For Analysis Reported in Tables S8)

	Mean	Std. dev.	Min.	Max.
Receiving NIH funding (Yes=1)	0.113	0.316	0	1
Non-White Scientist (Yes=1)	0.271	0.445	0	1
Non-white & non-Asian Scientist (Yes=1)	0.092	0.289	0	1
% non-white scientists in the research fields	0.276	0.053	0	1
% non-white & non-Asian scientists in the research fields	0.096	0.011	0	0.254
Professional age	11.82	10.35	0	40
5-year publication count	8.280	10.73	1	412
5-year coauthor count	39.95	68.78	0	1,000
Calendar year	2001	5.659	1985	2009
Number of individual recipient-year observations 3,580,116				
Number of unique scientists 728,424				

Table S4 Descriptive Statistics for Biomedical Scientists in NSF Surveys of Doctoral Recipients (SDR 1993-2017)

(For Analysis Reported in Table S9)

Variable	Mean	Std. dev.	Min	Max
Holding a tenured position (Yes=1)	0.321	0.467	0	1
Woman (Yes=1)	0.394	0.489	0	1
Non-white (Yes=1)	0.317	0.465	0	1
Survey years: 1993-1999 (Yes=1)	0.295	0.456	0	1
Survey years: 2001-2008 (Yes=1)	0.274	0.446	0	1
Survey years: 2010-2017 (Yes=1)	0.431	0.495	0	1
Age	43.24	9.326	24	65
U.S. Citizens (Yes = 1)	0.854	0.353	0	1
Married (Yes = 1)	0.793	0.405	0	1
Living with children in household (Yes = 1)	0.498	0.500	0	1
Spouse working full time (Yes = 1)	0.526	0.499	0	1
Ph.D. degree program ranking	3.255	0.765	0.632	4.588
# of hours working in a typical week	50.06	4.192	39	52
Ph.D. degree year	1994	11.47	1970	2015
Number of individual scientist-year observations 27,354				
Number of unique scientists 13,338				

Table S5 OLS Estimates of Effect of Funding Panel Racial/Ethnic Diversity on Within-Race/Ethnicity Funding Concentration

Dependent Variables:	(1) Gini Index	(2) Gini Index	(3) Coefficient of Variation	(4) Coefficient of Variation
Non-white subgroup (Yes=1)	-0.028**	-0.051**	-0.066**	-0.126**
	(0.001)	(0.002)	(0.003)	(0.007)
% of non-white awardees in funding panel	0.064**	0.006	0.170**	0.020
	(0.014)	(0.014)	(0.037)	(0.039)
Non-white subgroup × % of non-white awardees in funding panel		0.115**		0.300**
		(0.010)		(0.027)
Funding Panel-Level controls				
Number of awardees	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Total grant amount awarded	0.043**	0.043**	0.110**	0.110**
	(0.003)	(0.003)	(0.009)	(0.009)
% of competitive grant among all awarded	0.035**	0.035**	0.093**	0.093**
	(0.005)	(0.005)	(0.016)	(0.016)
Constant	-0.496**	-0.484**	-1.359**	-1.330**
	(0.046)	(0.046)	(0.144)	(0.144)
Observations	14,746	14,746	14,746	14,746
R-squared	0.717	0.720	0.663	0.666
Unique Number of Panels	797	797	797	797
Year FE	YES	YES	YES	YES
Panel FE	YES	YES	YES	YES

Notes: (1) OLS models estimate the effect of an increase in funding panel racial/ethnic diversity (% of non-white awardees in a funding panel) on within-race/ethnicity funding concentration in the panel. (2) Unit of analysis is panel-race/ethnicity subgroup-year (e.g., non-white in a panel-year). (3) All funding panels included in the sample have a minimum of 5 awardees in the race/ethnicity sub-group in the year. (4) Grant amount was adjusted to the year of 2000. (5) Gini Index is calculated by using the 'ineqdeco' command in STATA. (6) Robust standard errors in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$.

