Academy of Medical Sciences 'Team science' Working Group

Call for evidence Questions

Please ensure that you have read the notes and guidance before completing this form.

Thank you for taking the time to answer these questions. The value of your answers is greatly increased if you are able to elaborate on any points you make, and provide illustrative examples wherever possible.

A note on our definition of 'team science': For the purposes of this project, 'team science' is defined as any team-based research involving two or more research groups (even if they are all within the same institution) that aims to result in an academic publication or other research output.

A note on individual respondents' anonymity: Only the Secretariat will see your response in full. We will provide the Working Group members with, and publish, only anonymised quotes and aggregate information regarding individuals' responses. The Secretariat would only de-anonymise your response if we have obtained your explicit permission.

Please make your answers as short or as long as required. Please return the completed form to teamscience@acmedsci.ac.uk by the end of (midnight on) Friday 7 November 2014.

*** Mandatory fields**

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Is this evidence submitted as an organisational or individual response?*

Organisational response on behalf of The Institute of Cancer Research, London

1. What are the drivers for the increasing importance and growth of 'team science'?

Scientific drivers

Scientists now increasingly appreciate that the most challenging research problems are only going to be solved through a team science approach. Today's complex scientific challenges will only be met by multidisciplinary team working drawing together diverse skill sets, expertise and ways of working. Researchers working independently do continue to make big discoveries, but most major advances are these days made by teams of scientists – no one individual or team can have a full understanding of all the different techniques required. At the most basic level, biomedical research often requires collaboration between 'wet' and 'dry' lab work. Drug discovery work needs complex team science approaches combining biology, pharmacology, medicinal chemistry, clinical expertise, maths and computing.

Academic drivers

It is increasingly important that scientific organisations can demonstrate impact of their research on society as a whole. Translating scientific discovery into societal impacts requires a collaborative, team science approach, between scientific, technological and clinical disciplines, between academic organisations, and between academia, industry and government. The ICR's mission is to make the discoveries that defeat cancer, and to deliver benefits for patients we have long embraced the need for a collaborative, team science approach. Academia more generally is now also increasingly focused on translational research, driven in part by the requirements set out in the REF for institutions to provide evidence of the impact of their research on society.

Funding drivers

There has been a significant reduction in the amount of funding available from governments and charities since the global financial crisis and funders have increasingly been interested in how they can spend resources on research more efficiently. Funders have begun shifting to models where resources are concentrated into centres of excellence and where costs are shared between research groups. Some funding streams now specifically specify work that must be done with partners – such as the ICR's grant for becoming a Movember Centre of Excellence, for instance.

International drivers

Research is global, and there are concerns that if researchers here in the UK don't participate in team science then we will lose out to other nations who already do. We have an opportunity to learn from other nations, such as the US, where the team science model is more widely used. The National Institutes of Health has used a team science funding model over the past decade, and the National Cancer Institute hosts a Team Science Toolkit featuring team science-related articles, tools, calls for evidence and jobs.

2. What are the barriers to the further growth of 'team science'?

Structural barriers

Academic research organisations have failed to properly align their reward and recognition systems to incentivise team science. Organisations tend to reward and recognise researchers who are successful under the Principal Investigator (PI) model of science, with an over-reliance on outdated first/senior authorship attributions. There is also too much emphasis on publication in leading journals ahead of delivering impact for research through collaborative, translational approaches. Junior researchers often feel their career progression depends on producing papers that are demonstrably their own, and that tends to discourage them from becoming highly collaborative early in their careers.

The whole structures of institutions can also act as a barrier to multidisciplinary collaborations, with research divided into traditional teams/ departments and reinforced by architecture, management structures, and social spaces.

Cultural barriers

Science has traditionally been a competitive and individualist pursuit, with researchers aiming to establish themselves as intellectual leaders rather than flexible collaborators. Academic career progression is geared towards recognition of first and last authors on papers and PI on grant proposals.

There can be challenges in integrating the perspectives of different academics or academic disciplines within a collaborative approach. The time cost of 'maintenance' activities such as meetings, negotiation and conflict resolution can be an additional barrier.

It can be difficult to communicate effectively across organisations and research disciplines, particularly as researchers from different specialisms speak different 'languages of research', and so communication takes time and requires people to facilitate interactions. The reinforcement of niche sub-disciplines in journals and publications leads to less, not more, collaboration.

