

The Physiological Society's submission to the 2020 Comprehensive Spending Review (CSR)



For more information about the CSR please visit: <https://www.gov.uk/government/publications/spending-review-2020-documents/spending-review-2020>

Executive summary:

- Physiology has a crucial role in delivering the ambitions of the Comprehensive Spending Review (CSR) in addition to the R&D roadmap and the Industrial Strategy
- The challenges of age and age-related decline should be given greater priority in the CSR and addressed accordingly by understanding the mechanisms and relationship between comorbidities and age-related decline.
- The disruption to education resulting from COVID-19 must be minimised, and potential long-term effects addressed.
- There is enormous demand for research and knowledge exchange funding, and continued investment from central Government and the devolved administrations, beyond the 2.4% target, is required to make the UK a 'scientific superpower' as outlined in the CSR. However, the effects of the pandemic on universities, charities and other organisations put this goal at risk.
- Achieving this will involve acknowledging and addressing elements of research culture that present barriers

About The Physiological Society:

The Physiological Society has a 140 year tradition at the forefront of life sciences. When physiologists collaborate around the world, their research contributes to a better understanding of the complex functions of living organisms. Expanding physiological knowledge helps us to understand how the body works. It also helps us to determine what goes wrong in disease, facilitating the discovery for new diagnostics, treatments and preventative measures. For example, the 2019 Nobel Prize in Physiology or Medicine was awarded to three researchers who discovered how cells sense and respond to changing oxygen levels by switching genes on and off. This discovery has been key in understanding human diseases such as cancer and anaemia because scientists are now able to target this 'switching on and off' mechanism to treat disease.

The Society's activities benefit the public in a variety of charitable ways. Our publications, meetings and educational resources directly benefit people actively involved in physiology such as researchers, teachers, and students. This investment then has a trickle-down effect by improving human health and broadening the public's understanding of how physiology relates to everyday life.

Consultation response:

- **Physiology has a crucial role in delivering the ambitions of the Comprehensive Spending Review (CSR) in addition to the R&D roadmap and the Industrial Strategy**

Physiology is the science of life. It is the branch of biology that aims to understand the mechanisms of living things, from the basis of cell function at the ionic and molecular level to the integrated behaviour of the whole body and the influence of the external environment. Research in physiology helps us to understand how the human body works in health and how it responds and adapts to the challenges of everyday life; it also helps us to

determine what goes wrong in disease, facilitating the development of new treatments and guidelines for maintaining health. The emphasis on integrating molecular, cellular, systems and whole-body function is what distinguishes physiology from the other life sciences.

Our work has demonstrated that investment in scientific research including physiology supports jobs and economic growth, improves national productivity, health and wellbeing and is vital to achieving many of the Government's ambitions.¹ Physiology and its subdisciplines are a broad and essential component of the research and innovation landscape, delivering key societal and economic benefits.

- **The challenges of age and age-related decline should be given greater priority in the CSR and addressed accordingly by understanding the mechanisms and relationship between comorbidities and age-related decline.**

Current funding for the Industrial Strategy Grand Challenge mission for 'Ageing Society' is focused predominantly on applied science in healthy ageing, particularly in the context of promoting the UK service sector overseas as a post-Brexit UK export to other economies with a significant ageing population such as China, India and Japan. The Physiological Society does not believe that focusing predominantly on innovations in artificial intelligence and managing age-related decline will be sufficient to meet the Government's own 'five healthier, more independent years by 2035', nor will it likely reduce the significant inequality gap that exists between socio-economic groups. A new DARPA-style organisation has the opportunity to invest in cutting-edge research that could lead to the step change required in order to meet this goal without the need for an immediate financial return on investment. The Government's own target means engaging with people that are at least a decade away from the State Pension age as well as those who are experiencing age-related conditions. Understanding the mechanisms behind ageing and age-related conditions will be crucial to improving the health and wealth of the nation in older age.

