

# HSJ

# INNOVATION EXPO

AN HSJ SUPPLEMENT/10 SEPTEMBER 2009

## THE FUTURE IS BRIGHT

**SHINING A LIGHT  
ON HEALTH'S  
NEXT BIG IDEAS**

IN ASSOCIATION WITH  
Innovation  
EXPO



FOR A HEALTHIER FUTURE

**DH** Department  
of Health

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## FOREWORD

# Securing the NHS future with innovation



**ANDY BURNHAM, SECRETARY OF STATE FOR HEALTH**

Innovation is, and must be seen to be, essential to the future of the NHS. The first Innovation EXPO, held in London this summer, was not only one of the biggest showcases of healthcare ideas ever seen in this country, it

encapsulated the sense that we are embarking on something very significant.

But why invest so heavily in healthcare innovation right now? For three reasons:

### **Innovation saves lives**

Innovation in the NHS isn't about people in lab coats staring at bubbling test tubes. It's about making a real and tangible difference to the lives of millions. Across the NHS, countless patients bear witness to the power of great ideas – adding years to life, and life to years.

### **Innovation is the future of the NHS**

It's widely accepted that more of the same will not do. Our thinking has to be more radical. Innovation can help us improve quality, boost efficiency and manage the funding challenges that countries around the world are currently facing.

### **Innovation will support UK plc**

Although we are feeling the effects of the recession, the NHS remains a major investor and wealth creator in the general UK economy. It's crucial to the future of our country. And if the past is anything to go by, it's a bright future at that.

The NHS has a proud history when it comes to innovation, and there is no shortage of what we can learn from both within the health and social care system and

other public, private, scientific, academic and voluntary organisations. However, the NHS cannot look to do this alone. We need to go forward in partnership, working together with industry for the benefit of patients, for business and the country.

We must open our eyes, minds and arms to these untapped reserves of creativity, and provide an environment that helps them to thrive.

That is why I was really impressed by the Innovation EXPO. It demonstrated the wide range of innovation opportunities from technology to service design. There were plenty of ideas and innovations for everyone to discuss, find out more about and take back and put into practice for the benefit of their patients.

Encouraging the systematic take-up of innovation across health and social care is particularly important at a time when the NHS can no longer expect the record rates of growth it has enjoyed over the past 12 years.

The question isn't so much "can we really afford to do this" but "can we afford not to?"



**NHS CHIEF EXECUTIVE DAVID NICHOLSON**

We've had everyone from NASA to Microsoft, the big names in medical technology, many parts of the NHS and others, talking about the way in which we can drive innovation in our system. The EXPO was dynamic and exciting. The exhibitions were

absolutely remarkable.

The challenge now in the NHS is to take hold of this issue about quality, innovation and productivity, and to see how organisations internally can maximise this equation. The other challenge is how we can work across the health system, and across both health and social care, to maximise the benefits.



# THE BUZZ STARTS HERE

The Innovation EXPO showcase for healthcare innovations was unprecedented in scale, ambition and the way it was run – which included real-time feedback from delegates

The Innovation EXPO had more than 130 seminars, more than 250 organisations taking part and more than 5,000 people through the doors during the two days. It was not just another event about innovation: its very format changed how a conference about healthcare is planned and run. We look at key aspects from the EXPO, with its wide-ranging programme and innovative technologies and products.

The word “buzz” is over-used, but that is exactly what was generated at the Innovation EXPO. Delegates enjoyed an event rich in content and choice, with not only a broad spectrum of innovations across the healthcare spectrum but many formal innovations in the way the event was run.

The mere scale of Innovation EXPO was impressive in its own right, filling one of ExCel's halls with international speakers, a diverse conference and seminar programme, and technological innovations new to a UK healthcare conference, such as a Twitter Wall, and delegate feedback in near-real time using a video diary room.

The main speaker stage was at the heart of the EXPO: surrounded by screens broadcasting the proceedings and clips of other innovations, it offered an intimate auditorium, open to a fully interactive discussion with all the speakers, chaired across the two days by BBC News journalist Gavin Esler.

### Innovative features at the EXPO

The navigation zone had representatives of 13 expert organisations offering practical advice to delegates including how to:

- Navigate the NHS and understand how to successfully partner with them
- Develop products and successfully introduce them to the NHS
- Gain support/assistance on how to work with the NHS
- Help companies grow and succeed internationally
- Manage intellectual property development



Interactive innovation wall at the EXPO

● Make valuable contacts – help international firms invest in the UK and access networks offering help and support.

Meanwhile, the staying healthy zone, with a range of exercise technology and lifestyle advice and support, reminded those attending the event of the importance of living the values of good health. Presented in association with Change4Life, the zone offered risk assessments, participatory exercise sessions and displays and advice from experts. This was about putting wellbeing into practice.

### Breaking the mould

Nor were the options merely traditional ones: the programme included *Starfish*, a

play exploring ethical and practical issues around clinical trials, which aimed to generate debate and discussion.

Equally, there was a “war game” session run by Simulstrat on interventional radiology, which has the potential to radically alter surgical practices, medical care and patient choice. Interventional radiology is imagery-guided surgery; currently in most widespread use in cardiac and vascular surgery. However, its use could be extended much more widely, potentially significantly reducing risks to patients, hospital stay time and recovery.

The war game session, which involved senior DH and NHS decision-makers, explored innovative strategies to



## OVERVIEW



itself, ranging from the research and development directorate to the world-class commissioning team. There were also “meet the department” sessions with all the senior directors of the Department of Health, and cross-government sessions in conjunction with UK Trade and Industry, to explore how innovation can be commercialised in the national interest.

Elsewhere, there was partnership working in action to see improvements in patient care, such as the Design Bugs Out project by the DH and the NHS Purchasing and Supplies Agency in association with the Design Council (see below).

The main floor was packed with exhibitors from the private, public and third sectors, showcasing their latest innovations from medical devices to battlefield healthcare products, the latest surgical advances and care pathway innovations.

### Learning by doing with Imperial College

One of the most striking displays at Innovation EXPO was from the department of Biosurgery and Surgical Technology at Imperial College, London.

Imperial, one of the Academic Health Science Centres, made the most of this opportunity to provide an interactive showcase of healthcare applications that directly improve patient care.

A huge inflatable theatre was set up and staff performed highly realistic scenarios for clinical teams ranging from A&E and GP surgeries to major surgery and intensive therapy unit scenarios.

The simulations and displays are used by the trust for team training.

This was not just a display: the large number of staff on hand from varying disciplines answered delegates' questions and provided guidance on the flexibility of this type of “clinical” environment.