Table S6 Difference-in-difference Analysis of Within-Race/Ethnicity Funding Concentration Before and After a Funding Panel Has Crossed a Racial/Ethnic Diversity Threshold

DV: Gini Index of awards given to scientists of a racial/ethnic subgroup in a panel-year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Racial/ethnic diversity threshold	10%	10%	15%	15%	20%	20%	25%	25%
Non-white subgroup (Yes=1)	-0.028**	-0.035**	-0.028**	-0.034**	-0.028**	-0.034**	-0.028**	-0.032**
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Panel racially/ethnically diversified (Yes=1)	0.002	-0.002	0.000	-0.004+	-0.005*	-0.011**	-0.003	-0.010**
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Non-white subgroup × Panel racially/ethnically diversified		0.008**		0.009**		0.012**		0.013**
		(0.003)		(0.002)		(0.002)		(0.002)
<u>Funding Panel-Level Controls</u>								
Number of Awardees	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total grant amount awarded	0.041**	0.041**	0.041**	0.041**	0.041**	0.041**	0.041**	0.041**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
% of competitive grant among all awarded	0.037**	0.037**	0.036**	0.036**	0.035**	0.035**	0.035**	0.035**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	-0.441**	-0.437**	-0.441**	-0.438**	-0.434**	-0.431**	-0.439**	-0.437**
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Observations	14,746	14,746	14,746	14,746	14,746	14,746	14,746	14,746
R-squared	0.716	0.717	0.716	0.717	0.716	0.717	0.716	0.717
Unique Number of Panels	797	797	797	797	797	797	797	797
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Panel FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes: (1) OLS models estimate the difference in within-race/ethnicity funding concentration before and after a funding panel has crossed a given racial/ethnic-representation threshold (e.g., 10% of non-white awardees in models 1-2, 15% in models 3-4, 20% in models 5-6, and 25% in models 7-8). (2) Unit of analysis is panel-race/ethnicity subgroup-year (e.g., non-white subgroup in a panel-year). (3) All funding panels included in the sample have a minimum of 5 awardees in the racial/ethnic sub-group in the year. (4) Grant amount was adjusted to the year of 2000. (5) Gini Index is calculated by using the 'ineqdeco' command in STATA. (6) A funding panel is considered racially/ethnically diversified at a given threshold if the proportion of non-white awardees in the panel has exceeded a give threshold for two years; the panel remains diversified after it has crossed the threshold. (7) Robust standard errors in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$.

Table S7 Fixed Effect OLS Models of NIH Funding Panel (Study-Section) Racial/Ethnic Diversification on Amount of Grant Awarded to Individual Recipient Scientists

