



National Institute for Health Research

60 years of research in
the NHS benefiting patients



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Foreword by the Secretary of State for Health



The 60th anniversary of the formation of the NHS is a time for reflection and celebration, and a time for looking forward.

Research was one of the founding principles of the NHS. It has been a core function ever since. Its impact has been profound.

The decades described in this inspiring account have seen unparalleled advances in medical science and in health care. The NHS has provided the means for so much of that development to take place. It has provided the structure and the resources that have allowed us to take major steps forward in the diagnosis, treatment and prevention of disease.

Health research depends critically on the willing participation of individual patients in clinical trials. We owe a great debt to the many thousands of people who have contributed over the years to the future health and well-being of us all. These advances could not have happened without the imagination and commitment of the scientists and clinicians we celebrate today. The people who took part in their research deserve to be part of that celebration.

I am determined that as we go forward as many patients as possible have the opportunity to be part of the research that today and in the years to come will transform healthcare and the well-being of our population.

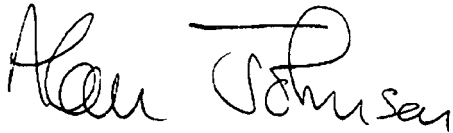
Health research depends on partnerships and on collaboration. Both characterise the success of the last 60 years. They are today more than ever part of a strong and vigorous research environment.

The government-funded National Institute for Health Research and Medical Research Council are working ever more closely together to ensure that scientific discoveries are effectively translated into healthcare benefits for patients and the public.

Health research charities play a vital role in funding research and in providing support and a voice for people at difficult and vulnerable times in their lives. Universities and hospitals are working more closely together and are forming exciting new alliances. The pharmaceutical, biotechnology and medical technology industries continue to contribute hugely to the health and wealth of the nation.

The UK is a world leader in health research. The reasons for that are set out in the pages of this report. The outstanding individuals and the quality of the teams they have led have been able to use our unique National Health Service and the willing co-operation of its staff and patients to bring lasting benefit. They show the central place that NHS has occupied in so much of what has been achieved.

Each of us and each of our families has gained immeasurably from the last 60 years of health research. We must continue to build on that tradition to meet the needs of our time and for the sake of future generations.

A handwritten signature in black ink that reads "Alan Johnson". The signature is written in a cursive style with a prominent horizontal line above the "J" in Johnson.

Rt Hon Alan Johnson MP
Secretary of State for Health
June 2008

Introduction

2008 is the 60th anniversary of the formation of the NHS. This account celebrates the vital role it has played in advancing medical science and healthcare since that time.

Health research is critical for improving health and in providing a more effective health service now and for future generations. When the NHS was established in 1948, the opportunities for medical advances were greatly expanded as it gave researchers, for the first time, access to vast numbers of patients and staff in a clinical setting. The enthusiasm of patients and NHS staff to participate in research over the intervening 60 years has led to dramatic improvements in diagnosis and treatment, had global impacts, and reflects the international status of UK health research.

Significant progress in healthcare can only be made through research that is carried out with sufficiently large groups of willing participants to provide the statistical validity for making the right healthcare decisions. The NHS, with its vast resources of socially and ethnically diverse patients and medical staff, provides the ideal environment within which researchers can obtain the data they need to generate robust results.

This document outlines some of the major advances in medical knowledge, treatment and patient care that have marked the first 60 years of the NHS. The achievements are characterised by partnerships between the NHS, funding bodies, academic institutions and innovative individuals with the public and patients. They demonstrate the importance of a collaborative, multidisciplinary approach to research.

Major advances in medical knowledge, treatment and patient care achieved in the first 60 years of the NHS

Research carried out in the first 60 years of the NHS has led to significant improvements in treatments and healthcare for patients. The following examples highlight some of these far-reaching achievements.

1948–1958

Lung cancer and smoking

Professor Sir Richard Doll and Professor Sir Austin Bradford Hill were among the first to point out that there was a statistical link between smoking and lung cancer, in a research paper published in the *British Medical Journal* in 1950.¹

Doll was a member of the Statistical Research Unit of the Medical Research Council, based at the Central Middlesex Hospital in London, and Hill was Professor of Medical Statistics at the London School of Hygiene and Tropical Medicine.

