Science in the NHS

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This year we celebrate the 60th anniversary of the National Health Service. In marking this momentous milestone, it is crucial that we acknowledge the important role science has played in driving forward crucial innovation and improvements, leading to better patient care for many and saving millions of lives.

The last sixty years have seen astonishing advances in diagnosis, treatment and care within the NHS. IVF, MRI and PET scans are just some of the advances powering innovation, providing evidence for change and ensuring that laboratory research is quickly translated into better and more effective care for patients.

In 1948, just a few hundred healthcare scientists were employed within the service. They were found behind the scenes, typically in pathology laboratories. Today, there are over 50,000 healthcare scientists working for the NHS and its related bodies such as the Health Protection Agency. They make up the single largest science workforce in Britain (and the third largest in Europe). The size of this workforce – which is a surprise to many – reflects the critical cross cutting importance of scientific services in patient care, with eight out of ten clinical decisions now depending on diagnostic information. They have been important innovators in health and have played a key role in ensuring that the many scientific advances of the last sixty years have been translated into opportunities for better care for patients. As a former nurse of more than 25 years' experience in the NHS, I have witnessed many of these advances.

For example, NHS medical physicists pioneered and developed many of the dazzling new imaging technologies which have revolutionised the diagnosis and management of disease. X rays have become safer for both patients and medical staff, with clearer images produced using a lower radiation dose. Ultrasound, developed within the NHS, no longer produces fuzzy pictures, but highly detailed 3D images which are used in cardiology, fetal medicine and many other areas. A whole new field, functional imaging, uses gamma and Postiron emission tomography (PET) cameras to track injected radioisotopes. Functional MRI scans show soft tissues in high definition along with brain physiology. This ability to reveal the brain at work has sparked an unprecedented era of discovery in neuroscience.

As science in the wider world advanced, so did science in the NHS. Watson & Crick's 1953 paper on DNA marked the beginning of an explosion of genetic knowledge and soon the NHS began employing geneticists to interpret the new knowledge about genes for patient benefit. As assisted reproductive technologies like in-vitro fertilisation (IVF) were developed, another new profession emerged – clinical embryologists – dedicated to ensuring that the highest quality standards are translated into the best chances of pregnancy for infertile couples.

Clinical engineering in the NHS meanwhile has quietly revolutionised rehabilitation, beginning with the design, manufacture and maintenance of improved artificial limbs, wheelchairs and other mobility aids. Developments in technology, including composite materials, electronics and computing have improved prosthetics which can now be controlled by stimulation from the central nervous system. Such systems are able to activate nerves affected by paralysis.

Measuring how effectively body systems are working is another key area. In 1948, patients had their breathing assessed by blowing into laboratory based water spirometers, a far cry from the hand-held devices used in GP practices today with embedded micro chips which can transmit data to offsite locations for reporting and interpreting, for monitoring changes in a patient's condition and for quality assurance purposes, important in national and global clinical trials. Much of this development in device technology has been done in a symbiotic partnership between NHS scientific departments and industry. The advance in technology has also allowed respiratory function to be assessed both awake and asleep. When this became possible, new diseases were revealed such as sleep apnoea which was virtually unknown in 1948.

Diagnosis is today moving out of the laboratory and into the GP's surgery and patient's home. 'Labs on a chip', developed and refined by scientists within the NHS, measure multiple substances simultaneously from a single drop of blood.

The NHS, with its unique structure, has always been at the forefront of health innovation. Over the past decade, the Government has more than doubled science spending, a large proportion of which has driven research with application in public health and healthcare. Investment in healthcare research through the Medical Research Council and the National Institute for Health Research (NIHR) has already made a difference for patients. When the NHS began, blindness was inevitable for those with inherited eye disease. One of the new NIHR funded specialist biomedical research centres is a collaboration between Moorfield's Eye Hospital and University College London. Gene therapy developed at the centre has already improved the sight of some young people with rare blinding conditions; further work with stem cell therapy and new medicines which prevent scarring in the eye show enormous promise for a range of other eye problems.

Science is also at the heart of public health policy within the Department of Health, informing it and providing the

evidence for response in the face of new threats to public health and safety. A current example is in the development of guidance and plans to support the NHS in its preparations for a flu pandemic. The DH Health Scientific Advisory Group completed comprehensive reviews of evidence supporting the use of clinical countermeasures, publishing them in 2007.

Many of the innovations that improve the lives of Britons during the next sixty years are as yet unimagined. Much more certain is the knowledge that science – and scientists – will continue to be the bedrock of the NHS – as they have been for the past sixty years.

Science in Universities

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It is well known but worth repeating that the UK produces nine per cent of the world's scientific papers with a citation share of 12 per cent, second only to the US, and has continued to strengthen its share of the world's most influential papers. The UK's universities have underpinned this success, which has been achieved with relatively lower investment than competitors. The continued strength of research in the UK's universities is present across the sector in a full range of disciplines from engineering and physical sciences through to the arts and humanities.

Universities' research performance is closely linked to our country's future economic and social prosperity, with science and innovation rising up the list of priorities for political attention and public investment. For their part, the current Government has demonstrated political commitment through the substantial investment that has flowed from the 10-year Science and Innovation Investment Framework. Parties from across the political spectrum have recognised its importance. This is good news.

Much of the recent additional investment in university research has gone to sustain the research base. Termed 'full economic costing', the basic principle has been to sustain the volume of project-based research funding through the Research Councils, but to ensure that more of the costs are covered to allow universities to re-invest in their infrastructure. To some this might seem a mere accounting issue, but it has been fundamental in helping to turn around years of under-investment and set UK universities on a firm footing to take on the biggest challenges, with labs and facilities that are world class and fit for purpose.

The success of the UK's Higher Education Institutions (HEI) research has also been underpinned by another seemingly arcane, but nonetheless essential, policy – the dual support system. This provides public funds to institutions in two streams, one as part of their block grant provided by the devolved funding councils (known as 'quality related' or QR), and the other in the form of project-based grants provided by the UK-wide Research Councils. A key strength of this system is that the QR grant is unhypothecated – that is not restricted to a specific purpose – allowing university leaders the freedom to take strategic decisions about the research activities of their own institutions. This means that risky or more innovative research can be supported, when it might otherwise slip though the net.

Universities UK's 2006 publication, *Eureka UK*, outlined some of the most outstanding world-changing discoveries, innovations and research projects that have come out of UK universities over the past 50 years. Many of these developed from individuals or groups supported through QR funds. They were given time to evolve in supportive research cultures. Put simply, if UK universities are going to be able to continue to punch above their weight in an increasingly competitive international environment, they need the flex and dynamism that dual support affords them.

A sustainable and dynamic university system will mean that we can also improve the attractiveness of the UK to inward investors and potential partners, draw the best mobile talent, and capitalise on international collaborations. New knowledge can arise anywhere and international research collaboration is a direct means of accessing it and increasing the UK's strategic capability for innovation. A recent report by Universities UK shows that we are already doing well. UK researchers are hugely active in international collaborations and their number is 50% higher than 10 years ago. We cannot, however, be complacent. China, India and South Korea are now significant players in global science and innovation networks that channel flows of people, ideas and technologies.

Research in UK universities is not only strong internationally, but also relevant to business and public sector users at regional and national levels. Strength in this area comes from the diversity of the sector and universities have worked extremely hard to ensure that we do not miss opportunities to exchange knowledge that has the potential to underpin the development of innovative products and services that can benefit us all. The commitment to a permanent source of funding to help make this happen, through the Higher Education