



From innovation to implementation: team science two years on

February 2019



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Executive summary

In March 2016, the Academy of Medical Sciences published a working group report on 'Improving recognition of team science contributions in biomedical research careers'.¹ This report highlighted the importance of team science – defined as output-focused research involving two or more research groups – to address increasingly complex and multifaceted research challenges. The main finding of the report was that the perceived lack of recognition of researchers' contributions is the major deterrent for their participation in team science. The report made a series of recommendations to improve recognition systems to encourage, support and reward biomedical researchers for participating in team-based approaches.

In June 2018, two years after the publication of the initial report, the Academy convened a follow up meeting to review progress against the original recommendations, which called for changes to recognition, funding, researcher behaviour, training and career development of skills specialists.

The meeting showcased areas of progress and examples of best practice across the sector. Discussions centred on identifying challenges and actions for the future, including the following four areas:

1. Publishing

Arguably the area where most progress has been made to support team-based approaches, the development and implementation of both CRediT – assigning roles to individuals on publications – and ORCID – a unique identifier for each researcher that collates all research outputs – have been influential in improving receipt of recognition for team science researchers.^{2,3} Future challenges include mandating adoption across all publishers and funders, and ensuring ongoing awareness and uptake of fair attribution of contribution roles to researchers.

2. Funders

The most impactful change amongst funders has been the formation of UK Research and Innovation (UKRI). Spanning multiple research councils and disciplines, it is hoped that UKRI will bring about an increased number of team science funding streams, and will act as a lever to influence research culture. Across funders, a welcome shift away from a sole focus on first author publications in grant applications has allowed a broader remit of impacts to be evaluated. This includes the opportunity to support outputs with descriptive text outlining roles and contributions, in addition to linking ORCIDs to grant applications.

3. Employers

Academic employers have been slow to implement measures in support of team-based approaches. One notable exception is the introduction of a competitive career path for skills specialists at the University of Glasgow.⁴ Adopting a similar career structure within universities across the UK could provide the recognition and reward mechanisms that are currently lacking to attract and retain talent. Further opportunities to increase support for team scientists include the development of metrics to measure excellence in team science in promotion applications and guidelines, as well as more effective training for researchers in team science. This could include training in team management, team working and unconscious bias to better prepare current and future researchers for team-based approaches and to improve mobility between academic and commercial sectors.

4. Research culture

Research culture remains a substantial challenge to the attribution of recognition for team scientists. Changes to the submission criteria for the upcoming research excellence framework (REF2021) should encourage team science submissions, whilst transparency surrounding the assessment of collaborative research submissions should reduce the perceived risk. However, changes to research culture will require a wider commitment across the biomedical research landscape and a collective responsibility to implement changes in support of team science. Overall, more opportunities for recognition and reward are needed, in addition to transparency surrounding the incorporation of team science evaluation in promotion criteria.

The event highlighted the wide array of upcoming mechanisms to support and encourage team science. For these to be realised, it will be important for stakeholders across the biomedical research sectors to embrace the very nature of team science, by sharing learnings and instances of success and best practise to catalyse further change.

1. Academy of Medical Sciences (2016). *Improving recognition of team science contributions in biomedical research careers*. <https://acmedsci.ac.uk/file-download/6924621>
2. <https://casrai.org/credit/>
3. <https://orcid.org/>
4. University of Glasgow (2017). *Job Family Role profiles*. https://www.gla.ac.uk/media/media_506090_en.pdf

Solving global and multifaceted research questions, such as how to combat antimicrobial resistance or food security, often requires a team based approach. Team science, defined as output-focused research involving two or more research groups, may involve a small number of teams where collaborations provide expertise in complementary specialisms, or major collaborations of thousands of researchers, scattered across the globe.

Team science has dramatically increased within academic institutions in recent decades as the benefits of team working in research environments have been recognised. This rise is clearly depicted by the steep upwards trajectory of the average number of authors on scientific publications over time, coupled with the rising proportion of papers featuring multiple disciplines as well as international and cross-sector collaborations.⁵

In March 2016, the Academy of Medical Sciences published a working group report on 'Improving recognition of team science contributions in biomedical research careers'.⁶ The report explored whether biomedical researchers were being supported and rewarded for participating in team-based approaches. A key finding was that the likely lack of recognition for one's contributions is the main challenge for researchers participating in team science. To create a supportive environment for, and to tackle the barriers to, team science, a series of recommendations was developed, targeted at four key stakeholder groups: employers, researchers, publishers, and funders. A co-ordinated effort from each of these stakeholder groups was called for, supported by a timeline of implementation aligned with influential activity in the research landscape (Figure 1).

Two years on from the report, the Academy delivered this follow-up event to assess what progress has been made against recommendations since the report was published. The meeting convened senior stakeholders from across biomedical research to take stock of progress made in the recognition of individuals, and to identify any new challenges and opportunities that have arisen in line with the evolving funding and research landscape; and the emergence of new research priorities. The event focused on priority areas from the original report.

The meeting was co-Chaired by Professor Anne Ridley FRS FMedSci and Professor Philippa Saunders FMedSci who were part of the working group that developed the report. The day comprised a series of talks, discussing team science in the context of REF2021; panel discussions where a representative funder, employer, publisher and NIHR spoke on the progress, challenges and opportunities for team science; breakout groups, where delegates considered recent progress made in team science and priorities for the future; and concluded with a speech by the Chief Executive of UK Research and Innovation (UKRI), Sir Mark Walport FRS FMedSci. Delegates and speakers alike were overwhelmingly positive about recent developments in this area, while reinforcing the need to maintain momentum if the full potential of team science is to be achieved in the UK and globally.

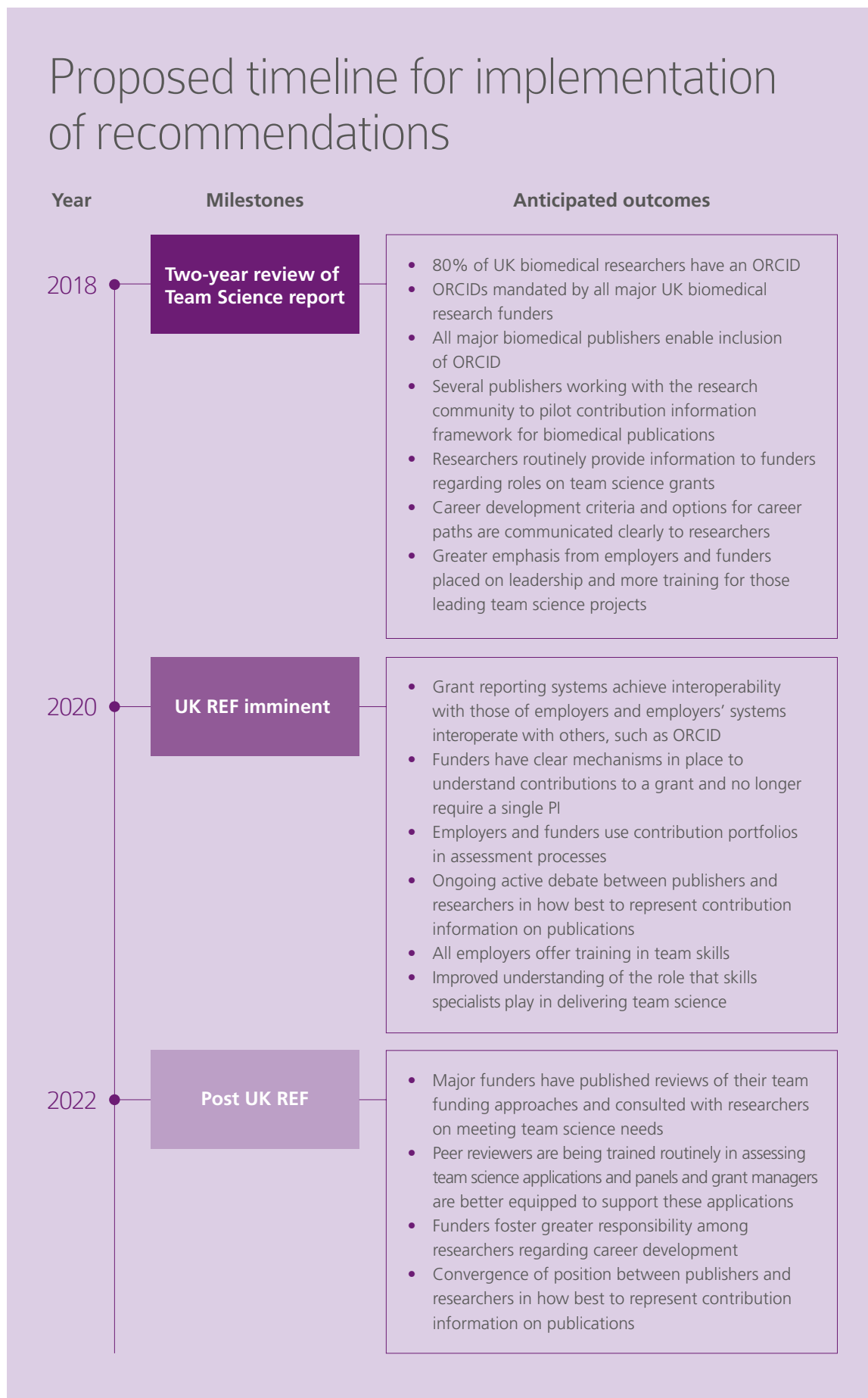
This report summarises the vibrant discussions at the meeting, setting out areas of progress and opportunity, as well as identifying future priorities to maintain momentum, and the specific stakeholder groups responsible for actioning further implementation. Detailed summaries of the speakers' presentations are annexed for further information.