Funding barriers

Team science requires a stable pool of funding across multiple collaborators, but only rarely do researchers have access to such a funding model. Funding structures are built around single projects and research grants are often given to individual teams and for short periods of time, leaving team science initiatives facing multiple points of jeopardy as they attempt to stitch resources together. The ICR has found the funding model provided for its Cancer Research UK Cancer Therapeutics Unit particularly effective at encouraging team science. The unit receives long-term financial support from Cancer Research UK for the whole project portfolio, with resources managed at the discretion of the Director. But this model is only rarely available in academia and requires exceptional leadership.

Infrastructure

It can be a challenge to provide the facilities and infrastructure required to support team science projects across multiple teams within an organisation, and in particular across multiple external collaborators. There are particular difficulties in establishing the systems and process for

sharing data across collaborators and ensuring long-term access to data. We recommend that a dedicated working group is set up to address this topic.

3. What are the incentives and disincentives for the broad research community in fostering and developing 'team science'?

3a. Incentives

Team science allows scientists to tackle the big problems in their fields, to do more complex research that any individual team would have the skills and knowledge to do, and to meet scientific goals that would not be achievable if they were working on their own. Working in collaborative, goal-orientated projects can also allow researchers to make progress in their research more quickly and more efficiently than would otherwise be the case, with research conducted in an integrated way rather than sequentially. Collaborations can also allow research risks to be shared across several partners, while shared services can bring equipment costs down.

3b. Disincentives

The disincentives for taking part in team science occur largely at the individual researcher level. For the research community in general, the main disincentive is that the sector will need to overhaul the entire academic research system to remove these disincentives for researchers. Organisations will need to better align the risk and reward systems for scientists with institutional aims, and provide training, performance management and leadership structures that are designed to support team science.

Other disincentives that we identified include the costs of maintenance activities such as resolving conflicts and negotiations, as well as discussions around Intellectual Property, Material Transfer Agreements, and Information Governance.

There is also the potential less motivated or competent staff to be carried along by the rest of a wider team and Team Leaders may not be equipped to manage and lead across teams and organisations. PIs are used to operating within and having control of their own teams rather than following the lead of others. It is also harder to form an ideal grant panel with appropriate expertise for transdisciplinary grant applications.

4. What are the incentives and disincentives for the individual researcher in taking part in 'team science'?

4a. Incentives

The greatest incentive for taking part in team science is that researchers can have great impact with their research that would otherwise be possible. There is also greater speed of progress of research within team science, the ability to achieve more, tackle bigger problems and be more competitive. Team science can give the opportunity to publish high-quality research that would not be possible without valuable contributions from the wider team.

There is also the potential to access other skills, techniques and resources outside a scientist's own field and to learn from peers. Our researchers also highlighted that working in a multidisciplinary team provides a support network, a feeling of inclusiveness and the potential for work to be more fun.

4b. Disincentives

For individuals, the main disincentives that we have identified focus on reward and recognition, and this is a problem at all stage of a researcher career. As researchers get more senior, they have to compete for fewer jobs at the level above, and that can intensify the pressure to claim work as their own. Junior faculty are often advised that the only way to get tenure is to get senior author papers in high-impact journals. Mid-term faculty will be seeking recognition such as Professorships and later stage faculty will be looking for esteem measures such as FMedSci and FRS, which may not reward team science.

Researchers express concerns about not receiving appropriate recognition for contributions to papers and grants, and how this will affect their career progression in the academic system. They also worry that more pushy team members can gain recognition at the expense of more reserved colleagues who also make valuable contributions, and fear being pushed to have 'generalist knowledge' rather than acting as an independent specialist.

Researchers may feel that their institutions do not do enough to support them in carrying out team science, and that there isn't a culture to promote this way of working. There may, for example, be a lack of models and mentors. It may be frustrating for individual researchers to see disparities or inequalities in implementation of team science within or between organisations.

The amount of time required to pursue successful team science projects may be off putting - good collaboration takes communication, lots of time and frequent compromise. This can be a particular barrier to those have who have had dysfunctional team experiences in the past, particularly when Team Leaders may not be experienced at managing and leading across teams and organisations.

5. We have identified four key stakeholder groups in which we seek to influence policy and practices: researchers, publishers, employers and funders - including those funders undertaking research assessment exercises. Please select all of the stakeholder groups below that apply to you as you provide this response.

Employer

5E1. Do you employ individuals whose research activity is mostly and/or entirely 'team science'? If so, please provide examples.

Team Science is a major part of the ICR's overall activity.

