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Underrepresentation of Black and Asian students in plant science: UK data and recommendations for action

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Abstract

Diverse scientific teams do more productive and high-impact science, and the UK plant science strategy establishes “Diverse People and Skills” as an important component of the future of plant science. Here we present ethnicity data from the UK Higher Education Statistics Authority (HESA) which demonstrates that UK plant science students are disproportionately white. Within the three-year data window used, there were no UK based students who self-identified as Black at either undergraduate or postgraduate level. We explore reasons that might underpin this, including the bias towards specialist plant science programmes being in research-focussed institutions with low proportions of Black students. We offer recommendations for action, providing practical suggestions for how our discipline can become less exclusionary and more welcoming to Black and Asian students.

Diverse scientific teams do more productive and high-impact science than homogenous groups [1,2]. However, UK research is known to be disproportionately dominated by white scientists [3]. Black, Asian and Ethnic minority scientists are less likely than white peers to be appointed to permanent scientific positions, reach professorship and obtain research funding [4]. This loss of scientific talent is damaging to UK science, and multiple bodies have identified diversifying the scientific workforce as an important issue [4].

The UK Plant Science Strategy establishes “Diverse People and Skills” as one of six key deliverables over the next decade [5]. It is therefore important to understand diversity within the educational pipeline of potential plant scientists. The relative lack of racial diversity in plant biology has been highlighted in the USA [6] but not elsewhere. We present three years of ethnic diversity data from the UK Higher Education Statistics Authority (HESA) within specialist plant science programmes, benchmarked against other relevant subjects. The HESA ethnicity data presented is for UK students only; ‘Asian’ in this context therefore means those of Asian heritage educated in the UK, and excludes international students from Asia [7]. While use of these ethnicity categories (e.g. Black, Asian) is standard practice in UK HE, these categories may not be relevant in other educational contexts (e.g. where indigenous students are an important component of racial diversity), making international comparisons technically challenging. It also should be noted that these categories represent a social construction of race which has no basis in biology and has a history linked to racism and oppression.

While the UK plant science cohort is small compared to other biology subdisciplines, its ethnic composition was significantly different to the UK population ($\chi^2_{(5)} = 2098612$, $p < 0.001$), the total student population ($\chi^2_{(5)} = 212.48$, $p < 0.001$) and the biology student cohort ($\chi^2_{(5)} = 131.06$, $p < 0.001$). Plant science is particularly dominated by white students (Figure 1). 90% of plant science undergraduates, 73% of postgraduate taught and 87% of postgraduate research students were white. The only bioscience discipline with a higher proportion of white students was Ecology and Environmental Biology (Figure 1). Some plant biology will be taught in the context of Agriculture programmes, but these do not fall within the biosciences subject group within the HESA data. Agriculture programmes are also more typically offered by Further Education (FE) based providers of HE (i.e. at local community colleges not universities), so data for Agriculture is not presented as it is not directly comparable. The lack of ethnic diversity within UK plant science PhD awards has been reported previously [5], but our analysis demonstrates this underrepresentation occurs earlier in the educational pipeline.

Strikingly, within this timeframe there were no UK plant science undergraduates or postgraduates self-identifying as Black (Figure 1). It is possible that there were a very small number of Black students as HESA rounds student numbers to the nearest 5. However, even with the caveat of this rounding approach it is clear that UK Black students are almost completely absent from specialist plant science programmes. Any Black students enrolled are almost certainly from overseas. While international students from all cultures make an invaluable contribution, UK plant science should be extremely concerned that our discipline is unattractive or exclusionary towards domestic Black students.