The report represents a snapshot of the views of the stakeholders present at the meeting. Ongoing engagement with the stakeholder communities as discussed in the report will be necessary as team science evolves. Opinions expressed in this report do not necessarily represent the views of all participants at the event, the Academy of Medical Sciences, or its Fellows.

5. US National Library of Medicine (2018). *Number of Authors per MEDLINE/PubMed Citation*. <https://www.nlm.nih.gov/bsd/authors1.html>

6. Academy of Medical Sciences (2016). *Improving recognition of team science contributions in biomedical research careers*. <https://acmedsci.ac.uk/file-download/6924621>

Figure 1: Proposed timeline for implementation of recommendations



Team science and the publishing community



Publishers

Recommendations

Recommendations from the team science report aimed at the publishing community:



Recommendation 1

All research outputs and grants should include open, transparent, standardised and structured contribution information.



Recommendation 2

The most effective way of providing contribution information will be an open and transparent research information infrastructure which links all research inputs and outputs to individual contributors.



Recommendation 3

Information infrastructure must minimise researchers' overall administrative burden and should be interoperable.



Recommendation 4

The use of 'key' positions on publications and grants as the primary indicator of research performance, leadership and independence in team science projects should be replaced by transparent, fair processes.



Contribution Information Framework



Contribution Portfolio



Digital Identifiers



Funding



Interoperability



Leadership



Researcher Responsibility



Team Skills Training

Improving the recognition of researchers

Participants largely thought that there was still a reliance on first and last authorship and were supportive of drawing parallels between other disciplines. The alphabetised format as seen in mathematical physics papers presents an interesting model for adoption, as does the absence of PhD supervisors on publications by PhD students in the arts and humanities. Alternatively, future publications may move away from authorship in bylines altogether, whereby detailed contribution information would be found elsewhere in the publication. Whilst a shift away from traditional authorship in the long-term is supportive of team science, participants noted that the attribution of recognition through publishing outputs is the area that has seen the greatest progress since the release of the report, with far-reaching uptake of recognition platforms and taxonomy. Rapid advances in technology and data have in part underpinned this remarkable progress, with software and databases being integral to changes. However, progress would not have been as great without the coordinated approach and action of the publishing community. Representing the major source of scientific outputs, participants felt that publishers hold a great responsibility to improve the receipt of recognition for researchers involved in team science.

Dr Veronique Kiermer, Executive Editor, Public Library of Science (PLOS), and Chair, ORCID Board of Directors spoke of the challenges and opportunities from the perspective of a publisher (further details in Annex 4). She highlighted a number of areas of progress in the publishing community and associated opportunities, as described below.

Progress and opportunities

Contributor Roles Taxonomy (CRediT)

Spanning 14 roles, representing those typically undertaken by contributors to scientific scholarly output, CRediT serves a role in demystifying the contributions of middle authors and attributing recognition.⁷ CRediT has now been taken up by over 100 journals worldwide, illustrating real momentum in this area and suggesting there is widespread support for the attribution of recognition. Dr Kiermer noted that although tension and discrepancies surrounding authorship are not fully resolved by CRediT, in part due to the corresponding author attributing the roles in the current implementations of the taxonomy, CRediT does provide a much-needed opportunity to attribute recognition for a wider range of contributions than might have been traditional in single principal investigator (PI)-led teams. If adopted more broadly, CRediT could be used as a consistent system between disciplines to mitigate differences in publishing culture, and to further support team science activities. This interdisciplinary application could be supported by the expansion of CRediT roles beyond 14 in order to maximise coverage of both research contributions and representation of team scientists.

Open Researchers and Contributor ID (ORCID)

ORCID has also been widely adopted by researchers, funders and publishers alike.⁸ Dr Kiermer described how 55 publishers have signed a commitment to:

- Implement best practises for ORCID collection and auto-update of ORCID records upon publication.
- Mandate ORCIDs for corresponding authors and encourage for co-authors.⁹

She highlighted that despite its original focus on capturing publications, the scope of ORCID now extends well beyond that aim. Indeed, following the ease of its adoption, ORCID has now implemented expanded affiliations beyond publications to capture the breadth of research outputs and impacts. Wider outputs include invited positions and distinctions, and activity as reviewers and editors.

Interoperability

Dr Kiermer reported that the increased demand for interoperability as a result of the uptake of recognition platforms has been met with appropriate software. For example, it is now possible to automatically update an individual ORCID with publications via Crossref and DataCite. DataCite works to assign a Digital Object identifier (DOI) to datasets and other research objects so that these can be shared, cited, managed, discovered and connected to journal articles.¹⁰ Crossref works primarily with the publishing community to assign DOIs to articles.¹¹ These tools allow a researcher's ORCID profile to be easily updated with all of their contributions, providing a single destination to find a complete and up to date portfolio of their research.

Dr Kiermer outlined the importance of the CRediT information being both human and machine readable. When combined with ORCIDs, this offers the potential to reliably link author records to publications, to capture author contributions in the journal's metadata, and to track an individual's authorship contribution across publications over time.¹²

The San Francisco Declaration on Research Assessment (DORA)

Finally, Dr Kiermer spoke of the relaunch of DORA in February 2018, gaining 49 new signatory organisations. DORA was developed in 2012 as an international initiative focused on improving the ways in which the outputs of scholarly research are evaluated. The relaunch and additional signatories signal a real desire by the community to improve standards, and share best practices to support wider adoption.

Future priorities

To capitalise on the momentum observed, participants proposed the following as possible priorities for the future:

- CRediT and ORCID are currently implemented by fewer than 50% of biomedical journals. To minimise the administrative burden associated with managing different platforms and maximise opportunities for recognition, these platforms should be adopted more widely.
- Associating ORCID to middle authors (often early career researchers) is challenging, likely due to their lack of interaction with submission systems. To encourage a positive shift in the upcoming generation of researchers, more should be done to encourage all researchers to register with ORCID and link their manuscript submissions to their ID. One step to support this would be the adoption of ORCID by employers instead of institution specific software currently used to record research outputs.
- Funders, employers and publishers should collaborate more closely to enable the collation of wider research outputs and impacts. Interoperability between inputs will be paramount; the use of interoperability platforms such as Crossref should help and should be encouraged.
- To ensure CRediT is suitable for interdisciplinary research that is typical of team science, evaluation of existing taxonomy roles may be necessary following cross-discipline engagement to include broader representation.

7. <https://casrai.org/credit/>

8. <https://orcid.org/>

9. <https://ORCID.org/content/requiring-ORCID-publication-workflows-open-letter>

10. <https://www.datacite.org/>

11. <https://www.crossref.org/>

12. McNutt M, et al. (2017). *Transparency in authors' contributions and responsibilities to promote integrity in scientific publication*. PNAS **115**, 2557-2560.

Team science and the funding community




Recommendations

Recommendations from the team science report aimed at the funding community:

 **Recommendation 5**
Team science funding should provide the length, breadth and magnitude of support required by recognising the longer timescales often needed to achieve outputs and additional costs associated with effective team working.

 **Recommendation 6**
Team science grant proposals need to be appraised holistically, as well as from the perspective of the relevant disciplines.

   **Recommendation 7**
The value of project leadership should be evaluated when appraising team science grant proposals.

   **Recommendation 8**
Researchers should drive change through their crucial roles as team members, peer reviewers and participants on recruitment, promotion and funding panels.



