

HOW UK SCIENCE IS FAILING ON DIVERSITY

Data show that Black scientists' representation dwindles at each stage of academia in the United Kingdom. **By Elizabeth Gibney**

This article is the first in a Nature series examining data on ethnic or racial diversity in science in different countries.

In 2018, Robert Mokaya discovered that he was the only Black chemistry professor in the United Kingdom. For a decade, he'd assumed there were others who he hadn't met – until investigations by the UK Royal Society of Chemistry revealed his lonely status. "Somebody said to me, 'You're an endangered species. When you retire, there won't be any,'" he says. "It is a terrible statistic."

Stark figures like these abound at the top echelons of UK academia. UK physics has no Black professors, according to 2020–21 data disclosed to the UK Higher Education Statistics Agency (HESA). Black people make up 4% of the country's working-age population, and 8% of its science undergraduates, yet just 0.6% of its science professors. In all academic fields, just 160 of the United Kingdom's 22,855 professors are Black (among those, just one-quarter are women). And the representation of researchers of Asian, 'mixed or multiple ethnic groups' (as the UK Census and HESA terms it), or 'other' ethnicities also dwindles with seniority, especially in science (see 'Diversity in UK science').

A finer-grained analysis shows that, in particular, people of Black Caribbean, Bangladeshi and Pakistani ethnicities are under-represented (see 'A closer look at ethnicity').

These figures show not only injustice, but also the way UK science is impoverished by losing diversity of thought and experience, says Tanvir Hussain, a materials engineer who, like Mokaya, is at the University of Nottingham.

Data gathered by *Nature* show attrition at almost every stage of the UK academic journey. Those who study these inequities say that responsibility shouldn't be placed on individuals who are struggling to thrive in UK academia. Rather, the system needs to change, with institutions asking what about their

environments and structures is inhospitable for some academics. "They don't need anything other than a fair system," says Mokaya.

Starting out

There are some positive signs. Undergraduates in the United Kingdom are more diverse than its wider population, across almost all minority ethnic groups. Yet particular science courses struggle to attract students from marginalized ethnicities. More than 8% of degree students in science subjects in 2020–21 were Black, but only 3.4% were in the physical sciences, for instance. Overall, engineering or vocational subjects such as law, business and medicine attract a more diverse range of students (see 'UK undergraduates').



THE SELECTION PROCESSES NEED TO EVOLVE FROM THE TRADITIONAL, WHITE-CENTRIC PROCEDURES."

Some of the reasons are financial, says Mahrukh Shameem, a PhD student in immunology at the University of Sheffield, and an advocate for equity, diversity and inclusion. People from minority ethnicities in the United Kingdom are often from disadvantaged socio-economic backgrounds. The trend is not universal, however – a 2020 UK government survey showed, for example, that people from Pakistani and Bangladeshi ethnic groups had the lowest household incomes, whereas people from Indian ethnic groups had the highest income of all groups. This might sway

some students to choose degrees that lead to financially secure jobs, such as engineering or medicine, she says. Cultural factors play a part, too: some students in the UK South Asian community, for instance, might have an expectation they'll be relied on to support their families financially across generations, Shameem adds.

Physics tends to be perceived as a "quest for knowledge" – a luxury, says Mark Richards, a physicist at Imperial College London and member of Imperial As One, the university's race equality advisory group. That's despite physics graduates often securing a range of prosperous jobs, from banking to the public sector, he says.

The pattern perpetuates, says Hussain, when prospective students feel they won't belong on a course because they don't see people like themselves doing it, or because its contents don't reflect their culture or the contributions of people like them. That's something Shameem has felt at first hand: "I haven't met a single Pakistani female principal investigator or lecturer, and I've been in academia for a decade," she says.

