Diversity landscape of the chemical sciences

A report by the Royal Society of Chemistry

ROYAL SOCIETY OF CHEMISTRY

Contents

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1 Foreword

Chemistry should be for everyone.

The Royal Society of Chemistry has a long history of commitment to increasing diversity and inclusion in the chemical sciences.

Yet, for too many people, there are still many obstacles to studying and undertaking careers in the chemical sciences. Much more needs to be done if we are to ensure that inclusion is the norm, and not the exception. Over the years, we have worked as a community to create real change, but we need to go further and faster.

This report is not intended to delineate our inclusion and diversity strategy. Rather, it draws together some of the available evidence about the current state of diversity in the chemical sciences, with particular focus in the United Kingdom. While it points to some areas of progress, it also shows up how far we have yet to go.

There is a real need for more progress around gender equality, specifically in regard to retention of women and their advancement to leadership positions. To achieve these goals, we need to identify, understand and then eliminate barriers to the progression and retention of women within the chemical sciences.

Tackling gender equality creates broader benefits. Encouraging greater gender equality is not only the morally right thing to do – it can help actively cultivate a positive climate for diversity and inclusion for all. Other issues of inclusion, such as mental health wellbeing, ethnicity and socioeconomic background, require greater focus and will feature in our next steps.

As a professional and membership body, and a key voice in the chemical sciences and the wider scientific community, we have the responsibility not just to think about inclusion and diversity but also to act.

That is why we call to all for five key changes to make "*chemistry for everyone*", outlining the steps that we intend to take in the years ahead.

We all need to play our part to bring about these changes.

This report seeks to inform our community and reaffirm our commitment to working closely with others on this important agenda, especially with our partners in higher education, industry and the wider scientific community.

I am proud of the achievements already realised by us and by the community, but it is clear that the task is far from finished. If we are to inspire, influence and accelerate real change on inclusion and diversity in the chemical sciences we must accelerate our actions now.

Robert Parker, CSci CChem FRSC
Chief Executive Officer

2 Executive summary

The chemical sciences should reflect our broader society.

We believe that for the chemical sciences to prosper, they must attract, develop and retain a diverse community of talented people – chemistry for everyone.

The Royal Society of Chemistry has a long history of promoting diversity and inclusion.

We have a responsibility as an employer, a professional and membership body, and as a key voice for the chemical science community to help encourage and inspire change. We changed our own governance, policies and activities to drive inclusion and diversity.

Our work has influenced the policy and practice of others.

While there have been successes, there is much more to do.

We are guided by robust evidence and data to make decisions about how we can best prioritise and focus our efforts and our resources, so that everyone can reach their full potential.

In this report, we identify themes around mental health, disability, ethnicity, sexual orientation, gender identity and socioeconomic background where we need to do better. These themes are systemic and interrelated. Most importantly, data are often limited.

It is resoundingly clear from our findings that there is still a lack of progress in developing and retaining women in leadership positions in the chemical sciences.

Gender equality remains a significant problem for chemistry. Specific challenges identified include: women's progression and retention, the pipeline of women in higher education, gender pay inequality, and lower impact publishing.

We must accelerate the pace of change.

Inclusion and diversity will continue to need strong and visible leadership by the Royal Society of Chemistry. In 2018, we will focus on women in leadership as one of our core themes.

We will do this because:

- the problem is particularly acute in STEM
- our 'leaky pipeline' is far more pronounced than in other scientific disciplines
- there is clear potential for us to have an impact at scale in this area, and
- we have the data and evidence to support our actions.

Tackling this issue head on is not merely the right thing to do – a more diverse workforce should result in better science and economic benefits. A more diverse representation at leadership level should in turn create longer-term social change.

Accordingly, we make a number of recommendations and commitments aimed at driving progress on diversity and inclusion.

We propose five key calls for change across the community to ensure that chemistry is for everyone:

1. Strong and visible leadership
2. More research and analysis
3. Greater focus on measuring impact
4. Effective collaboration
5. Cultural change

Our commitments

To accelerate the pace of change, we propose new commitments aimed at changing our policies and practices. We will:

- launch a new flagship programme of research to tackle gender equality and understand the barriers and enablers to women's retention and progression into leadership roles
- develop our new inclusion and diversity strategy, and
- review how we work with our community.

Our community

We cannot do this alone.

We also recommend that others should help to create momentum and promote further change.

We must raise the bar for diversity and inclusion in higher education.

Employers should better understand the contributions of diversity to their business and make stronger commitments to creating the right environments and policies for change.

The scientific research community needs to tackle systemic disadvantages and enable as many people as possible to contribute to scientific discovery and innovation.

This report is not an account of our inclusion and diversity strategy. It captures the current state of diversity and inclusion in the chemical sciences based on available data and evidence. It identifies gaps or questions that still need to be answered, and sets out new commitments about our future focus. We will use this report to guide and shape our next steps.

3 Introduction

The chemical sciences should represent our society.

Diverse teams produce better science.

It is only by drawing talent from the widest range of backgrounds, perspectives and experiences that we can be sure we are maximising innovation and creativity in science for the benefit of everyone.[1]

A varied range of intellectual approaches, different preferences, identities (both ethnic and gender) and educational and socioeconomic backgrounds is valuable to our community. Teams with diverse interests and complementary skills are much more likely to be able to identify and solve complex problems.

A more diverse workforce should result in more diverse representation at leadership level, which in turn creates longer-term social change.[2] Inclusion makes the difference.

However, this is not easy to achieve.

As an important voice for the chemical science community we recognise our responsibility and commit to accelerate the pace of change in areas where we can make the greatest impact.

We will examine the data, build the evidence and contribute to the leadership needed to make progress.

Our commitments and achievements so far

We have a long history of working on diversity and inclusion. We have shown leadership and commitment in this area over the last 20 years. A timeline of Royal Society of Chemistry key milestones and activities, and those of our partners, is shown below.

In particular, we have launched several programmes aimed at improving the status of women in chemistry and have investigated ways in which we can develop and increase the role of women in science. These programmes encouraged an open discussion within the community and stimulated changes in our organisation's outlook.

> “I am proud of our achievements on inclusion and diversity over the years. We've come a long way but there is still much more to do. The Royal Society of Chemistry needs to stay at the forefront of these issues and continue to demonstrate leadership in and on behalf of our community.”
>
> **Professor Lesley Yellowlees CBE**, October 2017

Our priorities and approach

For the chemical sciences to prosper, we must attract, develop and retain a diverse community of talented people.

We define diversity in a broad sense, as understood within the context of the Equality Act 2010. This includes age, disability, gender and gender reassignment, sex, sexual orientation, ethnicity, marriage and civil partnership, pregnancy and maternity/paternity, religion and belief. We also include career path and stage, communication style, education, experience, first language, geography, job sector, background and socioeconomic status.

1999

Athena Project established – a national project aimed at advancing and promoting the careers of women in STEMM[3]

2000

Royal Society of Chemistry report *Factors affecting the career choices of graduate chemists*[4]

2002

Royal Society of Chemistry report *Recruitment and retention of women in academic chemistry*[5]

2004

Royal Society of Chemistry – Athena Project report *Good practice in university chemistry departments*[6]

2005

Athena SWAN Charter launched[7]

2006

Royal Society of Chemistry–IOP report *Representation of ethnic groups in chemistry and physics*[8]

2008

Royal Society of Chemistry–Athena Project report *Planning for success – Good practice in university science departments*[9]

Royal Society of Chemistry–EPSRC report *Change of heart – Career intentions and the chemistry PhD*[10]

Royal Society of Chemistry–UKRC report *The chemistry PhD: The impact on women's retention*[11]

Royal Society of Chemistry–Biochemical Society–UKRC report *The molecular bioscience PhD and women's retention: A survey and comparison with chemistry*[12]

Athena Project becomes Athena Forum[13]

2011

Royal Society of Chemistry–IOP report *Mapping the future: Physics and chemistry postdoctoral researchers' experiences and career intentions*[14]

STEMM–DAC established to strengthen the inclusion of people with disabilities in STEMM[15]

2012

First Joliot-Curie conference for early career researchers

Professor Lesley Yellowlees becomes first female Royal Society of Chemistry President

2013

Royal Society of Chemistry diversity audit commissioned

2014

Royal Society of Chemistry Inclusion and Diversity Committee established

Royal Society of Chemistry partners with the Daphne Jackson Trust

Royal Society of Chemistry starts publishing gender statistics of our Prizes & Awards

2015

Royal Society of Chemistry signs the Science Council Declaration on Diversity, Equality and Inclusion

2016

Royal Society of Chemistry establishes the Inclusion and Diversity Fund[17]

Royal Society of Chemistry launches 175 faces of chemistry[18]

2017

Royal Society of Chemistry awards the first Inclusion and Diversity prize[19]

Royal Society of Chemistry implements RAEng Progression Framework

Chemistry World starts a series of articles on diversity[20]

Royal Society of Chemistry mental health working group established

Royal Society of Chemistry Diversity Community Hub established[21]

Royal Society of Chemistry launches new programme of diversity activities with first diversity event: Celebrating diversity in the chemical sciences

2018

LGBT+ Physical Sciences Network established by Institute of Physics, Royal Astronomical Society and Royal Society of Chemistry[22]

Royal Society of Chemistry participates in RAEng Progression Framework benchmarking

Royal Society of Chemistry report *Diversity landscape of the chemical sciences*

There is more work to do and we are impatient for change.

Our research and further feedback from the chemical science community presented in this report identified themes around mental health, disability, sexual orientation, ethnicity and socioeconomic background where we know improvement is needed.

We require a deeper understanding of mental health and wellbeing needs in the scientific community, what interventions have been considered in this setting, and whether those interventions have been effective in addressing the issues, especially among researchers.

More work is needed to understand the specific barriers to access for students with disabilities in STEM subjects.

Socioeconomic background has a strong effect on an individual's likelihood of entering higher education. Socioeconomic inequality in higher education participation and degree acquisition appears to be widening – these are broad and systemic problems. We need more research and more data to better understand the particular barriers and causes of inequality that exist for the chemical sciences and to use these insights to design appropriate interventions.

Chemistry undergraduate courses have a slight over-representation of minority ethnic students compared to the general population. However, these members of our community face unique barriers to retention, and progression into leadership roles is poor.

> “Diverse talent will thrive in an inclusive culture where everybody is valued and treated equally with respect and dignity without any form of discrimination. That's real inclusion. And what we do know is that if we get the 'I' [inclusion] bit right, then the 'D' [diversity] bit will follow.”
>
> **Dame Angela Strank**, Chief Scientist, BP, November 2017

Interplay between these issues can create further forms of disadvantage and discrimination. This intersectionality means that the inequality experienced by individuals who identify themselves with multiple underrepresented groups may be further compounded or exacerbated.

Data are a limiting factor.

A general increase in profile of diversity and inclusion issues has led to improvements in data collection and monitoring. However, our ability to properly describe the diversity of the chemical science community is still limited by the availability of data.

Sample sizes are limited and for many data gathering exercises it is difficult to cut by multiple dimensions (for example by ethnicity, socioeconomic background, disability or sexual orientation). This can raise more questions than answers. Therefore, there is a clear need for further and more detailed research and data gathering to be undertaken by us and by others.

Unfortunately, relevant information about scientists working in industry is also very limited, so inevitably there is greater focus on academia in this report. We have drawn on publicly available data from bodies including the Universities and Colleges Admission Services (UCAS), the Department for Education and the Higher Education Statistics Agency, as well as analysing our own membership data.

> “...I might like to challenge that industry could learn a lot from academia. From my experience, I think it's exactly the other way around and that academia can learn a huge amount from the way that industry does things. Actually, what we need is a dialogue. We need a dialogue because there are things that we will learn, there are things that they will learn, and the better that we can communicate, the better the whole thing will move forward.”
>
> **Professor Duncan Bruce**, Head of Chemistry, York University, November 2017

We commit to working with learned societies, academic and funding bodies, government agencies and industry to build a robust evidence base and actionable solutions. We have already established a partnership with the Institute of Physics in recognition of the shared diversity issues within the physical sciences community.

Gender equality has received most attention. Although the chemical science community has made progress, it remains a persistent problem.

Our key research reports as far back as 1999 have identified specific issues that could inhibit retaining and developing women into leadership positions.[5,10,14]

> “This study does find that there are a number of examples of good practice which seem to affect the recruitment and retention of women positively. Undoubtedly there is a long way to go to make such policies and practices universal but it is my belief that the fuller participation of women in academic chemistry will strengthen the subject in the long term.”
>
> **Professor Dame Julia Higgins,** Imperial College London and President of the Institute of Physics, Former Chair of the Athena Project, December 2002

While there have been some positive signs in the UK higher education sector overall ...

- Inclusion and diversity is now an even greater priority in the scientific community, with diversity becoming a focus for academic institutions and research funders.[23]
- The number of female chemistry professors has tripled in the last 10 years, from 15 to 45.[24]
- Chemistry is outperforming other fields as judged by the proportion of UK patents registered by female inventors.[25]
- Chemistry undergraduate courses continue to have a high proportion of female students (44%).[24]

...it is clear we have not yet solved the issues associated with gender parity:

- At the current rate of change, based on a linear model*, we will never reach gender parity in higher education institutions.
- Retention and development of women into senior positions remains poor. In 2016, only 9% of chemistry professors were women. Our membership data show that the proportion of women in our membership falls with age.
- Female physical science graduates are paid less than their male counterparts and the gender pay gap widens in the first five years.[26] Our own survey shows that the pay gap is present at all career stages.[27]
- Analysis of academic publishing output shows that women are underrepresented.[28]

It is resoundingly clear from our analysis of the evidence that a continued challenge for gender equality exists, particularly in retaining and developing women into positions of leadership within the chemical sciences.

Strong and visible joint leadership in the scientific community is called for to ensure that these issues are tackled head on and addressed as a matter of urgency.

*Within a 95% confidence interval

4 Recommendations and commitments

In the light of our findings, we propose five calls for change to ensure chemistry is for everyone.

1. Strong and visible leadership

Jointly with the scientific community and our partners, we need to take responsibility for issues specific to the chemical sciences and push for action towards a more inclusive and diverse community.

Our findings presented here clearly point to the lack of sufficient progress in gender equality. There is still a long way to go before seeing a transformation in scientific leadership, despite the rising numbers of women advancing through the field. This is a significant problem, not only in the chemical sciences, but also within the wider physical science community.

This calls for individuals and organisations to take a lead role in:

- focusing on gender equality especially with respect to women in leadership roles
- nurturing the next generation of scientists to reach their full potential
- encouraging different leadership styles and cultures
- sharing stories that showcase people from diverse backgrounds, and
- seeking out new thought leadership opportunities, raising a voice with key influencers.

2. More research and analysis

We need to address gaps in the current evidence base and help create a clearer picture of the benefits of a more diverse and inclusive chemical science community. We need data to cover all aspects of our community and we need to share good practice between academia and industry. We need further insight into how the interplay between multiple forms of discrimination can reinforce one another to create a negative impact on people's opportunities and experience, particularly with respect to the following characteristics:

- Mental health
- Disability
- Sexual orientation
- Gender identity
- Ethnicity
- Socioeconomic background

This calls for:

- better understanding of mental health needs, in particular the needs of early career researchers, and the interventions that could be used to support them[29]
- better understanding of underrepresentation of individuals with disabilities in higher education
- better understanding of areas where we are successful, such as relative diversity among chemistry undergraduates, and
- better understanding of workplace cultures, including incidents of harassment.