Doll and Hill asked 20 London hospitals, including Lewisham, the Middlesex, the Royal Free and St Thomas', to notify them of any patients admitted with lung, stomach, colon or rectal cancer. Patients were then invited to participate in the study, and those who agreed were interviewed to find if there was a common link between their lifestyle and the cancers. 'We asked them every question we could think of,' Doll told the BBC in 2004.² Doll had thought that the new tarmac being used on roads or toxic

¹ Doll, R and Hill, AB. 1950. 'Smoking and carcinoma of the lung: preliminary report.' *BMJ* 2:739–48

² <http://news.bbc.co.uk/1/hi/health/3826939.stm>

fumes from car exhausts might be responsible for the steadily rising incidence of lung cancer, but during this study, he discovered something that made him give up smoking himself. The original paper concluded that *'the risk of developing the disease increases in proportion to the amount smoked. It may be 50 times as great among those who smoke 25 or more cigarettes a day as among non-smokers'*.³

The two researchers followed up their patient survey with the much larger British Doctors' Study initiated in 1951. They recruited doctors through the Medical Registrar, asked them if they smoked, and followed their health outcomes. The Doctors' Study received responses from over 34,000 doctors, and a preliminary report published in 1954 demonstrated that there was a link not only between smoking and lung cancer, but also between smoking and a range of other health problems, including heart disease and stroke.⁴

Statistical research, in particular epidemiology or the study of disease in populations, requires data from vast numbers of subjects if it is to be of any use. Access to large numbers of patients and doctors in the NHS was key to establishing the causal relationship.

In 1954, around 80% of adults in the UK smoked. 50 years after Doll and Hill's groundbreaking work, that figure had fallen to 26%. This work saved, and continues to save, millions of lives. Today, the NHS has an active smoking cessation programme that aims to prevent illness and death from smoking.

3 Doll and Hill, op cit

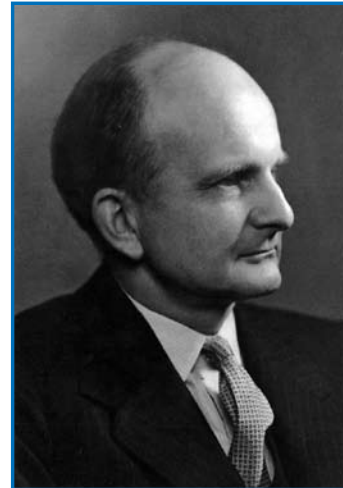
4 Doll, R and Hill, AB. 1954. 'The mortality of doctors in relation to their smoking habits: a preliminary report.' *BMJ* 1:1451-5

The dangers of bed rest

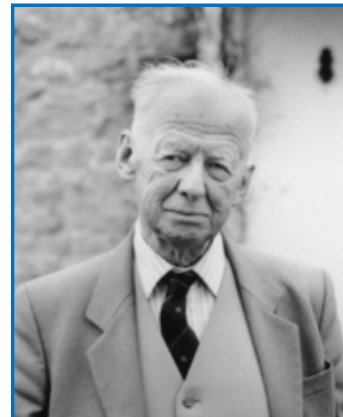
In 1947, Richard Asher of the Central Middlesex Hospital was one of the first doctors to highlight the risks of extended bed rest. Conventional wisdom was that patients should rest in bed for as long as possible after an operation or other treatment, but Asher pointed out that the risks of complications such as chest infections, deep vein thrombosis and bed sores far outweighed the risks associated with getting up too early.

The idea was taken up by Sir Francis Avery Jones, also of the Central Middlesex, who pointed out that patients' health was improved and indeed lives were saved through reducing bed rest. Dr Malcolm Farquharson of the Edinburgh Royal Infirmary proved the point that wounds were rarely the reason for post-operative problems in a study of 485 hernia patients who were operated on under local anaesthetic and discharged the same day. Only one in 200 returned with a problem related to the operation.⁵

In 1994, the Clinical Standards Advisory Group reversed previous recommendations for the treatment of back pain, recommending bed rest only in exceptional circumstances and promoting instead an 'active rehabilitation' approach.⁶ Today, even heart surgery patients typically spend only six or seven days in hospital before they are allowed home.⁷



Richard Alan John Asher,
MD, FRCP



Sir Francis Avery Jones

5 <http://www.nhshistory.net/Chapter%201.htm>

6 Clinical Standards Advisory Group. 1994. *Back Pain*. Report of a CSAG Committee. London, HMSO

7 http://www.bhf.org.uk/living_with_heart_conditions/treatment/having_heart_surgery.aspx

1959–1968

Hip replacement

The first total hip replacement operation was performed in 1962 by Sir John Charnley, an orthopaedic surgeon at the Wrightington Hospital in Wigan, Lancashire. Today hip replacement operations are common, with more than 62,000 being performed in the NHS every year. Hip replacements relieve pain and improve mobility for sufferers of osteoarthritis, rheumatoid arthritis, fractures and other conditions that affect this crucial joint, and have an enormous impact on quality of life.