FIGURE 1 HERE

We also need to understand the relative lack of appeal of plant science against other biology subdisciplines, particularly biomedical sciences which attract a very diverse cohort. One structural factor underpinning the lack of diversity may be the geographical distribution and characteristics of the 17 UK institutions that offer specialist plant science programmes. UK Black students in the UK are known to be less geographically mobile than white counterparts [8], and most frequently study in teaching focussed 'Post-92' universities, with London institutions being particularly popular (Figure 2). However, the majority of specialist plant science programmes are offered at research focussed 'Russell Group' institutions with selective academic entry requirements (Figure 2). To the best of our knowledge there is no specialist plant science undergraduate programme based in London. The proportion of Black students and academic staff was significantly lower in institutions that offered specialist plant science programmes than those without this provision (students Mann-Whitney $U = 1161$, $p = 0.039$; staff $U = 1210$, $p = 0.015$). Similarly, institutions offering ecology and environmental biology programmes had lower proportions of Black students and staff (Figure 2B,C). In contrast, the proportion of Black students and staff was significantly higher in institutions that offered biomedical science programmes (Figure 2B,C). This indicates that institutional availability of specialist provision may be a major influence on the student diversity within subdisciplines of biology at national level.

FIGURE 2 HERE

There are multiple factors that may be responsible for this effect. Black students may actively choose institutions in areas with vibrant Black communities, or institutions with high racial diversity to avoid being one of a tiny minority in a predominantly white cohort [9]. Alternatively it may reflect biases embedded through education. Black pupils are less likely to obtain high grades at A level (the typical academic entry qualification for university) and are more likely to obtain vocational (BTEC) qualifications which are not typically accepted by highly selective universities [10] . UK Black students are less likely to receive offers of university places than white peers even when equally well qualified [11], indicating racial bias in university admissions, particularly where interviews are used as these are particularly prone to bias. The well documented Black and Asian undergraduate awarding 'gap' means fewer students in these groups obtain the higher (1st/2i) degree classifications required for entry into most postgraduate programmes [12]. Without application data at subdiscipline level it is difficult to determine whether Black students are unsuccessful in their applications to plant science programmes, or whether they do not apply. However, the tendency for specialist plant science provision to be in white dominated research focussed institutions with (highly) selective admissions criteria reinforces racial bias within the discipline.

The lack of attractiveness of plant biology may reflect a disconnect between Black and Asian students and plants themselves. In the UK, Black people are four times more likely not to have a garden [13], and a lack of exposure to plants in urban environments contributes to a lack of plant awareness [14]. Plant biology as a discipline has particular work to do in confronting the legacies of colonial exploitation and oppression, sometimes referred to as decolonisation [15,16]. Botany was an active tool of empire building through expeditions to collect economically valuable and medicinal plants, with early colonial activity driven by the international spice trade. For example, Joseph Banks was the lead botanist on the 1768 voyage of HMS Endeavour, which was funded as a scientific exploration but led the way to British colonial domination over Australia, Aotearoa (New Zealand) and other Pacific islands

[16]. Many plants have Latin names that honour colonialists and even slave traders, with local naming traditions being erased from scientific study [17]. Many important plant biologists had links with colonial expansion and slavery, and many held racist views that are rarely acknowledged or challenged. In addition to developing taxonomical classification systems in the mid 1700s, Carl Linnaeus proposed four human subspecies of 'European white', 'Asian tawny' 'American red' and 'African black', which have no basis in biology and underpin scientific racism to this day [16]. Hans Sloane provided the initial botanical collections now owned by the Natural History Museum, but was a doctor on Caribbean slave plantations and many of 'his' specimens were collected through exploiting the labour and knowledge of enslaved people [16]. In contrast, the contributions of non- European plant biologists have been overlooked and removed from the history of our discipline [17]. It should also be emphasised that much colonial exploitation and slavery was agricultural; African slaves primarily worked in plantation farming throughout the Americas and Caribbean. This has resulted in Black people (particularly those with Caribbean ancestry) having a complex relationship with food production systems, which may also underpin the unattractiveness of plant biology. When this complex past is not acknowledged by almost entirely white teaching faculties, we risk the alienation and disillusionment of minority students.

Other reasons underpinning this lack of diversity are likely to be multifaceted, but we cannot make progress without understanding them. Factors may include a curriculum that doesn't feel relevant, implicit and explicit messaging from educators, family and community members and a lack of visible role models. For example, to the best of our knowledge in the UK there are fewer than 5 plant biology faculty members that self-identify as Black. Neither of the two Black full professors of plant biology were educated in the UK. Given the very low levels of racial diversity, we also need to consider whether our discipline is actively unwelcoming, implicitly or explicitly biased, or even discriminatory and hostile towards Black and ethnic minority students. These issues are unlikely to be unique to our discipline, but understanding them requires us to be humble and potentially confront some hard truths.

