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Improving collaboration between universities and partners to improve health and wellbeing in Scotland: **Physiology and knowledge exchange**

The life sciences sector has been crucial in the global response to COVID-19. Further investment and collaboration in this sector will be vital as Scotland addresses the significant economic challenges presented by the COVID-19 pandemic and the UK's withdrawal from the European Union.

Our recent report *Translating UK Knowledge and Research into Impact: Physiology and knowledge exchange* demonstrates how research in physiology and collaboration between higher education and partners such as businesses, public services and charities boosts productivity and economic benefit. As well as supporting Scotland's economy, greater interaction between higher education and partners will lead to innovation resulting in societal improvements, in areas such as healthcare and education.

Scotland is well placed to meet these challenges and is home to one of the largest life sciences clusters in Europe, with more than 770 life sciences organisations employing more than 41,000 people. The sector is growing 7% per year and is projected to reach a turnover of £8 billion by 2025 (see figure 1)¹.

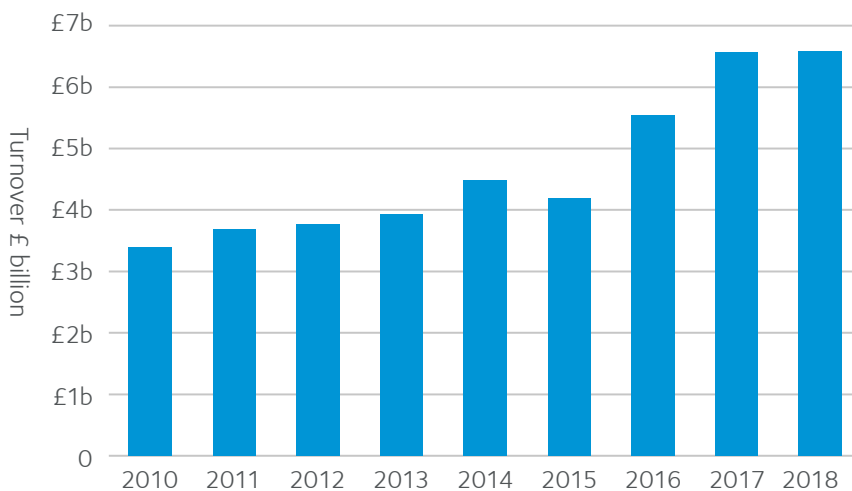


Figure 1 Growth of life sciences sector in Scotland (Total turnover £ billion)²

Physiology is central to the success of life sciences in Scotland.

Over the past few months we have all witnessed the vital contribution of physiological research in responding to the COVID-19 pandemic: from understanding how this novel disease affects multiple organs in the body, through to developing effective treatments. Longer term, improving health in older age will require intense focus on the physiological processes underpinning ageing. This factsheet contains case studies which highlight just some of the ways that Scottish knowledge exchange related to physiology is informing benefits to health and wellbeing throughout the lifecourse.

The Scottish Funding Council (SFC) *Strategic Framework 2019-2022* highlights the importance of “excellent research and innovation that adds to current knowledge, delivers economic and societal value, enhances Scotland’s international reputation and attractiveness, and makes the world around us prosperous, healthier and more sustainable”³. Physiology will be central to these efforts. Only by focusing investment on improving the networks and relationships essential to knowledge exchange, will it be possible to maximise the societal and economic benefit of research.



What is Physiology?

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.



What is Knowledge Exchange?

Knowledge exchange is the multiple interactions between higher education institutions and businesses, public services, charities, public engagement, communities, policymakers and government to create societal and economic benefit.

CASE STUDY

How does knowledge exchange related to physiology impact Scottish society and the economy?

PUPIL-LED BIOMEDICAL LESSONS FOR PRIMARY SCHOOL CHILDREN

Dr Fiona Murray and Professor Derek Scott, University of Aberdeen

In 2017, the Scottish Government published *Science, Technology, Engineering & Mathematics Education and Training Strategy for Scotland*, that recommended increasing science education at primary school level. It also stressed the need to enhance teacher confidence in teaching STEM-focused material, and equity of access to STEM learning be improved across Scottish schools. This pilot study aimed to develop a series of activities for primary school pupils and teachers, with children encouraged to take the lead in presenting what they had learned.

Primary 2 children in Aberdeen were given the opportunity to trade in classroom points for lessons on a variety of biomedical topics. Pupils could present topics and help organise 1-2 activities

for each class. Resources and possible activities were provided by the University of Aberdeen. The work was presented internationally, allowing the school teaching staff to evidence their continuing professional development.

The success of the first event led to more being requested by the school. Quotes from teachers included “all of [the class] were very, very engaged during the pupil-led lesson”, “the student told the class about the brain and organised children into groups to complete activities”, and “another fantastic pupil-led lesson about the heart, enjoyed by the whole class”.

We are developing science activity packs that we can send to schools across Scotland. These would include instructional videos to help teachers in remote or rural areas undertake such biomedical activities even when university staff cannot take part. This pilot study demonstrated that involving primary school students in biomedical learning activities can foster leadership, improve presentation skills, encourage pupil-led research and stimulate interest in STEM at a very young age.



Photo: University of Aberdeen

CASE STUDY

How does knowledge exchange related to physiology impact Scottish society and the economy?