Having previously worked on fractures and techniques using spring-loaded clamps to hold broken bones together until they mended, in the late 1950s Charnley switched to arthroplasty, where the objective was not to fuse bones, but to find a way to create an artificial joint that would move freely.⁸ 'This type of surgery demands training in mechanical techniques which, though elementary in practical engineering, are as yet unknown in the training of a surgeon,' Charnley told a British Medical Association audience in 1959.⁹

Low-frictional torque arthroplasty, to give hip replacement its proper name, involves replacing both the ball joint at the head of the femur and the socket part of the joint in the pelvis, the acetabulum. Charnley's laboratory at the Wrightington Hospital became known as the Hip Centre, and here Charnley tested materials on his own legs before using them on patients.¹⁰



8 Nisbet, N W and Woodruff, M. 1984. 'John Charnley, 29 August 1911 – 5 August 1982' *Biographical Memoirs of Fellows of the Royal Society*, 30:119-137.

9 <http://rheumatology.oxfordjournals.org/cgi/content/full/41/7/824>

10 <http://news.bbc.co.uk/1/hi/health/4906010.stm>

Earlier attempts at hip replacement had revealed a number of problems, and Charnley made vital improvements. He used a smaller, stainless steel head for the ball joint, and recognising that reducing friction in the joint could be achieved by using plastic for the socket, eventually selected high molecular weight polyethylene (HMWP). He also addressed the problem of how to fix the joint prosthetics to the existing bone, and identified a synthetic acrylic polymer that had good compatibility with human tissue, poly(methyl methacrylate) or PMMA, now known as 'bone cement'.

Crucially, Charnley recognised that successful hip replacement was not just the result of choosing the right materials. Post-operative infection, particularly in the bone, was the cause of many early failures. Charnley introduced operating procedures designed to reduce the chances of infection and cross-contamination, including 'clean air' conditions and the instrument tray system, techniques that remain in use today.

Palliative care and the modern hospice movement

Almost 513,000 deaths were registered in the UK in 2005. Of these, 153,491 were due to cancer,¹¹ the disease most frequently requiring terminal care.

Dame Cicely Saunders, OM, started a revolution in the care of the dying when she opened St Christopher's Hospice in South London in 1967. Strong support from the Deputy Chief Medical Officer of the then Ministry of Health, Albertine Winner, helped Dame Cicely in getting St Christopher's established, and today the Hospice is recognised globally as the leader in palliative



Dame Cicely Saunders
(Photograph St. Christopher's Hospice)

care and the modern hospice movement. A charitable organisation, St Christopher's receives approximately 45% of its patient care costs from the NHS.¹²

As the first hospice to link expert pain and symptom control, compassionate care, education and clinical research, St Christopher's has been a pioneer in the field of palliative care, now established worldwide. Dame Cicely's single-minded vision – and the clinical practice and dissemination of her work through St Christopher's teaching and outreach – revolutionised the way in which society cares for the dying and the bereaved.

Pioneering research showing that morphine is an effective drug for pain control was carried out at St Christopher's, along with other studies of new approaches to symptom control. Dame Cicely also understood that a dying person is more than a patient with symptoms to be controlled. She knew the paramount importance of combining excellent medical and nursing care with 'holistic' support that recognises practical, emotional, social and spiritual need. She saw the dying person and the family as the unit of care and developed bereavement services at St Christopher's Hospice to extend

11 <http://info.cancerresearchuk.org/cancerstats/mortality/a=5441>

12 Christopher Saunders. 2008. Pers. comm.

13 <http://www.cicelysaundersfoundation.org/index.php/palliative/history>

support beyond the death of the patient. In 1969 Dame Cicely pioneered the first home care team, taking St Christopher's care and philosophy out into the community. The Hospice's education programme, disseminating information nationally and internationally, has been supported by government funding since 1976.

Cicely Saunders International (CSI), was founded by Dame Cicely a few years before her death in 2005, and continues to fund and drive international research. With its academic partner King's College London, CSI is currently establishing the Cicely Saunders Institute of Palliative Care. At its launching ceremony in February 2008, Prime Minister Gordon Brown pledged more government support for palliative care, describing Dame Cicely as 'a real pioneer for the world'.¹⁴ Dame Cicely was one of the individuals Gordon Brown selected for his book, *Courage: Eight Portraits*.¹⁵

¹⁴ <http://www.number-10.gov.uk/output/Page14484.asp>

¹⁵ Brown, G. (2007). *Courage: Eight Portraits*. Bloomsbury, London

The Glasgow Coma Scale (GCS)

Hospital emergency room dramas on TV inevitably have at some point a doctor calling out a patient's GCS. The GCS is a scoring system used to quantify levels of consciousness in patients with head injuries and was developed by Professor Graham M Teasdale and Professor Bryan Jennett of Glasgow University.

