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Improving collaboration between universities and partners to improve health and wellbeing in Wales:

Physiology and knowledge exchange

Health and social care is a key priority in Wales. By 2030, one in four people in Wales will be over 65. New research and technology will help the population stay healthy, happy and active for as long as possible[1].

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The life sciences industry in Wales employs 11,000 people in well-paid, high quality jobs across the country and exports about £980 million[2]. Much of the life sciences sector is underpinned by physiology research which is central to improving health for all age groups.

In 2018, the *Reid Review* noted that **"the research and innovation ecosystem in Wales is strong and includes strikingly successful examples of university-business collaboration and research impact"[3]**. There is a clear opportunity to build on findings from the *Reid Review*. The Welsh Parliament's Economy, Infrastructure and Skills Committee published *Research and Innovation in Wales*[4] which makes recommendations to strengthen and embed research and innovation. Both documents note the excellent quality of research output from Welsh institutions and make recommendations for how to scale up this activity including funding not only critical research but providing specific resource for innovation. These findings align with our own work looking at the impact of physiology and knowledge exchange across the UK and beyond.

The Physiological Society

National Centre for Universities and Business

The life sciences sector has been crucial in the global response to COVID-19 and is well-positioned to drive the nation's economic recovery. Further investment and collaboration in this sector will be vital as Wales addresses the significant economic challenges presented by the COVID-19 pandemic and the UK's withdrawal from the European Union where the loss of European Regional Development Funding (ERDF) is being particularly keenly felt.

Our recent report *Translating 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. In order to ensure that Wales and the rest of the UK is best placed to lead the response to future challenges, now is the time to foster networks between universities, industry and the whole R&D ecosystem.

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 Welsh society and the economy?

MITIGATING RISK OF EXERCISE-INDUCED DYSGLYCAEMIA IN TYPE 1 DIABETES

Dr Richard Bracken, Swansea University

People with type 1 diabetes (T1D) have a dysfunctional pancreatic insulin response. This makes blood glucose management difficult and contributes to reduced life expectancy in those with, than in those without, T1D.

Regular physical activity is recommended to promote good lifelong health in people with T1D and close this lifespan gap. However, the risk of exercise inducing unmanaged low or high blood glucose levels (disglycaemia) is higher than at rest.

Our work is helping patients improve adherence to acute exercise and derive the full health benefits of being regularly physically active. Our research evidence is regularly included in global diabetes and physical activity guidelines such as the American Diabetes Association and European Association for Study of Diabetes (EASD) among others.

Furthermore, our research underpins the development and delivery of the world's first T1D physical activity educational programme Juvenile Diabetes Research Foundation, 'Peak Performance' (JDRF Peak), a $5m-funded project, that created a research evidence-based educational curriculum to address a significant knowledge gap in the T1D healthcare community around glucose management and exercise. Since its launch in 2017, JDRF Peak has educated and improved the knowledge of over 5000 participants and has reached many more since available online.

Finally, our research has also supported sport science provision for the world's first and only UCI-accredited professional cycling team comprised entirely of riders with T1D; Team Novo Nordisk. Their mission statement is to 'inspire, educate and empower those affected by diabetes'. Our published observational studies reveal the excellent glycaemia that can be attained during team training and competitions and fuel better cycle performance.

Photo: Swansea University

CASE STUDY

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

MOVE: EMPOWERING PATIENTS LIVING WITH KIDNEY DISEASE TO INCREASE PHYSICAL ACTIVITY

Dr Jamie Macdonald and Dr Jennifer Cooney, Bangor University

Chronic kidney disease affects 6% of the population. Treating patients living with chronic kidney disease consumes a disproportionally high NHS budget (approximately 3%) due to the high cost of renal replacement therapy (the treatment required for the most severely ill). One form of renal replacement therapy is haemodialysis. Health-related quality of life (HRQoL) remains poor in haemodialysis patients.

The physical components of HRQoL are directly influenced by underlying physiology. Enhancing the health and function of physiological systems is possible with interventions that increase physical activity. However, very few dialysis units choose to implement physical rehabilitation as an option for haemodialysis patients, despite patient and public involvement activities identifying that HRQoL should be targeted with alternative therapies to medication, including exercise. Using information gathered from focus group discussions, the research literature and current exercise guidelines, we created MOVE (move.bangor.ac.uk), which builds on previous research completed by our group and our collaborators showing that increasing physical activity enhances functional capacity.

MOVE provides knowledge and resources to help patients increase their physical activity and upskill health professionals to make exercise part of routine care for haemodialysis patients.

The MOVE resources are freely available and have been widely distributed, via printed booklets and a dedicated website, and are available in Welsh and Portuguese. Within 5 months of being released in 2018, the resources had been utilised in 79 renal units across the UK, Ireland, Portugal and the US. MOVE is recommended by kidney care charities and organisations including the British Renal Association and Kidney Care UK. The resources are also being incorporated into online rehabilitation platforms including Beam Feel Good, which is freely available for all patients in the UK living with chronic kidney disease.

