APPG on Diversity and Inclusion in STEM call for evidence: Inquiry into equity in the STEM workforce

This evidence is submitted by the Royal Society of Chemistry.

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We are an international organisation connecting chemical scientists with each other, with other scientists, and with society as a whole. Founded in 1841 and based in London, UK, we have an international membership of over 50,000. We use the surplus from our global publishing and knowledge business to give thousands of chemical scientists the support and resources required to make vital advances in chemical knowledge. We develop, recognise and celebrate professional capabilities, and we bring people together to spark new ideas and new partnerships. We support teachers to inspire future generations of scientists, and we speak up to influence the people making decisions that affect us all. We are a catalyst for the chemistry that enriches our world.

Summary of Evidence

Our data show that the chemical sciences are not representative of wider society. The Royal Society of Chemistry's ambition is that 'chemistry should be for everyone' and so we are working to improve access to high quality robust data and evidence that will give us all insight into the barriers people face and how we can improve them.

Current data show that women and Black chemists are under-represented in senior roles. There are still significant data gaps – we are working to further improve our understanding of the impact of socio-economic background and disability – the former being particularly challenging as it is not a protected characteristic and therefore less data is available.

Key Questions

1. What are the demographics of STEM workers in your organisation or sector? Are there gaps in the quality of evidence, monitoring or reporting?

Role of diversity of the chemical sciences workforce

1.1 In our 2020 workforce report, *Chemistry's contribution: Workforce trends and economic impact* [1], we provide a five-point action plan aimed at strengthening the chemical sciences workforce to enable economic recovery. The report identifies strong links between skills and innovation and outlines the vital role the chemistry workforce will play in boosting the UK economy and recovery. Diversity in the chemical sciences is vital to that innovation.

Diversity in our membership and the chemical sciences

1.2 Our *Diversity data report 2020* [2] presents diversity data from across our membership and organisational activities – including governance bodies, prizes, grants, education, publishing. The chemical sciences community, particularly that in the UK, is reflected in our membership. The demographics of our largest membership category (MRSC or 'Member') are: **gender identity** 25% female, 75% male, <1% self-described; **ethnicity** 7% Asian, 3% Black, 1% mixed, 1% other, 87% White; **disability** 91% not disabled, 9% disabled; **sexual orientation** 2% asexual, 2% bisexual or pansexual, 2% gay man, <1% gay woman/lesbian, 93% heterosexual/straight, 1% self-described; **age** 4% age 29 or under, 28% ages 30-44, 32% ages 45-59, 25% ages 60-74, 11% age 75 and over. As membership categories are in part reflective of an individual's career progression in the chemical sciences, we see variances in demographics including age. The diversity of our overall membership has increased over time as observed by the demographics broken down by length of membership. For example, for members of five years or less the gender breakdown is 39% female and 61% male, compared to members of over 30 years where the gender breakdown is 9% female and 91% male. A similar trend is seen for diversity in ethnicity. This could be indicative of similar changes in the future demographics of the chemical sciences workforce.

1.3 Our recent analysis of Black representation in UK academic chemistry [3] using HESA 2017/18 data for students and staff shows that there is an under-representation of ethnic minority-identifying people through academic progression in chemistry, which is particularly pronounced for Black chemists, starting with significant attrition at postgraduate studies and continuing to 0% representation at the professorial level. See also 2.4.

1.4 Our 2018 report *Diversity landscape of the chemical sciences* [4] showed that the chemical sciences are not representative of society as a whole in particular with regard to representation disability, ethnicity, sexual orientation, socio economic background and gender.

Diversity in chemical sciences publishing

1.5 In our 2020 report *Is publishing in the chemical sciences gender biased?* [5], an analysis of the gender profiles of authors of more than 700,000 manuscript submissions to RSC journals found that 35.9% of authors were women. As the report shows, this percentage tallies with other measures that we used to assess the overall gender balance of the chemistry community. Furthermore, we identified biases at each step of the publishing profiles, recognising that both the publication of research articles and the number of citations that those articles gather remain established markers of scientific success, putting women at a significant disadvantage in terms of promotion and retention. We have since developed a *Framework for action in scientific publishing* [6] and established a joint commitment for action on I&D in publishing with 31 other publishing organisations.