Hospitals in the UK see over 1 million head injuries every year.¹⁶ The GCS means that these injuries can be assessed for severity and tracked over time, using straightforward criteria that produce reliable, comparable results even when different medical staff carry out the assessment.

Teasdale and Jennett's 1974 paper published in *The Lancet*¹⁷ led to the GCS being adopted as the most widely used scoring system of this type in the world.

¹⁶ <http://news.bbc.co.uk/1/hi/health/5168560.stm>

¹⁷ Teasdale, G and Jennett, B. 1974. 'Assessment of coma and impaired consciousness. A practical scale.' *The Lancet* 2:81–84

The world's first IVF baby

Since the world's first in vitro fertilisation (IVF) baby, Louise Brown, was born in Oldham General Hospital in July 1978, more than 3 million so-called 'test tube' babies have been born around the world, bringing hope to the thousands of couples who undergo fertility treatment each year.

Professor Robert Edwards, a Cambridge University physiologist, had been working on the fertilisation of eggs (both human and animal) for some time and had been one of the first researchers to successfully produce fertilised eggs, in vitro. Patrick Steptoe, of the Department of Obstetrics and Gynaecology at Oldham General Hospital, had adapted the technique of laparoscopy to enable him to obtain eggs from the ovaries for medical reasons, but realised that eggs removed from healthy ovaries at the right time would be ready for fertilisation.

Edwards and Steptoe teamed up and applied their joint knowledge to the problems of infertile couples. Early attempts, where the fertilised egg spent several days in vitro until it had undergone around 32 divisions, were unsuccessful and the resulting pregnancies miscarried after a few weeks. After some 30 failures,¹⁸ a new protocol was needed.

Louise's mother came to Steptoe and Edwards because she was unable to conceive naturally due to blocked Fallopian tubes.¹⁹ Steptoe and Edwards decided to take what was to them the bold step of radically reducing the time the fertilised egg spent outside the body, and the embryo that was to become Louise was implanted after just two and a half days. A normal pregnancy resulted, and the era of the test tube baby had begun.²⁰



Louise just after her birth, with Robert Edwards, Patrick Steptoe (left) and their assistant Jean Purdy.

18 <http://www.time.com/time/printout/0,8816,990605,00.html>

19 http://news.bbc.co.uk/onthisday/hi/dates/stories/july/25/newsid_2499000/2499411.stm

20 Steptoe, PC and Edwards, RG. 1978. 'Birth after the reimplantation of a human embryo.' *The Lancet*, 12:2(8085):366

1979–1988

Detecting osteoporosis using ultrasound

Osteoporosis is a degenerative bone disease that results in high rates of fractures, particularly of the wrist, hip and spine, among sufferers, and considerably reduces quality of life. It is more prevalent with old age and affects around 3 million people in the UK. Over 230,000 fractures each year are attributed to the condition and, during their lifetime, one in two women and one in five men will suffer a fracture due to osteoporosis.²¹ In 2007, the estimated 60,000 hip fractures caused by osteoporosis each year were highlighted as costing the NHS some £1.73 billion.²²

One of the key issues in diagnosing and treating osteoporosis is the fact that there are few warning signs so, up until the 1980s, the condition was typically only discovered when the first fracture occurred. Osteoporosis can be slowed and even prevented with early intervention, potentially preventing significant hardship and saving millions of pounds, so finding a method to diagnose osteoporosis was of the utmost importance.

Osteoporotic bones are less dense than normal bones, hence their inherent weakness, but measuring the density of bones is not easy. Professor Chris Langton, a researcher at Hull University, began working with ultrasound to measure bones in 1978. By 1984, in collaboration with the Doncaster Royal Infirmary, he had developed the method now known as broadband ultrasonic attenuation (BUA).²³



Professor Christian M Langton



First 'contact' heel BUA device

21 <http://www.bbc.co.uk/health/conditions/osteoporosis1.shtml>, <http://www.nhsdirect.nhs.uk/articles/article.aspx?articleID=271>

22 <http://news.bbc.co.uk/1/hi/health/7109955.stm>

23 Langton, CM, Palmer, SB and Porter, RW. 1984. 'The measurement of broadband ultrasonic attenuation in cancellous bone.' *Engineering Medicine*, 12:89–91

Langton showed that patients who had suffered a hip fracture had lower BUA values than those who had not suffered a fracture and went on to develop the Ultrasound Bone Assessment System as an early detection system for osteoporosis.