To make positive change, all providers of plant science education could adopt models that have an impact on racial inequity. Positive actions may include the formation of networks to support Black students and researchers (e.g. blackinplantscience.org), summer schools specifically for ethnic minority students or funding streams specifically for ethnic minorities (e.g. as recently announced by Wellcome Trust, Royal Society). Others have also made recommendations for greater inclusivity in plant science, including raising interest in scientific careers, using personal narratives to relate plant biology to everyday life, access to mentoring and calling out barriers to participation [6]. Many learned societies and museums have started to address the history of exploitation within their collections [15], and more diverse narratives and individuals are starting to be recognised within plant biology [17].

Based on the data presented and our lived experiences of UK plant science education, we recommend the following specific actions:

- Target recruitment efforts at both undergraduate and school level, presenting plant biology as an exciting and relevant discipline to all students, but particularly to those from minoritised groups.
- Diversify the workforce and increase the visibility of Black and Asian role models in plant sciences.

- Provide targeted financial support and personal development opportunities to Black and Asian students interested in plant biology.
- Ensure attractiveness and inclusiveness of plant biology taught to undergraduates on general biology programmes or other specialist programmes (eg genetics, biochemistry) as a route into postgraduate plant biology study
- Revise curricula and teaching materials to reflect historical and contemporary plant based exploitation, and confront the relationship between key figures in plant biology and racism.
- Recognise that the stress of microaggressions and the emotional tax of being "othered" can leave individual students feeling as if they do not belong. Address this by aiming for psychologically safe environments by elevating the awareness and emotional intelligence of supervisors, tutors and staff.
- Acknowledge that racism exists. Do not dismiss the concerns of students who voice their experiences, or punish those who call out racial injustice.
- Create safe systems to report and address microaggressions within Universities and support communities/networks that connect Black and Asian students.
- For the community to come together and identify ways to make plant science available to students in institutions popular with Black students, either within formal curricula or by targeted outreach work.

To make change we need to be bold and creative, and work in genuine partnership with students and scientists of diverse backgrounds. We need to work within our own institutions and across the sector to create opportunities for a more diverse cohort of plant science students. Tackling this lack of racial diversity is the right thing to do, and will be to the direct benefit of plant science.

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Figure Captions

Figure 1: A: Ethnic diversity of UK bioscience students. Data aggregated for 2019/20, 2020/21 and 2021/22. Numbers in italics give the total size of the relevant student population, numbers on bars indicate % of students if the bar represents 7% or more. Due to rounding within HESA data, displayed percentages may not total 100%. UG = Undergraduate; PGT = Postgraduate taught; PGR = Postgraduate research. A subset of bioscience disciplines are presented for clarity. Data sources: UK Census 2021 and HESA Table 45.

