Academy of Medical Sciences - Team Science Consultation

Response by the Wellcome Trust

November 2014

Key points

- Collaboration across sectors and disciplines helps address complex global challenges, from combating epidemics to responding to climate change. Team science can allow researchers to work on issues that are difficult to tackle in isolation.

- The lines between scientific fields are becoming increasingly blurred. Harnessing the potential of big data, for example, will require input and coordination between bio-informaticians, mathematicians and data scientists.

- To facilitate team science, there must be sufficient funding for varying scales of partnerships, incentives that reward collaboration, recognition of different skills and career structures, and a removal of legal and intellectual property (IP) barriers. However, this should not compromise support for individual scientists.

- Clear attribution of contributions to a group is critically important, and isn't sufficiently recognised by current authorship models. The Trust and a number of other organisations are working to develop a taxonomy that could enable greater transparency and better reflect the different roles and responsibilities within a team.

Introduction

1. The Wellcome Trust is a global charitable foundation dedicated to improving health. This year, we are planning to invest £750 million in biomedical research and the medical humanities, as well as education, public engagement and the application of research to medicine.

2. The prevalence of team science in academia has increased over time. The average number of authors on published research funded by the Trust has risen from under six in 2005 to more than ten in 2013. The average number of institutions has also increased from less than three to more than five over the same period.

3. There are already good examples of collaborative working across many fields, supported by a diverse range of organisations. One example is the Medical Engineering Initiative[1] — backed by a £41 million investment from the Trust and the Engineering and Physical Sciences Research Council. The programme has funded four new centres of excellence since 2009, providing an environment for mathematics, physical science, engineering and medical research to come together.

4. We recognise the importance of team science. Effective networks, platforms and facilities need to be put in place to allow partnerships across sectors and disciplines to flourish. This must be coupled with continued support for individual scientists. Collaborative or multidisciplinary working can add value to research, but is not appropriate for all projects. It is therefore important to understand where team science can be beneficial and support it appropriately.

5. We welcome the consideration that the Academy of Medical Sciences is giving to this topic. This will help to ensure that the importance of team science is further acknowledged and appropriate steps are taken to support its continued growth.

[1] http://www.wellcome.ac.uk/Funding/Innovations/Major-initiatives/Medical-engineering/index.htm

Consultation questions

Defining team science

6. Team science is a complex spectrum ranging from individual researchers working together within a group to multiple consortia collaborating on distinct aspects of a larger question. The nature of a team varies along this spectrum and across disciplines due to the type, scale and complexity of research. These different scenarios require different support. It is important that initiatives to promote or facilitate team science are fit for purpose and targeted appropriately.

7. For the Trust, the foundation of a team is the sharing of goals, knowledge and responsibilities, together with work interdependencies. There is a difference between team science and 'big science'. Large-scale initiatives like the Human Genome Project or those seen in maths and physics extend beyond the Trust's definition of team science.

What are the drivers and incentives for participation in team science?

8. Increasingly complex scientific questions may require input from a range of specialisms. Partnerships between individuals, groups, sectors and disciplines can enable researchers to work towards objectives that could be unachievable in isolation. Bringing together different perspectives and ways of working drives the potential for innovation and allows problems to be considered from a broad range of angles. In addition to this, collaborations are often considered to be very prestigious, and can enhance the reputation of those associated with them. There also appears to be a trend in impact associated with team science, with papers with higher numbers of authors correlating with citation counts[2].

9. Top-down initiatives that offer funding for teams to tackle specific areas have acted as a catalyst for team science. One example is the Structural Genomics Consortium[3], funded by the Trust, nine pharmaceutical companies, Genome Canada and the Ontario Ministry of Research and Innovation. The consortium was formed to fill a knowledge gap and aims to determine the structure of medically important proteins. However, funders must strike a balance between directly incentivising collaborations and allowing them to develop organically, and need flexibility in funding to allow both.

10. Data is a key driver of collaborative science. The generation, storage and analysis of big datasets has necessitated division of workloads as single groups would be unable to tackle the amount and range of information available. It is becoming increasingly important to plan for the infrastructure and technology needed to support this — an issue which cuts across almost all research fields. A highly skilled workforce is essential, bringing together bio-informaticians, mathematicians and data scientists. A high degree of coordination in funding, joint initiatives and policy formulation will be crucial to ensuring the UK maintains its competitive advantage.

11. The community is increasingly looking to optimise its resources by sharing equipment, technologies, skills and knowledge. The first results from a recent Biotechnology and Biological Sciences Research Council and Medical Research Council survey have highlighted data analysis and multidisciplinary research as 'vulnerable' skills in biological and medical sciences[4]. High demand for and shortage of individuals with the requisite expertise, and the expense of highly specialised technology, necessitates the pooling of resources.