LIFE SCIENCES GRADUATE SKILLS WORKSHOPS

Dr Iain Rowe, University of Glasgow (formerly at Robert Gordon University)

Back in 2014, the Glasgow Economic Leadership (GEL) Life Sciences Skills Theme group developed an action plan focusing on graduate employability – in response to industry concerns over the modest knowledge graduates in physiology, pharmacology and biomedical sciences had of the Scottish Life Sciences sectors. A workshop approach was utilised where future physiology and biomedical science graduates could identify with the diversity of roles and careers within the Scottish science sectors and which exposed them to relevant industry knowledge targeted and focused in relation to future job opportunities with different employers in Glasgow, Edinburgh, Dundee and Aberdeen.

This model has been rolled out in Aberdeen over the last 2 years with a good mix of student attendance from both Robert Gordon University and Aberdeen University – predominantly from undergraduate final year students from courses including physiology, life sciences, neuroscience, immunology and genetics. Feedback from students was very positive, with the majority stating after each workshop that they had learned ‘a lot’ and felt ‘better informed about their career opportunities’. This prompted students to take the next steps such as finding out more about the commercial aspects of life sciences and being more active in applying for jobs.



Photo: Robert Gordon University

CASE STUDY

How does knowledge exchange related to physiology impact Scottish society and the economy?

IMPROVING HYDRATION IN OLDER PEOPLE

Dr Nidia Rodriguez-Sanchez, University of Stirling



Hydration status has an impact upon physical health, cognitive performance and patient outcomes following admission to hospital in all life stages and particularly in older adults. In ageing, several physiological and behavioural changes predispose older adults to dehydration. Inadequate fluid intake and subsequent dehydration are associated with increased risk of falls and infections, and are a frequent cause of hospital admission. These consequences negatively affect older adults' lifestyles and the global economy, considering that the population aged 65+ is growing faster than that of all other age groups. Understanding the physiology of water balance in the general population and in older adults has a positive impact on the development of strategies and recommendations for reducing the risk of low intake dehydration in older adults and improving their quality of life. As part of their research investigating the hydration potential of beverages, we developed the “beverage hydration index”. This is a comparison of how much of a drink (different from water) is retained 2 hours after ingestion compared with the same amount of water. We completed a pilot study supported by The Food Train where we obtained information from 303 independently living Scottish older adults about their daily fluid intake. We observed that 26% of older female adult and 50% of older male adults did not meet the European Food Safety Authority (EFSA) daily fluid intake recommendations.

In particular, water intake during the mid-morning and early-afternoon was lower in those not meeting the guidelines. We are very interested in continuing to work with the older population, investigating the most appropriate drink strategies for improving their hydration status and health outcomes and therefore having a positive impact on their quality of life.

Recommendations

The Scottish Government

RECOMMENDATIONS

Scotland has great strengths in both discovery and commercialisation of biotech – collaboration between the UK's leading physiologists would see an economy of scale where the UK is able to lead the world in not only prolonging life but adding healthier and happier years for every generation.

1. Building on strategic investment in Edinburgh's BioQuarter⁴ and the BioHub in Aberdeen⁵ the Scottish Government should engage with UK Research and Innovation (UKRI), in establishing a Global Coordinating Centre for Healthy Ageing Research and Development to focus on identifying world-class productive knowledge exchange between academia and public and private sectors to meet the challenges associated with an ageing population.
2. The Scottish Government should place R&D at the heart of a new Scottish Industrial Strategy with the aim of building a strong home grown R&D industrial base and a large-scale research-intensive economy in order to retain more of the benefits of R&D within Scotland and attract more talent and investment from around the globe.

The Scottish Funding Council (SFC)

RECOMMENDATIONS

As we begin to consider further challenges which stem from COVID-19 and national lockdowns, physiology will be integral to promoting healthy living across all age groups as evidenced by the case studies.

3. The SFC should continue to invest in the University Innovation Fund so that it keeps pace with development of wider research funding to ensure Scotland gains a timely return on public investment in research by the way of new commercialised products and services.

Physiology typifies the interdisciplinary approach required to solve the major societal challenges that confront us. Bringing together the required skills and facilities not only addresses the central questions such as healthy ageing but provides fertile ground for further synergy and fundamental breakthroughs. These collaborations combine the best elements of basic and applied research practice.

4. The SFC should build on successful collaborations such as the Translational Research Group with UKRI⁶ and the bio-medical catalyst which provides funding and support for innovative partnerships from initial investigation and discovery through to global commercialisation.

There will be immense pressure on public funding in the short- to medium-term as we recover from COVID-19 but we must ensure we maintain our commitment to funding excellent research given the myriad of economic and social benefits that flow in terms of skilled graduates and immediate economic and social benefit. Decay in the research base could take generations to repair.

5. The SFC should continue to fund Scotland's world-leading basic research base through periods of budgetary pressure. Successes in physiology and knowledge exchange stem from sustained investment in the basic research base, and it is crucial that this funding remains in place.

Download our report



While the benefits of knowledge exchange as a whole are relatively well understood, The Physiological Society and National Centre for Universities and Business recent report *Translating UK Knowledge and Research into Impact: Physiology and knowledge exchange* focused on the specific contribution to the economy and society of knowledge exchange carried out by physiologists.

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[PHYSOC.ORG/KNOWLEDGE-EXCHANGE](https://physoc.org/knowledge-exchange)

1. Scottish Development International, 'Life Sciences and Biotech' www.sdi.co.uk/key-sectors/life-sciences-and-biotech
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6. UK Research & Innovation – Medical Research Council, 'Translational Research Group', <https://mrc.ukri.org/about/our-structure/strategy-board-overview-groups/translational-research-group>



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