Improving the recognition of researchers

The formation of UK Research and Innovation (UKRI) in 2018 – an umbrella organisation, encompassing the seven research councils, Innovation UK, and a new funding council, Research England – has brought about a significant change in the funding landscape with increased opportunities for multidisciplinary research. Set up as a result of a cross-research council review which outlined the value of mobility and collaboration between different sectors and disciplines, UKRI delivers novel interdisciplinary and collaborative schemes, aiming to break down the artificial barriers between disciplines.¹³ Consistent with streamlining funding activity and supporting more collaborative working, the National Institute for Health Research's (NIHR's) academic training and higher career personal awards will also be integrated into a new structure: the NIHR Academy.¹⁴ This shift in behaviour of two of the UK's major funders is supportive of a cultural change to support team science practises.

Participants at the meeting believed that funders had embraced team science practises in the two years since the release of the report, as collaborative approaches to research questions are sought.

Professor Fiona Watt FRS FMedSci, Executive Chair, Medical Research Council (MRC), and Sir Mark Walport FRS FMedSci, Chief Executive, UKRI, spoke of recent efforts by funders to encourage the uptake of team science models of research as described below (detailed summaries in annexes 2 and 6).

Progress and opportunities

Sir Mark described how the formation of UKRI has been met with a substantially increased budget for research, and an expectation to deliver economic impact and social prosperity – a challenge that demands international collaboration between talented individuals across all career stages. This shift in priorities from the UK's largest funder could present a great opportunity for team science.

More broadly across the funding community, many new international and interdisciplinary funding schemes, in addition to schemes to promote movement between sectors, have arisen in recent years. Examples include the Industrial Strategy Challenge Fund, combining research and business; the Strategic Priorities Fund, providing funding for research and innovation that falls outside of the remit of existing schemes; and the Global Challenges Research Fund, tackling challenges faced by developing countries.^{15,16,17}

Whilst these examples are all offerings by UKRI, participants hoped that the increase in team science funding schemes across funders will lead to a research culture more supportive of team science, and to more researchers engaged in team science projects.

Appraisal of research outputs

Professor Watt indicated that new models of funding will require a fresh look at how grant applications are assessed. Steps have already been taken to look beyond first and last authorship alone when assessing research outputs. For example, the 50-word narrative outlining contributions to accompany key research outputs in grant applications, as implemented by the Wellcome Trust, has been widely welcomed (see Case study 1).¹⁸ Participants agreed that the adoption of similar practices across funders would support increased granularity in assessment.

Case study 1: Looking beyond authorship

In support of valuing outputs beyond first and last author publications, the Wellcome Trust invites funding applicants to list up to 20 additional outputs, such as preprint articles, datasets and patents. The applicant is also able to provide a 50-word narrative on 10 of these outputs to outline their significance and contribution.¹⁹ This provides an opportunity to gain recognition for both the conventional and unconventional outputs often arising from team science projects. Similar activities across all funders could reduce the focus on high impact publications as outputs and reduce some of the career risks associated with gaining recognition in large team settings.

Building 'team science' teams

Sir Mark noted that one of the values of team science is that individuals can each bring a unique contribution of expertise and strengths to the research process. However, this diversity can present a challenge when evaluating teams, for example in funding applications. In support of team science evaluation, Professor Watt described consortium grants, where reviewers with expertise in a range of backgrounds are responsible for reviewing applications. The UK Prevention Research Partnership (UKPRP) Consortium Awards have adopted this approach (see Case study 2).²⁰ This approach to grant appraisal has the potential to provide a fairer and more effective review model as larger and more collaborative grants, which are often designed to address complex research questions, are developed.

Case study 2: Building team science teams

Traditional grant panels are often not suitable for the assessment of team science applications where both the content and researchers undertaking the research span many sectors and disciplines. To assess applications to their UK Prevention Research Partnership (UKPRP) Consortium Awards, which aim to support the broad challenge of primary prevention research in non-communicable diseases, the MRC formed an Expert Review Group. Comprised of senior independent academics from international institutions, the group's expertise reflects the breadth of disciplines involved in the awards to ensure fair assessment.²¹

Supporting team scientists

Professor Watt provided an overview of some of the incremental changes implemented by the MRC to facilitate team science projects, which also have the potential to improve research culture more broadly. These include clarified support for team scientists whereby the MRC has provided necessary clarification on costings relating to how grants can support team science. Participants welcomed this initiative and encouraged other funders to follow suit.²² Secondly, there has been a rise in co-investigator statuses on grants, enabling joint accountability for group leaders and thereby promoting appropriate recognition. In addition, a new Researcher Co-Investigator (RCo-I) status has been introduced, which enables more junior researchers to receive recognition for their contribution to a grant proposal.²³ This new status aims to prime early career researchers to secure future funding themselves, in addition to attributing recognition at an earlier career stage where named status on a grant is a marker of success (see Case study 3).

Case study 3: Recognition of researchers on funding applications

Receipt of grant funding is a marker of success in research. However, the size and multidisciplinary nature of team science, as well as the associated increase in competition for this type of funding may act as a barrier to successfully securing funding. The role of a PI is still valid and necessary, especially in non-team science settings, and an administrative PI is always important. To better recognise team members' contributions, MRC has developed a Researcher Co-Investigator status for researchers who have made substantial intellectual contributions but do not have a university contract (e.g. senior postdoctoral researchers).²⁴ In addition, all named individuals on a grant will be encouraged to clarify their contribution.

Future priorities

Although the funding community has implemented welcome changes, and opportunities are being created and embraced, it was felt that challenges still remain. Participants suggested that the following issues should be addressed as a priority:

- 'Team science' teams often differ from the traditional hierarchal model and they therefore require different mechanisms of support. Roles such as MRC's RCo-I status offer the opportunity for more researchers to be listed on grants, thereby supporting careers and attributing recognition. Further mechanisms to support non-conventional team structures should be developed across all funders.
- A focus on first and last author publications is no longer fit for purpose. Funders and employers should identify broader criteria and metrics to measure research excellence in order to support funding applications and promotion panels.
- Finally, to better assess team science applications, training in team science should be developed and mandated for all grant panel members. This will ensure the fair assessment of team science submissions.

13. Department for Business, Innovation & Skills (2015). *Ensuring a successful research endeavour: review of the UK research councils*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/478125/BIS-15-625-ensuring-a-successful-UK-research-endeavour.pdf
14. National Institute of Health Research (2017). *New Challenges in developing tomorrow's health research leaders*. <https://www.nihr.ac.uk/our-research-community/documents/TCC-NIHR-Strategic-Review-of-Training-2017.pdf>
15. <https://www.ukri.org/innovation/industrial-strategy-challenge-fund/>
16. <https://www.ukri.org/about-us/strategic-prospectus/how-we-will-deliver-and-measure-success/>
17. <https://www.ukri.org/research/global-challenges-research-fund/>
18. <https://wellcome.ac.uk/sites/default/files/sample-full-app-form-equipment-resources-lps-201803.pdf>
19. *Ibid.*, 18.
20. <https://mrc.ukri.org/funding/browse/ukprp/uk-prevention-research-partnership-ukprp-consortium-and-network-awards/>
21. *Ibid.*, 20.
22. <https://mrc.ukri.org/funding/guidance-for-applicants/resources/>
23. <https://mrc.ukri.org/skills-careers/additional-career-support/researcher-co-investigator-rcoi/>
24. *Ibid.*, 23.

Team science for employers



Employers

Recommendations

Recommendations from the team science report aimed at employers:



Recommendation 9

Focused and appropriate training in team skills should be provided.

Recommendation 10

Clear career paths and development opportunities should be provided for researchers outside of the 'PI track' who play key roles in (and provide key competencies to) team science, such as skills specialists.



Contribution Information Framework



Contribution Portfolio



Digital Identifiers



Funding



Interoperability



Leadership



Researcher Responsibility



Team Skills Training

Supporting and nurturing skills specialists

It was agreed that skills specialists have soared in prevalence as advances in technology have given rise to niche, yet highly valuable skill sets. Professor Dame Anna Dominiczak DBE FRSE FMedSci, Regius Professor of Medicine, Vice Principal and Head of the College of Medical, Veterinary and Life Sciences at the University of Glasgow spoke from the perspective of an employer on the support of skills specialists' careers (detailed summary in annex 3). Professor Fiona Watt FMedSci, Executive Chair, Medical Research Council (MRC), also described the support provided by funders for these career pathways.

Progress & opportunities

Participants agreed that the overall adoption and implementation of practises in support of team science from employers could be significantly improved. Reliance on authorship of publications as a metric for promotion and reward is no longer fit for purpose, and the development and implementation of alternative metrics is needed. In addition to metrics, parity of esteem is necessary in career structures between technical and traditional academic career pathways. Despite this, there have been some excellent examples of change, which could be mirrored across the sector.