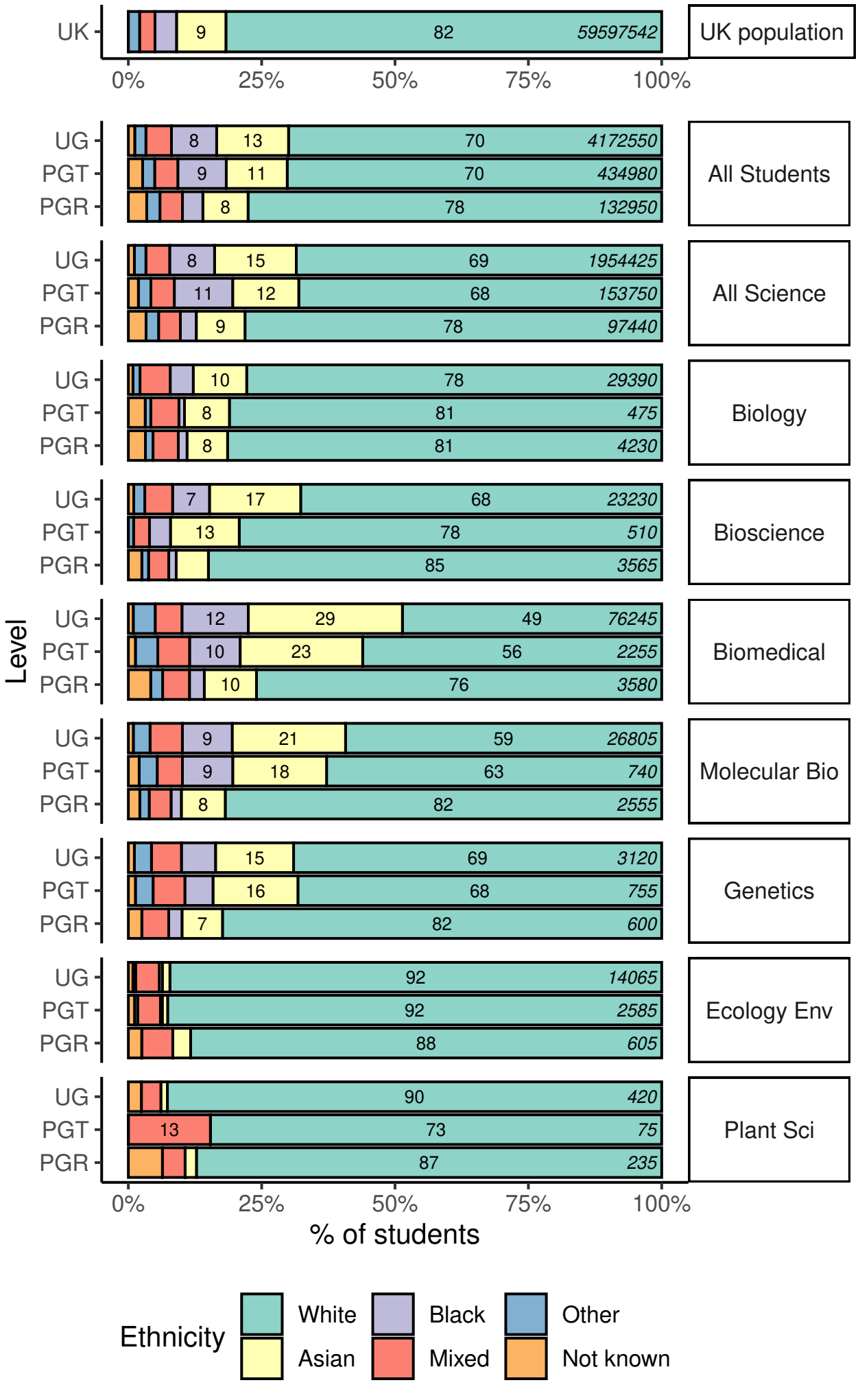
Figure 2: Relationship between institutional diversity and availability of plant science programmes. A: Proportions of Black students and academic staff in UK institutions offering specialist Plant Science programmes. Percentages are for the whole institution. Above the dotted line are the top 20 institutions by % of Black students, below the line are all other institutions offering plant science undergraduate (UG) and postgraduate masters (PG) programmes. Student data aggregated for 2014/15 to 2021/22, Staff data for 2022/23. Numbers at the ends of bars give total number of Black students/staff. Data sources: HESA student table 5, staff table 2, Universities and Colleges Admissions Service (UCAS) and Institute of Biomedical Science (IBMS). Entry tariff groups defined using Guardian league table 2024, '-' indicates institutions not included in the league table. Remote/online only providers removed from analysis. B: Proportions of Black students in institutions with and without specialist programmes in plant science, ecology and environmental biology and biomedical science. Each point represents one institution. C: Proportions of Black staff in institutions with and without the same specialist programmes. Statistical annotations give results of Mann-Whitney tests.

