

extraordinary
you



The 55,000 strong healthcare science workforce of the NHS and its related bodies, the Health Protection Agency and NHS Blood and Transplant, represent the largest group of scientists in a single employment sector in the UK.

Their vast scientific knowledge and skill base stretches across some 45 scientific specialisms encompassing biology, genetics, physiology, physics and bioengineering. This knowledge lies at the foundation of the profession's crucial and often unique role in:

- providing complex and specialist diagnostic services, analysis and clinical interpretation
- offering direct therapeutic service provision and support
- introducing technological and scientific advances into healthcare, and undertaking research, development and innovation
- providing performance and quality assurance, risk management and clinical safety design and management
- teaching, training and providing a specialist consultancy and clinical advice service to other clinicians with respect to all of the key functions above.

The healthcare science workforce plays a critical part in delivering healthcare. More than 80% of all diagnoses are reached with a contribution from healthcare scientists.

**Extraordinary careers.
Extraordinary science.
Extraordinary patient journeys.**

Professor Sue Hill OBE
Chief Scientific Officer, Department of Health

The pages of this book will be a revelation to many people. They contain stories of a little known but unique scientific and technological workforce in the NHS. What makes them unique is the astonishing breadth and depth of their talents and skills. They contribute not just to patient care – although this is at the core of everything they do – but to cutting edge science and, through their innovation and invention, to the nation's wealth.

There are more than 50,000 in the workforce, so to pick a few from many was very hard. Chosen are ordinary people doing extraordinary jobs. People doing extraordinary science and people who have made extraordinary journeys in their careers. There are legions more who could have been chosen by their peers.

It would be invidious to single out any one of these remarkable people but looking at them in total, it is remarkable how many different niches within the NHS are populated by healthcare scientists, many at very senior levels. Science training equips people with a particular set of highly transferable skills in analysis and problem solving, allowing them to break down barriers and develop new ways of working.

I'm proud to be able to say that as Chief Scientific Officer, I lead this workforce and it gives me great pleasure to be able to celebrate their remarkable achievements.

I too trained as a healthcare scientist. As a child, I was logical and analytical and as my mother will attest, constantly asking questions. I was an aspiring athlete as an adolescent and one of my teachers was an ex Olympic athlete. I became very interested in the physiology of exercise even before I joined the NHS, and had already carried out a number of experiments. It was an easy step into a career as a respiratory scientist. I felt very fortunate to have been involved in the NHS at a time when science and technology was rapidly evolving, when so many steps were taken to add to our knowledge base and when it was possible to take all of the wonderful career opportunities that were presented to me.

After my PhD, (on lung pathophysiology), I spent over 30 years in what has now become University Hospital Birmingham NHS Foundation Trust and at the Medical School, University of Birmingham. I was an active basic and translational researcher and involved in a range of early to late clinical trials, collaborating with centres in the US and Europe and presenting the outcomes at meetings and conferences across the world, whilst also still providing direct patient care for people with respiratory problems in specialist clinics and services. A particular joy was being able to teach and train many medical and scientific staff. I became interested in professional leadership and management and became the first non medical consultant clinical scientist to lead a medical specialty (respiratory medicine). I also became involved in professional matters first in my own field then in others, both nationally and internationally leading and contributing to for example guidelines and to scientific developments.

I began to lead on various initiatives for the Department of Health and one major project in the mid 1990s for example was leading the UK National Occupational Standards project for healthcare science. These standards describe competences for given roles in terms of outcomes and are an indispensable tool for those managing highly skilled workforces. It gave me a great insight into the many specialisms of healthcare science, preparing me for my current role as Chief Scientific Officer at the Department of Health which I took up in 2002. I feel very privileged to have this position and want to ensure that healthcare scientists continue to contribute fully to the NHS and to science itself and play a part in their own future.