Their da Vinci robotic system enabled delegates to experience the capabilities of 3-D surgery. Tools associated with this included body sensor networks; the i-Snake surgical robot; natural orifice transluminal endoscopic surgery; and eye-tracking software, enabling surgeons to work on highly complex, and sometimes moving, body parts. Visitors were also able to get hands-on with a laparoscopic virtual reality simulator, and even to attempt a synthetic lipoma.

### Innovation House

The Innovation House displayed more than 80 individual assistive technologies from more than 40 organisations. This was a unique opportunity to see, touch and feel all these assistive technologies working together and in context.

Ranging from the well-known telemedicine healthcare monitoring and falls support options to really innovative solutions such as bar codes on packets of food that can communicate the required



From top: Imperial College staff simulate operations in a huge inflatable theatre; the innovation house; and the Covidien human figure



1 ← overcome the barriers to adopting IR, thus increasing patient choice by expanding the range of such services offered by trusts.

### The seminar programme

The delegates, numbering more than 5,000 across the two days of the event, were able to choose from an enormous and wide-ranging programme of seminars.

The comprehensive seminar programme involved the National Endowment for Science, Technology and the Arts (NESTA) and the Design Council, and also important NHS innovation stakeholders such as the Innovation Hubs, the National Innovation Centre who were in charge of the WIGBI programme (see pages 12-13), and the NHS Institute for Innovation and Improvement.

The new Academic Health Science Centres were also represented, as were various parts of the Department of Health



cooking time to a microwave, the Innovation House helped delegates to experience how open innovation is improving quality of care at home, now and in the future.

Whether delegates were concerned about the increasing demands of an ageing population or delivering care closer to home, the wide range of devices on display and expert staff on-hand ensured an informed and interactive discussion.

The Innovation House enabled delegates to gain a clear insight into the possibilities to improve the quality of care and support and quality of life for millions of people to be as self-sufficient as possible.

### Design Bugs Out

The Design Bugs Out initiative was a joint project between the Department of Health, the NHS Purchasing and Supplies Agency and the Design Council. It lay down a challenge to UK designers to use good design principles to help in the ongoing campaign against healthcare associated infections.

Four designers have teamed up with British manufacturers to develop and prototype five new pieces of hospital furniture.

By sharing research and expertise, each team has designed a functional product that makes cleaning quicker and easier and eliminates dirt traps.

The bedside furniture is designed to reduce hard-to-reach corners. The use of durable, wipe-clean plastic eliminates the problems that come from using cheap and rough MDF-type material, which can absorb and harbour liquids, dirt and bacteria.

As well as the furniture, the Design Bugs Out initiative showcased a range of everyday equipment for doctors and nurses. These include a wipe-clean and magnetic-fastening blood pressure cuff; a canula time tracker; a detachable wipe-clean curtain handle/clip; an intelligent mattress system that has an inbuilt early warning system alerting on contamination; an easy-clean pulse oximeter; and a clip-on wipe dispenser for patient hand hygiene.

### iPatient software

iPatient is a new software portal from Paers, which allows primary care trusts to engage directly with their patients electronically when they arrange appointments or repeat prescriptions or look at their records online through iPatient portal.

This enables the PCT to offer both messages and health advice directly to the patient. iPatient allows service users in all GP practices using the EMIS system (which

is 60 per cent of the UK) to book appointments, order repeat prescriptions, and access their full GP record online. These services are free to practices.

Currently, 2,000 appointments and over 4,000 repeat prescriptions a day across the UK are being requested online. This rate of contact will continue to increase.

iPatient's practical benefit is summarised by Margaret Rickson, a service user in her 80s.

"When I went for my post-op I waited over an hour for my notes to come up to the ward. When they did not arrive I told the surgeon I had a copy of my medical records with me. He was very surprised, but he decided to use my medical records: this saved a busy man a lot of time. It also shows how useful having your own records can be," she said.

### Single incision laparoscopy system

The single incision laparoscopy system from Covidien uses a flexible port to allow surgeons to manipulate the tools for laparoscopic surgery through a single incision into the patient's abdominal areas, which can be placed in the belly-button to minimise visibility of the scar.

Barry Paraskevas of Imperial College works with manufacturers Covidien and the NHS to offer accreditation to consultant laparoscopic surgeons who attend a one-day course including lectures and a practical demonstration. Surgeons come from the UK and Europe.

He said: "Because there's only one incision with this system, [they] have the challenge of learning how to do with their left hand what they currently do with their right hand."

More than 30 surgeons have so far received accreditation in the UK, and interest is growing. Mr Paraskevas and colleagues are starting to collect trial data on patient outcomes, pain scores.

He foresaw the adoption curve as likely to be a short one: "There's real demand for this. In five years, the public will find this very attractive and now patient choice is a reality, that will drive adoption."

### The Dignity Commode

Not all innovations need to be high-tech or designed by scientists, as musician Andy Speechley's innovation proves. Visiting a friend who had been paralysed following a stroke, Mr Speechley found that his friend had soiled himself, being no longer willing to struggle to climb the stairs to his upstairs bathroom. The portable commode by his bed downstairs was simply a chair with a hole in it and an uncovered bucket below.

In light of his friend's problems, Mr Speechley developed a mobile bidet-commode. Its lavatory seat incorporates an electronically controlled shower nozzle, which extends under the patient once they've finished on the prompt of a button or hand-held remote control.

For three years, Mr Speechley worked with Devices4Dignity, based at Sheffield Teaching Hospitals trust, to ensure that his Dignity Commode passed safety standards. There is now also a model that folds down to go in the boot of a car.

It may not be at the cutting-edge of technology, but the Dignity Commode is an elegant, practical solution to improve the independence, quality of life and self-respect of people whose mobility is impaired by stroke or accident. ●

## BERNARD CRUMP, CHIEF EXECUTIVE OF THE NHS INSTITUTE FOR INNOVATION AND IMPROVEMENT, SHARES HIS VIEWS ON THE EXPO



"Innovation is at the heart of our work at the NHS Institute, and we know from experience that it can drive safety, quality and efficiency. The NHS is preparing itself for

a significant change in the financial climate, which will bring new challenges for leaders and frontline staff alike.

Innovation methods cause us to think differently, and this has already led to massive improvements in the NHS since its inception over 60 years ago. By providing supportive conditions for innovation, we will encourage NHS staff to think differently and do differently, and this will determine the level of difference we can actually make to productivity and quality in the NHS.

