House of Commons Scottish Affairs Committee inquiry on Science and Scotland: response from the British Neuroscience Association

Introduction

The British Neuroscience Association (BNA) is the largest UK organisation representing and promoting neuroscience and neuroscientists. We have over 2750 members, whose interests cover the whole range of neuroscience, from molecular ion channels to whole animal behaviour to real-life applications in the clinic and beyond. Over 300 of our members are based in Scotland, in addition to 6 of the BNA's Local Groups at Scottish higher education institutions.

World-leading neuroscience research can help us meet the societal challenges we face in the future. Neurological disorders are one of the leading causes of disability globally and over 1 billion people are living with mental health disorders.[1] This is an enormous burden for people living with these disorders and also for society at large. Brain disorders are estimated to cost over £100 billion per year in the UK alone.[2] The science of the nervous system is essential for understanding what makes us human, preventing and treating neurological and psychiatric disorders, and keeping the UK at the forefront of cutting-edge research internationally. Investment in neuroscience research is key to achieving this.

Neuroscience and Scotland

Neuroscience research in Scotland is helping to tackle these key societal challenges, and researchers in Scotland have been internationally recognised for their contributions to advancing neuroscience research. With Scotland's links between academia, industry and NHS Scotland it is well placed to widen its contribution further.

The BNA held an event at the Scottish Parliament in June 2023 showcasing some of the key research currently taking place across Scotland.

A world-leading gene therapy trial

Neuroscience research pioneered by teams at the University of Glasgow and University of Edinburgh has laid the path to a potential new treatment in Rett Syndrome. Rett Syndrome is a progressive neurodevelopmental disorder estimated to affect 1 in 10,000 girls (it is normally fatal in boys), making it one of the most common genetic causes of developmental and intellectual impairment.

There are no approved therapies for Rett Syndrome targeting the underlying cause of the disorder, with treatment focusing on symptom management and supportive care. Dr Stuart Cobb's lab was the first to report the effect of gene therapy in mice models of Rett Syndrome, in work supported by the Rett

[1] Feigin VL et al. The global burden of neurological disorders: translating evidence into policy. The Lancet Neurology 19, 255–265 (2020).
[2] Fineberg, N. A. et al. The size, burden and cost of disorders of the brain in the UK. J Psychopharmacol 27, 761–770 (2013).

Syndrome Research Trust. Many Rett symptoms are caused by mutations in a single gene, MECP2, and gene replacement therapy delivers healthy genes to compensate for mutated genes.[3]

The lab is now working with Neurogene to take their gene therapy platform into a clinical trial, with enrollment set to start in 2023.

Impacting our understanding of human cognition

Scotland is home to the longest study of human cognition in the world.[4] The Lothian Birth Cohorts are two groups of people, born in 1921 and 1936, who attended school in June of 1932 or 1947 respectively and took at that time an intelligence test called the Scottish Mental Survey. Surviving members of these cohorts were traced and have been tracked in new studies by researchers at the University of Edinburgh to investigate how the brain changes with age, and which lifestyle, health and genetic factors influence these changes.

Among the discoveries, the Lothian Birth Cohort Studies have shown that differences in people's genes might account for about 25% of the variation in how thinking skills change from childhood to old age, and that some genes become increasingly important for accelerated cognitive and brain ageing within older age. It has also shown that cognitive and brain health are harmed by smoking, loneliness, pollution and social isolation, and is aided by maintaining vascular health, physical and intellectual activity into older age.[5]

The studies' findings have influenced policy in the UK and internationally, from NHS Scotland, and the National Institutes of Health in the US, to the UK Government's Foresight Report on Mental Capital and Wellbeing.

Leading discoveries in ALS

Dr Jenna Gregory is a Consultant Pathologist and Principal Investigator at the University of Aberdeen, whose research focuses on the molecular mechanisms underlying neurodegenerative diseases with a particular focus on Amyotrophic Lateral Sclerosis (ALS).

The work in Dr Gregory's lab involves studying patient samples (tissue and biofluids) for molecular differences that could explain why people with ALS have such diverse symptoms. The aim of this work is to identify targets that could be used for diagnosis or to monitor disease progression, or ultimately, for therapies to improve the outlook for people with ALS. Her work is funded by Target ALS, MND Scotland and is also funded through a US National Institutes of Health Transformative Research Award. Her lab recently discovered that markers of ALS can be detected in the gut years before motor symptoms begin.