[2] http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0005910
[3] http://www.thesgc.org/
[4] http://www.timeshighereducation.co.uk/news/more-postdocs-more-data-skills-top-biology-sector-wish-list/2016475.article

12. Physical and virtual clusters provide one way to support and facilitate collaboration, promote knowledge sharing and accelerate innovation (see **case study 1**). They create an environment that helps cross-sector partnerships to flourish and, in a physical cluster, the close proximity of organisations gives people a degree of career flexibility. They are hubs for talent, ideas and investment, and bring people from diverse areas together.

Case study 1: Linking UK infrastructure to support collaborative research

The Farr Institute of Health Informatics Research aims to build UK capability and enable linkage and analysis of anonymised health and health-related datasets. Electronic patient records offer real potential to improve healthcare and advance biomedical research, and NHS cradle-to-grave records of the entire population give the UK a unique advantage. Cutting-edge research using large health datasets enables a wide range of impacts, from the development of more effective treatments, to improved drug safety and the identification of public health risks.

In 2012, ten UK funders including the Trust invested £19 million to strengthen the UK's capability and competitiveness in this field, and four centres of excellence in e-health informatics research were established in Dundee, London, Manchester and Swansea. In 2013, the Medical Research Council (MRC) invested a further £20 million of capital to create the overarching Farr Institute. Although work is led from four centres, Farr brings together 24 academic institutions and two MRC units based across the UK. It also facilitates collaboration by providing a physical structure to co-locate NHS organisations, industry, and other UK centres. Capacity Building activities across Farr will also train a new cadre of health informaticians and related methodologists. http://www.farrinstitute.org/

What are the barriers and disincentives for participation in team science?

13. An absence of appropriate skills may restrict an individual's ability to work in a productive team. Training must be provided at all levels of academic careers to empower researchers to collaborate when this could add value to their work. Career structures for those who enable team science should be more clearly defined. Lessons can be learnt from outside of academia about how to appropriately recognise and reward these roles.

14. Poor attribution of an individual's contribution to a group is a key barrier to team science. Traditional author lists in scholarly publications do not provide transparency or enable recognition of the different contributions to a team. In the current climate of assessment, researchers strive to be a prominent author on publications associated with their work. In large teams, these opportunities are less likely, particularly for junior researchers or those in a supporting role or with a specialist skill. The Trust is currently exploring new approaches to enable greater transparency of the varying roles and responsibilities within a team (see **case study 2**). This would remove the reliance on author position as a proxy for effort — something that doesn't occur in industry as groups, rather than individuals, tend to be rewarded.

15. While publication outputs are a significant metric for scientific success, it is important to value and reward the range of behaviours that contribute to a world-class research environment. This includes collaborative, cross-disciplinary and cross-sector working, advisory roles, entrepreneurship, and mentoring activities. These activities should be recognised, particularly in grant applications. This is particularly true for research with outputs other than publications, for example blogs, or development of policies or public engagement initiatives. The Higher Education Funding Council for England should also consider how it can incentivise collaborative working through the Research Excellence Framework.

Case Study 2: Describing and recognising contribution

Current models of authorship do not readily allow the reader to decipher an individual's contribution to collaborative work. The number of authors on papers has increased over time, accentuating the need to develop a new system of attribution. In a joint initiative, the Wellcome Trust, Digital Science, Science Europe, the Consortia Advancing Standards in Research Administration Information, and the National Information Standards Organisation are working with researchers, funders, publishers and institutions to develop a taxonomy that can be used across science to enable greater transparency and accessibility to the different contributions to research. Models of implementation are currently being scoped and aim to minimise the impact on researchers.

An online survey conducted in 2013 tested whether recent contributions to journal articles could be classified using a 14-role taxonomy, and authors were asked to comment on the comprehensiveness of the categories. We received feedback from 230 people, with 85% stating that they found the taxonomy easy to use and that all contributor roles were covered. The pilot yielded substantial feedback on several themes, including serviceability and how to ensure agreement among authors. We have since collaborated with the National Information Standards Organisation to evolve the taxonomy in preparation for a second workshop on contributor roles, including testing models of implementation. We hope that through this initiative, we can help to alleviate some of the issues researchers face in gaining recognition for their contributions to collaborations and also help to incentivise team-based research.

16. Sufficient funding must be available to enable collaborative science to grow and flourish. This is particularly acute for those participating in medium-sized initiatives — small, informal collaborations may not require specific funding, and provisions exist for large-scale partnerships. The Trust will be launching a major new scheme for research by teams in the near future. Further details will be announced in the coming months, and we expect the first awards to be made in autumn 2015.

17. Team science can put an increased administrative burden on institutions. Informal collaborations are prevalent, but where large amounts of resource pooling occurs, legal agreements are often put in place that stipulate input requirements and IP ownership. These require legal expertise and although the required specialists are available in many institutions, this incurs additional expense and the processes take time.

18. Team science may also increase the complexity of peer review, particularly in interdisciplinary collaborations. Having to secure multiple reviewers for each different field of research could be a particular challenge, and existing reviewers may struggle to assess proposals outside of their area of expertise.