

Science and research: proposals for long-term capital investment

Response by the Wellcome Trust

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Key points

- We welcome the Government's long-term commitment to capital to 2021. World-class infrastructure underpins our excellence in science, and will help attract scientists, industry and funding to the UK.
- This investment must be supported by a long-term strategy for science that includes appropriate resource and provisions to support a highly skilled workforce of researchers and technical staff.
- World class infrastructure must be maintained as such, and needs operational funding as well as capital. There must be mix of support at the project, institutional, national and international level to ensure that the UK's 'well found laboratories' and large-scale facilities are sustainably operated, upgraded where necessary and have access to cutting-edge technologies and equipment.
- We are pleased to see that big data has been identified as a priority for research infrastructure. For the UK to maintain its competitive advantage in this area, we must consider the critical underlying platforms and enablers that will drive it forward.
- The consultation also identifies a number of other important projects including enhanced synchrotron capability, next generation imaging, and support for Science and Discovery Centres that play a key role in stimulating informal science learning.

Introduction

1. The Wellcome Trust is a global charitable foundation dedicated to achieving extraordinary improvements in health. This year, we are planning to invest £750 million in biomedical research and the medical humanities. The majority of this will be spent in the UK as a direct result of both the excellence of the research base and the Government's commitment to science. Our breadth of support includes public engagement, education, and the application of research to improve health.
2. We are pleased to respond to the Department for Business, Innovation and Skills' (BIS) consultation on capital investment. World-class research requires state-of-the-art facilities and cutting-edge equipment. Sustainable investment in capital is at the heart of scientific excellence, and will help ensure that the UK is the location of choice for international scientists, industry and investors.
3. In recent years, economic pressures have led to a piecemeal approach to capital, impacting on the UK's ability to make strategic decisions and support existing facilities. We welcome moves to address this with a commitment until 2020-21. However, while we are pleased to see a vision for investment in this area, the House of Lords Science and Technology Select Committee recently called for a plan covering 10 to 15 years in its *Scientific Infrastructure* report¹. Science is a 'long game' and Government support must reflect this.

¹ House of Lords Science and Technology Select Committee: *Scientific Infrastructure* (2013)
<http://www.publications.parliament.uk/pa/ld201314/ldselect/ldsctech/76/7602.htm>

4. Capital projects must be carefully planned so they are delivered effectively and efficiently, and a clearly defined roadmap is essential. This will also ensure continued partnerships and opportunities to leverage funding from universities, industry and medical research charities. However, there must be a degree of flexibility and agility. Science is unpredictable and technology moves quickly — we must be able to invest in future innovations or technical advances as they arise, and take the decision to stop projects as they become outdated.
5. Capital investment should be underpinned by an overarching, long-term science strategy with strategic oversight of the UK's capabilities and areas of strength. Critically, this should include the following components:
 - A resource investment plan spanning at least 10 years. Investment in infrastructure, equipment and enabling technologies can only realise its full potential with appropriate operational funding. There is no point building new facilities if they cannot be operated effectively.
 - Provisions to support education, training, development and retention of a highly skilled, multidisciplinary workforce. Any capital strategy is useless without investment in researchers and technical staff. UK facilities must also be able to pay salaries that are internationally competitive and attract and retain the very best people.

Consultation questions

What balance should we strike between meeting capital requirements at the individual research project and institution level, relative to the need for large-scale investments at the national and international levels?

6. We welcome the consideration that BIS is giving to ensuring an appropriate mix of capital support at the project level via Research Councils, the institutional level via Funding Councils, and the national and international level. Such diversity ensures that universities can act strategically and flexibly, and researchers can access the best technologies and facilities. The Government has an important role in deciding strategic areas of importance, identifying grand challenges for research, and setting broad priorities for funding. However, it should be informed by expert advice, both from Research Councils and institutions including the Council for Science and Technology and the Learned Academies. Ultimately, funding decisions should be based on excellence and not politicised.
7. If the UK is to maintain its standing as an international leader in science, ongoing underpinning support for research is essential. We must ensure that our well found laboratories can operate effectively and sustainably, are upgraded and refurbished where necessary, and can access cutting-edge equipment as it becomes available.
8. In the late 90s, our universities were suffering from a historic underinvestment in infrastructure. Recognising this, the Trust partnered with the Government to provide funding for new buildings under the Joint Infrastructure Fund and the Science Research Investment Fund. This revitalised the sector, and researchers can now draw on a range of excellent buildings and equipment. However, we have seen how rapidly things can deteriorate, and robust plans are needed to mitigate against this.
9. While the consultation considers the split between capital at the project and institutional levels versus the national and international levels, it also rightly considers how collaboration can be incentivised. Universities are increasingly looking to optimise their resources by sharing equipment between research groups. There are now a number of examples of research-intensive universities working together more effectively: the N8 partnership, the M5 group, the GW4 group, and the SES-5