Gaps in evidence, monitoring and reporting

1.6 Access to high-quality data and evidence is essential to improving the diversity of the STEM workforce. To ensure talented people thrive and progress in the chemical sciences, we need greater transparency in reporting the data that gives us insight into the barriers people face and the ways in which we can remove them. Systematic data are limited outside of statutory reporting requirements, limiting available evidence particularly in industry. Obtaining self-reported data across the sector remains a challenge. In our *Diversity data report 2020* [2], response rates of self-reported diversity data ranged between 9.0-73.8% across the different areas. We identified the critical need to develop trust within the community to encourage higher rates of self-reporting, and to communicate the importance of self-reporting in order to obtain robust data to guide our work in making chemistry more accessible and inclusive for all. There is additionally a need for intersectional data.

1.7 Many organisations have knowledge gaps in understanding the barriers to those with disability and/or impairments. Our *Diversity data report 2020* [2] revealed that disabled people are under-represented in our membership and activities, when compared to the UK population. We do not yet have data to understand if this is reflective of the chemical sciences sector, or whether disabled people in the chemical sciences face additional barriers of exclusion in RSC membership and activities. This is a priority area for the RSC in 2021.

1.8 We are seeking to better understand access and progression within chemistry in relation to socio-economic background. Currently there is a lack of clarity, consensus and understanding of good practice measures of socio-economic background. As this is not a protected characteristic (Equality Act 2010 [8]) higher education institutions and/or organisations often have limited data related to socio-economic status.

2. Where is there inequity across the different protected characteristics and how are different communities impacted across different:

- STEM disciplines or sector/subsectors
- types of organisation (e.g. private, public, non-profit)
- type of STEM activity (e.g. academic research, education, engagement, commercial, funding)
- job levels and/or qualification.

2.1 Our 2018 report *Diversity landscape of the chemical sciences* [4] showed that the chemical sciences are not representative of society. We identified themes of mental health, disability, ethnicity, sexual orientation, socio-economic background and gender where we need to improve equality and inclusivity. In particular, the report showed a clear lack of progress in the retention and progression of women in the chemical sciences. We showed that gender inequality is particularly prominent in STEM, and that the chemical sciences lose talent at a higher rate through the academic career path compared to physics.

2.2 Following the evidence of gender inequality in the chemical sciences from our report *Diversity landscape of the chemical sciences* [4], our 2018 report *Breaking the barriers* [7] focused on understanding the barriers to women's retention and progression in the chemical sciences. 99% of the women who responded to this research said that they could evidence a lack of retention and progression of women in the chemical sciences. Three key barriers were uncovered: academic funding structures, balancing diverse commitments and an out-dated culture in academia. The report also uncovered evidence of discrimination, bullying and harassment and a systemic failure to deal with these issues effectively. We have since launched the chemical sciences first bullying and harassment support service and are members of the UKRI forum to tackle bullying and harassment. Our evidence shows that a fair and inclusive research culture is vital to retain women and other underrepresented groups in research careers.

2.3 In partnership with the Institute of Physics and the Royal Astronomical Society, our 2019 report Exploring the workplace for LGBT+ physical scientists [9] gathered data and evidence on the experiences of LGBT+ individuals in the physical sciences and the barriers to their retention and career progression. The report shows that STEM workplace policies and procedures do not adequately support employees that are not heterosexual and cisgender. We reported that 18% of LGBT+ physical scientists have experienced exclusionary behaviour at work.

2.4 Our 2020 analysis of HESA data for ethnicity in academic chemistry [3] shows that there is a clear retention problem for Black chemists. Although Black students are well-represented at the undergraduate level compared to the UK population, there is a significant point of attrition from undergraduate (4.8%) to PhD (1.3%) studies. This drops even further through the academic pipeline, to 0.9% non-professorial staff and 0% professors who are Black. We see the highest percentage of Black students at post-92 universities (8.9%), followed by those at non-Russell Group universities (4.7%), and lastly the lowest percentage of Black students is found at Russell Group universities (3.3%), which may provide further insights into the barriers behind the observed retention gap for Black chemists. Focusing on Black representation, we also see a greater loss through the academic pipeline in chemistry and biology, as compared to physics, showing a clear loss of talent in our discipline. Throughout 2021 we will be carrying out research to further understand the barriers to retention and progression related to race and ethnicity across the sector.