The NHS Institute was delighted to be involved in Innovation EXPO. It was great to see the reactions of so many frontline staff, visibly enthused by the experience and encouraged by the many excellent examples of innovation that had been delivered in practice.

I personally found the EXPO very stimulating, and I felt the involvement of contributors representing so many sectors, both organisations and individuals, was energising and engaging. The NHS Institute stands were very busy during the two days, enabling us to discuss our work with an ever expanding network of people interested in getting involved in innovation for the benefit of the NHS and patients – now and in the future."

# IT'S NOT JUST ABOUT GADGETS

Frontline staff as well as inventors are going to have to shape innovations. So how does the government plan to encourage this creative spirit among NHS staff?



The NHS Innovation Fund will support individuals to bring their ideas to fruition

In April 2009, the government launched *Innovation for a Healthier Future*, a programme of initiatives to stimulate innovation in the NHS, building on the *High Quality Care for All* commitments.

It set out:

- Regional innovation funds – £220m over the next five years to support faster innovation and more universal diffusion of best practice.
- Innovation leadership – a legal duty on strategic health authorities to promote innovation.
- The creation of a series of Innovation Challenge Prizes to reward those who have

excelled in creating and spreading innovative ideas.

- The launch of NHS Evidence, a new online portal providing quick and easy access to sources of clinical information and best practice.

- The Innovation Expo, showcasing healthcare innovations to thousands of people from the NHS and around the world.

*Innovation for a Healthier Future* has challenged all who work in health and social care not only to think again about innovation, but to bring it into their daily work. It is about frontline staff most of all: encouraging them to discover and take

ownership of improvements in patient care, helping ensure access to cutting edge treatments – improving outcomes, experiences and safety.

In Lord Darzi's words, creating an innovative NHS will ensure a health service "that gives patients and the public more information and choice, works in partnership and has quality of care at its heart".

For patients, the commitments in *High Quality Care for All* will, in time, profoundly affect how people perceive and experience the NHS. The focus on continuous improvement and innovation will mean that



## MILES AYLING, DIRECTOR OF SERVICE DESIGN IN THE DEPARTMENT OF HEALTH, ANSWERS QUESTIONS ON SOME OF THESE KEY NATIONAL POLICY INITIATIVES FOR INNOVATION

### Why do we need the Innovation Fund?

The NHS is full of brilliant people with brilliant ideas, but too often it is left to the individual to develop those ideas.

We need to support them to take those ideas, test them, prototype them, and then get them into every day use and benefiting patients as quickly as we can.

That might mean help with financing; it might mean with a business case; it might mean help scaling ideas. That support hasn't been available before – it is now.

### Why NHS Evidence?

If patients are to receive the best possible care and support, NHS staff need to have access to the world's best information and evidence. This just hasn't been possible before.

NHS Evidence will put that information at the fingertips of all 1.3 million staff.

### And why prizes?

It helps focus effort on areas of greatest concern to us – obesity, ageing and dementia. It can encourage investment from public and private sectors, and will help celebrate success.

### Why the new duty on strategic health authorities to promote innovation?

Innovation isn't just about ideas. It's about getting those ideas shared and into practice. That needs leadership and a strong

entrepreneurial culture. The new duty creates the right conditions for this to happen.

We need to do things better and do them differently if we are to continue to deliver better health, better care and better value for patients and the taxpayer. More of the same will not be enough.

### What needs to change to put innovation at centre-stage?

The NHS already has a worldwide reputation for invention and R&D. But we need to do more to recognise the contribution that innovators and innovative organisations make.

We also need to work more closely with our partners in academia, the voluntary sector and the private sector to jointly develop solutions to some of the big healthcare challenges we face. We need to experiment more.

And we need staff to seek out and adopt best practice.

### How will this benefit patients?

Imagine a world without antibiotics, without insulin, without cancer screening. Now imagine a world with a cure for obesity, and reversal of brain pathology for dementia.

Many ideas come from the interaction staff have with patients. Indeed, patient-led innovation will help to ensure that innovation is focused on real needs that significantly improve people lives.

### What are the challenges of putting this policy into practice?

We know this is not easy. Some of the biggest challenges are about culture and mindsets, but the potential benefits are worth the effort.



patients see a real difference in their care. Demographic change, with an ageing population living longer (and with more long-term conditions) and rising public expectations of the NHS will have a crucial impact on meeting future needs. Also, the advances in technology enable healthcare to do more each year, improving health but often increasing costs.

Therefore, innovation should not be seen as a silo for academics or researchers, nor as merely an end in itself. NHS policy has moved towards a patient-centred philosophy. To meet this drive, innovation will be at its best when its focus is improving patient care and it is shaped by frontline staff.

This was a key theme of the presentations at Innovation EXPO by NHS chief executive David Nicholson and then health minister Lord Darzi. The point was reinforced by Mark Jennings, formerly of the NHS Institute for Innovation and Improvement and now director of healthcare improvement at the King's Fund, who observed that innovation "can tend to be seen as something about gadgets. The real potential of innovation is finding something that works in one context, and successfully transferring it to another context".

He continued: "A good example would be hospital care pathways for cataract surgery. In some hospitals, the pathway is just two hours; in others, it's six. Innovation is about learning from best practice."

Innovation is both an opportunity and a threat. Probably the first management book,

written in a bid to regain political favour by 15th century courtier-politician Niccolò Machiavelli, *The Prince* observes: "The innovator makes enemies of all those who prospered under the old order, and only lukewarm support is forthcoming from those who would prosper under the new order."

"Their support is lukewarm partly from fear of their adversaries, who have the existing laws on their side, and partly because men are generally incredulous,

never really trusting new things unless they have tested them by experience."

The recognition of this human need, to test innovations by experiencing them, underpinned the planning and delivery of Innovation EXPO. This year's EXPO gave thousands of people from across health and social care the chance to experience for themselves the very latest in innovations and make their own mind up about how to adopt and diffuse the best ways to improve the quality of care for their patients. ●

### Lord Darzi stressed the importance of frontline staff shaping innovation



# SPEAKERS' CORNER

The Innovation EXPO featured a rich programme of main-stage speakers. Andy Cowper took notes on what the top names had to say about getting things done

The programme of main-stage speakers showed an impressive range, from Douglas A Comstock of NASA to NHS chief executive David Nicholson and Sir Gus O'Donnell, cabinet secretary and head of the civil service. It included ministers Lord Drayson and Lord Davies as well as Andrew Witty, global CEO of GSK. Here is a sample of what the speakers had to say.