To circumvent this issue, the University of Glasgow has developed parallel career tracks for traditional researchers and technical staff (Case study 4). Technical roles currently reach a level comparable to that of a senior lecturer and there is an ambition to extend this to the level of professor, as depicted in Figure 2. This system offers a mechanism to reward and attribute credit to leading technical experts, recognising the valuable role of skills specialists with the aim to encourage uptake of these careers.²⁵

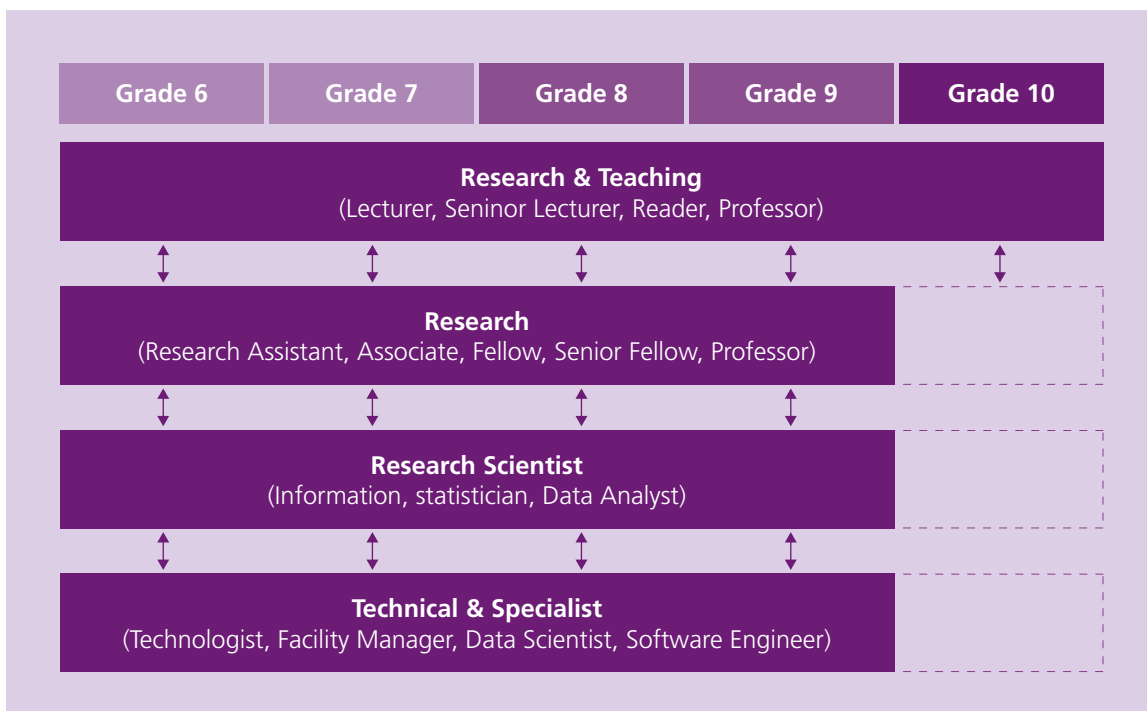
Case study 4: Creating new career pathways for skills specialists

The University of Glasgow has implemented changes to combat the lack of career pathways for skills specialist scientists. Aiming to attribute parity for both skills specialists and those on the traditional 'PI track', the University of Glasgow has developed parallel career pathways or 'job families'. The roles are relevant, accurate and fit for purpose, and remain underpinned by a job evaluation methodology. Job family profiles define groups of jobs that share similar characteristics and undertake similar work; while the level of skills, competency and responsibility differ between each level, the core nature of activities carried out is similar across all levels in the job family.²⁶

The development of this process was underpinned by the desire to build a conducive infrastructure and environment fundamental to the attraction and retention of world leading talent. The implementation of the scheme faced some challenges and delays, but was achieved within 10 years thanks to the dedication, determination and shared vision of the College Management Group and especially Directors of seven research institutes and the human resources team.

As illustrated in Figure 2, skills specialists can currently reach a level comparable to a Senior Lecturer and there is scope to extend this to Professor level. The release of these distinct job family roles in 2016 saw the immediate promotions of skills scientists demonstrating the impact of this activity.

Figure 2: The University of Glasgow job families



Progress made by funders in the support of skills specialist scientists

Funders also have a responsibility to support technical careers. Professor Watt highlighted the schemes developed by the MRC to support early career researchers in skills specialist roles, including their Skills Development Fellowships, which provide early career training across quantitative and biological disciplines.²⁷ Their interactive career framework also showcases existing team scientists alongside other scientific routes to offer inspiration and role models.²⁸

Furthermore, a cross-research council statement supporting technology and skills specialists was developed in 2017. The statement outlines expectations for both research organisations and team scientists. Meeting participants welcomed the statement as recognition of the current inadequacy of existing career routes.²⁹

Providing the necessary skills to succeed in team science

Participants agreed that appropriate training is important to equip team members with the necessary skills to fulfil their potential as a member of a successful team. Provision of effective training would also raise awareness of the benefits of team science, thereby encouraging the more widespread adoption of a receptive research culture.

Progress and opportunities

It was agreed that there are few opportunities for team science training across employers, especially in biological sciences, where very little progress has been observed since the release of the team science report. Despite this, there are pockets of excellence that can lead to more extensive changes. Instances of best practise include the National Institute for Health Research (NIHR) team science conference (as outlined in annex 5), and the package of team science support delivered by the Centre of Membrane Proteins and Receptors (COMPARE) group (Case study 5).³⁰

Case study 5: Training teams in team science

The Centre of Membrane Proteins and Receptors (COMPARE), a cross-institutional group spanning the University of Nottingham and the University of Birmingham, has embraced the concept of team science following the publication of the Academy's report. By designating a proportion of funding to deliver capacity building in team science, a committee of early career researchers has been formed, tasked with developing an annual programme of team science activities.³¹ Driven by early career researchers, the aim is to empower the next generation of scientists to build a team science workforce for the future and to incentivise a wider cultural change through marked successes. Activities include:

- An annual away day to promote team skills
- Travel and training grants offered as incentives to network and form novel interdisciplinary collaborations
- An early career researcher- (ECR) driven annual symposium to foster collaborations across the wider team and maximise existing team science opportunities. ECRs chair all sessions and invite talks from the ECR community.
- A summer studentship programme to provide: (a) post-doctoral researchers with grant funding and supervisory opportunities; (b) undergraduates with hands on lab experience; (c) Principal Investigators (PIs) with the opportunity to trial prospective PhD students.

As this initiative moves into the next phase, the COMPARE team science approach will engage more directly with PIs through sandpit activities, technology spotlight sessions, and grant development programmes. It is hoped that the positive steps achieved with the ECR team will be maintained and developed, by including them in these PI-directed discussions, wherever possible.

Future priorities

Participants proposed the following as possible priorities for the future:

- Employers, particularly Higher Education Institutions (HEIs), should play a greater role in supporting skills specialist scientists and team science more broadly. They should look to develop appropriate career pathways to incentivise uptake of these professional routes.
- More career pathways should be created for team scientists and interdisciplinary researchers across all career stages.
- Parallel structures to the career track for skills specialists developed by the University of Glasgow should be replicated across HEIs in the UK. Not only would this serve to attract and retain talent in technical roles in academia, it would also enable the mobility of researchers across similar structures at different organisations.
- Skills specialists are a source of valuable skills highly in demand from both academia and industry. A joint model of funding between HEIs and funders was proposed to provide financially attractive and competitive salaries for skills specialist scientists in academia.
- Given the relative paucity of opportunities for team science training, an incentive based structure with the implementation of metrics as markers of team science success should be developed and team science training should be embedded as part of employers' core Continuing Professional Development (CPD) programmes.

25. University of Glasgow (2017). *Job Family Role profiles*. https://www.gla.ac.uk/media/media_506090_en.pdf

26. *Ibid.*, 25.

27. <https://mrc.ukri.org/skills-careers/fellowships/skills-development-fellowships/>

28. <https://mrc.ukri.org/skills-careers/interactive-career-framework/>

29. RCUK. *Statement of expectations for technology / skills specialists*. <https://www.ukri.org/files/legacy/skills/soe-technology-skills-specialists/>

30. <http://www.birmingham-nottingham.ac.uk/compare/>

31. *Ibid.*, 30.

A research culture supportive of team science



Employers



Researchers



Publishers



Funders

Research culture and the challenges that it presents was a recurring theme at the event, and was seen to present the greatest barrier to team science across the different stakeholder groups present at the meeting. An individualistic culture is still deeply embedded in research, whereby the collaborative nature of team science causes tension. Opportunities for a more collaborative culture are emerging, including the formation of UKRI and recognition tools in publishing. However, a greater awareness of collaborative actions is required to realise change at the cultural level.