3. Greater focus on measuring impact

We need to prioritise gathering evidence to allow us to track and evaluate progress and long-term outcomes. New data can be used to identify opportunities for improvement and ways to support key decision makers and managers across different sectors, to improve recruitment, progression and retention. We must also be transparent in setting and reporting on key performance indicators in the area of diversity – tracking progress and monitoring long-term outcomes.

This means:

- improving the collection and scrutiny of diversity data across all sectors
- reviewing metrics and indicators for monitoring diversity, inclusion, equality and impact
- identifying new opportunities for sharing strategies, targets and progress
- establishing new levels of transparency on policies for progression and promotion, and
- tracking and reducing pay inequality.

4. Effective collaboration

We need to work together to inspire the scientific community to accelerate the pace for greater inclusion and diversity. We need to find new ways of working more effectively so partnerships can deliver significant results and cause step changes in the community.

This means:

- deepening existing partnerships and networks
- identifying new partnerships and routes to more innovative forms of collaboration, and
- drawing on the wide range of knowledge and good practice in other sectors.

5. Cultural change

We need to promote and encourage different sectors and institutions to change the way they work – not just their processes, but the values and behaviours that support them. In the absence of a changing culture, diversity policies alone will not enhance people's lives. Inclusion is essential.

This means:

- ensuring that institutions provide training to encourage new approaches and styles in management and leadership to positively encourage not only diverse, but inclusive teams
- creating an inclusive environment for students and staff, including flexible working practices, and ensuring that systems and processes do not penalise the uptake of these policies
- raising awareness through a wide and inclusive range of workshops, events and conferences to keep diversity at the forefront of attention, and
- helping create new tools to assist the promotion of a supportive environment for change.

Our commitments

We make three major commitments for the immediate future. We will:

Launch a new flagship programme of research

We will tackle the lack of progress in developing and retaining women into leadership roles and make this one of our principal initiatives for 2018. We will design and launch a new research and evidence gathering programme on barriers and enablers to their progression and retention.

Develop a new inclusion and diversity strategy

We will set out a clear view of our ambition for inclusion and diversity, developing and setting new goals and targets. We will influence the policy and practices of others and ensure accountability through monitoring and reporting on progress.

Review how we work with our community

With over 55,000 members, we have the responsibility to ensure that the chemical sciences attract, develop and retain a diverse and inclusive community of talented people. We commit to reviewing our own policy and practices to find new ways of accelerating the pace of change. This will include:

- collaborating and partnering with other organisations to identify and develop joint solutions
- continuing to explore appropriate approaches to monitoring diversity characteristics across our membership and the wider chemical science community
- developing approaches to encourage the progression and retention of women throughout their careers
- analysing our publishing data for gender trends in commissioning, submission, editorial and refereeing decisions, and citations, and
- reviewing appointment policies and practice for our boards and all relevant committees.

Our community

We cannot do this alone.

We need our community to come together to create momentum and promote further change. We see opportunities in higher education, amongst employers and in the scientific community at large.

In **higher education**, we want to continue to raise the bar for inclusion and diversity. We want to support the sector to better understand and address the barriers to progression and the inequalities that still persist.

The sector should consider:

- building on the successful action taken in higher education institutions, ensuring that the leadership necessary to maximise impact is in place
- improving transparency by sharing staff diversity data, including recruitment and retention rates and exploring the potential for participating in benchmarking
- investing in training and support to ensure inclusive management, and
- exploring the reasons behind gender disparity in those holding permanent contracts in higher education institutions.

Employers should better understand the contributions of diversity and inclusion to their business. They need to make stronger commitments to creating supportive work environments and implement better monitoring and reporting to help drive and sustain change.

We recommend that employers consider:

- reviewing early-career salary award policies and practice to ensure they support equality and inclusion, including promotion practices
- promoting a culture conducive to flexible working and career breaks by reviewing policies and actively supporting these options, including during recruitment
- raising awareness of individuals working flexibly, in particular in senior roles, and of parental leave options, encouraging take-up by men, and
- how better to attract and support returners, building on learning from various schemes that already target this group.

The **chemical science community** must confront systemic disadvantages and enable as many different kinds of people as possible to contribute to scientific discovery and innovation. We will work with colleagues and partners to drive positive change and promote inclusion and diversity across different sectors.

5 Inclusion and diversity: the current state

What follows is a summary of, and conclusions arising from, the best available data on diversity and inclusion in the chemical sciences. The evidence raises many questions and points to the need for further research and analysis.

Our survey examines diversity and inclusion as viewed from three principal perspectives.

Students in higher education: Analysis of the data revealed concerning issues in regard to applications for admission, participation, and subsequent transition. Although applications for admission to the chemical sciences showed an encouraging trend, much remains to be done in order to achieve more inclusive participation. Disabled students in STEM subjects face challenges that do not arise in other subjects. Transition issues are very important. For example, the transition from undergraduate to postgraduate study appears to be a pivotal moment in determining decreased female participation.

Staffing and careers in higher education: It is very apparent that the restricted progression of women into leadership roles is a major issue that must be understood and addressed. Although the evidence base is limited, we recognise that this is not due to a lack of ambition on the part of women. Addressing this critically important subject should drive wider policy and cultural change in all aspects of the inclusion and diversity agenda.

Diversity in scientific research: Many of the issues identified relate to scientific research in general, rather than the chemical sciences in particular. There is evidence of gender-related trends which indicate that women tend to submit to lower impact journals.

We present information and analysis of our membership and its activities. Nearly 30% of our members are women and in 2016, 16% of our prize and award winners were female; 10% of our Fellows are women. These are significant improvements in comparison to recent years, but arising from a very low base.

The best available data about gender, ethnicity and disability are presented: they provide a partial view, and there are important dimensions of diversity that are not adequately captured currently. This deficiency must be addressed. Historically underrepresented dimensions, such as mental health wellbeing and socioeconomic inequality, call for more attention. New evidence becomes available regularly, so this report is to be regarded as a snapshot derived from what is currently available.

Likewise, the focus on higher education, scientific research and output of publications is to a large extent determined by the availability of data. We need to cast the net more widely so as to address the important questions as comprehensively as possible. For example, there is a pressing need to expand the very limited data available on diversity in industry and to acquire information regarding initiatives being undertaken within the private sector.

Finally, we recognise that to ensure that the chemical science community is diverse, we must embed inclusion and diversity at all stages of education. This will broaden the pool of potential chemists in the future and will be key to achieving our goals.

These urgent issues should be addressed by future research, by our own diversity strategy, and by the actions of others in our wider community.

6 Students in higher education

Gender

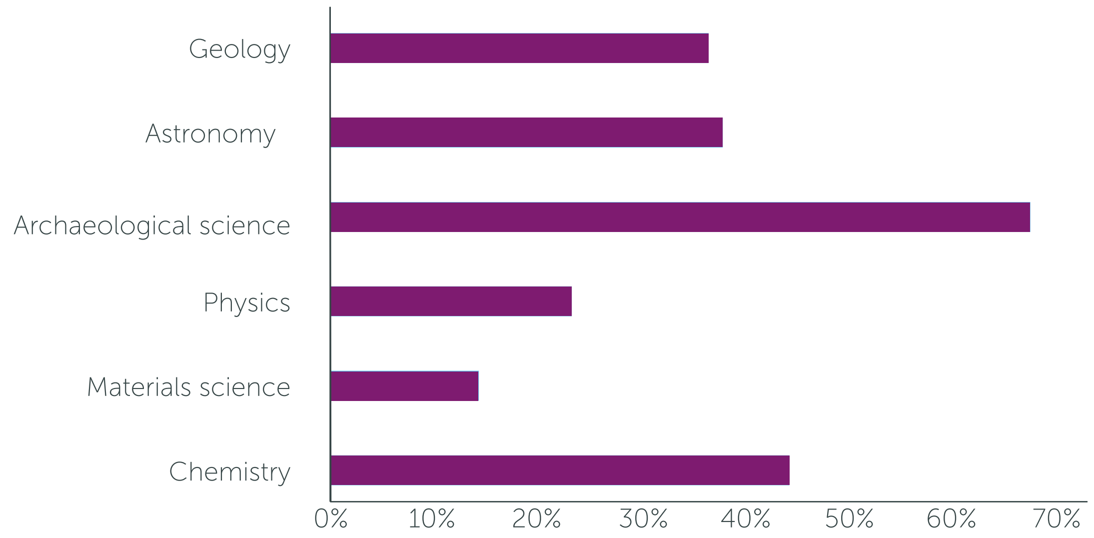
The proportion of female first degree entrants has risen by only four percentage points in 10 years.

Chemistry is ahead of the majority of other physical sciences, including physics (23%) and geology (36%), but at the current rate of progress it will never reach gender parity.*

According to the Joint Council for Qualifications, analysis of the number of pupils sitting chemistry A-level shows gender parity and **little difference in attainment.**[30] In 2016, 32.8% of male students gained an A* or A grade compared to 31.1% of female students, suggesting that as young people progress into higher education, gender parity should be an achievable goal.

An undergraduate chemistry degree intake that is 44% female is evidence of a relatively healthy gender balance and potential for the pipeline of talent. It is a positive foundation on which to build effective progression and retention policies and procedures.

Figure 1. Proportion of female undergraduates accepted in 2016, by subject. Source: UCAS[31]



Degree outcomes

The evidence suggests that there is no difference in achievement between male and female first degree students.

There is no significant difference between the percentages of male and female undergraduate students achieving a 2:1 or better classification.

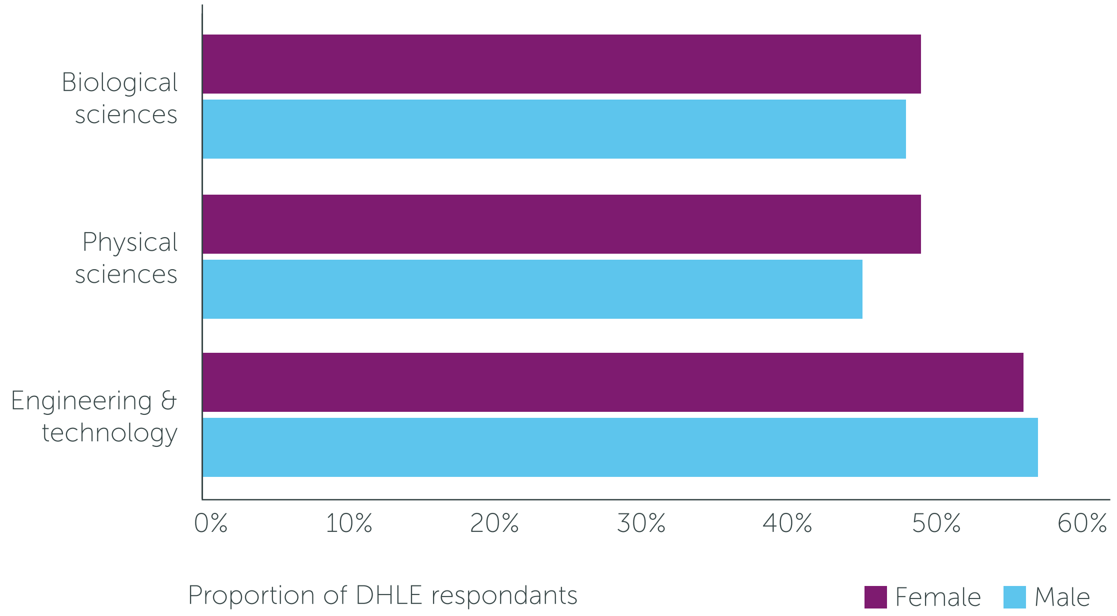
The Destinations of Leavers from Higher Education (DLHE)[32] survey collects data on the destinations of students at UK higher education institutions after graduation. Female physical science graduates are marginally more likely to be in employment six months after graduating, at 49%, compared to 45% of male physical science graduates. This trend in early employment holds for biological sciences (F: 49%, M: 48%), but engineering and technology show the opposite trend (F: 56%, M: 57%). Across all subjects, the proportions of graduates in employment six months post-graduation are 58% of women compared to 55% of men.

*based on a linear model, within a 95% confidence interval

Table 1. Degree classification for chemistry, by gender. Source: HESA[24]

Year	Gender	Degree classification				
		1st	2.1	2.2	3rd/Pass	Unclassified
2013	Female	27%	39%	28%	5%	2%
	Male	24%	40%	28%	6%	2%
2014	Female	26%	46%	22%	4%	2%
	Male	27%	42%	24%	5%	2%
2015	Female	30%	44%	19%	4%	3%
	Male	28%	41%	22%	5%	4%

Figure 2. Proportion of Destination of Leavers from Higher Education survey respondents in employment six months after graduation in 2015. Source: HESA[32]



At this stage, data suggest that women are more likely to be retained in employment.

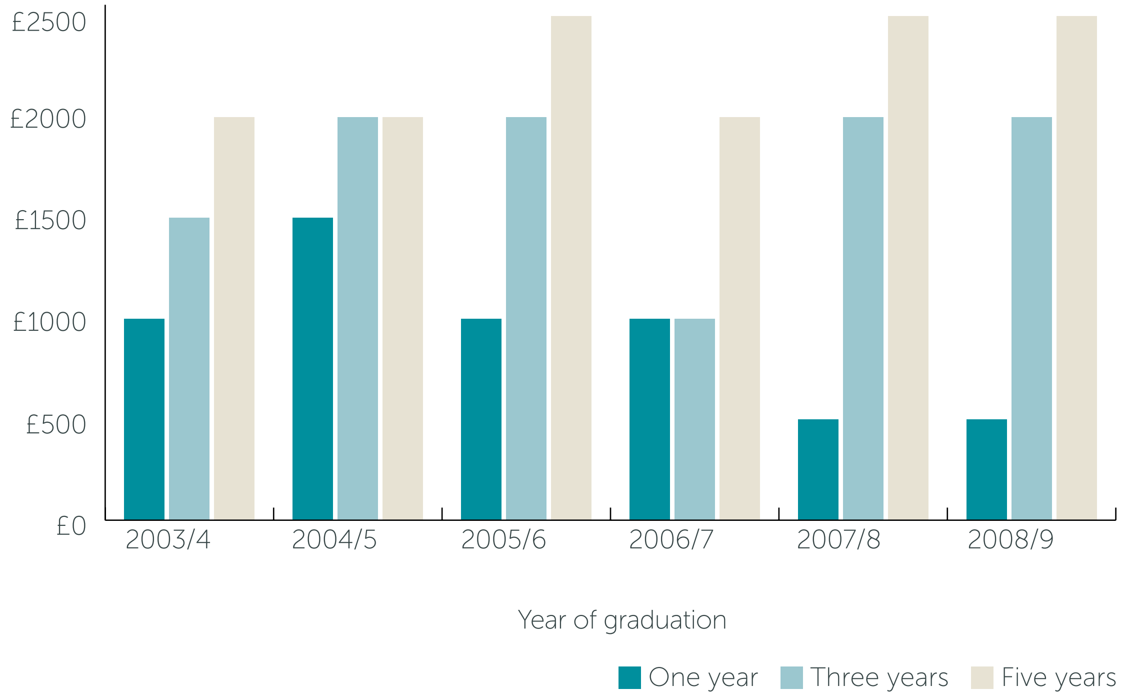
Over a ten-year period, female physical science graduates have been consistently 1-3% more likely to be in employment, or undertaking further study, one year after graduation. This trend persists three or five years after graduation.

Graduate earnings

The first year post-graduation appears to be critical. This is the point at which the gender pay gap starts to emerge.