consortium. We have also been pleased to hear of the development of asset registers to catalogue equipment and facilitate wider access. This collaborative approach to capital enables efficiency and costs savings, increases cross-sector partnerships, and allows resources to be pooled to buy large pieces of equipment, but it must be supported by an appropriate governance and management framework. The Higher Education Funding Council for England should also consider how it can incentivise collaborative working through the Research Excellence Framework.

10. The UK Research Partnership Investment Fund has been particularly successful in stimulating collaborative investment in higher education research facilities. Public funding of £300 million has already leveraged over £800 million of private investment. The Trust has been pleased to be part of this initiative, supporting successful bids from the University of Dundee and Queen's University, Belfast. However, funders must be engaged at an early stage to maximise opportunities for partnership.
11. Today's grand challenges in health will only be solved with multidisciplinary working, and we must ensure that effective networks, platforms and facilities are in place to bring people from diverse sectors together. One example is the Medical Engineering Initiative — a £41 million collaboration between the Wellcome Trust and the Engineering and Physical Sciences Research Council. The programme has funded four new Centres of Excellence in Medical Engineering since 2009, providing an environment for mathematics, physical science, engineering and medical research to come together. As of 2012, £121 million of additional funding has been leveraged and 29 patents have been filed.
12. Existing capital capability should be maximised wherever possible. This includes ensuring that existing campuses have appropriate supporting infrastructure. Recently, we have also been pleased to support the creation of the Farr Institute of Health Informatics Research. This was funded by a consortium led by the Medical Research Council (MRC) and established to support existing centres of excellence in e-health informatics across the UK. The institute brings 24 institutions and two MRC units together, and will build our capability to enable linkage and analysis of anonymised health and health-related datasets.
13. UK researchers must also have access to world-class national and international large facilities, and we welcome the Government's commitment to develop a roadmap to ensure strategic investment and prioritisation. However, world-class facilities must be supported at a world-class level. On occasion, we have been concerned that longer-term operational costs have not been fully considered when capital decisions have been made for large projects. The Trust has stressed the importance of ensuring operational funding throughout our involvement with the Diamond Light Source — one of our key infrastructure investments and operated as a joint venture with the Science and Technology Facilities Council. When Diamond's new Dual Imaging and Diffraction beamline (DIAD) was given funding in the 2012 Autumn Statement, the full capital costs were not covered and no provisions were made for recurrent costs.
14. A major challenge for large complex projects is the need for flexibility in spending plans over several years. Facilities must be able to carry over capital funding from one year to the next as required, and respond to external events and unexpected budgetary circumstances. The loss of year-end flexibility is a particular challenge when trying to develop and maintain a world-leading, state-of-the-art facility. It is difficult to push the boundaries of technology, and access the most cutting edge equipment, if decisions have to be made on the basis of any single year without the flexibility to carry over underspend or amend spend profiles or budget phasing. Non-Government funding partners can help mitigate against this.

What should be the UK's priorities for large scale capital investments in the national interest, including where appropriate collaborating in international projects?

Big Data in the 'Exabyte Age'