Recommendations

Recommendation from the team science report that focuses on research behaviour



Recommendation 8

Researchers should drive change through their crucial roles as team members, peer reviewers and participants on recruitment, promotion and funding panels.



Contribution Information Framework



Contribution Portfolio



Digital Identifiers



Funding



Interoperability



Leadership



Researcher Responsibility



Team Skills Training

Progress and Opportunities

The Research Excellence Framework (REF)

The upcoming REF assessment in 2021 presents an opportunity to support team science as a whole and was a key topic of discussion during the meeting. Professor John Iredale FRSE FMedSci, Chair of the Research Excellence Framework Main Panel A, shared details of the proposed changes to ensure support and equality for team science submissions (detailed in annex 1). It is hoped that these changes will lead to positive changes in research culture.

Reflections from the REF2014 exercise identified the perception of risk as a barrier to interdisciplinary submissions. Despite this, close analysis demonstrated that no significant difference in the assessment of interdisciplinary submissions was found when compared to others.³² Changes in the support of interdisciplinary research ahead of REF2021, as well as engagement with the research community about the importance of interdisciplinary research submissions will hopefully allay any remaining fears and encourage the submission of all research, including team science projects.

Academic curriculum vitae (CV)

Participants acknowledged that the REF alone is unlikely to be able to combat the barriers to team science embedded in research culture and that a wider approach will be needed. The current research culture programme delivered by the Royal Society is looking to explore how the UK can promote cultural conditions to best support excellent research and researchers.³³ Many of its elements are applicable to team science. In particular, the Royal Society is working towards a novel format for displaying research outputs.³⁴ Outlined in Case study 6, the 'Resume4Researchers' enables non-traditional outputs to be recorded and recognised.

Case study 6: A broad recognition of a researcher's activities

The Royal Society is in the process of developing a 'Resume4Researchers' to summarise an individual's net contribution to science and society.³⁵ Developed as part of its research culture programme, the two page document aims to fulfil the aspiration of many researchers by attributing recognition for all that they do, from peer review to policy engagement. The document will give the opportunity to place outputs in their broader context across four modules in line with a set of guidelines. The ultimate aim is to influence the existing performance indication-based culture of appraisal to a more holistic view.

Future priorities

Possible priorities proposed by participants to enhance research culture included the following:

- Metrics should be developed to offer an incentive to team science participation whereby they could feed into reward mechanisms such as promotion and funding panels.
- To best realise the benefits of the upcoming REF2021 exercise, team science submissions should be encouraged. It is hoped that the adoption and implementation of its new guidelines will have a major impact on the perceived risk associated with team science.
- In support of risk reduction, best practise for team science should be better shared and communicated. The idea of a database was suggested to allow the wider community to learn and benefit from the mistakes and successes of others.
- The risk averse nature of academia contrasts with that of industry where the failure of high-risk research does not affect job security; research is often orientated around team-focused goals; and financial incentives accompany research excellence. It was agreed that academia could learn from industry and move away from the often strict, competitive, and individualistic culture of academia.

32. Digital Research Report (2015). *The Diversity of UK Research and Knowledge - Analysis from the REF impact case studies*. <https://www.digital-science.com/resources/digital-research-reports/digital-research-report-the-diversity-of-uk-research-and-knowledge/>

33. <https://royalsociety.org/topics-policy/projects/research-culture/>

34. <https://royalsociety.org/topics-policy/projects/research-culture/changing-expectations/>

35. *Ibid.*, 34.

Future research will need to respond to ever more complex research questions, and will therefore be increasingly reliant on a team science approach. A recent research challenge that demands a team science approach is that of multimorbidity. The focus of a recent Academy report, 'Multimorbidity: a priority for global health research'.³⁶ Broadly defined as the existence of multiple medical conditions in an individual, there is evidence that a substantial, and likely growing, proportion of the world's adult population is affected by more than one chronic condition. Highly heterogeneous in disease type and cluster, it is not uncommon to observe co-existing mental and physical health conditions. As such, multimorbidity as a research priority spans some of the broadest disciplines in medicine and social science. Consistent with many team science projects, it represents a critical research challenge with the potential to improve the health and wealth of society.

Furthermore, the Grand Challenges outlined in the Life Sciences Industrial Strategy are each multifaceted.³⁷ These include: an ageing society, clean growth, the future of mobility, and artificial intelligence and data. As areas for strategic funding, these challenges are likely to result in an increased need for team science in the UK.

Changes made by the UK's largest funders have the potential to not only provide the infrastructure to explore more complex research questions, but also to influence the research culture to support and recognise individuals undertaking collaborative research. This heightened demand and increase in prevalence of team-based approaches reinforces the value of the 'Team science' report, and is hoped to provide momentum to build on the implementation of the report's recommendations as we move towards 2020.

Professor Anne Ridley FRS FMedSci, co-Chair of the workshop, concluded the meeting by highlighting the remarkable progress that has been made in the attribution of recognition for researchers involved in team science. However, in order to fully capitalise on the progress made, a call to action was shared to maintain momentum in this area. The implementation of recommendations was agreed to be a collective responsibility, requiring a coordination of efforts both nationally and internationally, in addition to buy-in from all stakeholders. Participants thought that goals set out in the team science report for 2020 are realistic and achievable, and serve as a measurable target for the next two years.

36. Academy of Medical Sciences (2018). *Multimorbidity: a priority for global health research*. <https://acmedsci.ac.uk/file-download/82222577>

37. Department for Business, Innovation & Skills (2017). *Industrial Strategy: building a Britain fit for the future*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

Progress, challenges and opportunities: from the perspective of the Research Excellence Framework 2021, Professor John Iredale FRSE FMedSci, Chair of the Research Excellence Framework Main Panel A.

The team science two-year follow up event coincided with an influential time in the development and shaping of the Research Excellence Framework (REF) ahead of the next assessment in 2021. Professor Iredale discussed how best to support team science through the REF, and outlined possible initiatives that support the team science endeavour in the upcoming REF2021 exercise.

Professor Iredale spoke interchangeably about team science and interdisciplinary research, which is largely accepted to align with the team science definition of 'output-focused research involving two or more research groups'.³⁸

Professor Iredale noted that as identified from the REF2014, the major barrier to team science and interdisciplinary submissions was a perception of risk. Indeed, research assessment has been identified as a main driver of some of the more negative aspects of research culture.³⁹ The 'Team Science' report found that various metrics including both the REF and league tables, were commonly viewed as rewarding a single discipline mentality and therefore biasing against team science.

Professor Iredale stressed that higher education institutes should not be deterred from submitting interdisciplinary examples to the REF as all research will be marked equally. In support of this, Professor Iredale outlined some proposed changes to the REF which are supportive of interdisciplinary research.⁴⁰ The changes include:

1. Interdisciplinary Advisers

As proposed by the interdisciplinary research advisory panel (IDAP), a minimum of one interdisciplinary adviser will sit on each subpanel to oversee and participate in the assessment of interdisciplinary research. An 'interdisciplinary identifier' will be built into the submission system to highlight any submissions that fall within the oversight of interdisciplinary advisers.

2. The Environment statement

A more structured and expanded environment statement, accounting for 15% of the total score, will allow for HEIs to detail their approach to submitting interdisciplinary research. Credit will be awarded to practises that have enhanced the vitality and sustainability of the research environment.

3. Decoupling staff from outputs

The number of outputs required for each submission will be determined by the full time equivalent (FTE) of Category A (biomedical sciences) submitted staff. This will offer flexibility to return outputs from across the unit's staff, 1 to 5 outputs for each individual.

Additional changes in support of interdisciplinary research include: a) the submission of all staff with significant responsibility for research; b) a new transitional approach to non-portability of outputs, enabling a submitting unit to include outputs of previous staff formally employed; and c) an open access requirement of all outputs.

38. Academy of Medical Sciences (2016). *Improving recognition of team science contributions in biomedical research careers*. <https://acmedsci.ac.uk/file-download/6924621>

39. Nuffield Council on Bioethics (2014). *The culture of scientific research in the UK*. http://nuffieldbioethics.org/wp-content/uploads/Nuffield_research_culture_full_report_web.pdf

40. https://www.ref.ac.uk/media/1016/draft-guidance-on-submissions-ref-2018_1.pdf

Annex 2

Progress, challenges and opportunities: a funder's perspective, Professor Fiona Watt FMedSci, MRC Executive Chair.

Professor Fiona Watt FMedSci delivered a presentation from the perspective of a funder whilst reflecting on her role as a research leader. Professor Watt spoke largely of the progress and opportunities in funding processes, and the broader support for skills specialists.