Supporting a positive research culture

The BNA Scholars Programme, launched in October 2020, supports students and early career researchers from underrepresented ethnic groups to thrive in neuroscience, and to build a supportive community through networking opportunities, bursaries and mentorship. Through the support of 16

[3] reverserett.org/research/cures/gene-replacement
[4] nms.ac.uk/explore-our-collections/stories/science-and-technology/made-in-scotland-changing-the-world/scottish-science-innovations/the-lothian-birth-cohort/
[5] ed.ac.uk/lothian-birth-cohorts

forward thinking organisations representing the full breadth of the neuroscience sector we have so far provided support to 21 scholars, each carefully matched with a mentor. Our 2023 cohort includes Arish Mudra Rakshasa-Loots, a neuroscientist, liberal arts scholar, and EDI consultant, studying at the University of Edinburgh.[6]

Arish is completing a PhD in Translational Neuroscience, researching the neurobiological mechanisms underlying the high prevalence of depression amongst people living with HIV. This work is driven by Arish's passion for HIV healthcare and interest in neuropsychiatric disorders. Leveraging HIV participant cohorts in the UK, the Netherlands, and South Africa, Arish is working to determine whether neuroinflammation can explain why people living with HIV face a significantly higher risk of depression. Arish has also worked in partnership with collaborators, mental health professionals, and people with lived experience of depression to develop a transcultural translation in isiXhosa of a widely used depression screening tool.

Strengthening Credibility in Neuroscience

The BNA is committed to driving neuroscience research to be as robust, reliable, replicable, and reproducible as possible, to create an exciting and sustainable future for 21st century neuroscience. Our Credibility in Neuroscience programme, supported by the Gatsby Foundation, is helping to change the research culture, provide neuroscientists with new skills and knowledge, and change the broader environment researchers work in.[7]

In 2021, we launched a set of annual Credibility Prizes to champion leading examples of credible practice in neuroscience research, with the inaugural team prize winner the CAMARADES research group at the University of Edinburgh. CAMARADES was founded in 2004 by Professors Malcolm Macleod and David Howells, and has used systematic review and meta-analysis to address translational failures in preclinical research in disease models such as neuropathic pain and Alzheimer's disease.[8] The team pioneered the use of the systematic review as a method to interrogate the reproducibility of preclinical research studies.

As part of their goal to improve the validity and value of the preclinical models of human diseases, CAMARADES have also campaigned and advocated for changes in the reporting of preclinical research, working with Nature Publishing Group and PLOS One to revise editorial policy.

The Brain Prize

In addition to the research above, neuroscience in Scotland has received further international recognition in recent years, as two Scottish neuroscientists from the University of Edinburgh have won the Brain Prize – the highest neuroscience prize announced annually and often referred to as the 'Nobel of Neuroscience'. In 2020, Professor Sir Adrian Bird was jointly awarded the prize for fundamental, pioneering work on Rett Syndrome[9], which showed that this could be reversed in laboratory mice – paving the way for the gene therapy trial mentioned above. Before then in 2016, Professor Richard

[6] bna.org.uk/mediacentre/news/2023-scholars/
[7] bnacredibility.org.uk
[8] ed.ac.uk/clinical-brain-sciences/research/camarades
[9] edinburghneuroscience.ed.ac.uk/news/professor-sir-adrian-bird-jointly-awarded-2020-brain-prize

Morris was also jointly awarded the Brain Prize in recognition of his work to understand the mechanisms of memory.[10]

Research Excellence Framework (REF)

While not in a position to comment on the allocation of resources through the REF specifically for institutions in Scotland, the BNA has participated in the Future Research Assessment Programme, a project supported by the funding councils in the UK nations to consider way of improving how REF assesses research. We highlighted during the consultation that providing a fully credible assessment requires credibility to be embedded into the design, methodology, and reporting stages of research.

Advanced Research and Invention Agency (ARIA)

ARIA provides a significant opportunity for the UK to invest in high risk, high reward research into areas of neuroscience such as neurotechnologies, neuro-regeneration, bioelectric medicine and more.[11] ARIA is still at a very early stage of development, and too early for this to be assessed, however we note that half of the programme directors announced in September 2023 have experience within neuroscience research.

Horizon Europe

The BNA is relieved at the recent news that the UK will join Horizon Europe as an associate member, as an inclusive European Research Area is essential for neuroscience collaboration. We helped to coordinate a united message on behalf of the European neuroscience community, which highlighted our concerns over the damage that delays to securing membership were having on neuroscience research, and stressed the urgent need for Horizon Europe to be agreed.

The BNA is a stakeholder member of the iRISE project, funded through Horizon Europe to understand, investigate and guide strategies to address irreproducibility in research.[12] iRISE had initially been submitted as an application by a team at the University of Edinburgh, who had intended to be the institutional lead for the project, however the delays to associating to Horizon Europe have meant that this lead role had to be taken on by an institution based in Germany.

The delays to associate membership have however had impacts on the UK's ability to lead international collaborations in neuroscience and other fields[13], which researchers across the whole UK including Scotland will have to work hard to repair now that they can fully participate in Horizon Europe's funding calls.

[10] ed.ac.uk/biomedical-sciences/news/archives/2016/prof-richard-morris-awarded-top-research-prize
[11] bna.org.uk/mediacentre/news/a-new-funding-agency-for-uk-research/
[12] irise-project.eu/
[13] www.bna.org.uk/mediacentre/news/horizon-klein-flugge/