The PhD precipice

The proportion of Black students in postgraduate science drops sharply compared with those at undergraduate level. For instance, just 3.8% of students who started research master's or PhDs in science subjects in 2020–21 were Black, compared with 8.3% of those who started first degrees in those subjects three years earlier (an approximate way to follow cohorts; both statistics refer only to students who lived in the United Kingdom before starting their course). In taught science postgraduate courses, however – those that do not involve research – 8.2% of students are of Black ethnicities. Fewer students of Asian ethnicity also continue to postdoctoral research than could be expected on the basis of undergraduate science populations. In the majority of subjects, the representation of



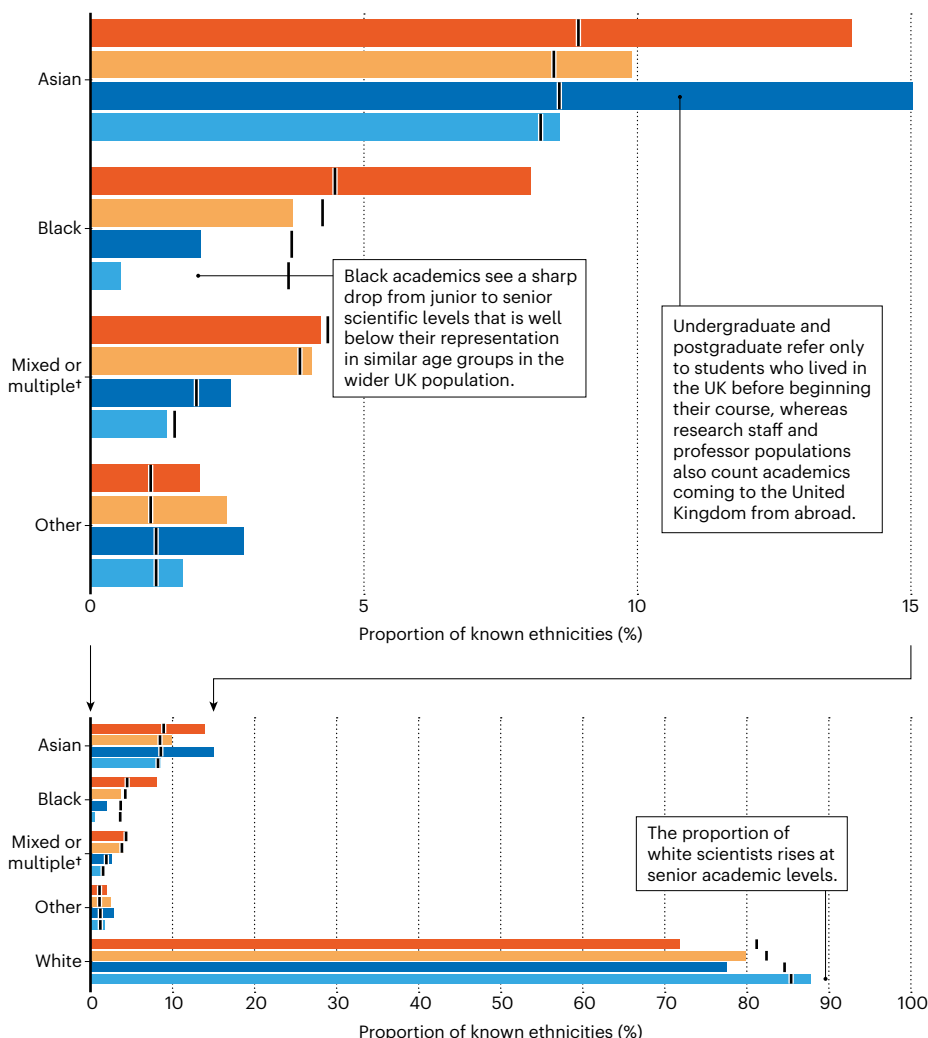
Feature

DIVERSITY IN UK SCIENCE

UK undergraduates from minority ethnic groups are largely better represented than in the general population. But by senior levels, that trend reverses.

Career stage (science subjects, 2020–21)

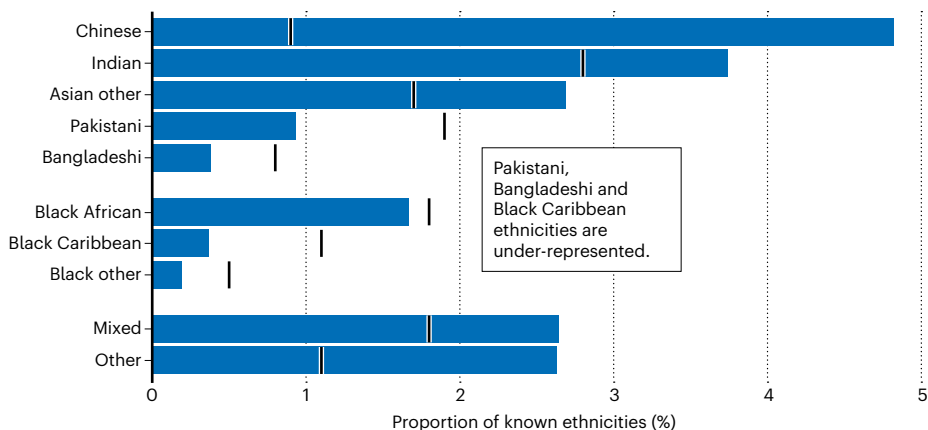
Undergraduate Postgraduate Academic research staff Professors
 Estimated census population levels for each age group*