CASE STUDY

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

DEVELOPING A MULTI-DISCIPLINARY PROGRAM OF PHYSIOLOGICAL RESEARCH THAT HAS RAISED PUBLIC AWARENESS OF THE LONG-TERM VASCULAR BENEFITS OF PHYSICAL ACTIVITY

Professor Damian Bailey, University of South Wales

An estimated 1.4 billion adults fail to meet the World Health Organization physical activity guidelines, claiming more than 3 million 'preventable' deaths each year. To better address this global health crisis, Professor Bailey leads a multi-disciplinary program of physiological research that has raised public awareness of the long-term vascular benefits of physical activity unified by free radical-mediated improvements in oxygen transport. Application of novel techniques and experimental models has helped better define the sources, mechanisms and consequences of exercise-induced free radical formation. This has led to the development of novel biomarkers of vascular health and wellbeing.

Professor Bailey has reached out to the media, lay public, athletes, NHS practitioners, patients and government, raising awareness of the physiological benefits of physical activity that has changed attitudes, behaviours and working practices and improved health and wellbeing with evidence of economic benefit.

University of South Wales academics have been involved in extensive public engagement in the form of televised science documentaries including the BBC's *Horizon: Truth About Exercise, Richard Parks on Everest* and *How to Stay Young* as well as Channel 4's *How to Beat...Ageing*. These opportunities publicised underpinning research. University of South Wales academics have also engaged the lay public in 'live' experiments such as 'Cognitron Challenge', 'Brain-Train vs. Brain-Drain' which explored the link between physical activity and intelligence, encouraging more people to enjoy the benefits of being more physically active.

Additionally, underpinning research from the University of South Wales has helped support clinical implementation of cardiopulmonary exercise testing in hospitals. Patients who fall below objectively defined physical fitness thresholds are less likely to survive certain types of vascular surgical interventions. This research has optimised surgical risk stratification boosting financial revenue and informing the reporting content of established bodies such as the Royal College of Surgeons.

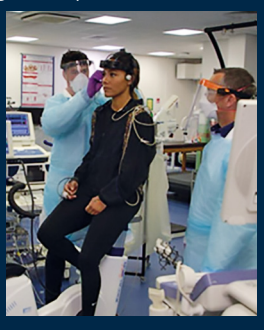

Photo: University of South Wales

Recommendations

The Welsh Government

RECOMMENDATIONS

To maximise the appeal of Wales for future investment, the Welsh Government should facilitate a collaborative and coherent offering from Welsh Higher Education Institutions (HEIs) to make R&D partnerships in Wales more attractive to private investment.

1. We support the *Reid Review*'s call to increase the visibility, coherence and impact of research and innovation in Wales by creating a single overarching brand for its innovation activities.

This highly-visible branding of Welsh R&D needs to be accompanied by appropriate collaboration between HEIs to ensure that there is an agreed infrastructure in place to support this national promotion of R&D capabilities

2. The Welsh Government and HEFCW should work with Universities Wales to establish a joint protocol for collaboration between HEIs in Wales that can act as an initial framework to make it quicker and easier for individual collaborations to take place. As *Strength in Diversity* suggests this protocol covers issues regarding intellectual property (IP), risk-sharing across capital-intensive facilities, employment of staff across multiple institutions and costs associated with consortia-led funding bids.

The Higher Education Funding Council for Wales (HEFCW)

RECOMMENDATIONS

As the second phase of Life Sciences Hub Wales & Life Sciences Research Network Wales (LSRNW) is developed during 2021, physiology will be central to the objectives of "drug discovery, and precision diagnostics and therapeutics in areas of unmet clinical and veterinary need". By linking the success of LSRNW to capacity and demand in the rest of the UK and beyond, HEFCW will be able to stimulate collaboration with industry both in problem solving and commercialisation of solutions and attract further talent and investment.

3. Building on strategic investment LSRNW[5], the Welsh Government and HEFCW 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 objectives of the Healthy Ageing Grand Challenge.

4. HEFCW should continue to invest in the Research Wales Innovation Fund (RWIF) and ensure it keeps pace with development of wider research funding to ensure Wales gains a timely return on public investment in research by the way of new commercialised products and services.

Global grand challenges in life sciences require research and innovations from across the academic spectrum – physiologists play a central role in understanding and promoting healthy living, but real advances come from cross-disciplinary partnerships where the core academic strengths of HE in Wales can be fully utilised.

5. HEFCW with UKRI should build on successful collaborations such as the Global Challenges Research Fund (GCRF).

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 economic and social benefits that flow in terms of skilled graduates and immediate economic and social benefit. Decay in the research base would take generations to repair.

6. HEFCW should continue to fund the 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 full report

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PHYSOC.ORG/KNOWLEDGE-EXCHANGE

1 Life Sciences Hub Wales, 'Healthy Ageing', lshubwales.com/our-priorities/healthy-ageing

2 Life Sciences Hub Wales, 'Working with Industry', lshubwales.com/working-industry

3 Welsh Government, 'Review of Government Funded Research and Innovation in Wales', gov.wales/sites/default/files/publications/2019-04/review-of-government-funded-research-and-innovation-reid-review.pdf

4 Welsh Parliament - Infrastructure and Skills Committee, National Assembly for Wales Economy, senedd.wales/laid%20documents/cr-ld12496/cr-ld12496-e.pdf, April 2019

5 www.lsrnw.ac.uk/

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