Multidisciplinary team science has been a central element of our successful drug discovery work over many years, with a team from the ICR and The Royal Marsden winning the AACR Team Science Award in 2012 for work in drug discovery and development. The team is unusual, if not

unique, in academic cancer research in the scale of the investment in innovative drug discovery and development, involving 15 senior team members and around 280 research staff overall. The team brings together the wide range of skills that are necessary for modern preclinical drug discovery and clinical development, namely: basic and translational cell and molecular biology, tumour biology, medicinal chemistry, high-throughput and fragment-based screening, structure-based drug design, computational biology and chemogenomics, pharmacokinetics and metabolism, predictive and pharmacodynamic biomarker science, clinical pharmacology and phase I clinical trials expertise. We are particularly careful to make effective and well integrated collaborative links between the key interfaces, for example between basic research and the initiation of drug discovery on a new target and between drug candidate selection and entry into clinical trials.

The ICR has also recently launched a new Centre for Cancer Imaging which uses cutting-edge imaging techniques to understand cancer's development and response to treatment as a means of accelerating the discovery of new therapies. The centre houses 130 imaging researchers from a range of disciplines and will use a multi-modality imaging approach, where researchers combine different techniques such as MRI and ultrasound – providing greater depth and breadth of knowledge than use of a single imaging technique alone.

In addition, other centres within the ICR which employ a team science model include:

- The Breakthrough Breast Cancer Research Centre
- Movember's London Prostate Cancer Centre of Excellence
- ICR Clinical Trials and Statistics Unit

5E2. What mechanisms exist that enable you as an employer to evaluate 'team science' research activity as part of the research 'track record' of individuals seeking employment or promotion?

The ICR's promotion, appraisal, academic title, and salary enhancement criteria all seek to actively recognise those involved in team science and collaborative approaches. For example the assessment criteria for our faculty member appraisals include 'strengthening the links between lab-based and clinical researchers to develop novel therapies'.

5E3. If your organisation has such mechanisms in place: How were they developed? How were (and are) they implemented? How are the mechanisms communicated to job applicants and decision makers (e.g. members of promotion panels)? How have you evaluated the impact they have had? How could they be improved? What more could be done?

We have clear and transparent policies and procedures and set clear expectations for staff at the ICR. These policies and procedures are discussed openly across the organisation, including at interview and events such as the ICR's Faculty Retreat. All organisational management committees such as the Board of Trustees, Management Executive, Integrated Risk and Performance Committee include representatives from across disciplines. Our search and tenure panels are multidisciplinary.

We have not yet formally evaluated the impact of our processes but we will be examining them as part of a several workstreams that have recently been established. We are keen to examine whether our processes could be even clearer and more transparent, whether there is more they

could do to promote team science, and whether they are being implemented consistently across the organisation.

5E4. If you are not aware of any such mechanisms in your organisation, what are the barriers to their development?

Not applicable

5E5. What mechanisms could feasibly be developed and implemented in the future to capture this activity for recruitment and promotion in organisations that employ researchers?

Team science is vital to the work that we conduct here at ICR. Our Interim Chief Executive, Professor Paul Workman, is personally sponsoring a workstream aimed at ensuring that the ICR does more to encourage team science and recognises the contributions of those who have driven discoveries and their translation to patient benefit through collaboration.

The ICR's Appraisal Scheme is currently being reviewed with an intention to link contribution with pay. We are exploring mechanisms to align reward and recognition to team science.

The ICR is developing methods for evaluating team science projects, learning from them, and assessing and recognising individual contributions. We believe more training will be required in the specific skills which support team science including managing people in teams as well as complex trans-disciplinary technical management skills, communication, milestone-setting, problem-solving, decision-making, cross-disciplinary research data integrity audit, and conflict resolution.

As an Athena SWAN charter member, the ICR is concerned about how to develop a team science approach while maintaining and promoting a culture of equality and diversity. Research indicates that diverse teams can have positive benefits to research outputs and quality, but some studies indicate that men are more likely than women to be the central nodes in a network and thus more likely to lead team science projects as these require strong networks. There may be areas in which we should take care to ensure equity of opportunity, for example in promotion and career development and leadership of team science projects.

5E6. Do you have any additional comments?

Additional areas where the ICR is working to support team science include:

Appointments and promotion – We have joint appointments with other organisations like The Royal Marsden and Imperial College London to foster collaboration across organisations. We also have visiting appointments, allowing leading researchers from around the world to engage with researchers at the ICR. Our search and tenure panels are always multidisciplinary.

Training and development – We provide researchers with training in skills to support team science such as project management, managing conflict, and influencing.

Fostering collaborations – The ICR runs various events to foster collaborations and team science across the organisation, including a 'collaboration speed dating' event for postdocs to identify potential cross-discipline collaborations, annual faculty retreats, and cross-disciplinary staff groups such as the Career Development Faculty, PostDoc Association and Scientific Officer Association. The Pathways to Independence Programme brings together postdocs from across different organisations and disciplines.