A DARPA-style fund also provides the opportunity to think more broadly and harnessing a cross-discipline approach about the step-change in the government's approach to the challenges presented by ageing and inequality gap. For example, while epidemiological data can highlight inequality of outcomes, it can only demonstrate correlation. In order to prove causation, we will need a combination of state-of-the-art imaging, diagnostic equipment and research funding to facilitate the understanding of mechanisms at a cellular level. This understanding will not be possible without investment in hardware, expertise and experimentation

- **The disruption to education resulting from COVID-19 must be minimised, and potential long-term effects addressed.**

Physiological research has been at the heart of the science community's response to COVID-19. The novel nature of COVID-19 has been one of the major challenges of finding vaccines or treatment that can mitigate the different ways that the virus affects the body. Physiology helps to not only better understand the virus but also how it impacts on the different systems of the body such as sensory loss as a symptom, through to 'insidious hypoxia' and 'COVID toe'.

In response to the COVID-19 crisis, The Physiological Society has mobilised physiologists around the world to provide operational support to frontline healthcare workers in the fight against COVID-19. In collaboration with the Intensive Care Society, it has established a website called 'Questions from the Front Line' (<https://www.physoc.org/covid19/questions/>). This has allowed an expert advisory panel to offer the most up-to-

¹ <https://static.physoc.org/app/uploads/2019/10/11135853/Growing-old-better-Full-report-and-summary-document.pdf>

date physiological insight to answer questions and observations posed by medics treating people who are currently infected with the COVID-19 virus, as well as offering links to the most relevant physiological research. The Society has also worked to explain and dispel rumours about how the public can respond to the coronavirus to protect their health from erroneous or unproven approaches (such as the use of ibruprofen and Vitamin C).

Frontline healthcare professionals have sought advice from physiologists in areas such as shielding during pregnancy, gastrointestinal symptoms, intubation and hypoxaemia and co-morbidities such as diabetes. In addition, physiologists' advice has been sought for PPE research and development. As such, the advice has been applied and practical, not just mechanistic and theoretical. This support demonstrates the crucial role that physiology has in underpinning how healthcare professionals treat disease and support people to live better, for longer in both health and disease.

Ensuring "every young person receives a superb education" is a priority for the CSR. The Physiological Society entirely supports the Royal Society of Biology's view that the unprecedented disruption to school and university education risks leaving a generation with a diminished education. The sciences, in particular, could suffer the long term impact of further compression of teaching time due to ongoing disruptions to face-to-face teaching. Through the pandemic and after, education must be fit for purpose and available to all - schools and teachers must be properly equipped and resourced.

The Government should also give considerable thought to the long-term physical and mental consequences of both the coronavirus and the UK's lockdown response and how it can better prepare the population to respond to future outbreaks and pandemics. Age remains the single best indicator of likely mortality from COVID-19. As the ONS notes; 'The age-specific mortality rate due to the coronavirus (COVID-19) increased significantly in each age group, starting from ages 35 to 39 years in males and ages 40 to 44 years in females.' Mortality in those aged 90+ is twenty-two times higher than the population as a whole. Similarly, the most common pre-existing conditions recorded for those dying of COVID-19 were dementia, frailty, pneumonia, diabetes, hypertension, COPD and urinary tract system diseases, all diseases that are associated with age-related decline. As such, ensuring that the whole of the UK is encouraged and empowered to take control of their health to improve their healthy life expectancy will not only help to fight further outbreaks of respiratory infections such as COVID-19, it will have the added benefit of furthering the Government's own Industrial Strategy 'Ageing Society' Grand Challenge.

- **There is enormous demand for research and knowledge exchange funding, and continued investment from central Government and the devolved administrations, beyond the 2.4% target, is required to make the UK a 'scientific superpower' as outlined in the CSR. However, the effects of the pandemic on universities, charities and other organisations put this goal at risk.**

In order to maximise knowledge and understanding through research, equal emphasis must be placed on both applied and fundamental research. Ensuring that the R&D pipeline is maintained throughout the innovation cycle will be crucial. Research and innovation rarely follow political timelines and applied knowledge can only be developed by understanding the mechanisms that underpin it. We support the ambition to make the UK a "scientific superpower". Support for future discovery will require supplementary public investment towards both funding new research projects and maintaining and expanding research infrastructure.

UKRI provides £230 million of funding per year for knowledge exchange (KE) via the Higher Education Innovation Fund (HEIF) to support and develop engagement between higher education institutions (HEIs) and the wider

world, which results in benefits to the economy and society. HEIF provides a strong return on investment, with £9.30 generated for every £1 of funding².