Racial/ethnic diversification measure used	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Continuous (% non-white in panel)		Dichotomous: have ≥15% non-white in panel		Dichotomous: have ≥20% non-white in panel		Dichotomous: have ≥25% non-white in panel	
Sample	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median
DV: Amount of grants awarded to individual recipient (in 100,000 USD)								
Panel racially/ethnically diversification	-0.010**	-0.009**	-0.004	0.329**	-0.220**	-0.098+	-0.200**	-0.114
	(0.002)	(0.003)	(0.046)	(0.098)	(0.026)	(0.058)	(0.037)	(0.071)
Non-white scientist (Yes=1) × Panel racially/ethnically diversification	0.012**	0.026**	-0.008	0.168	0.068*	0.285**	0.020	0.339**
	(0.002)	(0.006)	(0.068)	(0.126)	(0.033)	(0.069)	(0.067)	(0.082)
Controls								
% of competitive grants among all awarded grants	0.151**	0.091*	0.154**	0.120**	0.108**	0.091*	0.147**	0.094*
	(0.019)	(0.037)	(0.020)	(0.036)	(0.019)	(0.036)	(0.019)	(0.037)
% of research project grants among all awarded grants	0.708**	0.414+	0.711**	0.406+	0.718**	0.411+	0.699**	0.413+
	(0.126)	(0.222)	(0.126)	(0.222)	(0.126)	(0.222)	(0.126)	(0.222)
Funding panel size (# of awardees)	0.001**	0.000**	0.001**	0.000**	0.001**	0.000**	0.001**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.137**	3.677**	1.998**	3.316**	2.084**	3.635**	2.025**	3.620**
	(0.108)	(0.200)	(0.107)	(0.183)	(0.105)	(0.189)	(0.105)	(0.193)
Observations	82,594	97,636	82,594	97,636	82,594	97,636	82,594	97,636
Adjusted R-squared	0.730	0.556	0.730	0.556	0.730	0.556	0.730	0.556
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) OLS models estimating the relationship between funding panel (study section) racial diversification and the amount of grant awarded to individual grant recipients, broken out by recipient seniority. (2) Models 5-6 highlighted in blue box are the basis for Fig.4A in text. (3) Continuous diversification measure used in models 1-2, 15%, 20% and 25%-threshold dichotomous diversification measures used in models 3-4, 5-6, and 7-8, respectively. (4) Unit of analysis is individual-scientist-year. (5) Estimation sample consists of scientists who received at least two grants--one in above-threshold and one in below-diversification threshold panel. (6) For the dichotomous racial/ethnic diversification measures at 15%, 20% and 25% thresholds, a funding panel is considered diversified if it has at least above-threshold non-white awardees for two years and the panel remains diversified after it has crossed the threshold. (7) Grant amount is inflation adjusted to year 2000. (8) Robust standard errors in parentheses; ** p<0.01, * p<0.05, + p<0.1.

Table S8 Linear Probability Models of Research Fields' Racial/Ethnic Diversification on Probability of Receiving NIH Funding

Research fields' racial/ethnic diversification measure used	(1) (2) Continuous (% non-white in research fields)		(3) (4) Dichotomous: ≥15% non-white in research fields		(5) (6) Dichotomous: ≥20% non-white in research fields		(7) (8) Dichotomous: ≥25% non-white in research fields	
Sample	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median
DV: Probability of receiving NIH funding								
Research field racial/ethnic diversification	0.000**	-0.000	-0.002	0.025**	0.003**	-0.009**	0.003**	-0.014**
	(0.000)	(0.000)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Non-white scientist (Yes=1) × Research field racial/ethnic diversification	-0.002**	0.005**	-0.000	0.016	-0.010**	0.024**	-0.008**	0.028**
	(0.000)	(0.000)	(0.004)	(0.010)	(0.001)	(0.002)	(0.001)	(0.001)
Controls								
5-year publication count (/10)	0.041**	0.052**	0.040**	0.052**	0.040**	0.052**	0.040**	0.052**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
5-year coauthor count (/10)	-0.001**	-0.002**	-0.001**	-0.002**	-0.001**	-0.002**	-0.001**	-0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.003+	0.113**	0.004*	0.112**	0.003**	0.144**	0.002**	0.145**
	(0.001)	(0.003)	(0.002)	(0.004)	(0.001)	(0.001)	(0.000)	(0.001)
Observations	1,597,647	1,988,658	1,597,647	1,988,658	1,597,647	1,988,658	1,597,647	1,988,658
Adjusted R-squared	0.421	0.611	0.421	0.611	0.421	0.611	0.421	0.611
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) Linear probability models estimating the relationship between average level of racial/ethnic diversification of a scientist's MeSH research fields and the probability of getting NIH funding, broken out by scientist's seniority. (2) Models 5-6 highlighted in blue box are the basis for Fig.4B in text. (3) Continuous diversification measure used in models 1-2, 15%, 20% and 25%-threshold dichotomous diversification measures used in models 3-4, 5-6, and 7-8, respectively. (4) Unit of analysis is individual-scientist-year. (5) For dichotomous racial/ethnic diversification at 15%, 20% and 25% thresholds, the indicator takes the value 1 if the % of non-white scientists in the MeSH fields in which a scientist conducts research on average surpasses the corresponding diversity threshold, otherwise taking the value 0. (6) Robust standard errors in parentheses; ** p<0.01, * p<0.05, + p<0.1.