A CLOSER LOOK AT ETHNICITY

Analyses that examine broad UK categories of ethnicity (such as 'Black' or 'Asian') don't show that certain ethnicities within these groupings are particularly under-represented.

Academic research staff (all subjects) Estimated census levels for working-age population*



*Population age-range estimates for 2020, extrapolating from 2011 census. Undergraduate: 19–23 years old; postgraduate: 24–26; academic staff: 24–68; professors: 34–68. *The Higher Education Statistics Agency (HESA) follows UK census definitions in describing this category as 'Mixed'; it was renamed to 'Mixed or multiple ethnic groups' in the UK 2021 census. *From 2011 census (16–64); that is, 25–73 in 2020.

white students rises (see 'PhD cliff face').

Shameem is not surprised by the drop. Relatively few students from lower socio-economic backgrounds know that PhDs exist and that they are often funded, she says.

But socio-economic factors only go so far in explaining the trend. A student's undergraduate experience also has an impact, says Wayne Mitchell, a molecular biologist at Imperial College London and co-chair of Imperial As One. If they feel they've been "banging their head against a brick wall", they are not likely to want to continue, he says.

UK universities often suggest that the drop-off is down largely to students' choice, says Hussain. In fact, he says, there are structural barriers that affect selection. Universities tend to want PhD students with top grades, for instance. Yet students from marginalized ethnicities are less likely than their white peers to leave university with top grades, even when their school grades suggest they are equally able – which affects their ability to go on to further study. Known as the awarding or attainment gap, this is due to a range of factors, including biased curriculum design, a lack of role models and guidance, and students feeling like they don't belong, according to a 2019 report from Universities UK, an advocacy group for British higher-education institutions.

PhD courses also privilege students from prestigious universities. But Black students are over-represented in less research-focused universities for their first degrees, says Richards, for myriad reasons not related to talent, including that they don't see elite institutions as for them. The awarding gap between Black and white students is also exacerbated in these institutions.

PhD applications, meanwhile, often depend on reference letters that invoke superficial metrics and impressions of how engaged students are, which leave wide scope for bias, says Izzy Jayasinghe, a cell biologist at the University of Sheffield. The focus should instead be on the quality of students' work, the challenges they have overcome and achievements that reflect on their character broadly. "The selection processes need to evolve from the traditional, white-centric procedures," she says.

It's unclear whether PhD funding contributes to the diversity drop: owing to data collection methods, the ethnicity of almost 30% of those awarded PhD studentships by UKRI (the UK's national funder) is unknown. That makes it very difficult to analyse disparities.

Whether because of structural factors or just straight-up bias, marginalized students "aren't deemed as competitive", says Mitchell.

Seniority drop

Past PhD level, there's a further drop. HESA data comparable with today's statistics go back only to 2008–09, making it difficult to

SOURCES: HESA/2011 UK CENSUS



Robert Mokaya discovered in 2018 that he was the only Black chemistry professor in the United Kingdom.

collate cohorts, but a snapshot of 2020–21 shows that 2.5% of junior UK research staff in science subjects were Black, compared with 0.6% among senior levels, including professors. There's a drop for researchers of other minority ethnicities, too (see 'Drop in diversity: junior to senior research staff').

Although it takes time for increased diversity at junior levels to filter through to senior ones, data suggest that the current pace of change is slow, particularly among Black researchers. People from Black ethnicities accounted for 1.7% of junior academic science staff in 2008–09, growing to 2.5% in 2020–21. But over those 12 years, the proportion of Black scientists in professor and senior management roles barely shifted, rising from 0.5% to 0.6% (see 'Diversity among UK science faculty over time').