Professor Watt noted that platforms such as ORCID to capture and monitor grant and research outputs have been widely adopted to allow the evaluation of contributions to grants. This enables researchers to take ownership of their data to construct multi-purpose portfolios of outputs and impacts. To fully realise their benefit, there is a need to ensure that content is regularly updated to accurately reflect research outputs, and assign recognition to an individual.

Professor Watt highlighted how the 50 word narrative describing author contributions for key publications in grant applications, as implemented by the Wellcome Trust, was an important initiative. Wider adoption across funders could support granularity in assessment.⁴¹

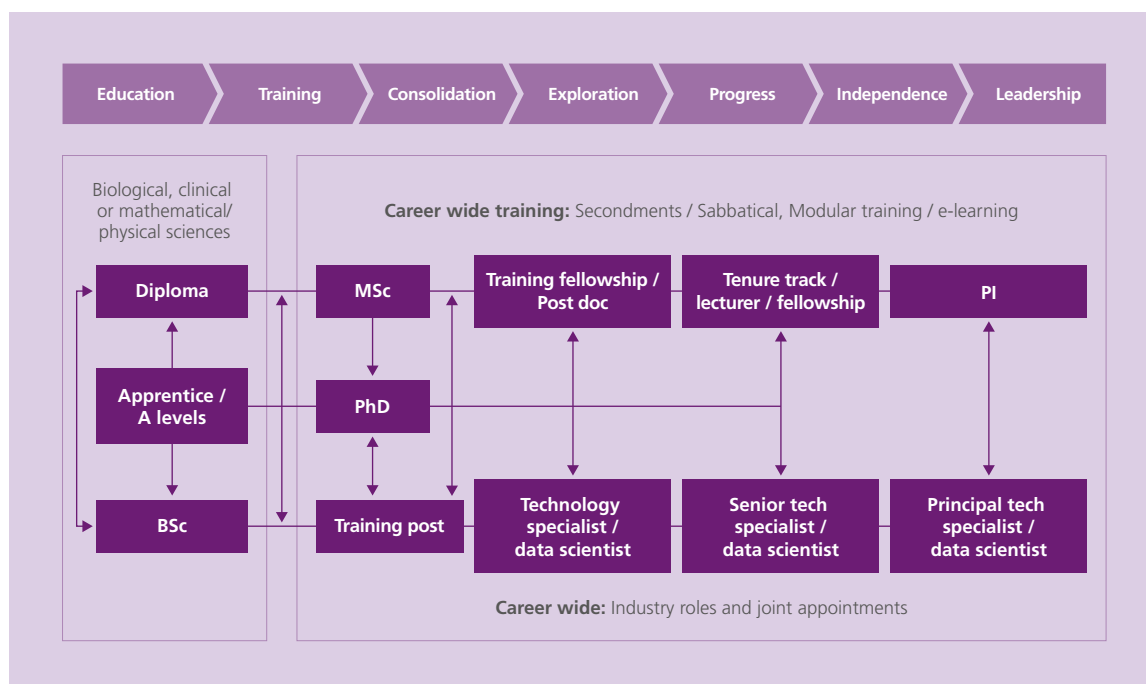
Looking ahead, Professor Watt described how all grants will support team science and spoke of the guidance that has been provided to facilitate budget development for team science projects.⁴² Additionally, to attribute recognition for contributions to grant applications made by early career researchers, a new researcher co-investigator status (RCol) has been introduced by the MRC that supports researchers on their journey to independence.⁴³

In support of team scientists more broadly, a cross-council statement supporting technology and skills specialists was developed in 2017.⁴⁴ The statement outlines expectations for both research organisations and researchers, and is indicative of a desire to implement change in the recognition of skills specialists. In support of the diversity of roles involved in team science, the MRC's interactive career framework now showcases team scientists amongst more traditional scientific roles and career pathways, to improve recognition and recruitment.⁴⁵ Finally, strategic support has been identified as a necessary element for the success of team science research groups. This is an approach that the MRC is applying to projects such as their Stratified Medicine project.⁴⁶ Composed of 17 consortia and 6 nodes, strategic support is necessary to coordinate expertise and to maximise outputs, in addition to offering expertise in the management of consortia.

Although funders are progressing well and opportunities are being both created and embraced, Professor Watt described a number of challenges that still remain.

In order to develop new ways to support all researchers with clear career structures and appropriate recognition and reward, a draft career framework has been developed by the MRC that sets out two career tracks: one being a more traditional 'academic' pathway, the other a more 'technical' specialist route, with flexibility and mobility for researchers (Figure 3). This model builds on the job families developed by the University of Glasgow (Case study 4) and the MRC skills development Fellows that promote the progression of skills scientists.⁴⁷ The model will be tested for its effectiveness at the Health Data Research-UK Institute, before being promoted more widely. It is hoped that this will go some way towards stimulating the cultural and system changes needed for better recognition of, and career support for, interdisciplinary individuals and teams.

Figure 3: Proposed career framework for technologists



Finally, Professor Watt described a series of new funding schemes in development that are supportive of team science and interdisciplinary working, including:

- MRC/NIHR Clinical Academic Research Partnerships, which aims to enable full-time NHS consultants to participate in high quality research with a research-active partner⁴⁸
- UKRI Innovation scholarships, which will aim to enable and promote the circulation of talent between academia and industry.⁴⁹

41. <https://wellcome.ac.uk/sites/default/files/sample-full-app-form-equipment-resources-lps-201803.pdf>

42. <https://mrc.ukri.org/funding/guidance-for-applicants/resources/>

43. <https://mrc.ukri.org/skills-careers/additional-career-support/researcher-co-investigator-rcoi/>

44. Research Councils UK. *RCUK Statement of expectations for technology / skills specialists*. <https://www.ukri.org/files/legacy/skills/soe-technology-skills-specialists/>

45. <https://mrc.ukri.org/skills-careers/interactive-career-framework/>

46. <https://mrc.ukri.org/research/initiatives/stratified-medicine/>

47. <https://mrc.ukri.org/about/institutes-units-centres/uk-institute-for-health-and-biomedical-informatics-research/>

48. <https://mrc.ukri.org/funding/browse/carp/clinical-academic-research-partnerships/>

49. <https://epsrc.ukri.org/funding/calls/epsrcukriinnovationfellowships/>

Annex 3

Progress, challenges and opportunities: an employer's perspective, Professor Dame Anna Dominiczak DBE FRSE FMedSci, Regius Professor of Medicine, Vice Principal and Head of the College of Medical, Veterinary and Life Sciences at the University of Glasgow.

As noted in the Academy's report, *Improving Recognition of Team Science Contributions in Biomedical Research Careers*, there is a unique opportunity for employers to influence research culture within their institution, with the potential to reach researchers across all career stages.⁵⁰ However, participants agreed that limited progress in the support of researchers involved in team science projects has been made.

Professor Dame Anna Dominiczak DBE FRSE FMedSci described the development of a pioneering new career pathway to support skills specialists, who are central to much of team science.

The recent increase in team science projects has led to the formation of specialist research and scientific support roles, distinct from the traditional academic career track (often termed the 'PI track'). Typical areas of expertise include statistics, bioinformatics and data science- skills highly coveted by both academia and industry. Professor Dominiczak noted that to date, the lack of career structure for these roles in academia has resulted in challenges for recruitment and retention of staff, especially given that similar rewarding and flexible career paths exist in industry.

To overcome this issue, the University of Glasgow has now developed a fair and transparent progression process for traditional researchers and skills specialists alike: the Job Family Profiles (see Figure 2). These are groups of jobs which share similar characteristics and undertake similar work, while the level of skills, competency and responsibility differ between each level. Role profiles are used to match posts to levels within job families and, ultimately, to grades on the single pay spine.⁵¹ Looking ahead Professor Dominiczak highlighted that they aim to extend all job families to a grade equal to professorship.

Professor Dominiczak noted that team science projects often carry a greater risk, which is often perceived as a barrier to participation as researchers are concerned by the potential damaging effect it might have on their career. Participants agreed that academia could learn from industry and develop mechanisms to decouple risks from career progression and incentivise team science.

Outstanding challenges discussed include how to provide competitive salaries to skills scientists in order to retain talent and remain competitive against industry; with a collaborative solution between funders and universities proposed. In addition to this, participants called for similar structures across the UK, to enable mobility of talent and to further build the skills specialist careers pathway.

50. Academy of Medical Sciences (2016). *Improving recognition of team science contributions in biomedical research careers*. <https://acmedsci.ac.uk/file-download/6924621>

51. University of Glasgow (2017). *Job Family Role profiles*. https://www.gla.ac.uk/media/media_506090_en.pdf

Progress, challenges and opportunities: a publisher's perspective, Dr Veronique Kiermer, Executive Editor, Public Library of Science.