Langton's invention, known more commonly as the 'bone-box', is currently used in over 12,000 hospitals around the world and, in 2006, Universities UK listed it among 100 world-changing discoveries produced by British universities since 1946. 'It's probably fair to say that there is an ultrasound bone analyser in every major city hospital throughout the world,' Professor Langton told network Knowledge RICH in 2006.²⁴

A genetically engineered vaccine for hepatitis B

Hepatitis B is a virus that affects the liver, and is the most widespread infectious disease in the world. The World Health Organization estimates that a third of the world's population has been infected with the virus at some time in their lives, and that over 350 million people suffer long-term infection. Chronic hepatitis B can lead to inflammation of the liver, cirrhosis and cancer. The British Liver Trust claims that approximately 1 in 1,000 people in the UK carry the infection, with rates being much higher in some inner city areas with high immigrant populations. Hepatitis B Foundation UK estimates that there are some 326,000 people in the UK with chronic hepatitis B, the most dangerous form of the disease.²⁵

Up until the early 1980s, hepatitis B vaccines could only be produced using the blood of hepatitis B carriers and supplies of the vaccine were limited. Professor Ken Murray of Edinburgh University, a pioneer in genetic engineering, used cloning techniques to develop the first vaccine made from sub-units of the virus and large-scale production became possible.²⁶

Murray's vaccine has saved millions of lives worldwide. His work inspired the creation of the Warren Alpert Foundation prize for significant advances in disease treatment. Alpert read of Murray's breakthrough and decided to reward him. Murray was offered the prize even before Alpert had established his Foundation.

²⁴ <http://www.knowledge-rich.com/Keynote.aspx?id=110>

²⁵ <http://www.hepb.org.uk>

²⁶ <http://www.research-innovation.ed.ac.uk/success/hepatitisB.asp>

1989–1998

Preventing recurrent miscarriage

10–15% of clinically recognised pregnancies end in miscarriage according to the Royal College of Obstetricians and Gynaecologists,²⁷ but most women go on to carry a later pregnancy to term. However, 1–2% of women suffer from recurrent miscarriage, defined as when three or more consecutive pregnancies miscarry.

While it is impossible to predict whether or not a woman will miscarry, there are several factors that appear to make miscarriage more likely including age, genetic abnormalities and physiological disorders of the cervix. One study found that 15% of women who suffered recurrent miscarriages carried antiphospholipid antibodies (aPL) in their blood,

significantly higher than the less than 2% of women with normal pregnancies who tested positive for aPL. The presence of aPL is an indication for antiphospholipid, or Hughes Syndrome, which results in a cluster of conditions related to blood clotting, including vascular thrombosis. Sufferers are sometimes referred to as having 'sticky blood' because their blood clots more easily.

Standard treatments for blood clotting typically involve small daily doses of aspirin or a combination of aspirin and heparin to thin the blood. A joint effort between the Arthritis Research Campaign and the NHS saw Professor Lesley Regan and her colleagues at St Mary's Hospital in London explore hitherto anecdotal evidence that aspirin and heparin helped women who had suffered recurrent miscarriage to carry a pregnancy successfully to term.

Standard treatments for blood clotting typically involve small daily doses of aspirin or a combination of aspirin and heparin to thin the blood. A joint effort between the Arthritis Research Campaign and the NHS saw Professor Lesley Regan and her colleagues at St Mary's Hospital in London explore hitherto anecdotal evidence that aspirin and heparin helped women who had suffered recurrent miscarriage to carry a pregnancy successfully to term.

Professor Regan found that the live birth rate of women with aPL could be increased from 10% to 70% by treating them with a combination of aspirin and heparin. Regan's work resulted in the UK Royal College of Obstetricians and Gynaecologists issuing new guidelines in 2003 for the treatment of women with recurrent miscarriage and raised levels of aPL. Similar guidelines were subsequently issued by other professional bodies around the world, all referring to Professor Regan's research.²⁸



Professor Lesley Regan

27 http://www.rcog.org.uk/resources/Public/pdf/Recurrent_Miscarriage_No17.pdf

28 Wooding, S, Anton, S, Grant, J, Hanney, S, Hoorens, S, Lierens, A and Shergold, M. 2004. *The returns from arthritis research. Volume 2: Case studies*. Cambridge, RAND Europe

Joining up the dots to save premature babies

The journey from basic research to patient benefit is often complex. One such journey began with sheep in the 1960s and eventually led, via a series of studies on the problem, to the 1992 publication of guidelines that would significantly reduce neonatal death rates in premature babies.²⁹

Individual research projects may be small and provide insufficient evidence to justify new treatments. The Cochrane Collaboration, an international not-for-profit organisation that receives nearly 50% of its funding from the NHS, undertakes systematic reviews of health care and research globally. By conducting meta-analyses, collating research and creating 'critical mass' from the results of small trials, Cochrane reviews can build the evidence base for or against a particular medical intervention.