Progression up the seniority ladder relies on opaque factors, such as social networks, and being vouched for by other academics, as well as access to information on grants and how to win them. Multiple studies have found that, whether consciously or not, senior figures are more likely to see potential in – and guide – people who are similar to themselves, an effect sometimes termed affinity bias.

Richards compares it to navigating from one side of a dark, cluttered room to the other – some are given a torch and others are not. "You can't blame people for shining a torch to help someone out. But if you're not being helped out as much as others, then

inevitably, it's going to make a difference in progression," he says.

Other factors make it harder for people from marginalized ethnicities to progress. Various studies have shown that staff from minority ethnic groups report experiences of isolation and marginalization. This can include microaggressions, such as colleagues questioning their credibility or expressing surprise that academics who are Black or from other minority groups are scientists. The process of awarding grants and promotions also favours those who can travel and negotiate positions, says Jayasinghe. "We need to adopt an approach that is not biased towards those who shout the loudest," she says.

Hussain also points to bias in how students rate their lecturers; studies show that women and marginalized academics tend to get lower marks. Mitchell notes that time spent on work related to breaking down race- and ethnicity-based barriers also takes away from research time. Another major reason is disparities in the grants process (see 'Funding success rates').

Finally, researchers of colour often feel they have to do more to demonstrate their ability than white colleagues, says Mokaya. This is backed up by wider studies, such as the UK government's 2017 McGregor-Smith Review, which found that in the UK workforce, people from Black and minority ethnicities were more likely to be overqualified for their job but less likely to be promoted, compared with those



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from white ethnic groups. "People talk about a leaky pipeline. I say it's a blocked pipeline," says Mokaya.

Women from Black and minority ethnicities face an additional systemic bias, which results in them being less likely than their peers to be promoted and get the largest grants, adds Ijeoma Uchegbu, a pharmaceutical nanoscientist and envoy for race equality at University College London.

Unbalanced elite

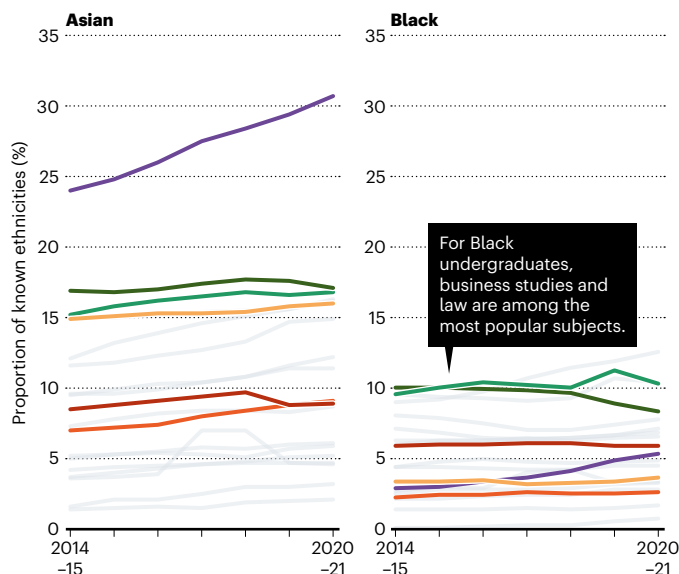
At the professor level, the highest echelon of UK science, most people are white (88%) and male (75%). HESA data show 70 Black professors in science subjects in the United Kingdom (0.6% of the total), of whom just 10 are women (HESA provides both figures rounded to the nearest 5; it also allows respondents to identify as 'other', not male or female).

Meanwhile, just 4% of professors in the biosciences are of Asian ethnicity,

UK UNDERGRADUATES

Some science subjects attract fewer Asian and Black students than do courses perceived to lead to higher-wage jobs such as business studies.