Competing Interests

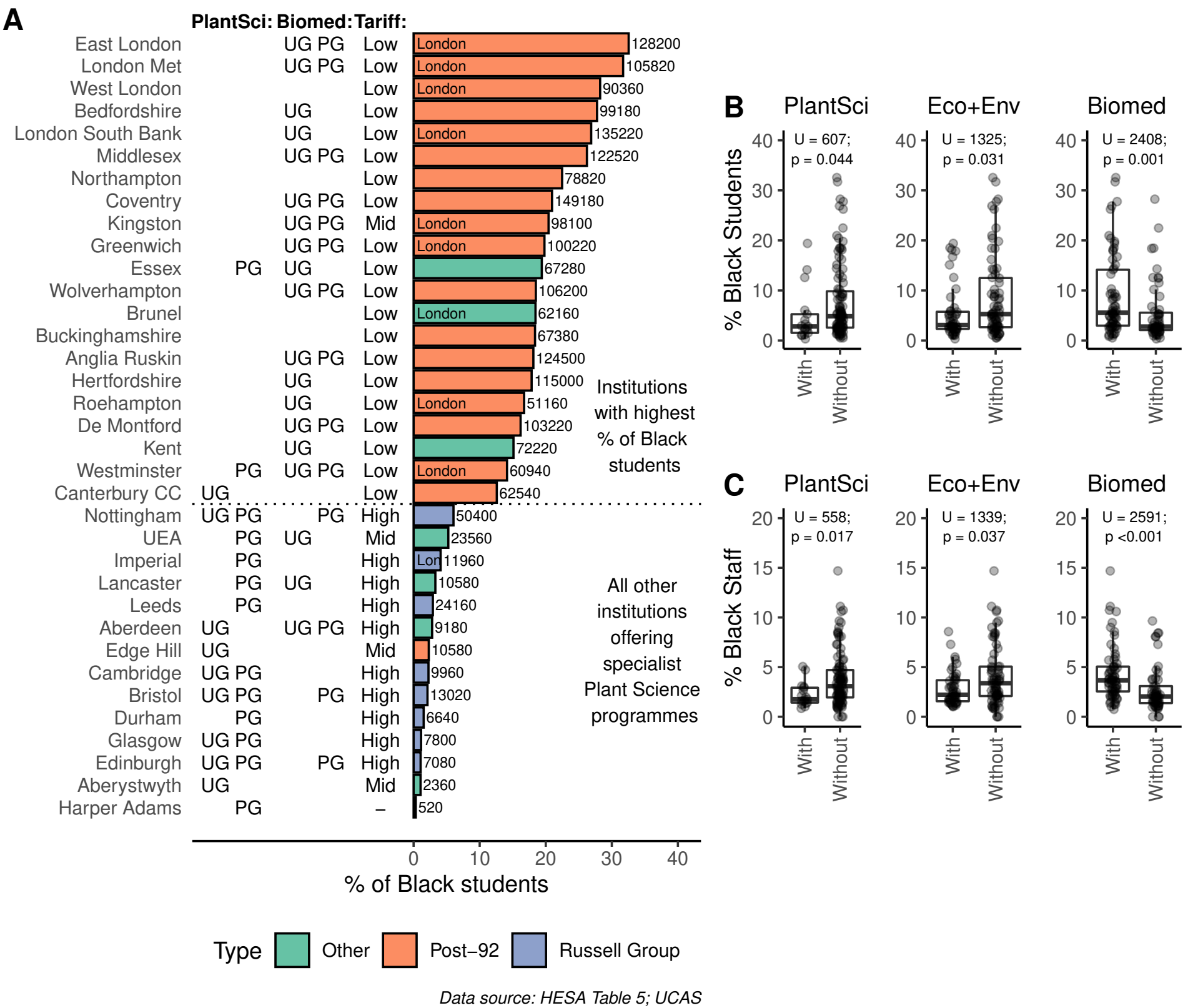
No authors had any competing interests to declare.

Author Contributions

KH initiated the project, analysed data and led writing. YBA, NJP and JB generated ideas, suggested further data analysis, contributed to writing, reviewing and editing of the manuscript.



Data source: HESA Table 45



Data source: HESA Table 5; UCAS