Table S9 Logit Model of Probability of Holding a Tenured Position among Biomedical-Scientist Respondents to NSF's 1993-2017 Survey of Doctoral Recipients (SDR)

DV: Holding a tenured position	(1) Survey Years 1993-1999	(2) Survey Years 2001-2008	(3) Survey Years 2010-2017	(4) All Years
Woman (Yes=1)	-0.532**	-0.471**	-0.451**	-0.482**
	(0.107)	(0.111)	(0.075)	(0.066)
Non-white (Yes=1)	0.129	0.182	-0.214**	0.014
	(0.120)	(0.112)	(0.082)	(0.114)
Survey years: 2001-2008 (Yes=1)				0.798**
				(0.074)
Survey years: 2010-2017 (Yes=1)				2.308**
				(0.114)
Non-white × Survey years: 2001-2008				0.157
				(0.120)
Non-white × Survey years: 2010-2017				-0.187
				(0.131)
Age	0.784**	0.805**	0.754**	0.776**
	(0.069)	(0.061)	(0.043)	(0.030)
Age squared	-0.008**	-0.008**	-0.007**	-0.008**
	(0.001)	(0.001)	(0.000)	(0.000)
U.S. citizen (Yes=1)	1.136**	0.683**	0.309**	0.547**
	(0.247)	(0.193)	(0.119)	(0.104)
Married (Yes=1)	0.330*	0.363*	0.258*	0.313**
	(0.136)	(0.146)	(0.114)	(0.086)
Living with children in household	-0.007	0.130	0.084	0.073
(Yes=1)	(0.098)	(0.105)	(0.073)	(0.058)
Spouse working full-time (Yes=1)	-0.217*	-0.219*	0.015	-0.122*
	(0.094)	(0.107)	(0.079)	(0.062)
Ph.D. degree program ranking	-0.087	-0.031	-0.082+	-0.069+
	(0.060)	(0.065)	(0.046)	(0.039)
# of hours working in a typical week	-0.089**	-0.131**	-0.128**	-0.119**
	(0.009)	(0.009)	(0.007)	(0.005)
Ph.D. degree year	-0.170**	-0.141**	-0.140**	-0.149**
	(0.010)	(0.009)	(0.007)	(0.006)
Constant	321.57**	265.06**	267.20**	280.84**
	(20.211)	(18.922)	(14.717)	(11.701)
Observations	8,061	7,501	11,792	27,354
Likelihood	-3029	-2902	-4204	-10169
Chi2	1385	1073	2178	3817
Pseudo-R2	0.400	0.396	0.425	0.408
N of respondents	5,068	3,822	8,010	13,338

Notes: (1) Table reports logit estimates of the probability of a scientist responding to NSF's Survey of Doctoral Recipients (SDR) is holding a tenured position, broken down by period. (2) Sample are SDR (1993-2017) respondent scientists who: (i) are located in the U.S.; (ii) received a Ph.D. degree in life sciences in or after 1970; (iii) working in life sciences in a 4-year college or university, medical school, or university-affiliated research institute; (iv) working full time for pay, which is defined as working 35 hours or more in a week and 39 weeks or more in a year and drawing a salary no less than $10,000. (3) Raw coefficients reported in the table. (4) Robust standard errors in parentheses; ** $p<0.01$, * $p<0.05$, + $p<0.1$.