## THE FUTURE IS COMPARATIVE EFFECTIVENESS

### Dr Stephen Oesterle, Medtronic

Referring to President Barack Obama's proposals to overhaul the US health system as "his biggest challenge", Dr Oesterle of US health technology company Medtronic looked at how technology will change, and help to take cost out of the system.

Medtronic's strategic decisions (the company's basis was in pacemaker technology) look at innovations in the more traditional fields of delivery, distribution and manufacturing – but also, crucially, of

payment – and Dr Oesterle characterised the National Institute for Health and Clinical Excellence as hugely innovative and impressive in this regard. The data to prove the benefits of adoption will, Dr Oesterle proposed, outweigh clinical judgment. He clearly saw a NICE-type body as essential to saving US healthcare from bankruptcy.

The importance of long-term conditions and the resulting challenges of coping with the healthcare needs of an ageing population are, Dr Oesterle noted, as much the bulk consumers of healthcare costs in the US as in the UK.

He emphasised the potential of technology to use remote monitoring to prevent ill-health in at-risk groups, enabling not only the possibility of reducing costs but improving patients' quality of life.

## A PATIENT PERSPECTIVE

### Martha Lane Fox

The businesswoman is probably best known as the co-founder of the successful website

lastminute.com. Her presentation focused on her experiences of healthcare following a serious and near-fatal car crash when she was hospitalised for nearly two years.

Balancing reflections from a successful career in the innovative business environment, she talked about the "collision between technology and healthcare". The technology involved in her care was highly impressive, but Ms Lane Fox cited "the micro things" that nurses did to provide her care and to make her feel better – including something as simple as a nurse talking to her while she was in the intensive care unit, frightened and unable to sleep.

The importance of nurses and carers taking highly thoughtful personal care was something she suggested can get "lost as staff move up the food chain".

"It's the small thing, both good and bad, that I have taken away and that technology may be able to help," she added.

She suggested that using Web 2.0 technology to capture and convey patient feedback can allow proper and timely communication, with immense potential for not only patient feedback but also for clinical peer communication.

Quoting Nye Bevan's words "freedom of discussion and readiness to do so are the only way to safeguard what we have done and open new discoveries", she emphasised the importance of openness of discussion. The opportunity for technology to provide a voice could, she suggested, form a movement of people with similar experiences to drive change.

## THINKING DIFFERENTLY

### Jonathan Kestenbaum, chief executive, NESTA

The National Endowment for Science, Technology and the Arts is the largest independent body in the UK responsible for promoting and investing in innovation, and as its leader, Mr Kestenbaum outlined how his background in venture capital helped

## WHAT PARTICIPANTS SAID ABOUT THE INNOVATION EXPO

### DOUGLAS A COMSTOCK, INNOVATIVE PARTNERSHIPS PROGRAM DIRECTOR, NASA

"NASA's exploration missions push back frontiers not only in space, but also in the new technologies and innovations needed to get us there.

"Those technologies are also improving lives here on our home planet. From life-saving devices that improve circulation to robotic surgery techniques and improved diagnostics, we benefit from space exploration – and most of us are unaware. I am delighted to participate in the Innovation EXPO and share some examples of benefits from the US investment in NASA and space exploration."

### JOE ALMEIDA, MEDICAL DEVICES PRESIDENT, COVIDIEN

"Covidien was excited to participate in the 2009 Healthcare Innovation EXPO. We shared how our innovative product leadership strategy has resulted in improved patient outcomes and reduced costs for our customers."

### DAVID McCARRON, EMEA HEALTHCARE MANAGER, INTEL CORPORATION

"Innovation is poised to help the healthcare industry deliver better healthcare at lower cost, ultimately making people's lives better around the world. The Innovation EXPO is a great chance to showcase some of the best ideas that will enhance the continuum of care – from hospital to clinic to ambulance to home – and also to encourage both their adoption and diffusion."





Sir Gus O'Donnell (top) championed collaboration while Martha Lane Fox gave a patient perspective and Jonathan Kestenbaum listed innovation qualities

his understanding of the importance of innovative ways of working and technologies. However, he added that his personal experiences of the NHS, through his daughter who is in nursing at Great Ormond Street Hospital, taught him to beware of management-speak obsessions such as “transformational change” and “paradigm shift”. “Innovation in health means enhancing people’s lives or it’s not doing its job,” he said.

Critiquing management guru Tom Friedman’s book thesis that *The World Is Flat*, Mr Kestenbaum observed that there are always “pockets of innovation and imagination”, and discussed the conditions that facilitate these pockets and then create great breakthroughs.

He listed five key qualities:

- a strong sense of shared vision
- a culture of experimentation (acknowledging that disruptive innovation has at its heart the risk of failure)
- the power of unexpected networks and collaborations
- the importance of money, capital and flexible capital
- the importance of relentless focus on driving the delivery of innovative ways of

working (a need which the recession will heighten).

Mr Kestenbaum concluded that the recession will leave the NHS “no choice but to deliver imaginative, ingenious solutions. It can be done. And it can be done here in UK. There is a huge appetite for this approach to delivering great services, giving much greater trust to men and women on the front line. And we must remember that real risk-taking involves as much discipline as ingenuity – so we need disciplined risk-taking”.

**‘It’s the small thing, good and bad, that I have taken away and that technology may be able to help’**

#### VALUING ENTREPRENEURSHIP

**Sir Gus O'Donnell, Cabinet secretary and head of the civil service**

Sir Gus emphasised the importance of events such as the Innovation EXPO to creating a collaborative learning forum, citing Civil Service Live as a similar approach.

He also made it clear that innovation in the public sector would need to be strongly based on data and measurement of change and improvement.

Other prerequisites for public sector innovation he described include “risk mitigation” (a concept from the banking

sector) – effectively, understanding that not all innovations will work and that people will need to be supported when projects fail.

This was, he described, part of “valuing entrepreneurship”. He also said that leaders will need to get out from behind the desk more and go around their organisation to see for themselves what frontline innovation is under way and perhaps in need of support.

He outlined the need for cross-departmental working “to tackle the wicked problems which mean we have to work as a team – you can’t solve obesity in health alone; you have to work with education, Treasury, communities...” ●

#### THE IMPORTANCE OF INNOVATION TO THE ECONOMY

- The UK spent £23.2bn on research and development in 2006. This is 1.75 per cent of GDP and a 4 per cent increase in real terms from 2005 (*Annual Innovation Report 2008*, DIUS).
- 79 per cent of global research and development in 2007 was carried out by companies registered in five countries – the UK is one (2008 R&D Scoreboard, DIUS).
- The development of penicillin alone has saved millions of lives by curing fatal illnesses and infections that are now considered minor.