The Physiological Society is currently undertaking a piece of research to better understand the specific contribution of physiology to this overall figure. While the data are yet to be finalised, we can say that Oxford alone received around £5m in international investment for Anatomy & Physiology in 2018-19³. Research funding data (REF UoAs and HESA Cost centres) rightly use simplified and often combined definitions to lower potential burden although this does limit the usefulness of analysis. Specifically, physiology research should not be viewed in isolation but as an integral and underpinning component of all work in the life-sciences much as mathematics underpins the physical sciences. For example, work clinical medicine demands an understanding of physiology.

In addition, Sport and Exercise Science makes a valuable contribution to the UK economy, not only in terms of the savings it makes for the health and social care system but also in its role as a significant driver of employment and economic growth. The Physiological Society demonstrated these economic and social impacts in its 2019 report *Sport and Exercise Science Education: Impact on the UK Economy*. The report's economic data found that Sport and Exercise Science higher education provision provides an impact of £3.9 billion in added income to the UK economy each year. This is equivalent to 147,300 jobs.

Furthermore, physiological research makes a significant contribution to the UK economy. Research into cold water immersion from the University of Portsmouth has reduced the human cost of drowning which is estimated at £63 million per year. Similarly, stair falls are the leading cause of accidental death in older people. Falls on domestic stairs cause over 350,000 injuries to older UK residents each year, with personal consequences such as loss of independence, hospitalisation, and even death, not to mention £2 billion in demands on the NHS. Sport and Exercise Science research is investigating the integrated relation of functional capabilities such as strength, balance, and cognitive status on causing stair falls.

A DARPA-style organisation will need to have significant financial resources at its disposal in order to deliver on its potential but funding for an DARPA-style organisation should not, of course, replace other established approaches to research funding, which would remain a vital part of the research and development ecosystem.

Budgets for UKRI and ARPA should be entirely separate, to avoid competition over funding streams during budget-setting. Many areas of bioscience, including physiology, require longer funded periods to accomplish full projects – this could be accommodated where necessary in the funding stream. The importance of skills is rightly recognised in the CSR, and learned societies academies and membership organisations can play an important role in developing skills and professional standards.

Info from our KE project

Initial findings from our innovative project to investigate Physiology's contribution to KE suggest that the subject very much punches above its weight in terms of the proportion of UK KE that is directly or indirectly reliant on physiology. Further, Physiologists are very active beyond their own institutions with high proportions working with business, community and public-sector partners by comparison with the most recent data available for the UK academic sector at large.

² <https://re.ukri.org/knowledge-exchange/the-higher-education-innovation-fund-heif/>

³ <https://www.hesa.ac.uk/data-and-analysis/finances/table-5.csv>

- **Achieving this will involve acknowledging and addressing elements of research culture that present barriers**

In order to meet the Government's commitment to 'enable regions right across the UK to realise their potential to drive innovation-led economic growth' and fulfil its objective to 'embed equality, diversity and inclusion at all levels', investment outside the 'Golden Triangle' should be encouraged as a means to identify the most promising research and researchers from across the UK. It should be noted that existing funds that have been established to encourage a small group of individuals identified as potential future leaders should take careful consideration of the need to increase the diversity of the UK science base. The Government must therefore ensure that its laudable objective to maintain the UK as a place of academic and research excellence should not be undermined by drawing from a small or homogenous talent pool.

While support for homegrown R&D talent remains crucial, it is also pleasing to see that the Government's R&D roadmap recognises the need for an immigration system that facilitates the inclusion of staff from outside the UK. This includes not only the most prominent and promising scientists, but also the technical staff with the skills required to support the research base. It is reassuring to see that the Government remains committed to 'close and friendly' collaboration with European partners following the end of the transition period later this year and has committed to matching EU funding that would have been available to UK R&D through the Horizon Europe programme in the event that the UK is no longer able to participate in this programme. When we surveyed our members in 2017 about their biggest concerns about changes to the research base following the UK's departure from the European Union, 72% felt that their funding had already been affected or would be in future and access to EU funding was the most important thing members felt the Government needed to achieve for science as part of the Brexit negotiations.