Table S10 Robustness Test – Replicating Table S7 with Data Restricted to RPG Grants

(FE OLS Models of NIH Funding Panel Racial/Ethnic Diversification on Amount of Grant Awarded to Individual Recipient Scientists)

Racial/ethnic diversification measure used	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Continuous (% non-white in panel)		Dichotomous: have ≥15% non-white in panel		Dichotomous: have ≥20% non-white in panel		Dichotomous: have ≥25% non-white in panel	
Sample	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median
DV: Amount of grants awarded to individual recipient (in 100,000 USD)								
Panel racially/ethnically diversified (Yes = 1)	-0.002	-0.002	-0.124+	0.250*	-0.248**	-0.380**	-0.080+	-0.359**
	(0.002)	(0.004)	(0.065)	(0.121)	(0.037)	(0.076)	(0.045)	(0.115)
Non-white scientist (Yes=1) × Panel racially/ethnically diversified	-0.000	0.011	0.066	0.104	0.079*	0.114	-0.063	0.038
	(0.004)	(0.011)	(0.069)	(0.269)	(0.039)	(0.137)	(0.056)	(0.125)
Controls								
% of competitive grants among all awarded grants	-0.031	-0.127**	-0.043*	-0.100*	-0.087**	-0.195**	-0.039+	-0.145**
	(0.020)	(0.043)	(0.020)	(0.046)	(0.024)	(0.043)	(0.020)	(0.043)
Funding panel size (# of awardees)	-0.000	-0.001*	0.000	-0.001*	0.000	-0.000+	0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.639**	3.506**	2.668**	3.291**	2.684**	3.698**	2.599**	3.571**
	(0.066)	(0.129)	(0.065)	(0.117)	(0.057)	(0.113)	(0.055)	(0.109)
Observations	25,611	25,946	25,611	25,946	25,611	25,946	25,611	25,946
Adjusted R-squared	0.553	0.327	0.553	0.327	0.554	0.328	0.553	0.328
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) This table reports replication of Table S7 by restricting data to first-period observation of RPG grants. (2) Research project grants (RPG) grants include grant categories R00, R01, R03, R15, R21-R23, R29, R33-R37, R50, R55, R56, R61, RC1-RC4, RF1, RL1, RL2, RL9, P01, P42, PM1, PN1, RM1, UA5, UC1-UC4, UC7, UF1, UG3, UH2, UH3, UH5, UM1, UM2, U01, U19, U34, DP1-DP5; coded based on NIH (https://grants.nih.gov/grants/glossary.htm#ResearchProjectGrant(RPG). (3) The original Table S7 reports OLS models estimating the relationship between funding panel (study section) racial diversification and the amount of grant awarded to individual grant recipients, broken out by recipient seniority. (4) Notes that explain measures and model specifications in Table S7 also apply to this table as well.

Table S11a Robustness Test – Replicating Table S7 with African-American-named Scientists Excluded

(FE OLS Models of NIH Funding Panel Racial/Ethnic Diversification on Amount of Grant Awarded to Individual Recipient Scientists)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Racial/ethnic diversification measure used	Continuous (% non-white in panel)		Dichotomous: have ≥15% non-white in panel		Dichotomous: have ≥20% non-white in panel		Dichotomous: have ≥25% non-white in panel	
Sample	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median
DV: Amount of grants awarded to individual recipient (in 100,000 USD)								
Panel racially/ethnically diversified (Yes = 1)	-0.010**	-0.015**	-0.050	-0.032	-0.204**	-0.166**	-0.187**	-0.060
	(0.002)	(0.004)	(0.031)	(0.043)	(0.021)	(0.031)	(0.025)	(0.037)
Non-white scientist (Yes=1) × Panel racially/ethnically diversified	0.017**	0.051**	-0.028	0.101	0.040	0.152**	-0.004	0.229**
	(0.003)	(0.006)	(0.063)	(0.067)	(0.035)	(0.044)	(0.078)	(0.049)
Controls								
% of competitive grants among all awarded grants	0.122**	0.109**	0.142**	0.005	0.104**	-0.015	0.140**	0.006
	(0.022)	(0.042)	(0.017)	(0.023)	(0.017)	(0.023)	(0.017)	(0.022)
% of research project grants among all awarded grants	0.754**	0.644**	0.074	0.168	0.074	0.169	0.065	0.166
	(0.159)	(0.199)	(0.129)	(0.179)	(0.129)	(0.178)	(0.129)	(0.179)
Funding panel size (# of awardees)	0.001**	0.000**	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.261**	3.835**	2.323**	3.040**	2.390**	3.110**	2.316**	3.034**
	(0.126)	(0.178)	(0.115)	(0.156)	(0.115)	(0.155)	(0.115)	(0.155)
Observations	62,775	71,478	62,775	71,478	62,775	71,478	62,775	71,478
Adjusted R-squared	0.753	0.622	0.658	0.645	0.659	0.646	0.659	0.645
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) This table reports replication of Table S7 by excluding from the analyses scientists whose names are of African American origin (i.e., the minority scientists in this set of analyses include only non-AA minorities). (2) The original Table S7 reports OLS models estimating the relationship between funding panel (study section) racial diversification and the amount of grant awarded to individual grant recipients, broken out by recipient seniority. (3) Notes that explain measures and model specifications in Table S7 also apply to this table as well.