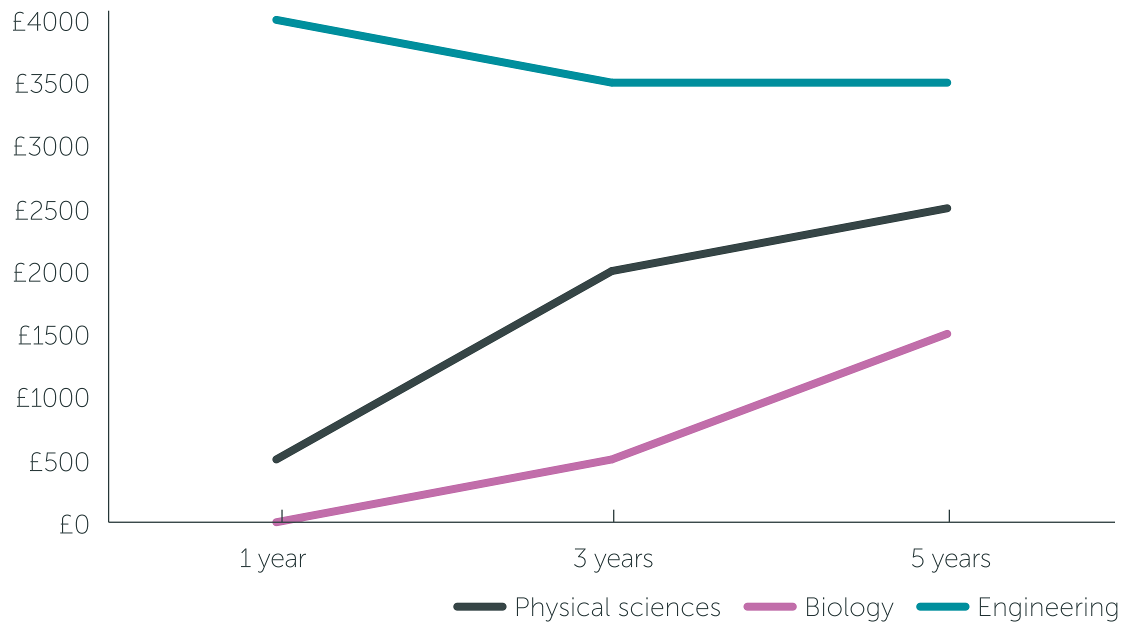
Steps to link datasets across government departments have improved the ability to track education outcomes and revealed that in the first year after graduation, a gender pay gap emerges. For the physical sciences, on average men initially earn over £500 more than their female peers. This increases to £2,500 after five years. A significant gender pay gap between male and female graduates is apparent in 73% of higher education institutions offering physical sciences.[26]

Figure 3. Gender pay gap between male and female median salary for physical science graduates one, three and five years after graduation. Source: Department for Education[26]



To set this in context in STEM, the pay gaps for biology and engineering graduates are shown in Figure 4. Proportionally fewer women graduate in engineering compared to the physical sciences, but they are subject to even greater pay disparity. Salaries for biology graduates are equal one year after graduation, but a gender pay gap emerges as their careers progress.

Figure 4. Difference between male and female median salary for students graduating in 2008/9, by subject, one, three and five years after graduation. Source: Department for Education[26]



Differences in career choices may influence the pay gap, but reviews of early career pay policies and further research to understand the data are necessary to understand the picture fully.

Postgraduate transition

The transition from undergraduate to postgraduate study also appears to be key.

The balance between women and men begins to change at the point of transition to postgraduate study. The proportion of women continuing to postgraduate study drops from 44% at undergraduate level to 39% at postgraduate level across the whole physical sciences cohort, and to 35% for UK domiciled postgraduate students. The gender balance at postgraduate level has remained virtually unchanged over the last 10 years.

The proportion of female full-time postgraduate chemistry students is the same as for the physical sciences as a whole. However, for UK nationals the proportion of women is four percentage points lower, at 35%.

Figure 5. Full-time postgraduate chemistry enrolments 2014/15, by gender. Source: HESA[24]

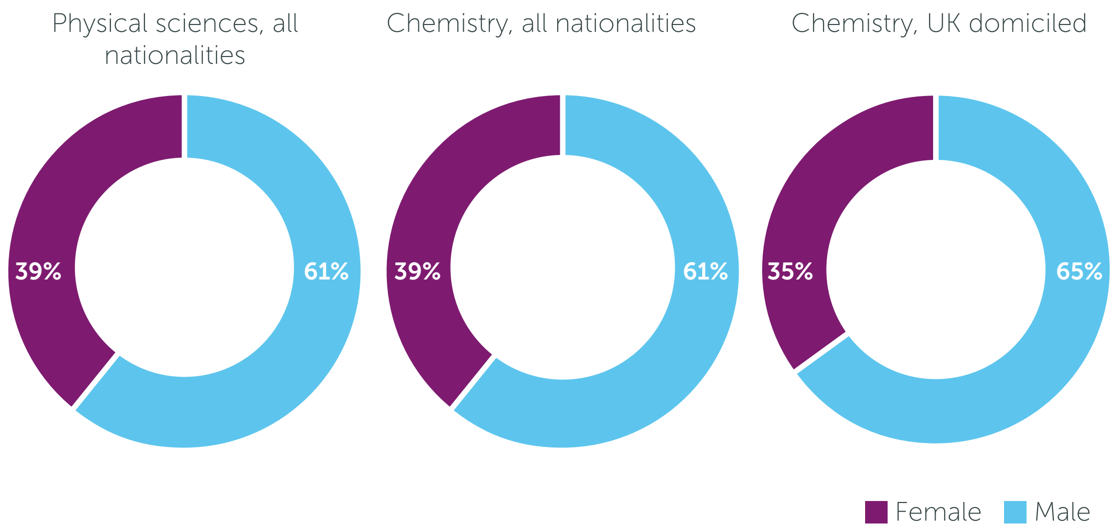
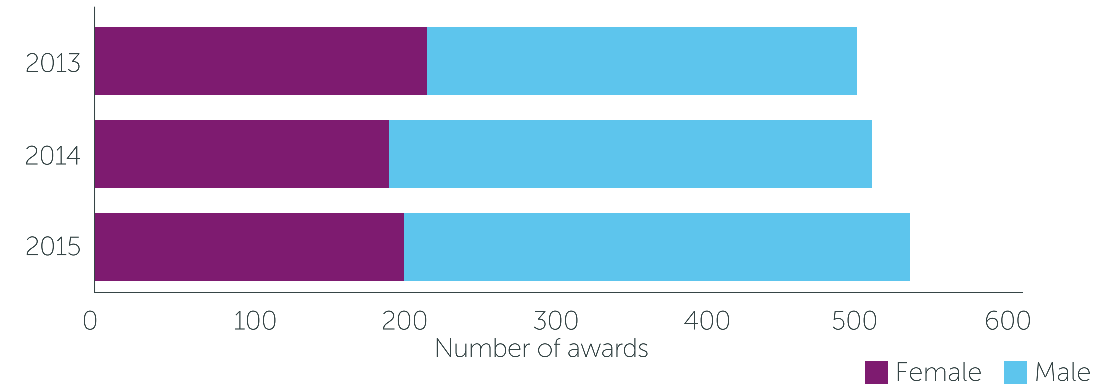


Figure 6. Chemistry postgraduate degree awards by gender. Source HESA[24]



The gender balance for students completing their postgraduate degree is virtually the same as at enrolment. This would suggest that there are no barriers specifically associated with gender that prevent students from completing their studies.

Ethnicity

There are increasing numbers of minority ethnic students entering higher education.

Numbers of minority ethnic students are increasing at entry level in higher education.[33] They accounted for 19% of UK domiciled undergraduate acceptances in 2007 across all disciplines, increasing to 25% in 2016. Acceptances of UK domiciled minority ethnic students onto chemistry undergraduate courses stood at 26% in 2016.[31]

The census data is now six years old and more recent information for ethnicity of the UK population is not yet available. However, it is possible to compare the ethnic diversity of students embarking on chemistry undergraduate degrees in 2016 with that of the corresponding cohort (young people who would have been 10–15 years old at the time of the census in 2011). This comparison shows the chemistry undergraduate intake to be more ethnically diverse than the general population, with an over-representation of Asian students.

Figure 7. Ethnicity of 2016 chemistry undergraduate entrants, compared to ethnicity of UK population aged 10–15 in 2011. Sources: UCAS[31] and 2011 census data[34]

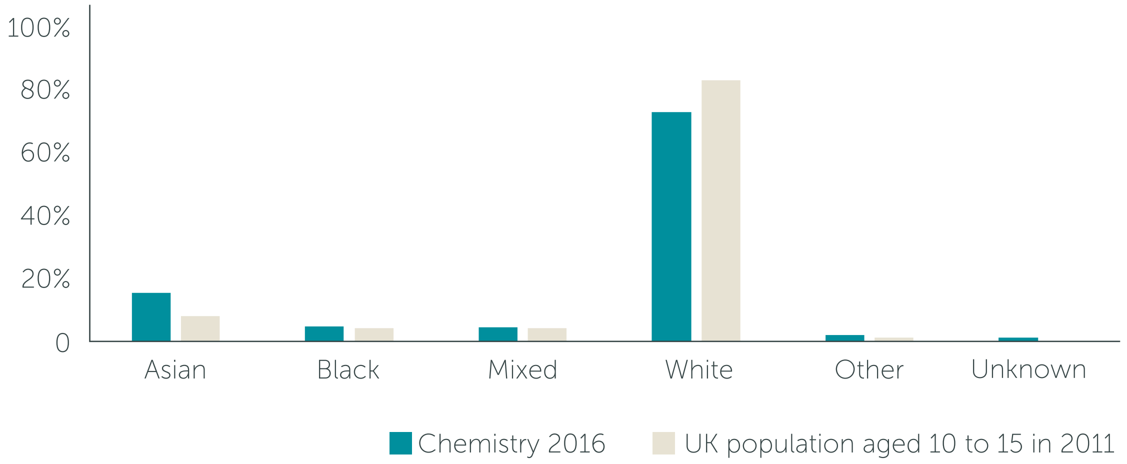


Figure 8. Ethnicity of UK domiciled chemistry undergraduate entrants. Source: UCAS[31]

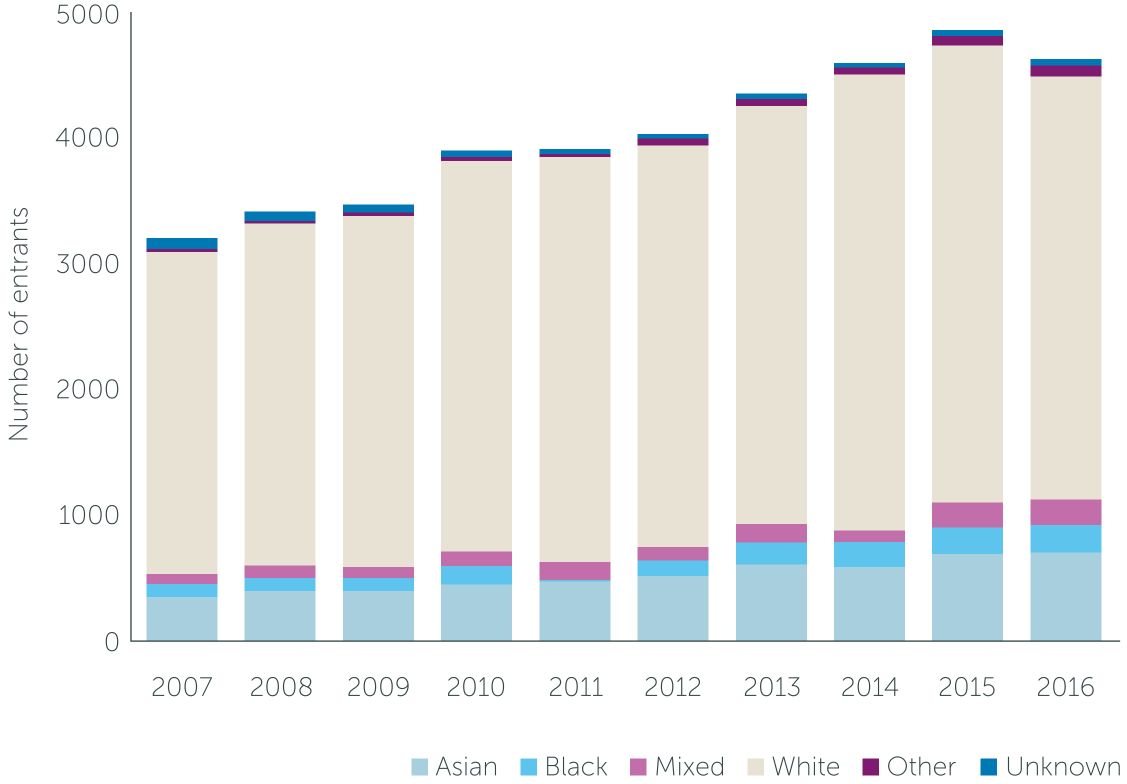
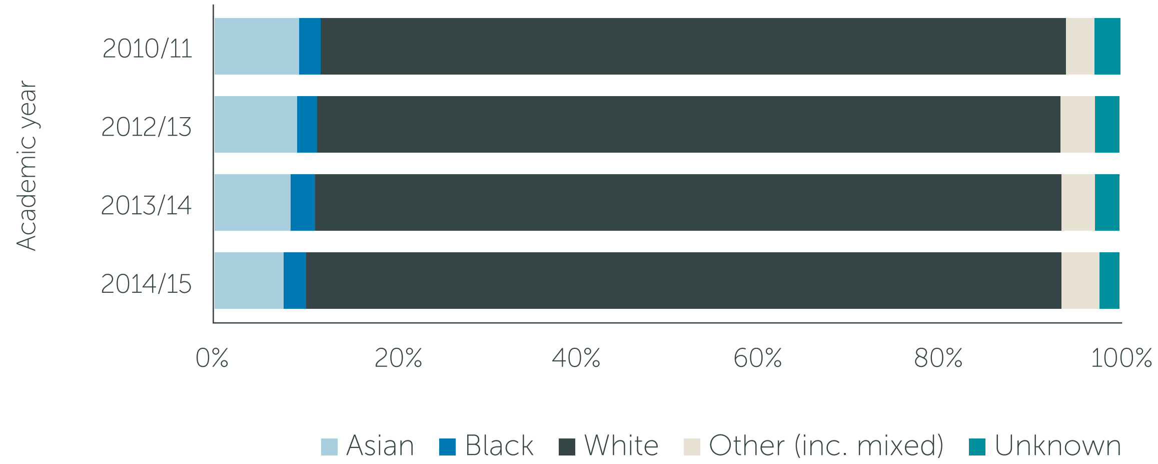
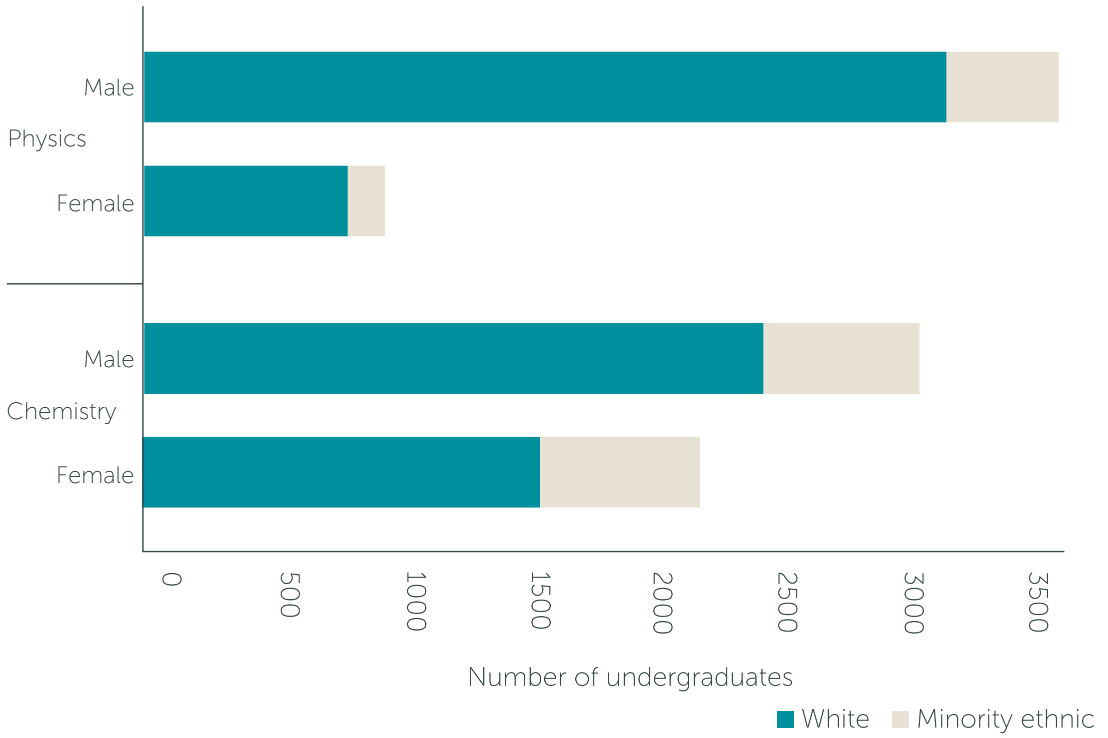


Figure 9. Ethnicity of UK domiciled postgraduate students. Source: HESA[24]



The data show that white students are slightly more likely to progress to postgraduate study than their Asian or black peers, with the proportion of minority ethnic students falling from 26% at undergraduate level to 14% at postgraduate level.