# UP CLOSE AND PERSONAL

NHS chief executive David Nicholson and then health minister Lord Darzi offered their thoughts on everything from commissioning to why the challenges of the new NHS are different from those of the past. Andy Cowper reports

## QUALITY AND PRODUCTIVITY CONNECTED BY INNOVATION

### NHS chief executive David Nicholson

The top man in the service told delegates: "The connection between quality and productivity is innovation. It's invention: finding new ways of doing things. It's also adoption: making sure we seek out the best things to do in the circumstances and spreading them across the service.

"And it's diffusion: the way in which we get information out so people know, and have information and knowledge to do it."

This focus on innovation was part of a remarkable reform journey for the NHS, starting with the NHS plan in 2000, and a big increase in funding and capacity, and the introduction of targets. The second phase had focused on expanding choice and contestability, and the introduction of levers like payment by results and practice based commissioning.

"In my view we slightly lost our way, getting so excited with technical bits of change that we slightly lost the point of why we're here as a service," Mr Nicholson added.

He said that the next stage review had been "so important because it was built by engaging people throughout the system who deliver services for patients".

Lord Darzi's final report, *High Quality Care for All*, had made quality the organising principle of the NHS. Innovation is the key to improving quality and productivity by driving sustained improvements across the system.

Innovation is, Mr Nicholson proposed, "answering the question of how to deliver in practice, an NHS service wrapped around individual patients' needs".

He said managers and staff should not fear risks in innovation. "Carrying on as before will not deliver the step-change in quality. We've created an NHS machine that's been good at delivering top-down targets, but the future is flexibility and responding to the population's changing health needs.



"So as chief executive, I must create an umbrella for managers, to protect people who have innovated trying to meet a patient need, but unfortunately fail. That's legitimate (whereas lack of attention to patient safety is never legitimate). We should support managers and clinicians who innovate in patients' best interests – and ministers should support them. If our approach is vindictive and we look for and punish failure, innovation will fail."

He emphasises the inefficiency of vast variation in activity and outcomes of care. "Billions of pounds are still being spent on not-best practice. Getting the NHS to adopt best practice would be massively beneficial in quality and productivity. I've just come from an exhibit profiling a breast surgery unit which does 'one-stop shop treatment', rather than the patient needing five to six visits to hospital," he explained.

The progress of commissioning to date



has, Mr Nicholson acknowledged, left him “not content”.

“So many things need to be driven by commissioning,” he said. “This is why we needed the major development programme of world class commissioning to support the leading edge; help us identify elite primary care trusts who are fit for more freedoms; and at the poor-performing end of the spectrum, consider the option of franchising the commissioning function.”

“The big issue is to see some world class decommissioning. As new services come online, old and outdated services don’t stop doing things that they should stop. It’s an important part of going forward to close some facilities when their work shifts into the community.”

Part of innovation is disruption. Mr Nicholson famously told the 2006 NHS Alliance Conference that he wanted primary

care is about looking at how services are delivered and engaging frontline staff to make it happen.”

Mr Nicholson described the adoption of good practice across the NHS in the fight against healthcare-associated infections as the most successful innovative change he has seen in his NHS career.

The least successful, by contrast, he sees as “the thousand-and-one lists of good practice that I see in the NHS that never get picked up beyond a team or organisation”.

Given the high political and media profile of the NHS, how possible is genuine innovation given that some projects must fail? He admitted that this risk is “more difficult, but more necessary to the delivery of high-quality care for patients and to increase productivity. It’s for people like me – and politicians – to provide people with the cover they need for genuine innovation”.

Is developing an innovative culture in the NHS more of a cultural matter or a technical one? Mr Nicholson said it is “much more about culture, but there are technical things we can do – for example the Innovation Funds, and the duty on SHAs to promote innovation. But fundamentally, it is about people’s mindsets”.

### INNOVATORS – REBELS WITH A CAUSE

**Lord Darzi of Denham, surgeon and former health minister**

Lord Darzi, still in post as health minister at the time of the event, has been a real advocate of innovation within the NHS. He told delegates: “One of the most important things I learned during the next stage review that led to *High Quality Care for All* was that local-level creativity in the NHS far exceeds any aspirations of anyone in the DH.”

Lord Darzi suggested that a tremendous amount of energy could be unleashed if clinicians and managers look together at the evidence base to see what is the best patient care achievable, and review their current practice in that light.

He termed this “a key part of innovation – and that’s why we made it clear that quality was what we were trying to achieve. The NHS and the UK healthcare industry have a proud history of inventions.”

“The big challenges that the NHS faces now are not those it faced in the past. They range across access and waiting time issues; rising accident and emergency attendance and admissions; ageing population; lifestyle diseases, rising expectations of patients and staff; the economic climbdown.

“Now the NHS has made the commitment that quality is going to be its organising

principle, the solution to that aspiration is innovation. It will also be the solution to many of the above-mentioned challenging problems.”

Innovation is, Lord Darzi suggested, actually an enabler. He said: “It is not just about new drugs and equipment: it is about changes in clinical practice, and about delivering new models of care. It is also about management.”

“Innovation is not only about the high-tech, expensive end of devices (important as that is to my work in robot-assisted surgery). It’s about the everyday work of frontline staff; about how it can be more streamlined and patient-centred. It is also, very importantly, about how to design in dignity.”

He also cited emerging evidence that innovation could be cheaper, saying that NHS North West, which has trialled the US Premier system across the region, found that in the best-performing hospitals, the

procedure cost is the lowest.

“Innovation requires challenge to the status quo culture and leadership, as we drive this into real, everyday clinical practice. That mindset change is the biggest challenge facing us.”

Lord Darzi emphasised the need to reduce clinical variations in his plenaries. Does he see a need for more regular publication of data on clinical variations to drive innovation, or would this scare the public and providers?

He said: “I think we have a sufficient commitment in the new quality accounts trusts have to publish. These will be based on the non-negotiable quality framework of safety, clinical quality and patient experience, and will be open and transparent. This information, transparently related, will truly drive quality improvement.”

“Most people want to measure things for improvement – that’s why *High Quality Care for All* won significant buy-in from clinical colleagues. Measuring something means you’re committed to improve it.”

Before he became a minister, what most frustrated Lord Darzi about the NHS’s pace of adoption of innovation? “There are challenges in adopting, and brick walls – but I never felt I could not break them. When I was involved in innovations in simulation for training, we introduced the changes using persuasion and persistence.

“Innovation is about knowing what is in patients’ best interest, and is a matter of bringing people with you. It’s about culture, mindset and leadership.