Medicine and dentistry Biological sciences Physical sciences
Mathematical sciences Law Business and administrative studies
Other subjects

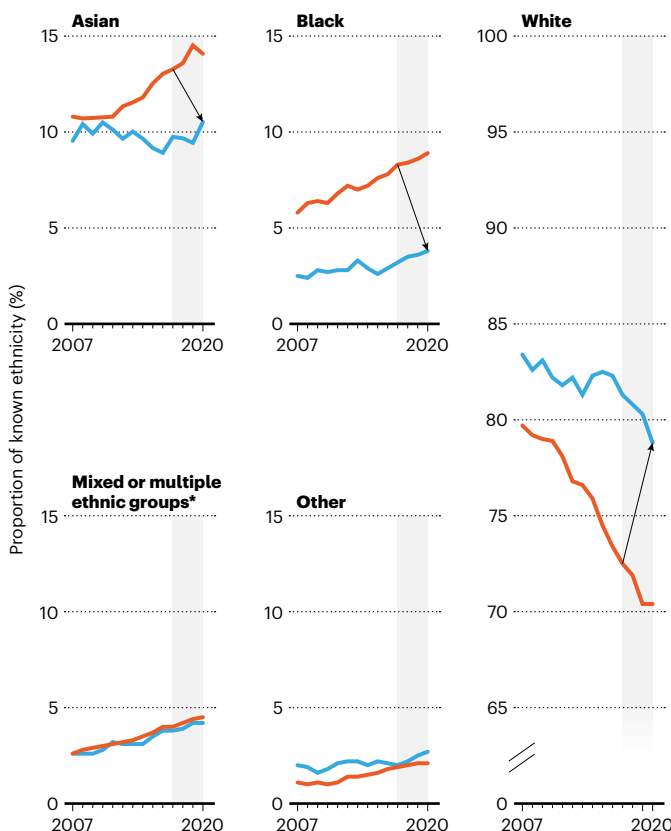


PHD CLIFF FACE

The proportion of Black and Asian students in postgraduate research courses in science subjects drops sharply compared with the undergraduate level. The trend is reversed for white students.

First degree Postgraduate

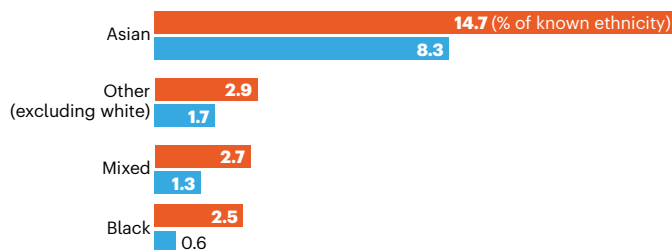
UK first degrees typically take three years. The arrow compares students starting first degrees with those starting postgraduate courses three years later. This is an approximate way to follow a cohort.



DROP IN DIVERSITY: JUNIOR TO SENIOR RESEARCH STAFF

Representation of minority ethnic groups continues to fall when comparing junior and mid-level academic science staff with professors (data from 2020–21).

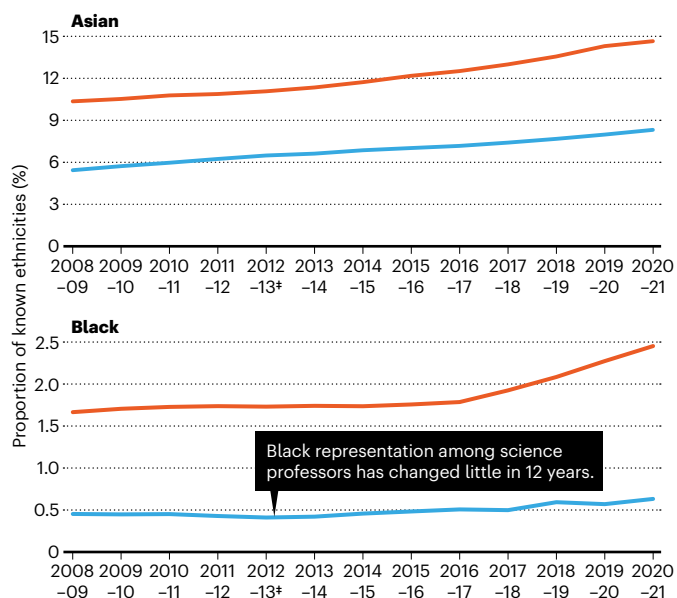
Junior and mid-level academic† Professor and senior academic



DIVERSITY AMONG UK SCIENCE FACULTY OVER TIME

Asian and Black representation is rising, but change is slow, and particularly sluggish for senior staff.