Table S11b Robustness Test – Replicating Table S8 with African-American-named Scientists Excluded

(Linear Probability Models of Research Fields' Racial/Ethnic Diversification on Probability of Receiving NIH Funding)

Research fields' racial/ethnic diversification measure used	(1) Continuous (% non-white in research fields)	(2)	(3) Dichotomous: ≥15% non-white in research fields	(4)	(5) Dichotomous: ≥20% non-white in research fields	(6)	(7) Dichotomous: ≥25% non-white in research fields	(8)
Sample	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median
DV: Probability of receiving NIH funding								
Research field racial/ethnic diversification	0.000**	-0.000	-0.002	0.025**	0.003**	-0.009**	0.003**	-0.014**
	(0.000)	(0.000)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)
Non-white scientist (Yes=1) × Research field racial/ethnic diversification	-0.002**	0.005**	-0.000	0.016	-0.011**	0.024**	-0.008**	0.029**
	(0.000)	(0.000)	(0.004)	(0.010)	(0.001)	(0.002)	(0.001)	(0.001)
Controls								
5-year publication count (/10)	0.041**	0.052**	0.040**	0.052**	0.040**	0.052**	0.040**	0.052**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
5-year coauthor count (/10)	-0.001**	-0.002**	-0.001**	-0.002**	-0.001**	-0.002**	-0.001**	-0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.003+	0.113**	0.004*	0.113**	0.003**	0.144**	0.002**	0.146**
	(0.001)	(0.003)	(0.002)	(0.004)	(0.001)	(0.001)	(0.000)	(0.001)
Observations	1,589,221	1,975,169	1,589,221	1,975,169	1,589,221	1,975,169	1,589,221	1,975,169
Adjusted R-squared	0.421	0.612	0.420	0.611	0.420	0.611	0.420	0.611
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) This table reports replication of Table S8 by excluding from the analyses scientists whose names are of African American origin (i.e., the minority scientists in this set of analyses include only non-AA minorities). (2) The original Table S8 reports linear probability models estimating the relationship between average level of racial/ethnic diversification of a scientist's MeSH research fields and the probability of getting NIH funding, broken out by scientist's seniority. (3) Notes that explain measures and model specifications in Table S8 also apply to this table as well.

Table S12a Robustness Test – Replicating Table S7 with Asian-named Scientists Excluded