“And there are many examples of fantastic innovation across the service – as *HSJ* has reported for years.” ●



David Nicholson (left) gave his views on the “reform journey” while Lord Darzi (second from left) praised “local-level creativity”

care to “make trouble for the NHS – root out bad deals and bad services”. Has it happened much?

“No”, he candidly stated. “There has been bits of it in some places; but one thing we know is that disruptive innovation can be a very powerful change driver to transform community services. People in PCTs who are only talking about new governance arrangements for their provider arm are missing the point. Innovation in primary

# REGIONAL TRAILBLAZERS

The duty on strategic health authorities to promote innovation complements their regional visions. Andy Cowper looks at good practice from around the country

## **NHS LONDON**

The capital of England always faces particular challenges, and NHS London has been innovative in its provision of services for heart attacks. Eight London heart attack centres and the London Ambulance Service work together to provide fast access to state-of-the-art equipment and highly specialised teams to give fast, expert care to heart attack victims 24 hours a day.

This joint co-ordination now saves hundreds of lives every year by training the ambulance paramedics to diagnose heart attacks within minutes of meeting the patient and by using an angioplasty treatment instead of the more common thrombolysis, which raises the chances of full recovery from 65 to 95 per cent.

## **NHS SOUTH CENTRAL**

One of the region's major cities, Portsmouth is well-known for being passionate about two things: disliking its near-neighbour Southampton (for reasons dating back to the latter's 12 century ownership of the former's docks) and football. As well as making the derbies between the two football teams lively affairs, these trends have helped to raise the profile of sport in the city.

In a shrewd move, Portsmouth primary care trust, the city council and Portsmouth City Football Club are working together to make Portsmouth a sportier, healthier and happier community. The initiative involves setting up blood pressure and screening units around the town; and arranging for children to grow their own vegetables.

The football connection is reached with the involvement of England players – striker Peter Crouch and goalkeeper David James – to encourage football training and healthy eating among communities that are regarded as more difficult to reach through traditional approaches.

## **NHS NORTH EAST**

Sport is again a theme in the example from the North East; this time, in conjunction



**NHS London continues to innovate in services relating to heart attacks**

with one of the former prime minister and ex-MP for Sedgefield's post-Parliament projects.

The Tony Blair Sports Foundation and NHS North East are working to fund the provision of Concept2 rowing machines in 10 schools in Gateshead. Objectives focus on attracting children into sport; also emphasising health promotion messages in the process. As well as simply offering equipment, the scheme also provides hands-on coaching opportunities to health diploma students, furthering their CVs.

In a documentary produced to promote this scheme, former Prime Minister Tony Blair himself plays a vital part in discussing the foundation and the importance of encouraging exercise and healthy eating, especially for children.

## **NHS WEST MIDLANDS**

Long-term conditions such as asthma, heart disease and diabetes are among the biggest health and economic challenges facing the NHS. Birmingham Own Health is a method of chronic disease management, which has



been trialled and implemented in deprived areas of the city.

The telehealth system uses case managers to give telephone-based support to “members” – people with chronic illnesses. The case managers are trained in motivational counselling and monitoring.

They also use assistive equipment that monitors members’ conditions each day, improving monitoring and hopefully, in most cases, circumventing the need for unnecessary hospital appointments, which in practise means better care closer to home.

### NHS EAST MIDLANDS

Innovation need not be costly or high-tech, and can combine smartly with patient involvement and engagement, as in this example from NHS East Midlands.

Nurses at the Ash Green Centre wanted their inpatients with learning difficulties to make their own food choices. To this end, they created a nutrition toolkit to supplement the printed menus with pictures, to help patients identify what they wanted to eat. When the pictures were introduced, the inpatients began to take more interest in their food, became more aware of healthy eating and most importantly were given a voice and choice in their own care.

### NHS SOUTH EAST COAST

Greater emphasis on healthcare-associated infections has driven down rates with great success. It has also produced new challenges, such as at Darent Valley Hospital where concerns were raised that swabs of wounds were being over-used (and therefore unnecessary antibiotics were often being prescribed), doctors at the hospital drew up a list of established wounds that need not be routinely tested without clinical evidence of a suspected infection.

This has avoided thousands of unnecessary swabs being taken, which keeps the microbiology lab free for more pressing processes, as well as saving the NHS many thousands of pounds.

### NHS EAST OF ENGLAND

Information can be just as significant to patients as treatment, particularly with an illness that can have such psychological impact as cancer. The West Essex Cancer Information Service, made up of three community development workers and 30 volunteers, combines unlimited support and information for cancer sufferers and their families and carers.

The scheme offers social and psychological support and also acts as an

advocacy service by being flexible and responsive to individual needs.

### NHS YORKSHIRE AND THE HUMBER

Prison health is often an under-recognised area. It’s not wholly surprising: many prisons are largely filled with people from lower socio-economic groups, who are likely to have below-average education. The number of people in prison with mental health issues is high.

NHS Yorkshire and Humberside have been trialling the use of telemedicine technology in prisons, with the obvious cost and security benefits of not having to transport prisoners to hospital. Telemedicine in these cases involves the use of video conferencing technology to conduct remote hospital appointment, enabling hospital consultants to

diagnose, order diagnostic tests and prescribe treatment, all without the need to physically see the patient.

### NHS NORTH WEST

Health promotion – getting upstream of ill-health – is not merely a concern for primary care trust and local authority public health teams. It can have a role in specialist acute care, as Alder Hey Children’s Hospital has found.

The trust has created their first public health strategy to nurture and protect the health and wellbeing not only of its patients, but also of their families, trust staff, visitors and the wider community.

The activities include various upbeat health promoting events that are being held at the hospital to encourage people to eat more fruit and vegetables, take care of their dental health and look after their physical and mental wellbeing.

### NHS SOUTH WEST

The NHS does not provide healthcare in isolation: partnership working with social services is essential for wrapping care around the highest users of services.

Torbay Care Trust’s hospital discharge project has worked alongside Swindon’s dementia department to develop a way to combine healthcare and social care within the NHS. They have introduced changes for their patients within weeks instead of months, which have made a huge impact and improvement for patients – as well as staff at the designated hospitals.

### NHS INNOVATIONS EAST

NHS Innovations East has created Max, an animated character devoted to hand hygiene. Featuring in a DVD and as an animated screensaver in hospitals, GP

surgeries and other settings, the character sells the concept of hand hygiene to a wide audience.