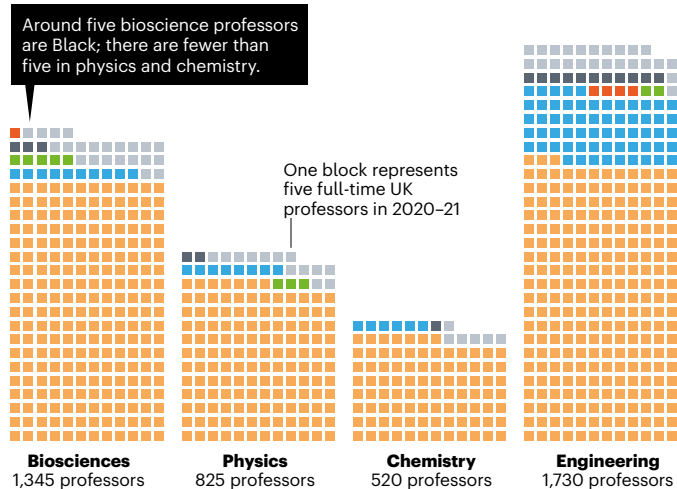
Junior and mid-level academic† Professor and senior academic



UK SCIENCE PROFESSORS

There are very few professors from minority ethnic groups in some science subjects.

White Asian Black
Mixed Not known Other



*The Higher Education Statistics Agency (HESA) follows UK census definitions in describing this category as 'Mixed'; it was renamed to the longer terminology in the UK 2021 census. †All other contract levels. ‡Slight change in categorization of seniority levels.

SOURCE: HESA

alongside 6.1% in chemistry and 5.3% in physics. Engineering subjects tend to be more diverse: 18% of civil-engineering professors, for example, are of Asian ethnicities and 2.6% are Black (see 'UK science professors').

The lack of diversity perpetuates inequality, not only because people are likely to promote others like them, but because leaders might be unable to empathize with problems that Black and minority ethnic researchers face. "It keeps feeding back as a sort of vicious cycle," says Hussain. For early-career Black women, slogging through the rejections that are rife in academia can also feel pointless if no examples of success exist, adds Uchegbu.

Funding concerns

Funding discrepancies are a major concern. Researchers of marginalized ethnicities win proportionately fewer of the grants they apply for than their white peers, according to data published by UKRI on 1 December. The difference was most stark for Black applicants applying for principal-investigator grants – success rates of 13% in 2020–21, compared with 29% for white applicants. Among Asian ethnicities, there were major differences between subcategories. For those of Bangladeshi heritage, for example, the cumulative success rate over 5 years was just 12%, compared with 21% for those of Chinese ethnicities and 23% for researchers from an Indian background (see 'Funding success rates').

When UKRI first published these data, in 2020, it noted that the figures weren't controlled for factors such as career stage, geographical location or discipline, so they shouldn't be interpreted as showing a causal relationship between ethnicity and award rates. But the funder added that data highlighting disparities between different ethnic groups "form part of ongoing work at UKRI to increase equality diversity and inclusion in the research and innovation system".

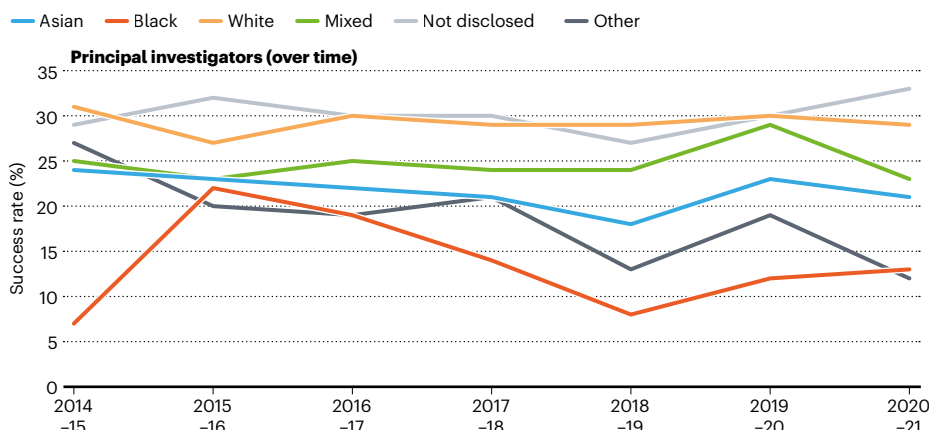
"Our work includes improving and better understanding the data, using these to design and then test interventions, and evaluating their effectiveness," says Melanie Welham, UKRI's executive champion for people, culture and talent (see go.nature.com/3bthsyj for the funder's full response).