Communication and spreading best practice – The ICR communicates about its multidisciplinary work, team science approach, how it works with partners and the awards that we have received in this area through a series of outlets including case studies, blogs, our website and the media in order to spread best practice, as well as celebrating successes internally.

Infrastructure – The ICR allocates funding for technical infrastructure to support team science across the organisation. We audit how this is implemented across the organisation and will continue to do so.

6a. As stated before, we identified four key stakeholder groups in which we seek to influence policy and practice: researchers, publishers, employers and funders including those funders undertaking research assessment exercises. Would you exclude any of these groups, or include any others?

Other relevant groups that you might want to include in this project are industrial and NHS partners who work with academics, start-ups and spinoffs from academic research, and organisations that provide recognition of esteem such as the Royal Society, and the AMS itself.

6b. Can you list these groups (and any that you have added) in order of priority (highest to lowest)?

The four groups you have identified are all very important. They closely interact and affect the behaviour of others so it will be important to influence the behaviour of all of them.

7a. What is being done by researchers to assist themselves to gain appropriate recognition for their contributions to 'team science' projects? What more do you think they could reasonably do?

Researchers need to buy into the cultural shift towards team science and try to take all opportunities to highlight work that they are doing in this area.

Individual researchers could include their contribution to team science projects in their appraisal documents, on their CV, in their academic biographies and in presentations about projects they're involved in.

7b. What is being done by funders to assist individual researchers to gain appropriate recognition for their contributions to 'team science' projects? What more do you think they could reasonably do?

Some funders do recognise and support individuals who participate in team science, but there is more funders can do to recognise individuals' contributions, and to fund and support team science projects.

Cancer Research UK, for example, offers prizes for team science which raise its profile as an endeavour and can be motivational for researchers who are working in teams.

We feel that funders could do more to ensure team science grant applications are assessed by scientists who actually have themselves gained experience of successful team science.

Funders could also assist in in career development activities to promote team science including those focused on managing people in teams, complex trans-disciplinary technical management skills, communication, milestone setting, problem solving, decision making, cross-disciplinary research data integrity audit, and conflict resolution. Funding for mentoring schemes in team science would also helpful. Researchers joining academia from industry often have strong team science skills so funding schemes which increase mobility and permeability would also be beneficial.

There is a move towards funding aimed at team science and at collaborative programmes. Funding for projects at large scale and for a long term is important for allowing optimum management of projects. Successful transdisciplinary science, for example drug discovery, usually takes time to establish and is more suited to five-year funding cycles than three-year cycles.

Flexible funding for multiple projects allows for appropriate resourcing and where necessary termination of projects and transfer of resources to new opportunities. This has worked well in the ICR's CRUK Cancer Therapeutics Unit, but is only achievable because of its long-term financial support in the form of a large single grant from Cancer Research UK for the whole project portfolio. The approach also requires strong leadership.

It is also important that funders support the technical infrastructure that is essential to underpin team science and which can be a challenge to fund outside of non-core funded institutes. Pump prime funding to set up large team science projects may also be useful.

7c. What is being done by publishers to assist individual researchers to gain appropriate recognition for their contributions to 'team science' projects? What more do you think they could reasonably do?

Several publishers, such as Nature journals and PNAS, provide a note on the individual contributions of each named author. This is not very common across journals though and could be adopted as standard practice. Appropriate recognition for intellectual/technical input to specialist aspects of a paper should be considered, and journals could also allow for multiple corresponding authors.

Thank you very much.

We are passionate about facilitating individual researchers to participate in team science.

We very much appreciate the time and effort you have made in answering these questions. Your input will help us better understand this issue, so that we can work to inform future policy in this direction.

Publication and attribution of your responses

The Academy reserves the right to:

- Publicise information about who has responded.
    - For organisational responses, this would be limited to the name of the organisation.
    - For individuals' responses, this would be limited to anonymous aggregate data such as the career stages and host institutions of respondents.
- Publish any responses submitted:
    - For organisational responses, this will be in full and not in an anonymised form, unless you have obtained approval from the Lead Secretariat, Dr Richard Malham.
    - For individuals' responses, only the Secretariat will see your response in full. We will provide the Working Group members with, and publish, only anonymised quotes and aggregate information regarding individuals' responses. The Secretariat would only de-anonymise your response if we have obtained your explicit permission.

We may wish to contact you to let you know about the study's progress. Please tick the box below if you DO NOT wish to be contacted about the study's progress.

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Individuals or organisations providing written evidence may subsequently be invited to provide oral evidence to the Working Group. This would involve them expanding on their written submission and/or answering a refined/novel set of questions of interest to the study.