Figure 10. Number of first year undergraduates in 2014/15, by gender and ethnicity, comparison to physics. Source: HESA[24]



With 24% minority ethic students, chemistry undergraduates are more ethnically diverse than physics undergraduates (13%).

For both subjects, the proportion of minority ethnic women is higher than for men: 4% for physics and 9% for chemistry.

Ethnicity data for higher education staff are not presented due to the incomplete nature of the dataset, which makes it difficult to draw significant conclusions. However, the percentage of minority ethnic chemical scientists in academia appears to drop significantly with increasing career stage.

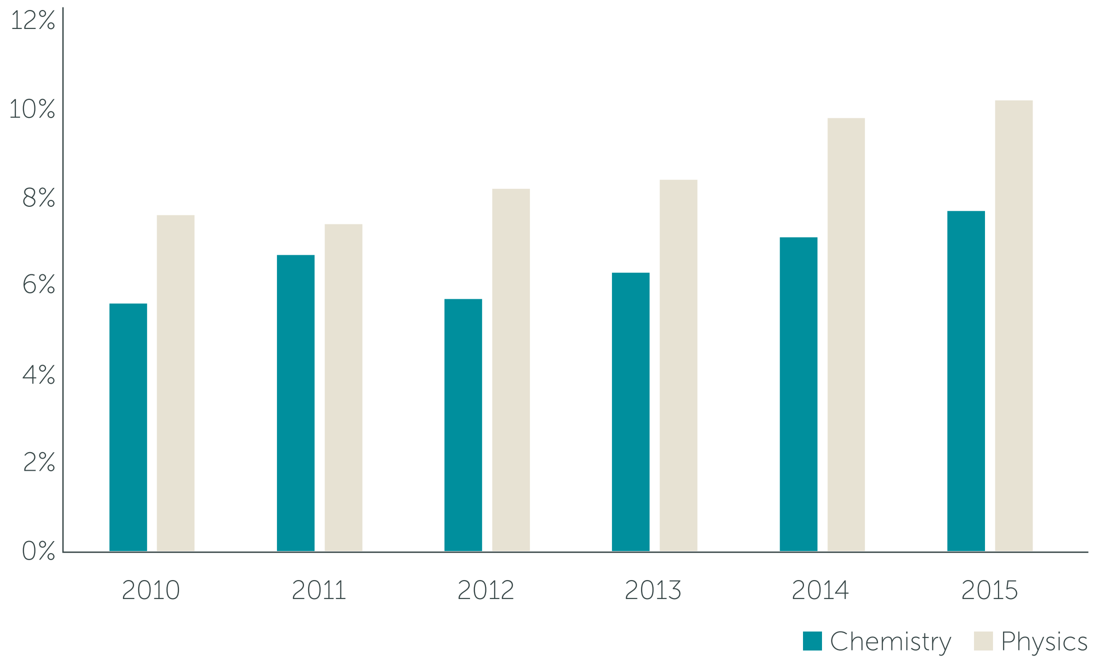
Disability

The proportion of chemistry degree entrants declaring a disability has risen from 6% to 9% between 2010 and 2016.

What is implied by the term 'disability' is important. We acknowledge there are differences in the way that people choose to identify themselves with different terms.

We need to encourage a more open culture for disclosure, to identify and address the different barriers faced by people with disabilities. Current data are very limited and do not differentiate between types of disability. More research is required to understand the barriers that confront different groups, and the stages of education at which they occur.

Figure 11. Proportion of undergraduate entrants declaring a disability, comparison to physics. Source: UCAS[31]



Students with disabilities studying STEM subjects face challenges that do not occur in other disciplines.

These include accessing laboratories and the challenge of translating scientific and mathematical notation with tools such as text readers.[35]

In 2015 the Royal Society of Chemistry investigated the challenges and opportunities in supporting students with disabilities at Key Stages 4 and 5 (14–18 year olds). The resulting report describes the difficulty of determining the size of the population for whom accessibility issues arise, but found no evidence to suggest that, in general, students with disabilities were put off pursuing chemistry at university level. However, the evidence suggests that students with disabilities have to cope with inconsistent levels of support, resource, and equipment.[36]

Cuts to the budget for the Disabled Student Allowance are squeezing the support universities can offer to students with disabilities and providing a greater impetus for the sharing of good practice. In 2017, the Institute of Physics published a report identifying and sharing good practice in university physics departments.[35]

It is clear that more work is needed to understand the specific issues and barriers faced by students with disabilities across a range of disability types.

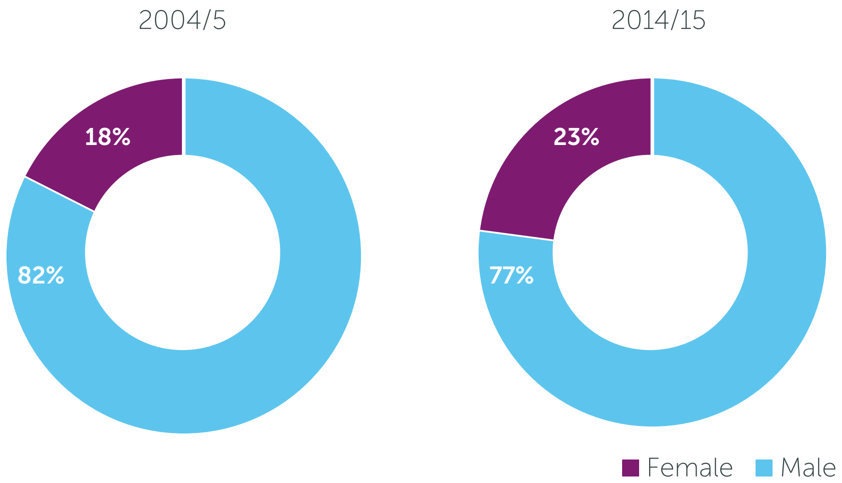
7 Higher education staff

Gender

Gender analysis of academic staff

Since 2004, the proportion of women employed as academic staff in UK chemistry departments has increased from 18% to 23%.

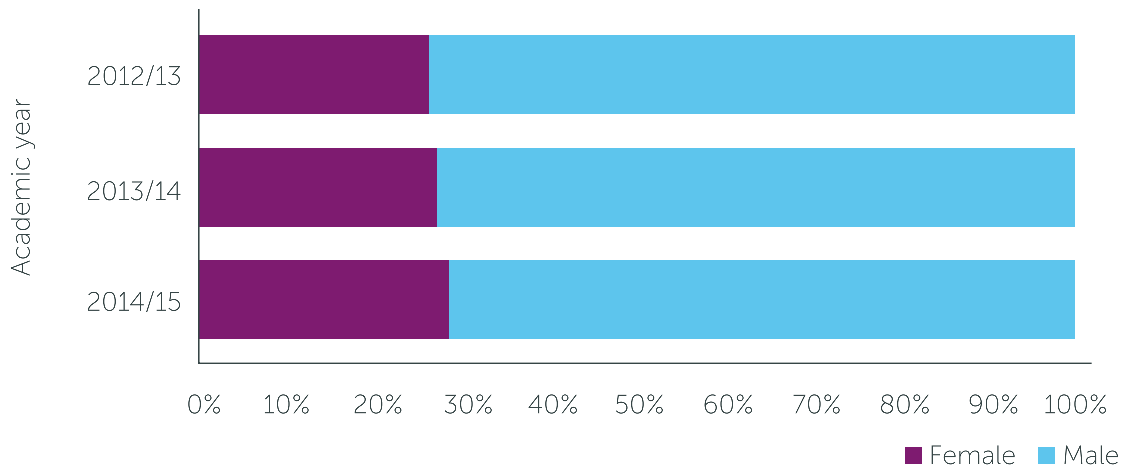
Figure 12. Academic staff in UK university chemistry departments, by gender. Source HESA[24]



Gender analysis of technical staff

Over 70% of professional and technical support staff in university departments are male.

Figure 13. UK university chemistry department senior administrative staff (professional/technical), by gender. Source HESA[24]

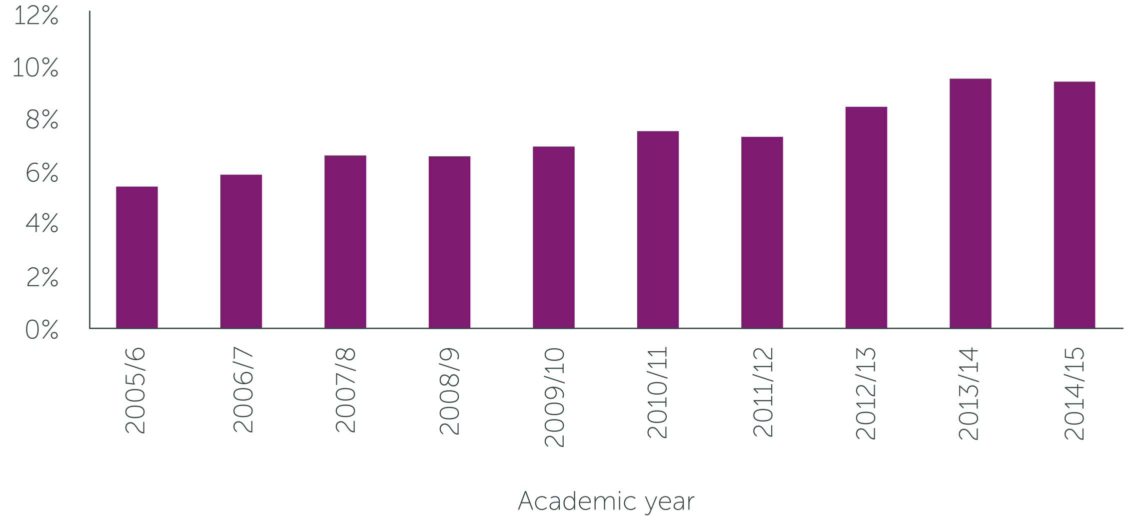


Gender analysis of chemistry professors

The limited progression of women into professorships remains a significant and serious issue for chemistry.

The progression of women to professorial positions remains poor. In 2015, only 9% of chemistry professors were women. This is very significantly below the national average, at 24% across all subject areas.[37]

Figure 14. Proportion of female professors in UK university chemistry departments. Source: HESA[24]

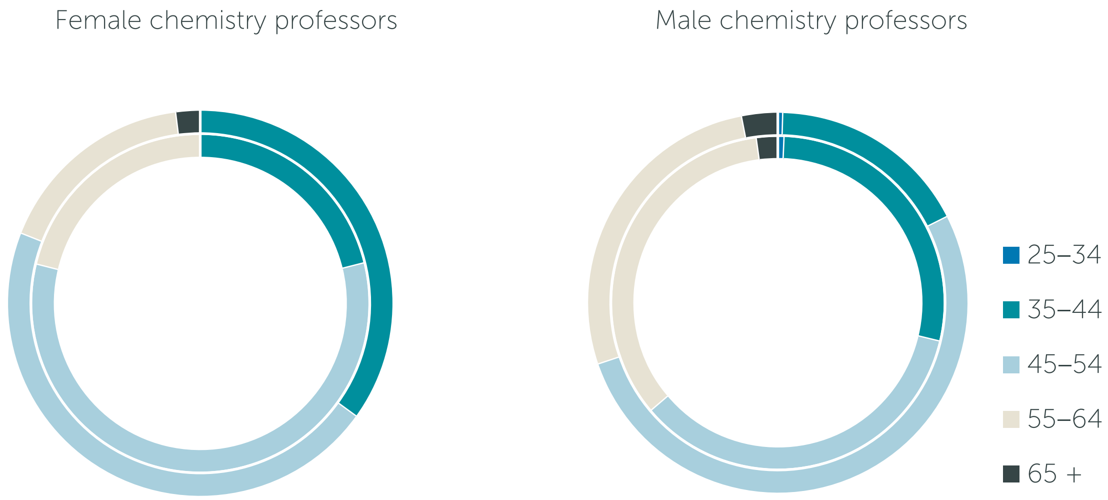


Age distribution of chemistry professors

While the numbers remain very low, HESA data suggest that in recent years a younger cohort of female academics have been appointed to professorial positions.

It is interesting to compare the age profile for male chemistry professors with that of their female counterparts. The number of professors in the 45–54 age bracket has more than doubled over the last 10 years. Although the proportion of female professors under the age of 44 has increased, a positive sign that a younger cohort is coming through, the absolute numbers are still low, with just 45 female professors, compared to 440 male professors.

Figure 15. Age distribution UK chemistry professors, 2004/5 (inner) and 2014/15 (outer). Source HESA[24]



Higher education pipeline

Retention and development of women into senior roles remains poor in the chemical sciences. The numbers drop off at each stage of the academic career ladder.

At undergraduate level the gender balance approaches parity (44% female) but at each successive stage there is attrition of women. Chemistry within higher education becomes increasingly male dominated at senior levels. At professorial level, the representation of women falls to only 9% – even lower than physics, where even though 20% of undergraduates are female, 10% of professors are female.

Not only is current retention of women within chemistry poor, but this has been the case for many years.

The 'Factors affecting the careers choices of graduate chemists' report published in 1999 highlighted these issues.[4]

It is important to note that this analysis does not account for further interaction between different forms of discrimination and disadvantage. Additional inequalities will be present in the pipeline. For example, students from disadvantaged backgrounds are underrepresented at highly selective universities.[38] More research and data are needed to better understand the intersectionality of these different factors.