2.5 Our *Diversity data report 2020* [2] identified that disabled people are under-represented in RSC membership and activities, as compared to the UK population. In this report, we identified that 9% of RSC members (MRSC category), 2% of editors, and 0% of prize winners self-report as having a disability.

2.6 Our 2020 report *Chemistry for all* [10] investigated the socio-economic family background make-up of chemistry undergraduates compared to all undergraduate subjects and to the wider UK population. Our findings show that social and economic factors widen the participation gap in chemistry. Students from socio-economically advantaged backgrounds are more likely to study chemistry at undergraduate level than socio-economically disadvantaged students. The most advantaged group, with family backgrounds in higher managerial and professional occupations, makes up 32.2% of undergraduate chemistry students, while the least advantaged group, with family backgrounds in routine occupations, numbers less than a fifth in comparison (6.1%), despite occupying more of the total UK population (11.8% most advantaged vs 13.3% least advantaged). This socio-economic gap found in chemistry undergraduate students is also wider than that found in all undergraduate subjects between the most and least advantaged groups (22.9% vs 8.0%, respectively).

3. Where are there evidenced inclusive behaviours and policies within different organisations, subsectors, sectors and countries on:

- Recruitment; and/or
- Retention

3.1 The Royal Academy of Engineering and Science Council's *Diversity and Inclusion Progression Framework* [11] is a tool for professional bodies to assess and monitor progress on inclusion and diversity. We have participated in the Framework's development, used it for assessment of our own processes and benchmarked ourselves against others within the sector. We will be carrying out the assessment again in 2021 and as steering group members we recommend other professional and learned bodies use the Progression Framework to improve inclusion and diversity.

4. Are there policies or activities undertaken by the UK Government, or its agencies, that advance or inhibit equity and inclusive cultures within the STEM workforce?

- Where could policy change or sector action lead to addressing the equity of opportunity within the UK's STEM workforce?

Education

4.1 The Department for Education's future proposals for funding of level 3 qualifications risks reducing equality of access to STEM education at post-16 and beyond, which in turn may negatively impact the diversity of the workforce over time. The consultation [12], which runs until 31 January 2021, makes clear the intention to remove funding from qualifications in science other than A-levels and T-levels; this would include applied science BTECs, for example. The intention is that prospective students would enter either A-levels or T-levels instead, depending on their aspirations. However, entry requirements for A-levels are such that students with average GCSE grades would routinely find themselves excluded. The Science T-level is yet to be rolled out and we are yet to see how broadly it will be available; the requirement for an industry placement, while valuable, is likely to limit the number of places. Currently, some 25,000 students annually study applied science qualifications, and we estimate only a few thousand of these would be able to access other routes if those qualifications disappear, leaving other students to pursue other subject areas. According to the impact assessment [13], this could have impacts for diversity, as students with certain characteristics are over-represented on the qualifications that are expected to no longer be offered. This includes students with special educational needs, students from Asian and Black ethnic backgrounds, and those from the most disadvantaged backgrounds.

4.2 The RSC plans to soon publish a report on level 4 and 5 qualifications in subject areas related to the chemical sciences. One of the key findings of the qualitative research is that these qualifications support a wide range of learner journeys and attract a diverse range of learners. Qualifications at this level may for example be more attractive than undergraduate degrees to recent migrants, those from poorer families, and those who have struggled in their educational histories. Future proposals for higher technical qualifications are welcome in their intention to raise the profile of technical education and give recognition to the importance of technical skills in areas such as chemistry. However, care must be taken that the reforms do not inadvertently erect barriers; for example, the establishment of distinct academic and technical pathways must not result in loss of flexibility in progression options.