### NHS INNOVATIONS YORKSHIRE AND HUMBER/MEDIPEX

Imagel, a collaborative venture between Medipex, the Universities of York and Hull and Hull and East Yorkshire Trust, has developed a novel three-dimensional dosimeter. It helps radiologists calculate the appropriate dose for intensity-modulated radiotherapy. The device will improve care for cancer patients by ensuring that the machinery functions correctly and at the clinically safe and appropriate setting.

### NHS INNOVATIONS NORTH WEST/ TRUSTECH

Measuring the hip range of children with cerebral palsy was a task that exercised Manchester PCT physiotherapists Patsy Pott and Andrea Selley and colleagues. They helped to create the Proximat – an easy-to-use, child-friendly and accurate tool, using a printed mat on which the child can lie and which has marked measurements to make the task straightforward and non-intrusive. The Proximat is already being sold nationally. ●

### MIKE FARRAR, CHIEF EXECUTIVE, NHS NORTH WEST



“There is a view that the NHS has traditionally been better at innovating than it has at spreading innovation. The NHS’s own structure – a national

collection of hundreds of organisations, each with its own board – sometimes presented challenges.

“Spreading innovation is crucial to making it effective. Part of the way to spread innovation effectively is about structure, and part is about context.

“In NHS North West, our work on clinical quality and outcomes has had an impact because we’ve been able to get every trust doing it. So the structural role of a third party organisation – in this example, the strategic health authority – can be important to spread of innovation.

“Leaders need to promote a culture that understands the value of innovation, and where ‘not invented here’ isn’t an acceptable reason for failing to try things. At a local level, that could be about a trust’s management being facilitative: identifying their creative and innovative people; understanding and quickly latching on to their innovations; and creating the conditions and incentives to support the adoption.”

# WANT ONE OF THEM

The Innovation EXPO aimed not only to promote innovation but also encourage putting it into practice. Andy Cowper hears about the 'wouldn't it be great if...' approach

One of the key reasons for slow take-up of innovation in some parts of the NHS is that products or technology do not always address the real needs of the service.

That is why the NHS National Innovation Centre starts by looking at the needs of the health service. In partnership with the Technology Strategy Board's Statement of Clinical Need team, they bring together groups of healthcare professionals to identify the most important problems.

The NIC calls the approach "wouldn't it be great if..." (WIBGI) and challenges teams of NHS staff, academics and industry to identify their priority needs.

The WIBGI process aims to match innovators with healthcare professionals. The aim is not for manufacturers or inventors to come along with an existing product they want to sell, but to explore the ideas for improvement among multidisciplinary teams.

The process starts with the goal to capture and agree genuine and common unmet needs. The NIC held five WIBGIs at Innovation EXPO in the fields of paediatrics, heart failure, ambulance, regenerative medicine and urology. Chosen because each field is a Department of Health priority area, these WIBGIs were actually the second step in a five-step

## THE FIVE DS: THE STAGES OF THE WIBGI PROCESS

1. Define the need.
2. Design the solution.
3. Develop the opportunity (putting the design into practice, not just on paper).
4. Demonstrate the benefits – put the product in a clinical environment and show that it does what's expected.
5. Distribute information or product into service.



This year's exhibition saw five WIBGIs

process that starts with need and ends with the production and distribution of a finished product.

Each WIBGI identified two or three key needs, agreed at previous workshops, and brought together groups of clinicians, industry representatives and academics to discuss possible solutions.

### Identified needs

The paediatric WIBGI, chaired by Peter Lachman, consultant paediatrician at Great Ormond Street, identified a need for an "intelligent mattress" for use by children with profound and multiple difficulties. The mattress would need to monitor a child's vital signs and be able to integrate and carry clinical care equipment.

The ambulance group, chaired by Brian Kellet, identified two needs, one of which

was for a piece of kit that would immobilise the hip in patients who have suffered a fractured neck of femur.

Although the meetings were stage two of the WIBGI process, some of the healthcare-associated infection exhibits at the show were at stage three, including an inflatable isolation ward and an "air curtain" to go over the bed of infected patients.

The NIC team are currently tasked to explore commercial pathways for the Design Bugs Out products (see page 3) and inflatable isolation ward.

During the process, the unmet needs discovered are ranked by the groups in order of priority. Once the finalised topics are chosen, there are three possible options:

- Do nothing (when the solution is not great, too hard or not cost-effective);
- Collaboration. The group believes that





Innovation in action at the ambulance WIBGI

the free market can fulfil the requirement, which leads to work to put the clinicians in touch with relevant partners in industry.

● **Challenges.** A strong need is identified, but market solutions are thought unlikely. The NIC posts these on the “challenges” part of its website – people can propose solutions and offer collaboration.

At EXPO, the outcomes were zero “do nothing”; seven “collaborations” and two (both from the ambulance WIBGI) to set as “challenges” as the projects move to the third stage.

### Solutions to market

Brian Winn, head of technology and product introduction at the National Innovation Centre said: “EXPO was an excellent opportunity to gather these

informed groups and dedicate time to identifying solutions to these universal needs.

“The WIBGI approach of getting out there and talking to the practitioners has already yielded huge efficiencies in speeding up the time it takes to get products to the bedside.”

The aim of the National Innovation Centre is, Mr Winn added, to “get people in the NHS doing WIBGIs themselves. We aim to train trainers and this is also about doing some pump priming”.

The process of bringing the solutions to market will now be managed by the National Innovation Centre and the progress will be tracked on their website [www.nic.nhs.uk](http://www.nic.nhs.uk). Due to the success

of the first event, Healthcare Innovation Expo will be repeated in 2010.



## WHAT PEOPLE THOUGHT OF THE EXPO

Attendees were asked to evaluate the event. The EXPO met or exceeded the expectations of the vast majority of respondents. Ninety-seven per cent thought the EXPO should be held again in the future.

### INNOVATION IN THE NHS

More than three-quarters thought the NHS is more innovative now than it was a few years ago. However, 43 per cent felt it is less innovative than healthcare systems abroad. Most respondents felt that the NHS is strong at invention, but almost half felt that it is weakest at diffusing innovation.

### INNOVATION AND PATIENTS

Respondents overwhelmingly felt that better patient outcomes was the most important result of innovation (53 per cent). Eighty per cent also thought that innovation is important to their patients.

### HOW THE NHS WORKS WITH ITS PARTNERS

A high number of respondents thought the NHS worked well with the academic and third sectors. Fewer respondents thought the NHS worked well with the private sector.

### INNOVATION IN THE WORKPLACE

Nearly nine in 10 respondents believed innovation is important to their job and more than three-quarters think their work place takes innovation seriously. The event made 70 per cent of respondents think more about innovation.