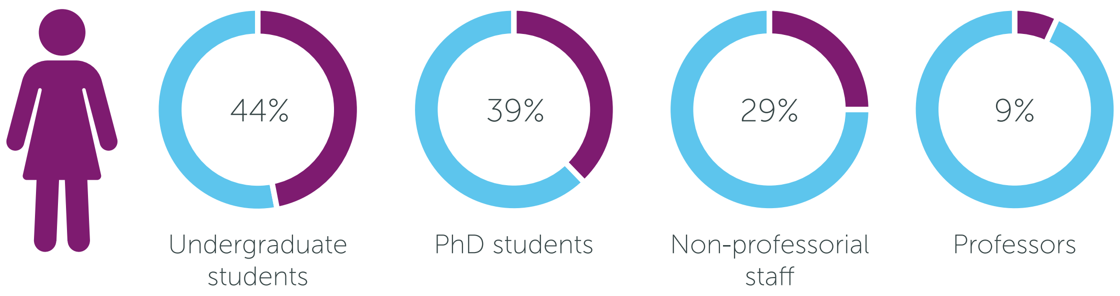
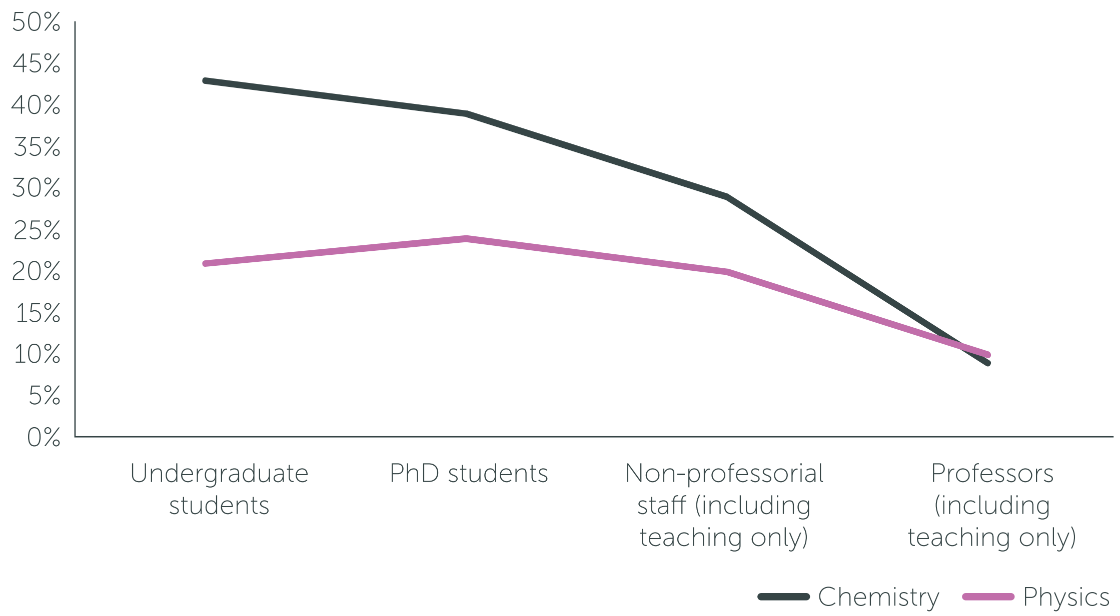


Figure 16. 'Leaky pipeline' – proportion of women in UK chemistry and physics departments in higher education, 2014/15. Source: HESA[24]



There are a number of factors that may affect women's access to opportunities. The evidence base is currently very limited.

There is no lack of ambition on the part of women. The 2016 Equality Challenge Unit (ECU) ASSETT report[39] found that women are actually more ambitious than men and highlighted some of the inequalities inhibiting women's progression. For example, a higher proportion of men than women reported being either encouraged or invited to apply for promotion. The ECU found that significantly more men than women had been promoted to their current position through a formal internal promotion round, and this finding was consistent with the 2010 report.

Other useful insights from the ECU report include:

- Women are likely to report greater teaching and administrative responsibilities than men: this impacts on their capacity to devote time to research, despite its importance for progression.
- Men are more likely than women to have the opportunity to serve on departmental committees, to feel their department valued their research, to have access to senior departmental staff, and to have a supportive line manager.
- The departmental culture favours men, particularly white, heterosexual men, through informal social networks that provide access to advantageous information and informal sponsorship.

The benefits of diversity will only be realised when there is an inclusive culture that embraces different approaches, thus building teams whose effectiveness is greater than the sum of their parts. This means developing a new generation of leaders and recognising a plurality of leadership styles. It requires performance and promotion criteria that focus on output, not input. The long-hours culture is unattractive for many and penalises those with other commitments, disproportionately women.

The paucity of women appointed to professorships is an issue common across higher education. In May 2017, the Times Higher Education found that a third of institutions have decreasing proportions of women in professorial positions since 2012, and that this finding is statistically significant.[37] It suggests that many of the challenges are not science specific. How work is organised in our wider society, even at the most basic level, is an important factor. Wholesale changes to the structure and culture of the workplace are necessary.[40]

It is important to consider intersectionality and monitoring of diversity characteristics in the widest sense. There are a number of axes of discrimination and potential bias to examine in more detail in order to understand the interplay between different forms of discrimination. For example, the ASSET survey found that minority ethnic women experienced compounded disadvantages. The advantages reported by male respondents did not apply to those self-identifying as gay or bisexual.[39]

"Much of the bias is structural and a result of a system that benefits a certain group of people. This doesn't just affect those from a BME background, but women, those with disabilities, or anyone who has experienced discrimination based upon preconceived notions of what makes a good employee."

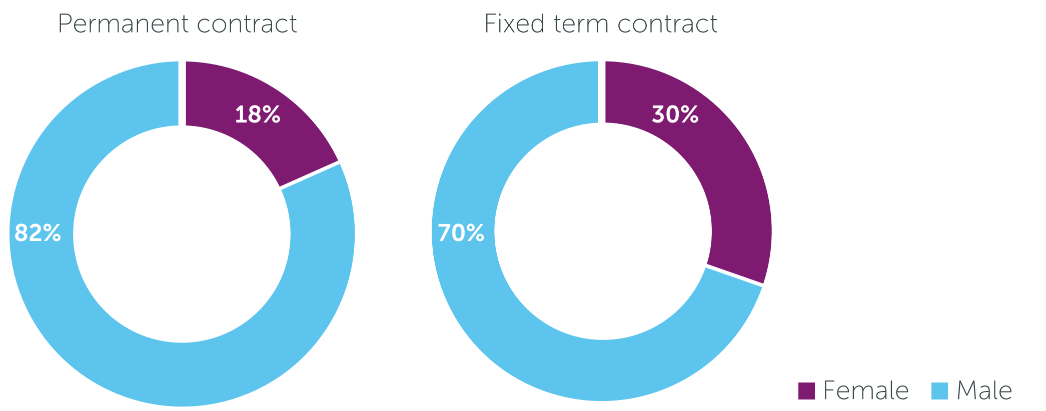
Baroness McGregor-Smith – Race in the workplace[41]

Terms of employment

Short-term contracts for early-career researchers are regularly cited as a barrier to equality.

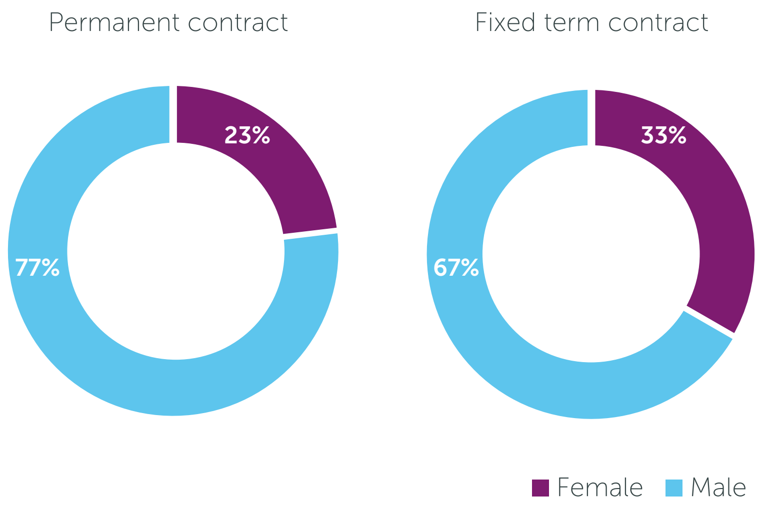
Since 2004, there has been little change in the number of fixed-term contracts. However, as a proportion of absolute staff numbers, there has been a small decrease. During this period, the proportion of women on fixed-term contracts has crept up. The most recent figures show that only 18.4% of permanent contract holders are women. The reasons for this gender disparity should be explored.

Figure 17. Contract terms for academic staff in UK chemistry departments, 2014/15 by gender. Source: HESA[24]



Within technical staff, men are more likely to be employed on permanent contracts.

Figure 18. UK university chemistry department senior administrative staff (professional/technical), 2014/15, by contract type and gender. Source HESA[24]



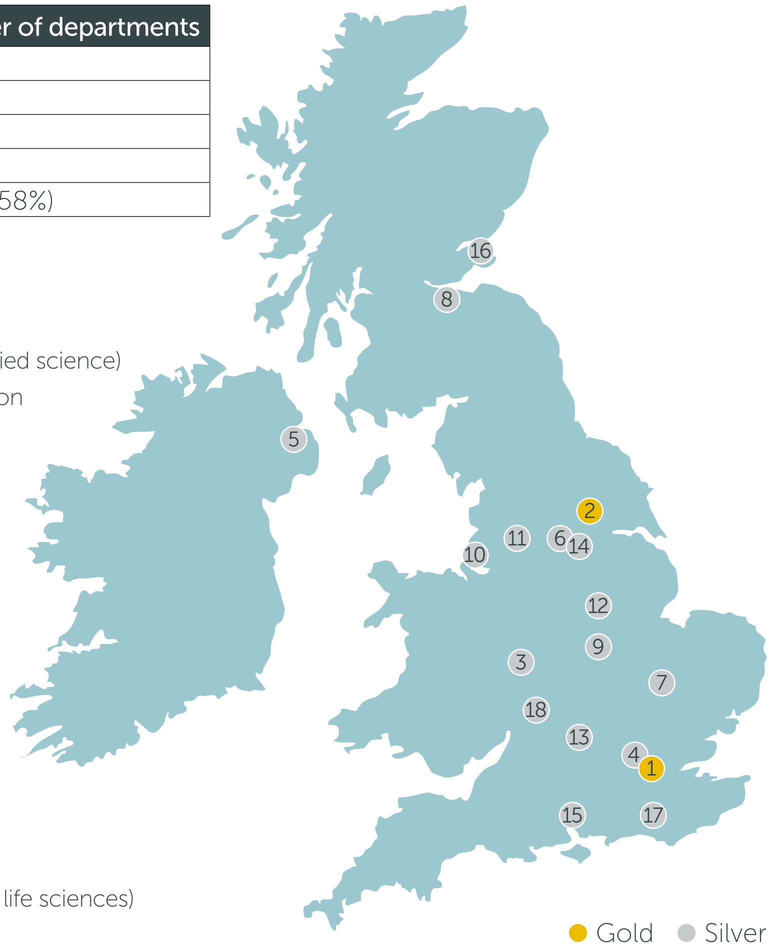
Athena SWAN Charter

The Royal Society of Chemistry has long taken a leading role in supporting university chemistry departments to work towards gender equality. The 2004 'Good Practice' report[6] set out a checklist and provided a benchmark for progress, which contributed towards the establishment of the Athena SWAN Charter the following year. The charter encourages and recognises employment practices that support gender equality in higher education and research. It has recently been expanded to include subjects beyond STEMM and to embrace professional and support staff.

Table 2: Chemical science departments holding Athena SWAN Charter awards:[42]

Award level	Number of departments
Gold	2
Silver	16
Bronze	24
None	30
Total holding awards	42/72 (58%)

1 Imperial College London
2 University of York
3 Aston University (School of engineering and applied science)
4 Queen Mary University of London
5 Queen's University of Belfast
6 Sheffield Hallam University (Department of biosciences)
7 University of Cambridge
8 University of Edinburgh
9 University of Leicester
10 University of Liverpool
11 University of Manchester
12 University of Nottingham
13 University of Oxford
14 University of Sheffield
15 University of Southampton
16 University of St Andrews
17 University of Sussex (School of life sciences)
18 University of Warwick



There are 30 chemical science departments that do not hold Athena SWAN awards. The scheme requires institutional level commitment, which may be a barrier for some departments. Funding bodies are taking action to create an environment that encourages positive change. As an example, the Department of Health introduced an expectation that universities applying for funding achieve an Athena SWAN award. In 2016, Research Councils UK published an action plan setting out the steps it will be taking to accelerate the pace of change both internally and within the research community.

Although diversity initiatives play an important role in maintaining focus, some have questioned when such action will become embedded:

> "If you are serious about change, you as CEOs and senior leaders need to take the lead on women's progression, moving this from a diversity initiative to a core business priority. Set aspirational targets for the numbers of women you want to see at each level in your organisation."
>
> **Opportunity Now** (2014) Project 28-40

In 2017 the Engineering and Physical Sciences Research Council (EPSRC) launched the 'Inclusion Matters' call, a competitive call to fund projects aimed at improving equality, diversity and inclusion within the engineering and physical sciences. The call was the first of its kind among the Research Councils and was piloted by the EPSRC as part of the Research Councils' collective approach to equality, diversity and inclusion during the transition to UK Research and Innovation (UKRI). £5 million was offered to support projects that aid with culture change and piloting new approaches, as well as disseminating and embedding best practice across the sector.[23]

8 Research

Research Excellence Framework

The Research Excellence Framework (REF) assesses the quality of research in UK higher education institutions and is important as a determinant of future funding. The REF results have a significant impact on the reputation of a university. As such, they have the ability to influence practice within university departments.

Adjustments to support equality were introduced in the 2014 REF assessment process. The revised rules permitted a reduced number of submissions where there were 'individual circumstances', such as parental leave. A report from the Higher Education Funding Council for England (HEFCE)[43] reviewed the impact of these changes and noted that the proportion of female academics submitted increased to 51%, up from 48% in the 2008 assessment. In comparison, 67% of eligible male researchers were submitted to the REF.

The report states that no subject area differed significantly from the overarching selection rates for gender and this indicates that the gender imbalance is linked to broad-based barriers. The selection rate for women in chemistry was 82% in comparison to 85% for men. Only two subject areas, or Units of Assessment, had selection rates that favoured women. One of these was physics where the rates were 87% for women and 85% for men. Five Units of Assessment had equal selection rates for men and women, including chemical engineering, which is grouped with aeronautical, mechanical and manufacturing engineering.

Other equality issues are evident, with lower selection rates for individuals with disabilities and for black, Asian UK and non-EU nationals. HEFCE's analysis showed that staff contracted to work less than full-time hours were significantly less likely to be selected.

In addition to analysing selection rates, HEFCE commissioned a report to review the research environment submissions for the REF 2014 and seek evidence of equality and diversity activity at the subject level (Unit of Assessment). Institutions were asked to report on how they were addressing equality and diversity within their research environment. The resulting "environment statements" were analysed for evidence of relevant initiatives. The report[44] found institutions to be predominantly focused on gender with age and disability the next most commonly mentioned of the protected diversity characteristics. In contrast, other protected characteristics featured more commonly in reports that broadly cover the social sciences, arts and humanities.