Research and innovation

4.3 Work has been undertaken and is ongoing by UKRI and other organisations in the UK research and innovation community to better understand the diversity of its workforce and effective practices to support inclusion and diversity but gaps remain. We welcome increased transparency from funders through increased diversity data publication and the development of policies to address exclusionary practice such as bullying and harassment. Opportunities to consider and address issues of equality and diversity in the research and innovation workforce and research practice present themselves in pending policy developments including the People and Culture Strategy and Place Strategy announced in the government's *UK Research and Development Roadmap* [14] and the upcoming review of the Research Excellence Framework [15]. These developments will shape investment, organisational behaviour and influence individual response.

5. What are the impacts of COVID-19 on equity for STEM workers (including job and income security, contract type etc) in the short- and medium-term? Which communities, groups, organisations or sectors are being most impacted?

5.1 Much evidence over this last year has shown that impacts of Covid-19 are further exacerbated for under-represented and minority groups. Evidence gathered from an RSC members' survey (data to be published soon) indicates that non-UK nationals based in the UK are more concerned about job loss and more likely to be considering retraining for a new career as a result of Covid-19, and are more likely to be looking for a new job in the coming months.

5.2 Evidence gathered from our Covid-19 impacts survey to RSC members (data to be published soon) indicates that the opportunity to work flexibly and/or part-time is important as a result of Covid-19. Respondents for whom flexible working was not available were more than twice as likely as others to be looking for a new job in the next six months and were more likely than others to be considering re-training for a new career. 32% of respondents working in industry said they have caring responsibilities. Of the respondents in industry who said they have caring responsibilities for a child and were affected by challenges accessing care, 67% said their productivity at work or study decreased as a result of challenges accessing childcare options as a result of Covid-19, during lockdown. 75% of respondents in all sectors who have caring responsibilities for a child, and were impacted by school/nursery closures or other challenges accessing childcare as a result of Covid-19, said that their productivity at work/study had decreased as a result. Women were more likely to report a significant decreased in productivity – 48% compared to 34% of men.

5.3 Our Covid-19 impacts survey to RSC members (data to be published soon) also showed the potential impact on the chemical science industry. Of respondents who were affected by restrictions on lab access, 60% of those at SMEs and 54% of those at large companies (500+ employees) also reported experiencing potential delays in research delivery as a result. For all organisation sizes, respondents in R&D and manufacturing roles were more likely than those in other roles to report a reduction of the chemistry workforce in their department as a result of the pandemic and to anticipate job losses in their team or department in the next year. 41% of respondents in mid-career agreed there were more concerned about losing their job as a result of Covid-19, compared to 28% of those with established careers. 20% of respondents in early or mid-career said they were considering, or maybe considering, retraining for a new career as a result of the Covid-19 pandemic.

5.4 The impacts of Covid-19 on education may have long-term impacts in terms of progression through to the chemical sciences and other areas of STEM. Inevitably, learning of practical and technical skills is interrupted during periods of lockdown, and at other times due to the requirements for additional hygiene and distancing measures. We currently do not have any evidence to suggest that particular groups are feeling these impacts disproportionately as the impacts are widespread; however, during the period of recovery we will need to monitor whether, for example, students in more advantaged circumstances are better placed to take part in opportunities to catch up, and therefore end up in a better position to progress into the workplace.

At school level, we are aware of disproportionate impacts of Covid-19 on the ability of students to engage with learning. When we surveyed 199 chemistry teachers in October 2020 (unpublished data), 80% of respondents said that students having limited access to a computer or tablet at home was a significant barrier to learning during the spring 2020 lockdown. 58% identified that their students were behind in terms of their general subject knowledge, but this percentage rose to 75% among schools with higher proportions of learners eligible for Free School Meals. This tallies with wider reports [16, 17] that learners in the least advantaged circumstances are missing out most on their learning, raising the very real prospect of a significant growth in the attainment gap for qualifications achieved in summer 2021. We are very concerned that this will lead to increased barriers to progression in sciences for the least advantaged, and therefore a long-term reduction in equity in the workforce.

Endnotes

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