(FE OLS Models of NIH Funding Panel Racial/Ethnic Diversification on Amount of Grant Awarded to Individual Recipient Scientists)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Racial/ethnic diversification measure used	Continuous: % non-white		Dichotomous: ≥7% non-white		Dichotomous: ≥8% non-white		Dichotomous: ≥9% non-white		Dichotomous: ≥10% non-white	
Sample	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median
DV: Amt of grants awarded to individual recipient (in 100,000 USD)										
Panel racially/ethnically diversified	-0.002	-0.030**	-0.222**	-0.230**	-0.136**	-0.132*	-0.165**	-0.161**	-0.087*	-0.055
(Yes = 1)	(0.004)	(0.007)	(0.044)	(0.061)	(0.039)	(0.061)	(0.037)	(0.057)	(0.037)	(0.075)
Non-white scientist (Yes=1)	0.010	0.029*	0.055	0.219	0.030	0.296+	0.041	0.193	-0.022	0.315+
× Panel racially/ethnically diversified	(0.007)	(0.014)	(0.071)	(0.147)	(0.058)	(0.171)	(0.054)	(0.153)	(0.059)	(0.185)
Controls										
% of competitive grants among all awarded grants	0.121**	-0.041	0.072*	-0.005	0.120**	0.033	0.159**	0.074+	0.118**	0.097+
	(0.025)	(0.037)	(0.033)	(0.050)	(0.026)	(0.049)	(0.023)	(0.045)	(0.022)	(0.059)
% of research project grants among all awarded grants	0.768**	0.703**	1.118**	1.176**	1.180**	1.314**	1.038**	1.086**	0.991**	0.344
	(0.186)	(0.168)	(0.180)	(0.207)	(0.161)	(0.223)	(0.141)	(0.206)	(0.163)	(0.593)
Funding panel size (# of awardees)	0.001**	0.001**	0.002**	0.002**	0.001**	0.001**	0.002**	0.001**	0.002**	0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.289**	4.183**	2.260**	4.095**	2.025**	3.815**	1.802**	3.649**	1.717**	3.483**
	(0.137)	(0.162)	(0.140)	(0.183)	(0.122)	(0.196)	(0.114)	(0.189)	(0.125)	(0.475)
Observations	121,912	150,827	118,819	142,378	106,836	117,878	92,511	89,430	63,713	59,658
Adjusted R-squared	0.647	0.587	0.690	0.605	0.766	0.610	0.787	0.590	0.844	0.588
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) This table reports replication of Table S7 by excluding from the analyses scientists whose names are of Asian origins (i.e., the minority scientists in this set of analyses include only non-Asian minorities). (2) Notes that explain measures and model specifications in Table S7 also apply to this table as well.

Table S12b Robustness Test – Replicating Table S8 with Asian-named Scientists Excluded

(Linear Probability Models of Research Fields' Racial/Ethnic Diversification on Probability of Receiving NIH Funding)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Research fields' racial/ethnic diversification measure used	Continuous: % non-white		Dichotomous: ≥7% non-white		Dichotomous: ≥8% non-white		Dichotomous: ≥9% non-white		Dichotomous: ≥10% non-white	
Sample	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median	Prof. age Below median	Prof. age Above median
DV: Probability of receiving NIH funding										
Research field racial/ethnic diversification	0.002**	-0.001+	0.009**	0.012**	-0.003**	-0.001	-0.000	0.006**	0.001*	-0.003**
	(0.000)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Non-white scientist (Yes=1) × Research field racial/ethnic diversification	-0.007**	0.014**	-0.005	0.041**	-0.005**	0.031**	-0.006**	0.025**	-0.006**	0.023**
	(0.001)	(0.001)	(0.004)	(0.013)	(0.002)	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)
Controls										
5-year publication count (/10)	0.040**	0.054**	0.039**	0.054**	0.040**	0.054**	0.040**	0.054**	0.040**	0.054**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
5-year coauthor count (/10)	-0.001**	-0.002**	-0.001**	-0.002**	-0.001**	-0.002**	-0.001**	-0.002**	-0.001**	-0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.005	0.143**	-0.006**	0.130**	0.004**	0.144**	0.002**	0.141**	0.001**	0.146**
	(0.003)	(0.007)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Observations	1,197,100	1,744,663	1,197,100	1,744,663	1,197,100	1,744,663	1,197,100	1,744,663	1,197,100	1,744,663
Adjusted R-squared	0.427	0.608	0.427	0.608	0.427	0.608	0.427	0.608	0.427	0.608
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: (1) This table reports replication of Table S8 by excluding from the analyses scientists whose names are of Asian origins (i.e., the minority scientists in this set of analyses include only non-Asian minorities). (2) The original Table S8 reports linear probability models estimating the relationship between average level of racial/ethnic diversification of a scientist's MeSH research fields and the probability of getting NIH funding, broken out by scientist's seniority. (3) Notes that explain measures and model specifications in Table S8 also apply to this table as well.