The analysis revealed a positive correlation between reporting of participation in the Athena SWAN initiative and attention to equality and diversity within the environment statement. Research intensive institutions reported more specific diversity and equality related awards than non-research intensive ones.

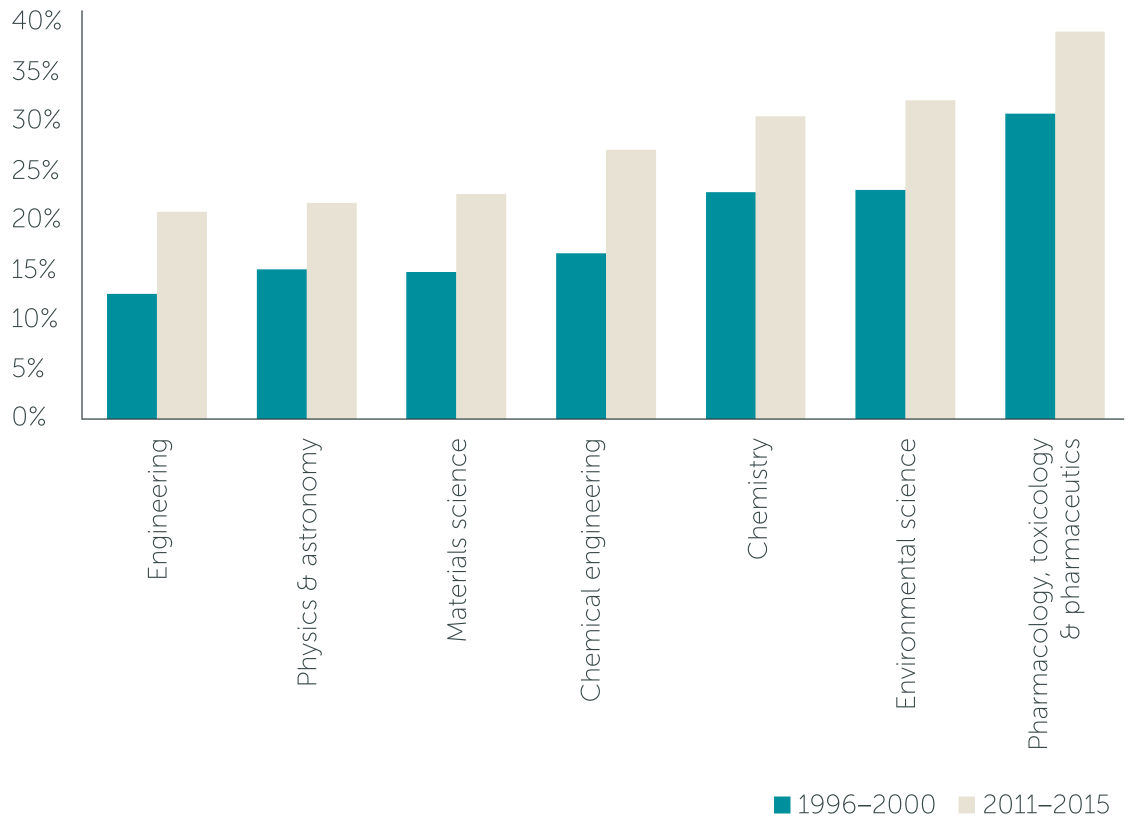
Gender in the global research landscape

Following the pilot project that investigated gender in German research output,[45] the publisher Elsevier recently undertook a gender analysis of research performance, drawing on 20 years of data across 27 subject areas, spanning 12 countries and regions. The report 'Gender in the Global Research Landscape'[28] draws on Elsevier's SciVal and Scopus data combined with name data from social media and Wikipedia. Two time periods are compared: 1996–2000 and 2011–2015.

There is incremental progress towards gender balance in research.

Chemistry in the UK fares well in comparison to the other physical sciences and engineering: 31% of research authors are female, while in engineering the corresponding figure is 21%.

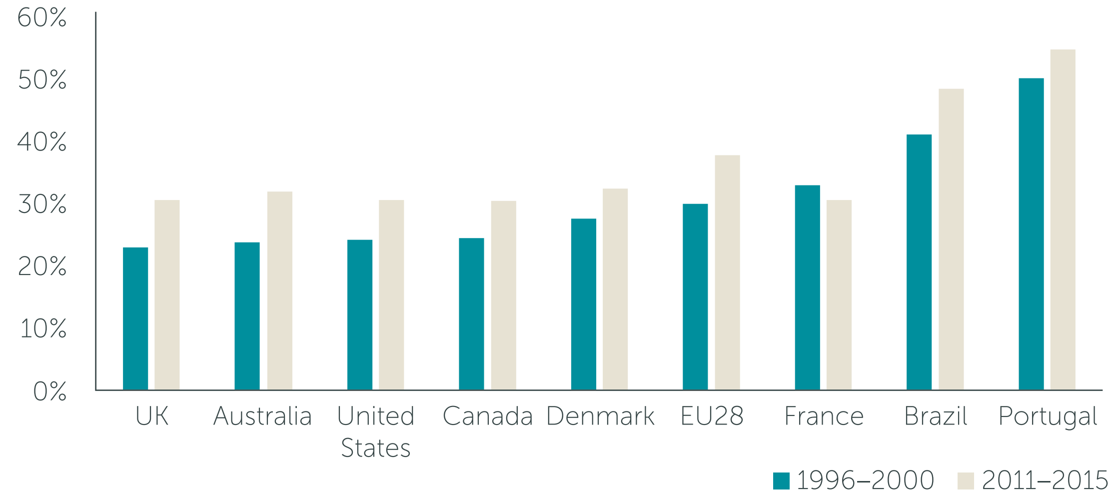
Figure 19. Proportion of female research authors in the UK, by discipline. Source: Elsevier[28]



The data show that the UK trails behind the EU28 for the proportion of female chemistry research authors.

This is also the case for countries including the United States, France and Canada. Germany is below the EU28 average with 28.4% female chemistry research authors in 2010 and 30.2% in 2014. The EU28 average may be skewed by the unusually positive gender balance of Portugal. It is worth noting that Brazil and Portugal, which both have significantly above average proportion of female research authors in the period 2011–2015, have experienced an above average growth in the total number of researchers.

Figure 20. Proportion of female chemistry research authors, country comparison. Source: Elsevier[28]



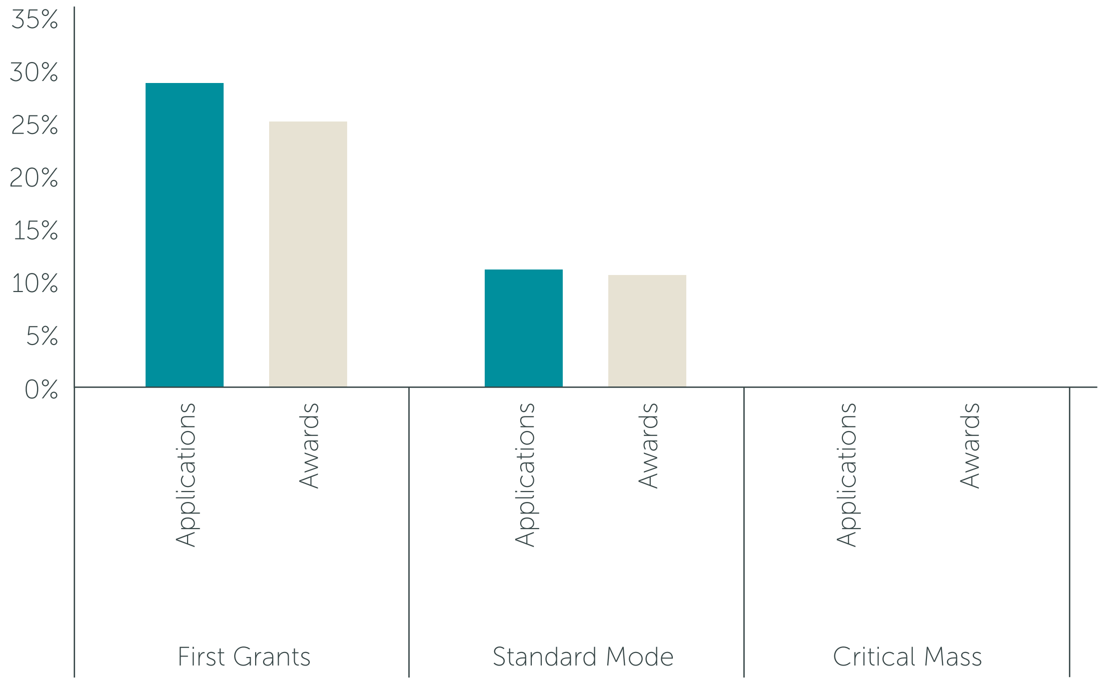
The Elsevier report[28] also concluded that:

- women's scholarly output includes a slightly larger proportion of highly interdisciplinary research than men's
- women are slightly less likely than men to collaborate across academic and corporate sectors on papers
- among researchers, women are generally less internationally mobile than men, and
- women publish fewer research papers on average, however, there was no evidence that this affects how papers are cited or downloaded.

Research funding

The EPSRC is the main distributor of public funding for research in the chemical sciences. The chart below shows the proportion of women applying for EPSRC grants, and the success rate.

Figure 21.Proportion of EPSRC grant applications in the physical sciences from, and awards to, female applicants, 2015/16. Source: RCUK[46]



The First Grants stream supports early-career researchers and receives the highest proportion of applications from women. The percentage of women applying falls for the two grant schemes that target more established researchers. The Critical Mass grants for the physical sciences, aimed at leading researchers, has received fewer than three applications from women in the last five rounds. Moreover, up to November 2017, no female principal investigator or co-investigator was awarded a critical mass grant.

The EPSRC ethnic diversity monitoring includes a separate category for Chinese applicants. The combined proportion of Asian and Chinese applicants to the 2015/16 physical science First Grants stream was 15.4%. This matches the 2016 proportion of Asian (including Chinese) undergraduates (15%)[31] and appears to indicate that there are no significant barriers to progression.

Returners

Supporting individuals to return to the chemical sciences following a career break is an important element in the retention of talent.

The Daphne Jackson Trust provides fellowships for scientists and engineers returning to research after a career break of two years or more. The Royal Society of Chemistry is one of the scheme's sponsors. In 2016, 10 of the 78 Fellows were working in chemistry.

A survey of former Daphne Jackson Fellows[47] provides evidence of the initiative's positive impact:

- Nine out of 10 former fellows remain in STEM-related careers after the fellowship.
- Seven out of 10 remain in research in the first year post-fellowship.
- 57% continued in research-based roles up to five years post-fellowship.
- 37% of survey respondents had completed their fellowship more than 10 years previously. Of these, 88% continued in STEM research or related work.

The All Party Parliamentary Group (APPG) Women and Work published a report on women returners in January 2017.[48] It covers a broad range of related issues facing women who take time out for caring responsibilities, or to pursue other interests. The Group's co-chair, Jess Phillips MP, stated:

> "It is unsurprising that some of the best examples of schemes to support and encourage women back into work came from the private sector where the business case of recruiting and keeping the best talent is understood."

Shared Parental Leave was introduced in April 2015. So far, take-up by men has been low[49] meaning that women are still far more likely to be the ones taking a career break. Many mothers wish to return to work or to increase their hours, but lack of affordable childcare, and/or lack of flexibility of work are often cited as barriers.[50]

Mothers are not the only group seeking flexible working. An aging population means that increasingly individuals have caring responsibilities for elderly relatives as well as children. One in four women between the ages of 50 and 64 have caring responsibilities, compared to one in six men.[51] Some employees wish to work flexibly in order to achieve a better balance with their life outside of work.

Supporting flexible working is an important step in attracting and retaining the best talent possible and helps to reduce stress. The Chartered Institute for Professional Development (CIPD) cites line managers' attitudes and organisational culture among the potential barriers to flexible working.[52] Since flexible working can benefit all employees, they recommend positioning it as gender neutral and making information about company policy available during the recruitment process.

Academic research is highly competitive and often seen as having a culture focused on extensive hours of work, and viewed as incompatible with alternative flexible working patterns. To counteract this perception, the Royal Society published a study with 150 profiles of parents and carers who have successfully combined family life with a career in academic science. The Parent Carer Scientist case studies highlight the importance of supportive employers and family friendly policies.[53]

Daphne Jackson Trust Fellowships – supporting returners

> "Above the obvious benefits of enabling a return to academic research are the opportunities to network with Daphne Jackson advisors and trustees. This support makes all the difference in settling back into research. Exposure to such inspiring stories and passion for research from other current and ex fellows really encourages you to make the most of your own fellowship. Undertaking a Daphne Jackson 'returnship' is a fantastic opportunity and one I would recommend wholeheartedly."
>
> **Brendan Garrett**, Daphne Jackson Research Fellow, 2017

> "What was really important to me was support to understand the legal concepts of reasonable adjustment... I had to have quite regular hospital appointments ..., which were every week at one stage. I'd have to take an afternoon off work. I'd read papers, but I still felt guilty that I didn't have that presence in the lab. Now I understand more that I was actually working, and it's not that someone is doing you a favour, it's what needs to happen to allow you to perform to your best."
>
> **Julia Hubbard**, Daphne Jackson Research Fellow, 2017

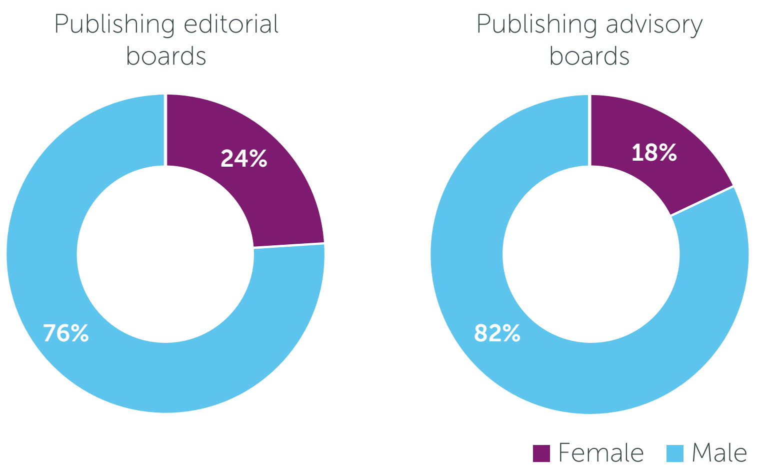
> "Although I had hoped to return, I honestly had no idea how I would go about this, and was starting to resign myself to the fact that I would have to try to find any job to fit around family life, and that a career in research was a long-lost hope.
>
> The differences between the start of my fellowship and now one year later are HUGE. At the start, I was excited but nervous, as the Fellowships are for "retraining" in a new area. One year on, I can apply complex statistical methods and program code to analyse data. I have attended several conferences and training courses, published research and conducted scientific outreach activities."
>
> **Elizabeth Dickinson**, Daphne Jackson Research Fellow, 2017

Royal Society of Chemistry publishing activities

The Royal Society of Chemistry publishing portfolio includes 44 peer-reviewed journals. Analysis of our publishing activity shows that female representation on our editorial and advisory boards has increased from the 2014 levels, by 5% and 4%, respectively. Our editorial boards have a higher representation of women than our advisory boards.

A target of 30% representation is often cited for boards and committees; 30% female membership is considered to be the point when critical mass is reached such that in a group setting, the minority individuals can be heard in their own right rather than as representatives of their minority.[54]

Figure 22. Gender balance for Royal Society of Chemistry editorial and advisory boards, January 2017.



Male authors of research papers receive more citations than female authors.