The first research into the use of corticosteroids to prevent respiratory distress syndrome in newborns was published in 1969. The original subjects were sheep, but three years later the results of a trial in humans were published. However, although the results were highly promising and backed up by subsequent studies, and strong recommendations to formalise the use of corticosteroids were received from several organisations, official endorsement was lacking.

In 1990, a meta-analysis of 23 human trials provided clear evidence that the corticosteroid treatment reduced the occurrence of respiratory distress syndrome in newborns and that there was no evidence of adverse effects. Crucially, the paper concluded that corticosteroid treatment improved the survival rate of premature babies by up to 50%.³⁰ The meta-analysis played a part in the development of the Cochrane Collaboration, and is still used today as its logo.³¹

In 1992, the Joint Working Group of the British Association of Perinatal Medicine, the Research Unit of the Royal College of Physicians and the Royal College of Obstetricians and Gynaecologists published guidelines recommending the use of corticosteroids to help prevent respiratory distress syndrome in premature babies.

29 Hanney, S, Mugford, M, Grant, J and Buxton, M. 2004. 'Assessing the benefits of health research: lessons from research into the use of antenatal corticosteroids for the prevention of neonatal respiratory distress syndrome.' *Social Science and Medicine* 937–947

30 Crowley, P, Chalmers, I and Keirse, M. 1990. 'The effects of corticosteroid administration before preterm delivery: An overview of the evidence from controlled trials.' *British Journal of Obstetrics and Gynaecology* 97, 11–25

31 <http://www.cochrane.org/logo/>

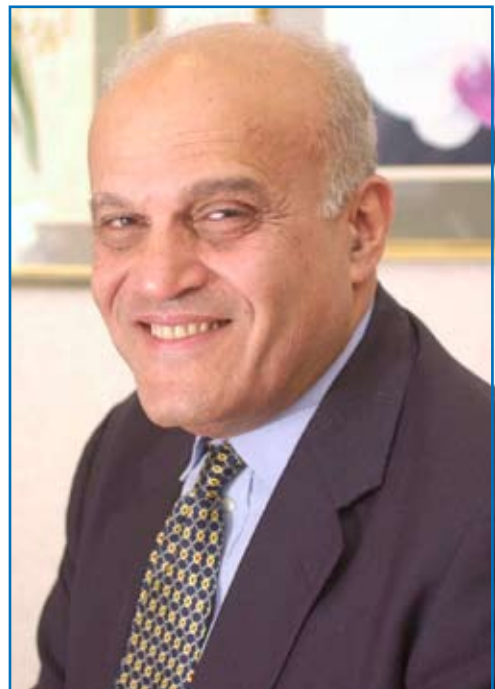
1999–2008

Bioengineering heart valves

The British Heart Foundation estimates that coronary heart disease costs the UK economy £7.9 billion per year. Over 2.5 million people in the UK live with heart disease. Every two minutes someone in the UK suffers from a heart attack, and 570 people die every day from heart and circulatory diseases.³² Heart valve defects are just one of the problems that make up these numbers and nearly 10,000 heart valve replacement operations were carried out in the UK in 2003.³³

While replacing heart valves has been possible for around 50 years, there are still difficulties with this procedure. Replacement valves are either mechanical, man-made artificial valves, or biological valves obtained from organ donation or from animals – usually pigs or cows. There are several designs of mechanical device, but all create a more turbulent flow of blood through the heart and this can lead to an increased risk of blood clots. Patients with artificial heart valves therefore have to take anti-coagulant drugs for the rest of their lives. Biological replacement valves are also not perfect, as they tend to lose efficiency over time and may have to be replaced after a few years, necessitating further open-heart surgery.