Table S13 OLS Model of NIH Funding Panel (Study-Section) Racial/Ethnic Diversification on Amount of Grant Awarded to Individual Recipient Scientists: 3-way Interaction Models Corresponding to Split-Sample Models in Table S7

	(1)	(2)	(3)	(4)
Racial/ethnic diversification measure used	Continuous (% non-white in panel)	Dichotomous: have ≥15% non-white in panel	Dichotomous: have ≥20% non-white in panel	Dichotomous: have ≥25% non-white in panel
Corresponding to models # in Table S5	Models 1&2	Models 3&4	Models 5&6	Models 7&8
Sample	Full	Full	Full	Full
DV: Amount of grants awarded to individual recipient (in 100,000 USD)				
Panel racial/ethnic diversification	0.014**	0.554**	0.131**	0.113*
	(0.003)	(0.061)	(0.035)	(0.044)
Non-white scientist (Yes=1) × Panel racial/ethnic diversification	0.004	-0.238**	0.014	0.057
	(0.003)	(0.071)	(0.035)	(0.065)
Prof. age above median (Yes=1)	1.084**	0.736**	0.501**	0.363**
	(0.124)	(0.081)	(0.068)	(0.060)
Non-white scientist × Prof. age above median	-0.581**	-0.519**	-0.276**	-0.156*
	(0.157)	(0.135)	(0.085)	(0.072)
Panel racial/ethnic diversification × Prof. age above median	-0.042**	-0.609**	-0.523**	-0.438**
	(0.004)	(0.071)	(0.044)	(0.062)
Non-white scientist × Panel racial/ethnic diversification × Prof. age above median	0.024**	0.558**	0.316**	0.278**
	(0.006)	(0.134)	(0.077)	(0.098)
Controls				
Ratio of Competitive Grants to All grants	0.120**	0.146**	0.115**	0.116**
	(0.022)	(0.022)	(0.022)	(0.022)
Ratio of Research Project Grants to All grants	0.533**	0.543**	0.527**	0.537**
	(0.124)	(0.124)	(0.125)	(0.124)
Panel Size (# of Awardees) in year t	0.000**	0.000*	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.567**	2.458**	2.811**	2.821**
	(0.120)	(0.107)	(0.106)	(0.108)
Observations	180,230	180,230	180,230	180,230
adj-R2	0.558	0.558	0.558	0.558
Year FE	YES	YES	YES	YES
Panel FE	YES	YES	YES	YES
Individual FE	YES	YES	YES	YES
Panel racial/ethnic diversification Threshold	Continuous	15%	20%	25%

Notes: (1) OLS models estimating the relationship between funding panel (study section) racial/ethnic diversification, recipient seniority, and the amount of grant awarded to individual grant recipients. (2) Continuous diversification measure used in model 1; 15%, 20% and 25%-threshold dichotomous diversification measures used in models 2-4, respectively. (3) Model 1 is the 3-way interaction model corresponding to models 1&2 of Table S7; model 2 corresponds to models 3&4 of TS7; model 3 corresponds to models 5&6 of TS7; model 4 corresponds to models 8&9 of TS7. (4) Unit of analysis is individual-scientist-year. (5) Estimation sample consists of scientists who received at least two grants--one in above-threshold and one in below-diversification threshold panel. (6) For the dichotomous racial/ethnic diversification measures at 15%, 20% and 25% thresholds, a funding panel is considered diversified if it has at least above-threshold for two years and the panel remains diversified after it has crossed the threshold. (7) Grant amount is inflation adjusted to year 2000. (8) Robust standard errors in parentheses; ** p<0.01, * p<0.05, + p<0.1.