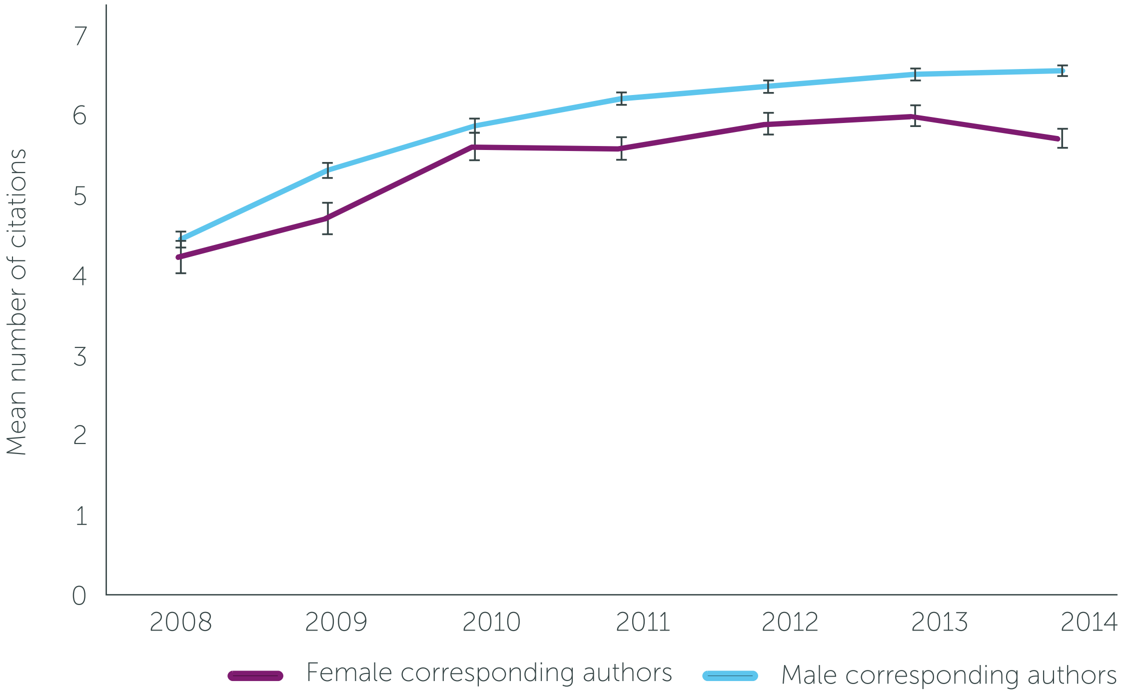
A preliminary analysis of papers published in the Royal Society of Chemistry's journals distinguished gender from author name.

Gender was assigned to names by following the approach suggested in the Gender Profiles in UK Patenting report authored by the UK Intellectual Property Office.[25] Matias data sets[55] were used to identify names based on data from the US Social Security Administration and the UK Office for National Statistics. Gender was assigned where a 95% confidence score was achieved, where the confidence level was below 95%, the two data sets were combined and binomial based scoring reapplied. If the confidence exceeded 95%, the name was categorised as the relevant specific gender; otherwise the gender was assigned as undefined.

Results are based upon analysis of 68,559 papers (corresponding to approximately 330,000 citations) across all Royal Society of Chemistry journals, where the corresponding author is identified, the paper is classified as a "research paper" and the gender of the corresponding author can be assigned.

An analysis of the mean number of citations a paper received in the first two years after publication versus corresponding author gender shows that male corresponding authors receive more citations than female authors. The discrepancy in the number of citations between men and women also appears to be widening over time. Papers with a large number of citations (>25) were not included in the analysis, showing that this effect is not driven by a small number of high performing papers.

Figure 23. Mean number of citations for male and female corresponding authors in the first two years after publication (error bars show 95% confidence).
Source: Royal Society of Chemistry Publishing



Male authors are more likely to submit to higher impact journals.

Analysis of author gender and journal showed a medium correlation between the impact factor of journals and the gender of authors submitting papers. Journals with a lower impact factor have a higher proportion of submissions from female authors.

Figure 24. Proportion of submitted papers with a female corresponding author, and journal impact factor (2015) for submissions to Royal Society of Chemistry journals in 2016. Source: Royal Society of Chemistry Publishing (shaded area indicates the 95% confidence).

Gender profiles in UK patenting

Measuring the outputs from science and engineering can be challenging, but patent registrations provide one avenue for doing so. There is no requirement to disclose diversity data relating to the inventor. However, the Intellectual Property Office has been able to apply gender inference techniques to name data. In March 2016, it released a report summarising its findings.[25]

That analysis found that the proportion of female inventors across all GB patent applications is low but has risen from 4% in the early 1980s, to over 8%. However, chemistry-related fields have an above average representation of women, and when ranked by proportion of female inventors all 11 chemistry fields feature in the top 21 patent fields.

Table 3: Female inventors on GB patent applications (2000–2015) by WIPO technology concordance [extract*] Source: UK Intellectual Property Office[25]

	Technology area	Male inventors	Female inventors
1	Chemistry: Biotechnology	74.5%	25.5%
2	Chemistry: Pharmaceuticals	75.6%	24.4%
3	Chemistry: Organic fine chemistry	76.6%	23.4%
4	Chemistry: Food chemistry	80.8	19.2%
5	Other fields: Other consumer goods	82.3%	17.7%
6	Instruments: Analysis of biological materials	82.7%	17.3%
7	Chemistry: Macromolecular chemistry, polymers	84.7%	15.3%
8	Chemistry: Basic materials chemistry	85.9%	14.1%
9	Instruments: Medical technology	87.9%	12.1%
10	Other fields: Furniture, games	89.9%	10.1%
11	Chemistry: Materials, metallurgy	90.4%	9.6%
12	Chemistry: Micro-structural and nano-technology	90.9%	9.1%
13	Mechanical engineering: Textile and paper machines	90.9%	9.1%
14	Electrical engineering: IT methods for management	91.0%	9.0%
15	Electrical engineering: Semiconductors	91.1%	8.9%
16	Mechanical engineering: Other special machines	92.1%	7.9%
17	Chemistry: Surface technology, coating	92.1%	7.9%
18	Electrical engineering: Digital communication	92.6%	7.4%
19	Mechanical engineering: Handling	92.6%	7.4%
20	Chemistry: Environmental technology	92.7%	7.3%
21	Chemistry: Chemical engineering	92.8%	7.2%

**Top 21 items only, no further occurrences of chemistry within table.*

9 The Royal Society of Chemistry membership, prizes and awards, events

As the UK's professional body for chemical scientists, the Royal Society of Chemistry has a key role to play in supporting and connecting individuals within the chemical science community throughout their careers, from the earliest stages of study through to retirement.

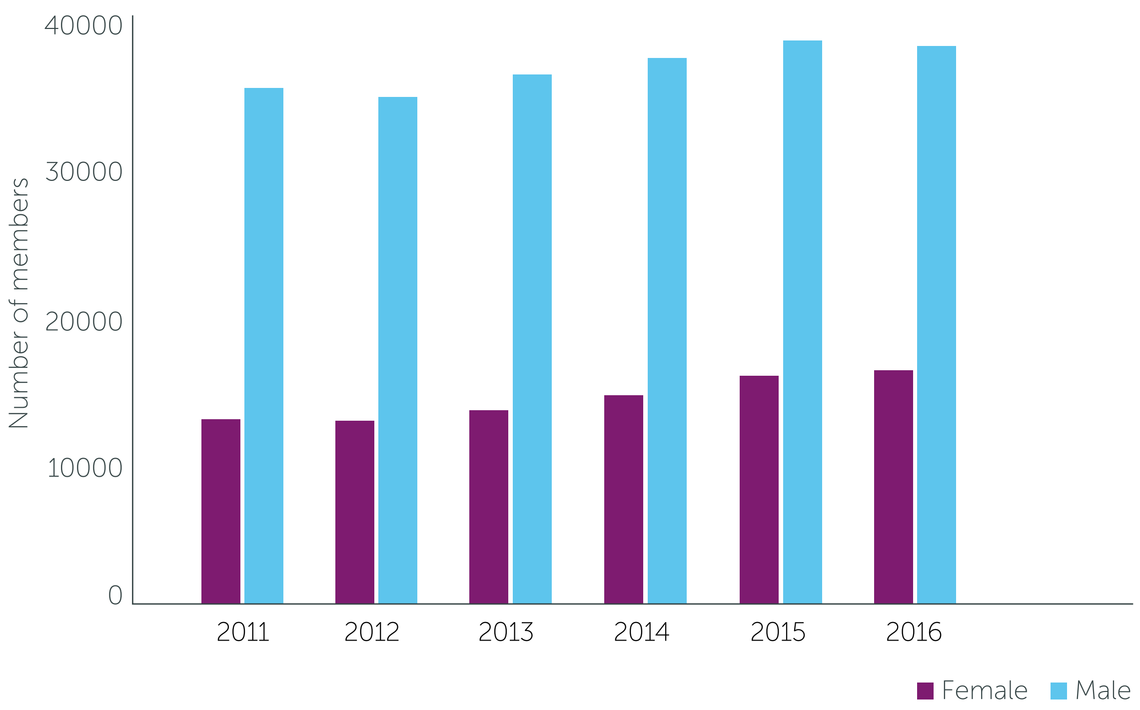
We currently hold age and gender information against member records. However, more appropriate monitoring and data gathering are needed to help deepen our understanding of the diversity of members.

Membership

Membership by gender

The proportion of women in membership has increased steadily over the last 10 years, from 22.8% in 2006 to 29.5% in 2016. However, the disparity between the genders remains stark.

Figure 25. Royal Society of Chemistry membership, split by gender



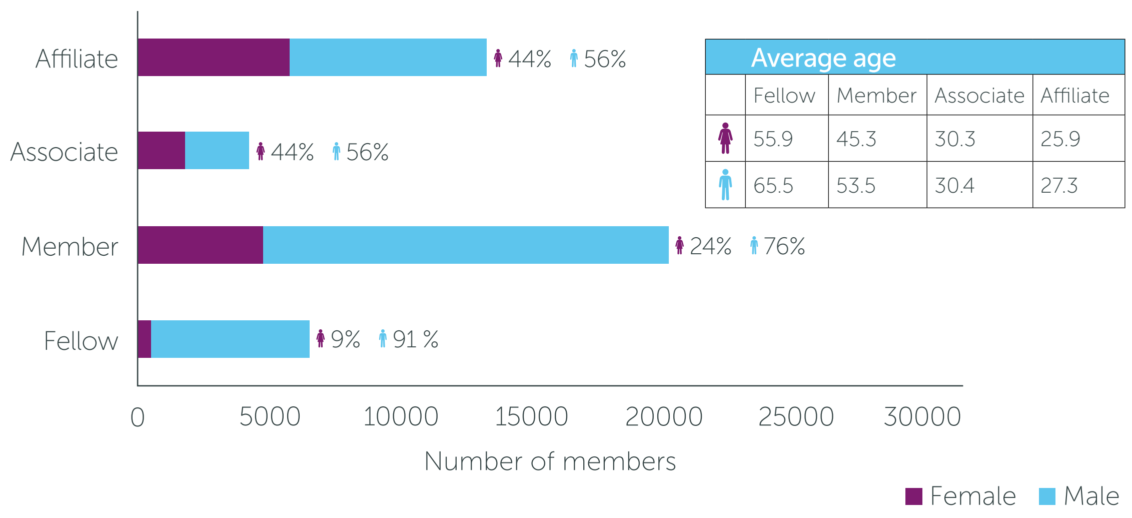
Membership by gender and age

Women are underrepresented in higher age brackets of our membership.

Figure 26. Royal Society of Chemistry membership by age and gender

2006		2015	2006		2015
500	Under 20	235	565	Under 20	300
1980	20–24	3460	1915	20–24	4240
1555	25–29	2520	1780	25–29	3310
1340	30–34	1830	1995	30–34	2570
1320	30–39	1595	2550	30–39	2525
1015	40–44	1385	2940	40–44	2580
790	40–49	1290	3210	40–49	2840
520	50–54	1090	3080	50–54	3160
310	50–59	780	3385	50–59	3110
200	60–64	450	3470	60–64	2600
110	60–69	220	2500	60–69	2345
70	70–74	150	1990	70–74	2445
140	75+	230	3950	75+	5625

Figure 27. Membership categories by gender and age

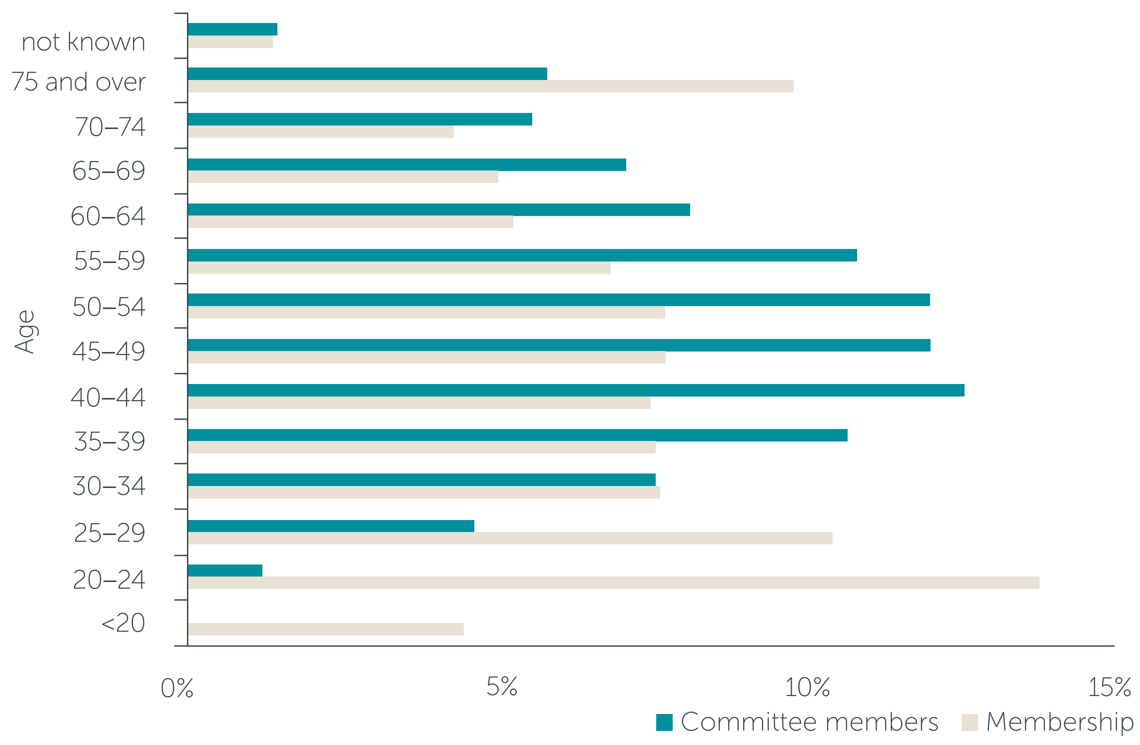


Average age	Fellow	Member	Associate	Affiliate
Female	55.9	45.3	30.3	25.9
Male	65.5	53.5	30.4	27.3

Analysis of our membership categories shows that at Affiliate and Associate levels, there is a healthy proportion of women in membership and the balance is reflective of the undergraduate population. However, the proportion of women in the two more senior categories of membership falls dramatically, mirroring the 'leaky pipeline' in academia.[56] The average age of female Members and Fellows is lower than that for men, as might be expected from the fact that the proportion of women in membership tails off with age.