UKRI must look closely at whether its process of evaluating proposals is fair, says Mokaya. In his 15 years as a professor, he has had all of his UKRI applications turned down – he estimates around one every 18 months. (As of this year, he technically holds UKRI funding, but only because the agency is replacing European Union funding that Mokaya lost as a result of Brexit.) There are also success-rate gaps between white and minority ethnic groups at the UK biomedical funder Wellcome and the UK National Institute of Health and Care Research.

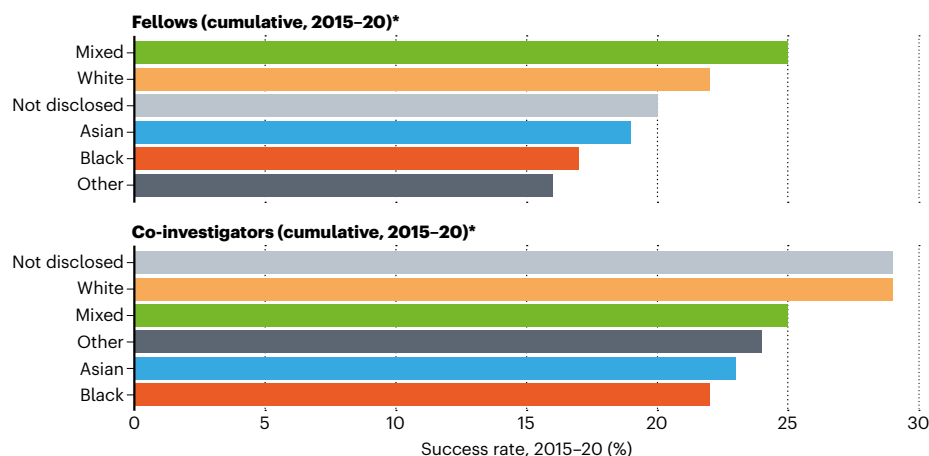
At the co-investigator level – a leadership

FUNDING SUCCESS RATES

Among UK grants given out by the national research-funding agency UKRI, Black researchers win fewer of the grants they apply for than do scientists of other ethnicities.



Similar patterns are seen for UKRI grants to less-senior researchers: fellows (postdoctoral researcher grants) and co-investigators.



*Cumulative figures shown for clarity because of year-on-year variability.

position in a grant supporting the principal investigator – there was a six percentage point gap between the success rates of Black and white applicants over the past five years, UKRI data suggest. (The figures show more variability year to year.) For fellows – personal grants awarded to postdoctoral researchers – the gap was nine percentage points.

Funding strategies are being trialled to reduce the effects of bias. In September, the British Academy announced it was randomizing its small research awards in social sciences, humanities and the arts for applications that are rated equally good. Greater diversity among peer-review panel chairs and members could also help, adds Uchegbu.

Wellcome is taking a more targeted route. After a damning report in August found that the funder was perpetuating racism, Wellcome pledged to create a dedicated funding stream for researchers who are Black and people of colour, as well as to apply "positive action principles". This means that when funding applications have similar merit, Wellcome will favour those that broaden diversity.

Mokaya, who came to the United Kingdom from Kenya as a PhD student in 1989, says he

is pleased more conversations are happening about inequity today. Following a Royal Society of Chemistry report earlier this year that found systemic inequalities in the field, the society has created a £1.5-million (US\$1.8-million) Race & Ethnicity Unit and a dedicated student mentoring scheme. It has also pledged to proactively increase representation in its governance, committees and editorial boards. UKRI has introduced a range of measures aimed at creating a more equitable research environment, including spending almost £8 million on projects to improve access to – and the experience of – postgraduate research for Black, Asian and minority ethnic students.

Overt racism has limited his career, Mokaya says, but it is not something he likes to dwell on. What hampers diversity in UK science are widespread structural issues that amount to a systemic form of racism, about which many are in denial, he says. "There needs to be the acceptance that not everybody's being given the opportunity to flourish and to do as well as they can," he says.

Elizabeth Gibney is a senior reporter based in London.