## LAST THOUGHTS FROM DELEGATES

### JANE PODKOLINSKI, ANTENATAL AND LABOUR WARD CO-ORDINATOR

“I went to the Innovation Expo and it was excellent. I thought all the main speakers were inspirational.”

### ADRIAN FLOWERDAY, DOCOBO

“As an SME growing in this difficult market we really appreciate such opportunities, and we think you all did a fantastic job with the event... We made some excellent contacts and I am sure we managed to get people thinking about how they can be innovative in their rollout of new services.”

### ALICE DEVITT, ARTHRITIS CARE

“We found the event very rewarding and the audience was excellent”.

For more information on the innovations and organisations featured at Innovation EXPO visit:

### EXPO

→ [www.healthcareinnovationexpo.com](http://www.healthcareinnovationexpo.com)

### SHAS

→ [www.westmidlands.nhs.uk](http://www.westmidlands.nhs.uk)  
 → [www.yorkandhumber.nhs.uk](http://www.yorkandhumber.nhs.uk)  
 → [www.eoe.nhs.uk](http://www.eoe.nhs.uk)  
 → [www.southcentral.nhs.uk](http://www.southcentral.nhs.uk)  
 → [www.southeastcoast.nhs.uk](http://www.southeastcoast.nhs.uk)  
 → [www.london.nhs.uk](http://www.london.nhs.uk)  
 → [www.eastmidlands.nhs.uk](http://www.eastmidlands.nhs.uk)  
 → [www.northeast.nhs.uk](http://www.northeast.nhs.uk)  
 → [www.southwest.nhs.uk](http://www.southwest.nhs.uk)  
 → [www.northwest.nhs.uk](http://www.northwest.nhs.uk)

### NHS RELATED ORGANISATIONS

→ [www.innovations.nhs.uk](http://www.innovations.nhs.uk)  
 → [www.nhs.uk/change4life](http://www.nhs.uk/change4life)  
 → [www.institute.nhs](http://www.institute.nhs)  
 → [www.ahsc.org.uk](http://www.ahsc.org.uk)  
 → [www.pasa.nhs.uk](http://www.pasa.nhs.uk)  
 → [www.evidence.nhs.uk](http://www.evidence.nhs.uk)  
 → [www.portal.nihr.ac.uk](http://www.portal.nihr.ac.uk)  
 → [www.nic.nhs.uk](http://www.nic.nhs.uk)

### MAJOR PARTICIPANTS

→ [www.designcouncil.org.uk](http://www.designcouncil.org.uk)  
 → [www.nasa.gov](http://www.nasa.gov)  
 → [www.covidien.com](http://www.covidien.com)  
 → [www.medtronic.com](http://www.medtronic.com)  
 → [www.intel.com](http://www.intel.com)  
 → [www3.imperial.ac.uk](http://www3.imperial.ac.uk)  
 → [www.nesta.org.uk](http://www.nesta.org.uk)  
 → [www.youngfoundation.org.uk](http://www.youngfoundation.org.uk)  
 → [www.devicesfordignity.org.uk](http://www.devicesfordignity.org.uk)  
 → [www.gsk.com](http://www.gsk.com)  
 → [www.simulstrat.com](http://www.simulstrat.com)

### GOVERNMENT

→ [www.dh.gov.uk](http://www.dh.gov.uk)  
 → [www.uktradeinvest.gov.uk](http://www.uktradeinvest.gov.uk)  
 → [www.berr.gov.uk](http://www.berr.gov.uk)  
 → [www.cabinetoffice.gov.uk](http://www.cabinetoffice.gov.uk)

# Healthcare Breakthroughs since 1948

**1948**

The NHS is founded to "provide a comprehensive service funded by taxation, available to all and free at the time of need."



**1950**

British physiologist Richard Doll discovers a link between lung cancer and tobacco smoking, and gives up smoking. At the time lung cancer was believed to be caused by tarmac or car exhaust fumes.



**1953**

The now iconic double helix structure of DNA is revealed by Brit Francis Crick and his US colleague James Watson.



**1956**

The disposable hypodermic syringe is invented by vet Colin Murdoch, a British citizen. Disposable syringes are now used by millions worldwide. His invention was initially dismissed by the New Zealand government

**1962**



Master surgeon Dr John Charnley designs a new type of low-friction hip replacement, which improves mobility and the quality of life for countless patients. Surgeons from all over the world travel to the Centre for Hip Surgery at Wrightington, England, to learn about his technique.

**1965**

The portable defibrillator is invented by Frank Pantridge, an Irish physician and cardiologist, to treat a ventricular fibrillation – a disturbance in the heart rhythm that needs rapid treatment. His first model weighs 70kg and is powered by car batteries.



**1967**

Cicely Saunders, a nurse, founds the first modern hospice, St. Christopher's, and a new approach to care for the dying.



**1973**

The CAT scanner, which uses hundreds of X-ray beams to build up a 3D picture of the inside of a human body, is invented by English engineer Godfrey Hounsfield. He won a Nobel Prize for his work in 1979.

**1988**

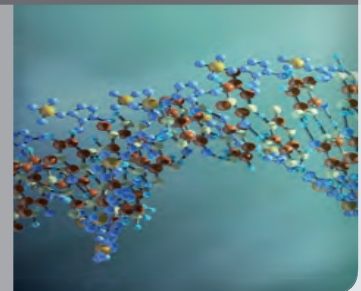
British biochemist James Black wins a Nobel Prize for inventing beta-blockers, which prevent heart attacks due to clogged arteries contracting with stress. His discovery has saved countless lives worldwide.

**1989**

Edward Arthur Boyse, a British immunologist, proposes that stem cell rich umbilical cord blood replace bone marrow cells damaged by chemotherapy. It is now a life-saving, routine practice.

**2000**

A 'working draft' of the human genome is produced by the Sanger Centre near Cambridge. The centre's director, a British biologist called John Sulston, won a Nobel Prize for Medicine in 2002.



**2003**

London-born physicist Peter Mansfield wins a Nobel Prize for work leading to the invention of Magnetic Resonance Imaging (MRI) scanners, an important technique for seeing inside a patient's body without surgery.

**2005**

British, American and Japanese scientists discover a gene that they believe triggers other cancer-causing genes leading to tumour formation.



**2007**

UK scientist Martin Evans is awarded a Nobel Prize for inventing the 'knock-out mouse'. These mice, have individual genes switched off or added, and are being used to study diseases like cancer, heart disease and diabetes.

**2007**

A British research team from Imperial College London grow a heart valve from stem cells for the first time, paving the way for it to be used in thousands of heart operations to remove the risk of rejection.