So the 2007 announcement that Professor Sir Magdi Yacoub and his team at Harefield Hospital had grown a human heart valve from stem cells has dramatic implications. An innovative researcher and surgeon who has carried out more heart transplants than anyone else in the world, Yacoub assembled a multidisciplinary team to work on the heart valve project, including physicists, biologists, engineers, pharmacologists, cellular scientists and clinicians.³⁴



Professor Sir Magdi H Yacoub FRS

32 <http://www.bhf.org.uk/report07>

33 <http://news.bbc.co.uk/1/hi/health/6517645.stm>

34 Yacoub, MH and Nerem, RM. 2007. 'Introduction. Bioengineering the heart.' *Philosophical Transactions of the Royal Society B* 362:1253–1255

The complex procedure of bioengineering a heart valve involves extracting stem cells from bone marrow, triggering the cells to grow into heart valve cells, and then culturing the cells on collagen scaffolds to create the heart valve structure.

The problems of valve rejection should be eliminated if a patient is fitted with a new heart valve grown from their own stem cells and the risks of clotting associated with mechanical valves avoided. The heart valve will be the most complex human tissue so far grown from stem cells. Animal tests will demonstrate if these bioengineered heart valves function normally, leading ultimately to use in the clinic.³⁵

35 <http://www.guardian.co.uk/science/2007/apr/02/stemcells.genetics>

Health research in the NHS

The past

The tradition of publicly funded health research goes back to before the days of the NHS, to the early 20th century. The National Insurance Act of 1911 established the Medical Research Fund, which was the first public fund for health-related research and received one penny for every individual insured.³⁶

The Medical Research Committee and Advisory Council, later to become the Medical Research Council (MRC), was created in 1913, and was responsible for a number of early medical breakthroughs including discovering that rickets was due to a lack of Vitamin D and developing the first large-scale production methods for penicillin.

Britain entered the post WWII era with a strong belief that science would help to strengthen the national economy and general well-being, and the arrival of the NHS in 1948 made the development of randomised drug and treatment trials possible along with large-scale epidemiology. The MRC partnered with the NHS in a range of projects, including trialling chemotherapy regimens for leukaemia and identifying that aspirin and warfarin reduce heart attacks and stroke.³⁷

By the late 1980s, publicly funded health-related research was taking place under the auspices of three principal bodies, the MRC, the Department of Health and the NHS. A report on *Priorities in Medical Research* by the House of Lords Science and Technology Committee³⁸ led to the formation of NHS R&D in 1991. This body was tasked with integrating decision-making, research, delivery and management of medical research across the three organisations and firmly positioned the NHS as the arena in which publicly funded, clinical and applied health research is undertaken.

The law (most recently Section 1 of the NHS Act 2006) includes a duty to promote a comprehensive health service designed to secure improvement in physical and mental health and in the prevention, diagnosis and treatment of illness.

36 Shergold, M and Grant, J. 2008. 'Freedom and need: The evolution of public strategy for biomedical and health research in England.' *Health Research Policy and Systems*, 6:2

37 <http://www.mrc.ac.uk/AboutUs/History/Achievements/index.htm>

38 House of Lords Select Committee on Science and Technology. 1988. *Priorities in Medical Research: Report Volume 1*. London, HMSO.

The present

Today, funding for medical research comes from different sources and operates through a number of channels, including the private sector, universities, research councils, charities and the NHS itself. All of these channels rely on the public sector and, in particular, the NHS to facilitate and support health research.

In recent years the Government has acknowledged the central role that public funding plays in promoting world-class, high-value, patient-focused research, and its total investment in health research will top £1.7 billion per annum by 2010/11. The 2006 NHS research strategy *Best Research for Best Health*³⁹ maintains the tradition of supporting excellence in health research and builds on this heritage by developing a practical and patient-orientated health research system to support applied, clinical and translational health research.

Best Research for Best Health led to the establishment of the National Institute for Health Research (NIHR). The NIHR's goal is to make the NHS a centre of excellence for health research and provide the infrastructure to optimise clinical and applied research funded by NIHR, MRC, charities such as the Wellcome Trust and industry. The NIHR supports clinical research networks, biomedical research centres and clinical research facilities through funding and the development of operational systems designed to attract and retain the best researchers to deliver high quality health research. The NIHR budget will be £992 million per annum by 2010/11.

An example of a type of research the NIHR has been set up to support is the successful clinical trial at the NIHR Biomedical Research Centre at Moorfields Eye Hospital/UCL Institute of Ophthalmology. This trial showed that the progressive deterioration in vision and blindness in teenagers which is caused by Leber's congenital amaurosis (LCA), a type of inherited retinal degeneration that affects 1 in 3,000 people, could be successfully treated by administering gene therapy to the human retina. This represents a major achievement for British science and the NHS and the challenge for the future is to replicate this success more widely in the NHS.

39 Department of Health. 2006. *Best Research for Best Health. A new national health research strategy*. Department of Health.