In June 2016, PLOS mandated the use of the contributor roles taxonomy (CRediT), which functions to attribute recognition for the roles undertaken by each of the named authors on a given publication. CRediT has since been adopted by over 100 journals worldwide, signalling both a need for, and widespread support for, recognition tools. Importantly, CRediT information if implemented well in the publishing system is both human and machine readable. By automatically feeding CRediT information into a researcher's ORCID profile, this advance could offer the potential to reliably link author records to publications, capture author contributions in the journal's metadata, and track an individual's authorship contribution across publications over time.⁵²

Dr Kiermer noted that CRediT roles provide less detail than free text contribution statements available in some publications. However, they are far more visible and in the future there may be the opportunity to expand the list of contributions beyond the agreed 14 roles, to capture wider details and include fields from other disciplines. Expanded contribution information could also be captured in the acknowledgements section, or in a separate statement.

In a research environment where first and last authorship is still highly regarded, although CRediT does not fully resolve discrepancies surrounding authorship, it provides a much needed opportunity to attribute recognition. If adopted widely enough, it could offer consistency between disciplines to mitigate differences in publishing culture.

Dr Kiermer described how ORCID has been widely adopted in the two years since the release of the Team Science report.⁵³ An open letter was signed by a coalition of publishers in 2016, committing to implement best practice for ORCID collection, to auto-update ORCID records upon publication, to mandate ORCID for corresponding authors, and to encourage ORCID for co-authors. 55 publishers are now signatories of which 21 have completed implementation.⁵⁴

To incentivise best practise across all publishers, the National Academy of Sciences has created a Transparency in Author Contributions in Science (TACS) webpage to track publishers' requirements for authorship contribution information, as well as the uptake of CRediT and ORCID.⁵⁵

Dr Kiermer highlighted existing projects to improve interoperability between these recognition platforms to increase the diversity of information captured and to decrease the administrative burden associated with maintaining multiple platforms. For example it is now possible to automatically update an individual ORCID with new publications via Crossref and DataCite. DataCite works to assign a Digital Object identifier (DOI) to datasets and other research objects so that these can be shared, cited, managed, discovered and connected to journal articles.⁵⁶ Whereas Crossref works primarily with the publishing community to assign DOIs to articles.⁵⁷

The ORBIT (ORCID Reducing the Burden and Improving Transparency) project is currently underway to expand ORCID's scope beyond publishers. The aim of the collaborative project between funders and ORCID is to facilitate grant applications and grant reports by using ORCID as a data source to simplify reporting on grants and publication history.

ORCID has implemented expanded affiliations beyond publishers to capture the breadth of research impacts and outputs. Recent inputs include invited positions and distinctions, and activity such as reviewers and editors of publications. Increasing the scope of ORCID further, a pilot is underway to capture and collate the research activity of a facility. A comprehensive understanding of facility use could benefit both the organisations funding the facility, and the facility itself by better understanding the impact on research outputs.⁵⁸

To capitalise on this progress, future priority areas outlined by Dr Kiermer include increasing the uptake of both CRediT and ORCID to cover the majority of journals; encouraging a greater uptake of ORCID for middle authors who rarely interact with submission systems; and increasing the uptake for the Crossref-mediated auto-update of ORCID records upon publication, currently only at a 42% uptake rate where offered.

52. McNutt M, et al. (2017). *Transparency in authors' contributions and responsibilities to promote integrity in scientific publication*. PNAS **115**, 2557-2560
53. Academy of Medical Sciences (2016). *Improving recognition of team science contributions in biomedical research careers*. <http://acmedsci.ac.uk/file-download/6924621>
54. <https://ORCID.org/content/requiring-ORCID-publication-workflows-open-letter>
55. http://www.nasonline.org/about-nas/Transparency_Author_Contributions.html
56. <https://www.datacite.org/>
57. <https://www.crossref.org/>
58. <https://ORCID.org/blog/2017/12/07/using-identifiers-capture-and-expose-facilities-use>

Progress, challenges and opportunities: the National Institute for Health Research's perspective, Professor Andrew Farmer, Professor of General Practice, University of Oxford.

Professor Andrew Farmer, Professor of General Practice, University of Oxford, spoke on behalf of the NIHR Team Science Catalyst Group, a 'bottom-up' group of individuals representing the breadth of NIHR activities. Professor Farmer described how NIHR has been funding and supporting team science projects for a number of years. However, he noted that NIHR could still do more to improve the attribution of credit. In particular, he noted that the evolving nature of research teams provides an opportunity to move away from the hierarchical team structure, and to re-evaluate responsibility and credit in the process.

Professor Farmer outlined NIHR's ongoing activities that are supportive of team science. These include:

- The NIHR Academy: NIHR's academic training and personal awards are being integrated into a new, more cohesive academic structure, with a more harmonised support system to award holders, and mechanisms to equip team scientists with appropriate team skills.⁵⁹
- Programme Grants for Applied Research support multidisciplinary research teams: This existing scheme delivered by NIHR supports mixed cross-discipline research teams through a programme of support that promotes effective team working.⁶⁰
- Research for Patient Benefit (RfPB): This scheme encourages early career researchers to apply as a co-investigator. This enables researchers to gain experience and recognition for themselves whilst the funding panel judges the team as a whole. By ensuring that the necessary skills are present amongst the team's constituent researchers, the chance of success is maximised.⁶¹
- Updated application form: In support of multidisciplinary schemes, the application process now incorporates a focus on the research team rather than a single researcher. There is a requirement to specify the roles of the lead and co-applicants and contributions by all team members and collaborators, while new supervisory arrangements for early career researchers have also been introduced.

Collaborative NIHR infrastructure was described by Professor Farmer, illustrating its extensive capacity to action change in team science. The NIHR's BioResource for Translational Research in Common and Rare Diseases (NIHR BioResource), a national resource of patients and the public searchable by genotype and phenotype, is a good example of this.⁶² Spanning 13 collaborative centres and 100,000 volunteers, this resource promotes multidisciplinary and team working.

The NIHR is unique in that it functions as an employer, funder and publisher. Professor Farmer noted that NIHR journals have implemented ORCID in addition to welcoming contribution information in the acknowledgements.⁶³ Work is underway to optimise how contributions are presented, in addition to how standardised fields can best be used for the collection of information, and the way that a standardised format can analyse data linkage with ORCID.

59. <https://www.nihr.ac.uk/our-research-community/documents/TCC-NIHR-Strategic-Review-of-Training-2017.pdf>

60. <https://www.nihr.ac.uk/research-and-impact/research/nihr-studies/programme-grants-for-applied-research.htm>

61. <https://www.nihr.ac.uk/funding-and-support/funding-for-research-studies/funding-programmes/research-for-patient-benefit/>

62. <https://cambridgebrc.nihr.ac.uk/expandables/nihr-bioresource/>

63. <https://www.journalslibrary.nihr.ac.uk/hta/#/>

Challenges and opportunities: the formation of UKRI, Sir Mark Walport FRS FMedSci, Chief Executive of UK Research and Innovation.

Sir Mark Walport FRS FMedSci, Chief Executive of UK Research and Innovation (UKRI) presented the keynote talk with a forward facing perspective on the opportunities for UK research and team science. Sir Mark began by emphasising the increasingly present need to tackle emerging challenges from a team perspective, highlighting examples such as the success of combating the recent Ebola epidemic by biologists and anthropologists working together as a team. He also spoke of the evolving nature of science, as disciplines are converging to tackle complex research questions.

Uniting the research councils, the formation of UKRI is helping to propel team science to the top of many research agendas. The shift to a more collaborative model of funding research by the UK's largest funder, and the breaking down of silos between research councils, presents a great opportunity to support team science and to recognise team scientists.

Sir Mark stated that a lack of recognition was often viewed as the biggest barrier to team science, with the existing recognition structure based to a great extent on first and last authorship. It was agreed that this could only be truly overcome by a shift in culture at the level of the individual research group, the department and the research institute. Sir Mark spoke of the need for incentives to encourage collaboration across existing boundaries. Academia has a lot to learn from industry, where collaboration is often orientated around team goals, with associated team rewards.

Sir Mark highlighted that existing funding models lack flexibility to build teams; that the provision of training in leadership and management is insufficient; that inadequate support is offered by funders and employers; and that inconsistencies exist in communication between disciplines. Although these challenges are longstanding, UKRI presents an unprecedented opportunity to break down these barriers and implement simplified working across the research councils.

Sir Mark noted that the increasing UKRI budget towards £8 billion has been met with expectations to deliver economic impact and social prosperity, a challenge that cannot be met without the recognition that team research is typically international, as well as that people and talent at all stages are crucial. UKRI is supportive of team science, but acknowledges that attaining its full potential is a major undertaking.