15. We are pleased to see that big data has been identified as a priority in the capital consultation. It is becoming increasingly important to plan for the infrastructure and technology needed to support the storage and analysis of very large quantities of data. This issue cuts across almost all research disciplines and requires us to think about capital in a new way — instead of focussing on bricks, mortar and equipment, we must instead consider hardware, software, data curation and efficient networks. A highly skilled workforce will be essential to underpin this, bringing together bio-informaticians, mathematicians and computer scientists. A high degree of coordination in funding, joint initiatives and policy formulation will be essential to ensure the UK maintains its competitive advantage.
16. We have highlighted some projects that we feel are particularly critical below. These underlying platforms and enablers will underpin a wide-range of research, but must be carefully planned so they are used effectively. It is also important to note that ongoing operational support is essential in this area.
 - **National e-Infrastructure.** The volume of research data is doubling every three years, putting increasing pressure on the infrastructure available for storage and analysis. It is crucial to ensure robust platforms for data storage and networking, with a focus on interoperability and standardisation.
 - **Bridging the Genotype to Phenotype Gap.** It is incredibly important to understand how molecules in the body are influenced by genetics and lifestyle, including diet, environment and stress levels. This can affect a person's disease susceptibility and response to therapeutics, and plays an important role in the stratification of treatments. Phenome analysis will also have applications in a wide range of areas including agriculture and microbiology.
 - **From Big Data to Medical Insight and Impact.** Biomedicine now generates an increasingly complex array of data. The UK is well placed to build on the uniqueness of the NHS, with its cradle-to-grave records of the entire population, to maximise the potential health impact of big data analytics. The Farr Institute and the Clinical Practice Research Datalink are essential foundations, but further investment will be needed to facilitate the broad uses of biomedical data, and to develop and disseminate analytical methods and software.
 - **High-throughput Medical Research.** This is a hugely exciting and growing area, and further commitment will enable the full potential of previous investment in cohorts, tissue and model organism collections to be realised. Integrating these resources with a sustainable data infrastructure and robust networks will help ensure inward investment into the UK.
 - **Longitudinal Studies.** Longitudinal studies are a significant component of the Trust's portfolio of research in populations and public health. Since 1996, we have contributed approximately £90 million in funding to 16 major national and international studies. We must ensure that there is a joined-up and sustainable approach to cohorts in the UK and globally, linking them wherever possible to enable pooling of datasets. Cohorts must also adapt to emerging technologies over time to maintain their scientific value.

Understanding How Materials Behave

- **Synchrotron capability.** The Diamond Light Source is the UK's national synchrotron and requires continued investment to maintain its current capability through planned replacements and efficiency improvements, and upgrades to add new capabilities. This will ensure that it can offer its users world-class instruments and expertise that are in keeping with global advances in synchrotron technology. Priorities include beamline upgrades or replacements; enhancements to the source and storage ring; completion of phase III beamlines; implementation of enabling technologies including automation and data collection, curation and analysis; and installation of a helium recovery system.
- **UK Free Electron Laser.** The Trust is supportive of this indicative project and its potential applications in structural biology. We have recently announced funding towards the European X-ray Free Electron Lasers (XFEL) project in Germany and the establishment of a UK hub to train scientists who wish to use serial femtosecond crystallography at the facility.
- **Capabilities in next generation imaging technologies.** The UK has traditionally been strong in the development of new imaging technologies, and there is a need for continued investment in order to maintain this. Imaging for biophysics and neuroscience is a key priority, and continued investment in high-end imaging facilities and equipment, particularly nuclear magnetic resonance and magnetic resonance imaging, is crucial.

Public Engagement

17. Public engagement is a key priority for the Trust and we support activities that enable people of all ages and from all walks of life to enjoy, understand, challenge and shape biomedical science. This includes grant-funded public engagement programmes; exhibitions and events at Wellcome Collection; film, television and games; and a growing social media and digital presence.
18. In 2012, the Trust published a *Review of Informal Learning*² which examined the informal science learning sector in the UK and its value to science education. We believe that informal learning stimulates interest in science, as well as an appreciation of its social, cultural and historical context. Informal learning experiences can also improve attainment levels and build learners' knowledge and skills. We are therefore supportive of the indicative public engagement projects outlined in the consultation document:
 - **'Inspiring Science' Capital Investment Fund.** We are very supportive of a capital fund that would enhance UK-wide hands-on science programmes. Science and Discovery Centres have an important role to play in educating, stimulating and inspiring people. After significant investment at the Millennium, the Trust has continued to fund the creation or renewal of exhibition and engagement spaces within museums and Science Centres. However Government funding has not been maintained. A number of centres now need refreshing and additional investment is essential. The Trust has significant experience in this area and would be interested in exploring the potential for working in a joined up way.

² GHK Consulting: *Review of Informal Science Learning* (2012) http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtp040862.pdf and Stanford and Oregon State Universities: *Analysing the UK Science Education Community: The contribution of informal providers* (2012) http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtp040860.pdf

- **Connecting Research and Communities.** This is an interesting ‘grassroots’ initiative which sees researchers collaborating with local communities, and could be a particularly good way of engaging disadvantaged groups who typically have less access to informal science experiences.

19. We would be happy to discuss any of the points made in this response in more detail if it would be helpful.

The Wellcome Trust is a global charitable foundation dedicated to achieving extraordinary improvements in human and animal health. We support the brightest minds in biomedical research and the medical humanities. Our breadth of support includes public engagement, education and the application of research to improve health. We are independent of both political and commercial interests.