To keep the UK at the forefront of research and innovation, the Department of Innovation, Universities and Skills has allocated almost £2 billion to the MRC over the next five years from its Science and Innovation Budget. This significant increase will fund both basic and translational health research in key areas such as disease models and biomarkers and enable the vast body of knowledge, and the advances in fundamental biological sciences and technologies, to be translated into applied clinical practice.

Charities play a significant role in funding medical research. The 114 members of the Association of Medical Research Charities (AMRC) contributed approximately £800 million to medical research in 2006/07. Their budget will rise to over £1 billion by 2010/11, with the Wellcome Trust contributing £650 million and Cancer Research UK around £400 million. The AMRC estimates that medical research charities are responsible for roughly one third of all public funding for medical and health research in the UK, and that in the five years to 2007, charities provided over £3.25 billion for medical research.⁴⁰

Private sector funding for medical research involves pharmaceutical, biotechnology, devices and diagnostics companies, and can range from 'pre-competitive' to 'near market' projects. The pharmaceutical industry spends around £3.5 billion per annum on R&D in the UK. Approximately 40% of this is spent on clinical trials which are the last phase in the development of new medicines prior to licensing.

40 <http://www.amrc.org.uk/HOMEPAGE?Nav=947,463>

The future

Funders are increasingly working together to maximise the impacts of their skills, resources and expenditure. Partnerships between industry, academia, charities, the NHS and patients are being forged and strengthened to contribute to this endeavour.

A prime example is the plans for a unique £500 million medical research partnership to create a world-class centre for medical research in London – the UK Centre for Medical Research and Innovation. The MRC, Cancer Research UK, the Wellcome Trust and University College London will fund the Centre and partnerships with the NHS will enable translation of groundbreaking scientific discoveries into new treatments for a range of diseases.

Making sure patients and the public benefit from new, improved treatments derived from health research is vital. A key step is to ensure that innovations in healthcare are safe and effective. To this end, the NIHR has set up Clinical Research Networks across the NHS to ensure that all patients and clinicians can share the benefits of participating in clinical research. An example of this is the National Cancer Research Network. Established in 2001, the Network has recruited at least 1 in 10 patients with cancer to take part in trials so now the NHS has a greater percentage of cancer patients in clinical research trials than any other nation.

Another key NIHR initiative, the Research Capability Programme, aims to enable research to achieve its full potential as a 'core' activity for healthcare, alongside other uses of NHS data that lead to improvements in the quality and safety of care. The Programme, implemented as a partnership with NHS Connecting for Health, will ensure there is capability within the NHS National IT System to facilitate, strictly within the bounds of patient confidentiality, the recruitment of patients to clinical trials and the gathering of data to support work on the health of the population and the effectiveness of health interventions.

The 24 NIHR Biomedical Research Centres and Units are collaborations between the NHS and medical schools. They have been allocated more than £560 million over the next four and a half years to drive innovation in the prevention, diagnosis and treatment of ill-health and to translate advances in biomedical research into NHS practice.

Close working between the NIHR and the MRC has resulted in joint funding, together with the other UK Health Departments, of a new Patient Research Cohorts Initiative. This brings together groups of patients with a particular disease, and whose symptoms are closely matched, for research into disease processes and to take part in early exploratory trials of new and promising treatments.

The type of collaborations and entrepreneurial partnerships illustrated above means the NHS will remain at the forefront of international health research for the benefit of patients and the public. With the pace of technological and scientific advance, this is even more important today than it was 60 years ago.

Summary

Research is critical for improved and more effective healthcare delivery. Progress in patient care depends on statistically valid results, and only by having a sufficiently large group of willing participants to collect data from can significant progress be made. The creation of the NHS in 1948 greatly expanded the opportunities for medical advances because it gave researchers access to vast numbers of patients and staff in a clinical setting.

Since its inception, the NHS has also formed a focal point for partnerships. Medical research is challenging and expensive so collaboration between funding bodies, the private sector and researchers with patients and the public is essential. As the examples above show, many major achievements resulted from a combination of efforts by different organisations, with the NHS providing the linchpin.

While all medical advances are to be celebrated, it is important to recognise that only a small proportion of projects actually result in step changes in treatment or patient care. Incremental change is more often the order of the day, and by its nature is harder to quantify, but all research adds to the body of knowledge that the next generation of researchers can build upon. The challenge is to identify those projects with the greatest potential for success in order to direct research funding to where it will have the greatest impact.

The NHS makes it possible to address big problems with big research projects, and represents a unique resource for researchers. Harnessing the full power of this resource benefits the UK economy and is the key to the future of healthcare in the UK and around the world.

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