Our Inclusion and Diversity Strategy for 2014–2017 set a target of 10% female FRSC and 30% female MRSC by 2017, compared to the 2013 levels of 6% and 22% respectively. The 2016 figures show that we are on track to reach these targets.

Figure 28. Age profile of committee members compared to membership age profile, 2015.

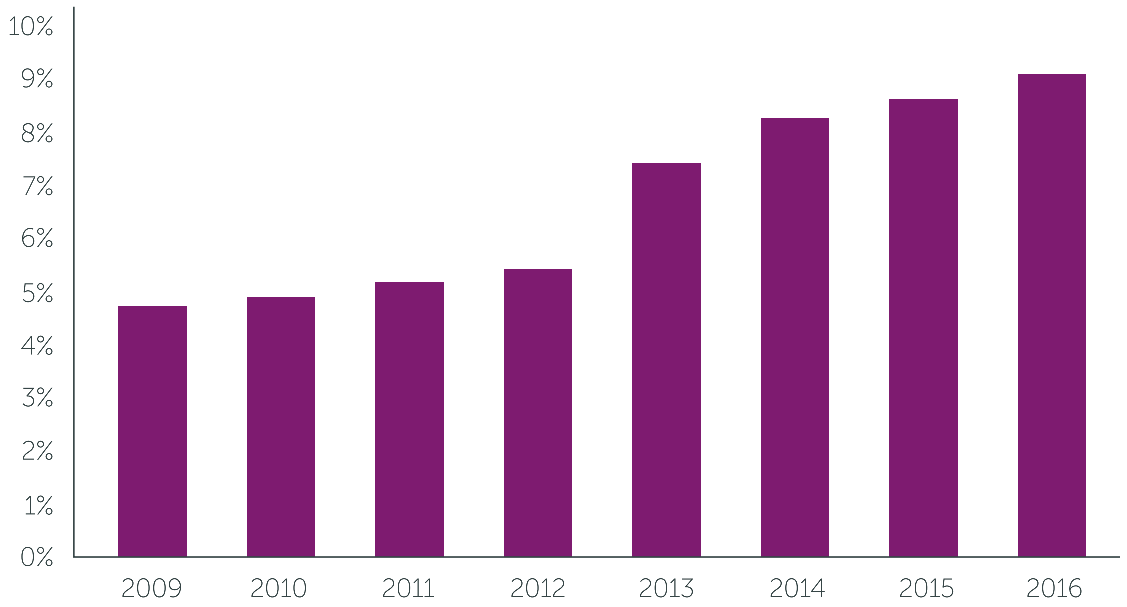


The age distribution of committee members broadly follows that of the membership as a whole with younger members being under represented.

Fellows by gender

The chart below shows there was a shift in the proportion of female Fellows in 2013. This was a positive outcome resulting from actively inviting senior female members to upgrade their membership. Progress has since slowed but the representation of women in this senior membership grade continues to increase.

Figure 29. Proportion of female FRSCs

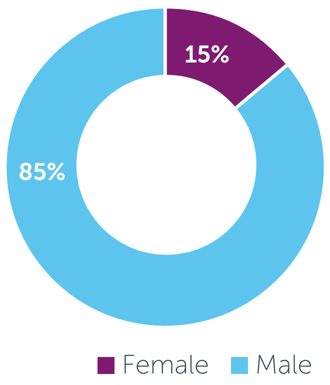


Chartered Status

There are established routes for chemistry professionals to work towards three different forms of Chartered Status: Chartered Chemist (CChem), Chartered Scientist (CSci) and Chartered Environmentalist (CEnv). Attaining chartered status recognises the achievement of professional standards and is a commitment to continuous professional development.

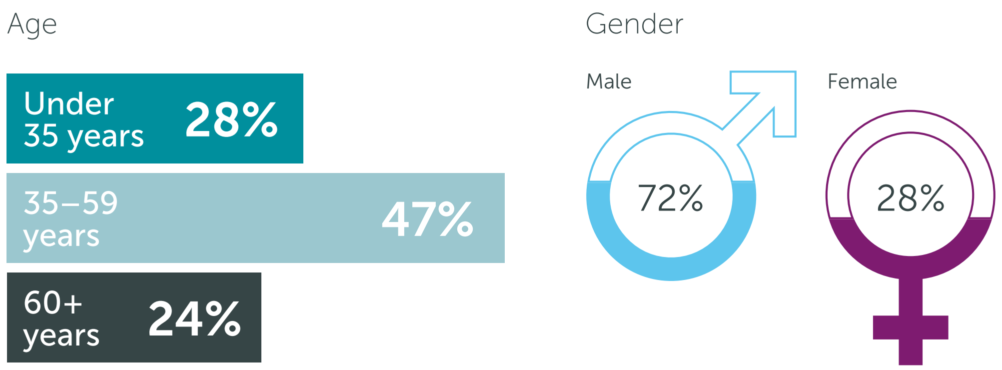
The majority of Chartered Chemists are male and their average age is eight years greater than that of female Chartered Chemists, for whom the mean average age is 52 years old. Our 2017 pay and reward survey found that the median salary for members and fellows with Chartered Chemist status was £13,800 more than those without.[57]

Figure 30. Chartered Chemists by gender, 2016



Pay and Reward Survey 2017

Every two years the Royal Society of Chemistry carries out a members' survey to collect data on salary, employment benefits and career satisfaction.[57] In 2017, over 6,000 members responded and the sample was representative of the membership as a whole with 28% female and 72% male. A higher proportion of respondents in the older age range were male. Therefore, the gender results are largely informed by age.



47% of surveyed members worked in an industrial or commercial firm, just under 30% are employed in an educational environment such as university. Women were more likely to be working in a school/sixth form or employed by not-for-profit organisations.

15% of members had taken a career break of more than three months since the beginning of their career – 33% of women, compared to 8% of men. 79% of the career breaks taken were up to one year in duration and family leave accounted for 56% of these career breaks. Nationally, the take up for Shared Parental Leave by men is still very low with 0.5%–2% of eligible fathers taking up the opportunity, which was introduced in October 2015. Other reasons for career breaks cited by members included unemployment (16%), study, travelling, or other caring responsibilities.

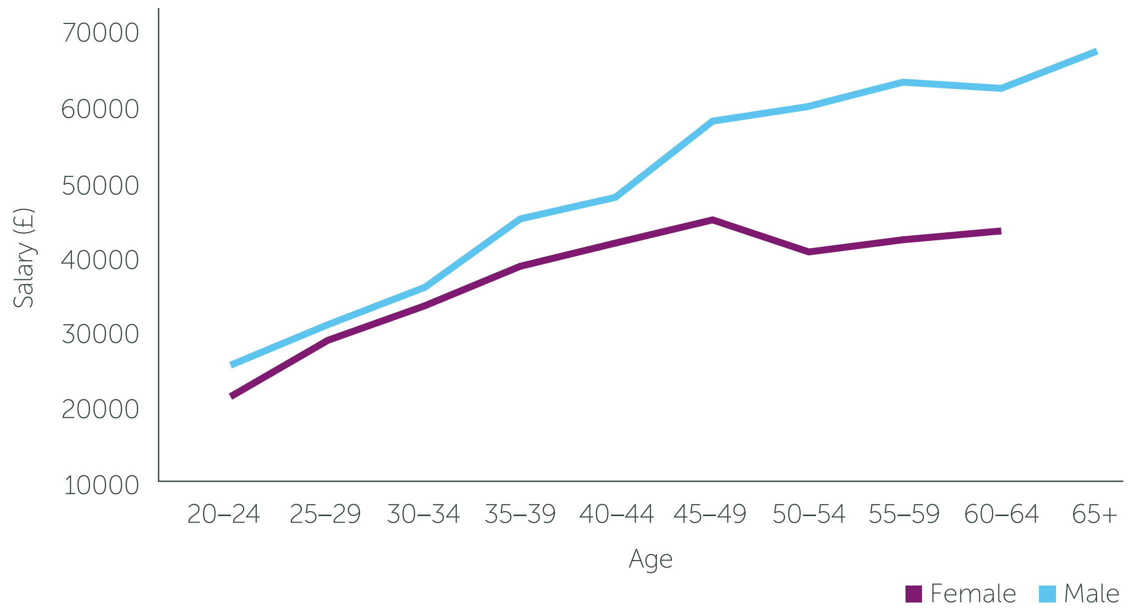
For 42% of employees who have taken a career break, their perceived prospects since returning to work have remained unchanged. However, 34% of women feel their prospects have worsened compared to only 14% for men.

62% of members' employers offer flexible working – the opportunity to choose the hours worked within the boundaries of core hours. 41% offer part-time working and 14% do not offer either flexible working or part-time working. It should be noted that all qualifying employees in the UK have the legal right to request flexible working – not just parents and carers.

Achieving a suitable work–life balance was the key priority for members when considering future employers. Flexible working or flexi-time was the highest priority benefit. The desire for a healthy work–life balance is reinforced by 70% of members selecting holiday allowance and flexible hours as their most important benefits. The Chartered Institute of Management defines good work–life balance as a situation where work/home conflict is minimised so that the demands of work do not prevent a person gaining satisfaction from their life outside work, while aspects of their personal life do not spill over to exert a negative impact on their work.[58] Positive work–life balance helps to minimise stress and improves productivity.

The survey results showed that the gender pay gap is still present and has increased since the 2015 survey to £13,000. Overall earning potential generally increases with age and experience, but when split by gender, it is apparent that the gender gap increases markedly with age.

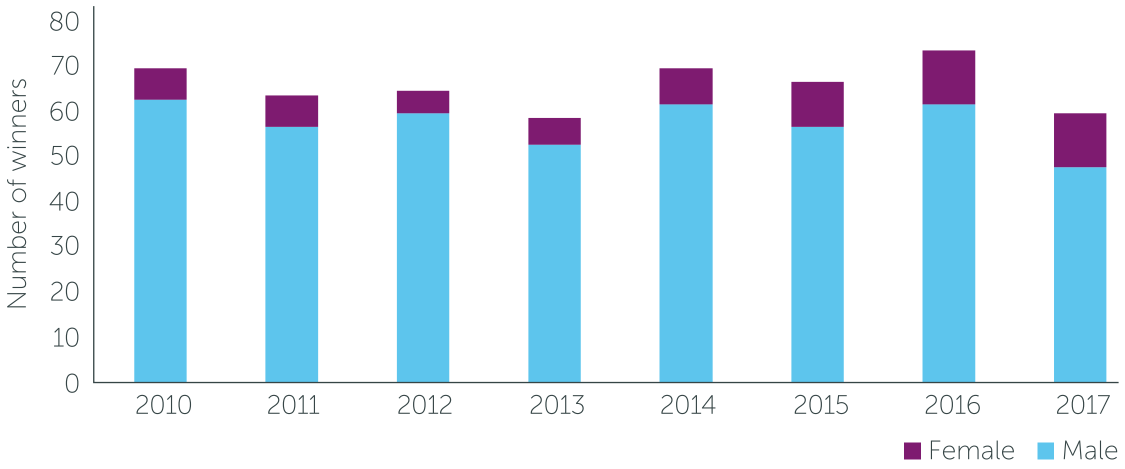
Figure 31. Gender pay gap by age – median remuneration by gender. Source: Royal Society of Chemistry Pay and Reward Survey 2017[57]



Prizes and awards

The chart below shows the gender breakdown of Royal Society of Chemistry prize and award winners. There has been an increase since 2010 in the percentage of female winners, rising to 17% in 2017.

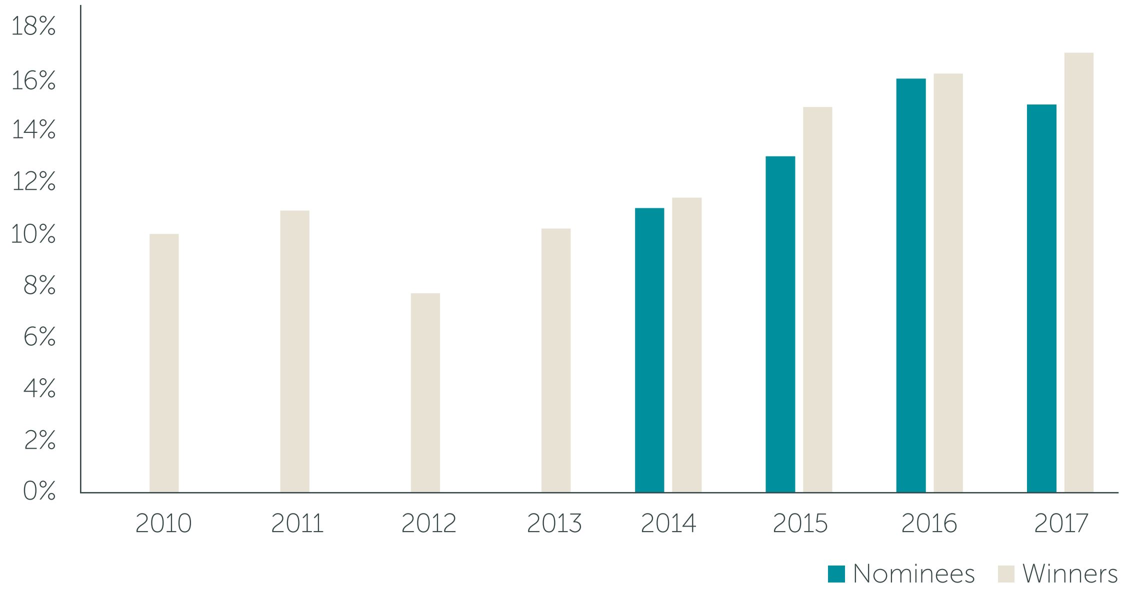
Figure 32. Royal Society of Chemistry award winners by gender



The Royal Society of Chemistry has collected data on the gender of nominees since 2014 and during that period the percentage of all nominees that were female was less than or equal to the percentage of female winners. There is therefore no evidence that there is bias at the point at which winners are selected. Measures such as unconscious bias training, continuous review of the nomination and judging processes, and broadening the pool of nominators and nominees remain a priority.

Since 2014 we have been proactive in communicating the statistics related to gender diversity and in encouraging the community, individually and collectively, to be proactive in considering inclusion and diversity when making nominations.

Figure 33. Proportion of female nominees and winners for Royal Society of Chemistry prizes and awards



Events

Our activities include a wide range of conferences, talks and networking opportunities. Some of these are organised centrally and some led by member groups, including our local branch network. It is important that these events are as inclusive as possible, which means providing sufficient variety in the style of event, topics, location and timing. Our events are an opportunity to raise the profile of individuals and we have a responsibility to ensure sufficiently diverse groups are able to present their work and opinions to the community.

The table below shows the gender balance at Royal Society of Chemistry events. The gender split of attendees is broadly in line with the gender split we see in the chemical sciences as a whole.

Table 4: Percentage of female attendees at different categories of Royal Society of Chemistry events

Event type	Percentage of female attendees (%)
Accreditation	25
Careers	45
Conference	35
CPD	63
Early career	43
Editors Symposium	24
Education	50
Faraday Discussion	29
Industry	28
Interest Group Meeting	38
Librarians	22
Member Network	34
Outreach	48
Poster session	33
Public lecture	50
Science policy	37
Symposium	34
Workshop	34

In order to track and measure our progress in this area we need to find new and appropriate ways to monitor and evaluate the impact of these activities. This presents challenges in collecting and storing personal information whilst protecting privacy. We will work closely with other organisations to identify and share best practice in this area.

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