To galvanise team science, Sir Mark outlined the cross-cutting funding activity supported by UKRI that spans disciplines and nations to foster a culture of team approaches. These include:

- The Industrial Strategy Challenge Fund, which brings together leading research and business to raise productivity and earning in the UK.
- The Strategic Priorities Fund, which will ensure that strategically important research and innovation that is not aligned with other funding programmes can seek direct support.
- The Global Challenges Research Fund, which supports research to address the challenges faced by developing countries.⁶⁴

The ultimate key to the success of team science and the receipt of recognition for researchers is cultural change. Beyond their role as a funder, UKRI is calling on institutions to promote collaboration, and to recognise and reward people for their successes in order to drive a wider cultural change. Although the most complex and ultimately most difficult area to drive change, it is evident that UKRI is intent on actioning change. It is hoped that a domino effect will ensue as a result of coordinated activity across the wider stakeholders.

64. <https://www.ukri.org/research/global-challenges-research-fund/>

Annex 7

Agenda

Wednesday 6 June 2018, 10.00 – 17.00

Academy of Medical Sciences, 41 Portland Place, London, W1B 1QH

Wednesday 6 June 2018, 10.00 – 17.00	
10.00 – 10.30	Registration
10.30 – 10.45	Welcome and introduction <ul style="list-style-type: none">• Professor Philippa Saunders FMedSci, Team Science Working Group, Academy of Medical Sciences Registrar• Professor Anne Ridley FMedSci, Chair Team Science Working Group
10.45 – 11.15	REF2021 and Team Science <ul style="list-style-type: none">• Professor John Iredale FRSE FMedSci, Chair REF Main Panel A
11.15 – 13.00	Presentation: MRC's interest and future plans <ul style="list-style-type: none">• Professor Paul Elliott FMedSci, Chair, MRC Population and Systems Medicine Board
12.00 – 13.30	Team Science: Progress <p>The aim of this session will be for stakeholders to respond to the report's recommendations, identify what has improved in the past two years and share case studies of good practice.</p> <ul style="list-style-type: none">• Professor Fiona Watt FMedSci, MRC, Executive Chair• Professor Dame Anna Dominiczak DBE FRSE FMedSci, University of Glasgow, Regius Professor of Medicine, Vice Principal and Head College of Medical, Veterinary and Life Sciences• Dr Veronique Kiermer, PLOS, Executive Editor• Professor Andrew Farmer, Professor of General Practice, University of Oxford, NIHR Catalyst Group
13.00 – 14.00	Lunch
14.00 – 15.15	Breakout groups: Challenges and opportunities in team science <p>The aim of this session will be to balance challenges with discussion of identifying and harnessing opportunities.</p>
15.15 – 16.00	Plenary session <p>This session will bring together all stakeholders to share key points from each of the breakout groups and to consider where we can have most impact in the next few years, particularly in the run-up to REF2021.</p>
16.00 – 16.20	Refreshment break
16.20 – 16.45	Keynote lecture <ul style="list-style-type: none">• Sir Mark Walport FRS FMedSci, Chief Executive of UK Research and Innovation (UKRI)
16.45 – 17.00	Questions and summary

Participant list

Co-Chairs

Professor Anne Ridley FRS FMedSci, Head, School of Cellular and Molecular Medicine, University of Bristol
Professor Philippa Saunders FMedSci, Director of Postgraduate Research, University of Edinburgh

Speakers

Professor Dame Anna Dominiczak DBE FRSE FMedSci, Regius Professor of Medicine, Vice Principal and Head College of Medical, Veterinary and Life Sciences, University of Glasgow
Professor Andrew Farmer, Professor of General Practice, University of Oxford
Professor John Iredale FRSE FMedSci, Pro Vice Chancellor (Health), University of Bristol
Dr Veronique Kiermer, Executive Editor, Public Library of Science
Professor Fiona Watt FRS FMedSci, Executive Chair, Medical Research Council
Sir Mark Walport FRS FMedSci, Chief Executive Officer, UK Research and Innovation

Participants

Dr Liz Allen, Director of Strategic Initiatives, F1000
Dr Caroline Aylott, Head of Research Awards, Arthritis Research UK
Ms Harriet Barnes, Head of Policy, British Academy
Dr Mark Bass, Lecturer, University of Sheffield
Dr Colby Benari, Head of Academic Careers Office, School of life and Medical Sciences, University College London
Dr Theodora Bloom, Director, BMJ
Dr Annette Bramley, Director, N8 Research Partnership
Mr Fergus Brown, Head of HR, University of Glasgow
Ms Christine Campbell, Head of Research and Impact, University of Liverpool
Mr Andrew Clark, Director of Programmes, Royal Academy of Engineering
Dr Anne-Marie Coriat, Head of Research Careers, Wellcome Trust
Dr Lisa Cotterill, Director for the NIHR Trainees Coordinating Centre, National Institute Health Research
Dr Andrew Croydon, Head of Education and Academic Liaison, the Association of the British Pharmaceutical Industry
Professor George Davey-Smith FMedSci, Professor of Clinical Epidemiology, University of Bristol
Dr Ritu Dhand, Editorial Director, Nature
Dr Frances Downey, Senior Policy Advisor, Royal Society
Professor David Dunger FMedSci, Professor of Paediatrics, University of Cambridge
Dr Amy Foulkes, Academic Clinical Lecturer in Dermatology, University of Manchester
Professor Kim Graham, College Dean for Research, Cardiff University
Professor Laura Green, Deputy Pro Vice Chancellor for Research, University of Warwick
Dr Laurel Haak, Executive Director, ORCID
Professor Harry Hemingway, Director, Farr Institute
Dr Michelle Heys, Senior Academic Clinical Lecturer in Community and Population Child Health, UCL
Professor Margaret Johnson, Academic Vice President, Royal College of Physicians
Dr Sawsan Khuri, Honorary Senior Lecturer, University of Exeter, and Collaboration Consultant, University of Exeter
Professor John Ladbury, Faculty Dean of Biological Sciences, University of Leeds
Ms Charlotte Lester, Head of Research Culture, Research England
Professor Derek Mann FMedSci, Dean of Research and Innovation, Newcastle University
Dr David McAllister, Associate Director- Research and Innovation Talent, Biotechnology and Biological Sciences Research Council

Dr Liz Philpots, Head of Research and Impact, Association of Medical Research Charities
Dr Natalie Poulter, Research Fellow, University of Birmingham
Dr Dani Preedy, Assistant Director, Editorial & Impact, National Institute of Health Research
Professor Caroline Relton, Professor of Epigenetic Epidemiology, University of Bristol
Dr Simon Richardson, Clinical Lecturer in Haematology, University College London
Dr Joanna Robinson, Head of Capacity and Skills, Medical Research Council
Dr Peter Rodgers, Features Editor, eLife
Dr Carol Routledge, Director of Research, Alzheimer's Research UK
Professor Hazel Scott, Dean of Medicine, University of Liverpool
Dr Eva Sharpe, Senior Policy and Engagement Manager, Institute of Cancer Research
Dr Andrew Sugden, Deputy Editor, AAAS
Ms Kelly Vere, Higher Education Engagement Manager, Science Council
Dr Simon Vincent, Director of Research, Breast Cancer Now
Professor Steve Watson FMedsci, British Heart Foundation Professor, University of Birmingham
Dr John Williams, Managing Director, Birmingham Health Partners
Dr Louise Wood, Director of Science, Research and Evidence, Department of Health and Social Care
Dr Jeanette Woolard, Associate Professor in Cardiovascular Pharmacology, University of Nottingham
Dr Anna Zecharia, Director of Policy and Public Affairs, British Pharmacological Society
Professor Eleftheria Zeggini, Group Leader, Wellcome Sanger Institute

Academy Staff

Dr Suzanne Candy, Director of Biomedical Grants and Policy, Academy of Medical Sciences
Mr Joseph Clift, Policy Manager, Academy of Medical Sciences
Dr Claire Cope, Policy Manager, Academy of Medical Sciences
Mr James Drew, Policy Intern, Academy of Medical Sciences
Mr Alberto Lazari, Policy Intern, Academy of Medical Sciences
Ms Ruth Lowe, Programmes Officer, Academy of Medical Sciences
Dr Rachel Macdonald, Head of Programmes, Academy of Medical Sciences
Dr Amy Slater, Policy Officer, Academy of Medical Sciences
Dr James Squires, Policy Officer, Academy of Medical Sciences



Academy of Medical Sciences
41 Portland Place
London W1B 1QH

 @acmedsci

+44 (0)20 3141 3200
info@acmedsci.ac.uk
www.acmedsci.ac.uk

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