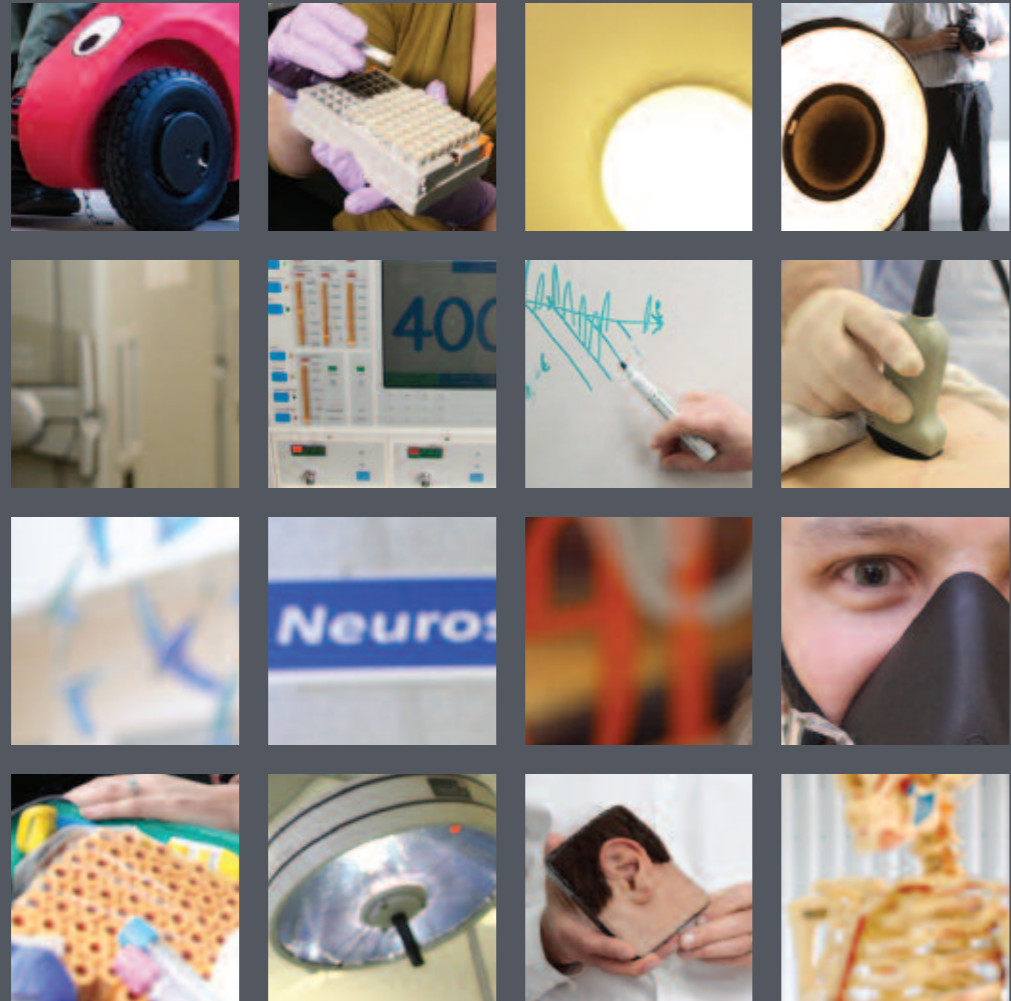
As for science, I remain as passionate about science and its role in health and society as I was at the very beginning of my career. And having seen how these stories have been brought to life by the tremendous writing skills of Vivienne Parry, I'd like to encourage more people to take up writing about science and to understand the contribution that it can make to the public's understanding of science.

Many themes emerge from the stories in this book: the diversity of talents within the scientific workforce, the value of their particular skills to the wider NHS but also the importance of great science teaching. So many people mentioned inspirational teaching as a reason for becoming involved with science. I hope that this book may also inspire.



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Extraordinary people.
Extraordinary jobs.
Extraordinary journeys.

“It’s like being
Sherlock Holmes”

Joyce Poole
NHS Blood & Transplant

Joyce Poole

Blood Transfusion Science

Joyce Poole is unique in the UK. In fact, there are only a handful of people like Joyce Poole in the whole world. She does the ultimate matchmaker’s job; finding blood donors for people with impossibly rare blood groups. The added twist is that both donor and patient can be anywhere on the globe.

‘I love my job because it’s so exciting. It’s like being Sherlock Holmes and when you solve a problem, it’s really satisfying’.

Joyce runs the International Blood Group Reference Laboratory in Bristol, which is a unit of NHS Blood and Transplant. Most people are familiar with ABO and Rhesus blood groups. Actually there are many, many more blood groups and a good match for each of these groups is sometimes critical. Compatibility between potential donor blood and recipient’s blood is first established in a tube in a laboratory. Put simply, if there is no reaction, blood can be safely transfused. If there is a reaction, another donor type is needed. But in some patients no routine donor type is suitable. This may occur because the recipient has developed antibodies in their blood following a previous pregnancy or transfusion or perhaps just because they have very unusual blood. Either way, the next stop is Joyce.

Joyce maintains a ‘blood library’. Every time an unusual case is solved in her laboratory, it is catalogued. Then, if a call comes in to either identify a strange blood group, or provide a match, they can call on their ‘back catalogue’ to help them. Recently a call came from Portugal where a critically sick baby with an extremely rare blood type required a transfusion. Joyce remembered a blood donor from Northern Ireland whose unusual blood group had been sent to her for confirmation of its type. She checked the sample they held and it matched that of the baby. A search was made for this rare donor who agreed to come in immediately to give blood which was then flown from Northern Ireland to Portugal. The baby made a complete recovery.

Along the way, Joyce has discovered many completely new blood groups, been celebrated by her peers and travels all over the world teaching others about her work – and all from the humblest of starts as a trainee biomedical scientist in the NHS.



“This job allows you to see a whole engineering project through to completion and also involves people”

Simon Halsey
BIME, Royal United Hospital Bath

Simon Halsey
Medical Engineering Design

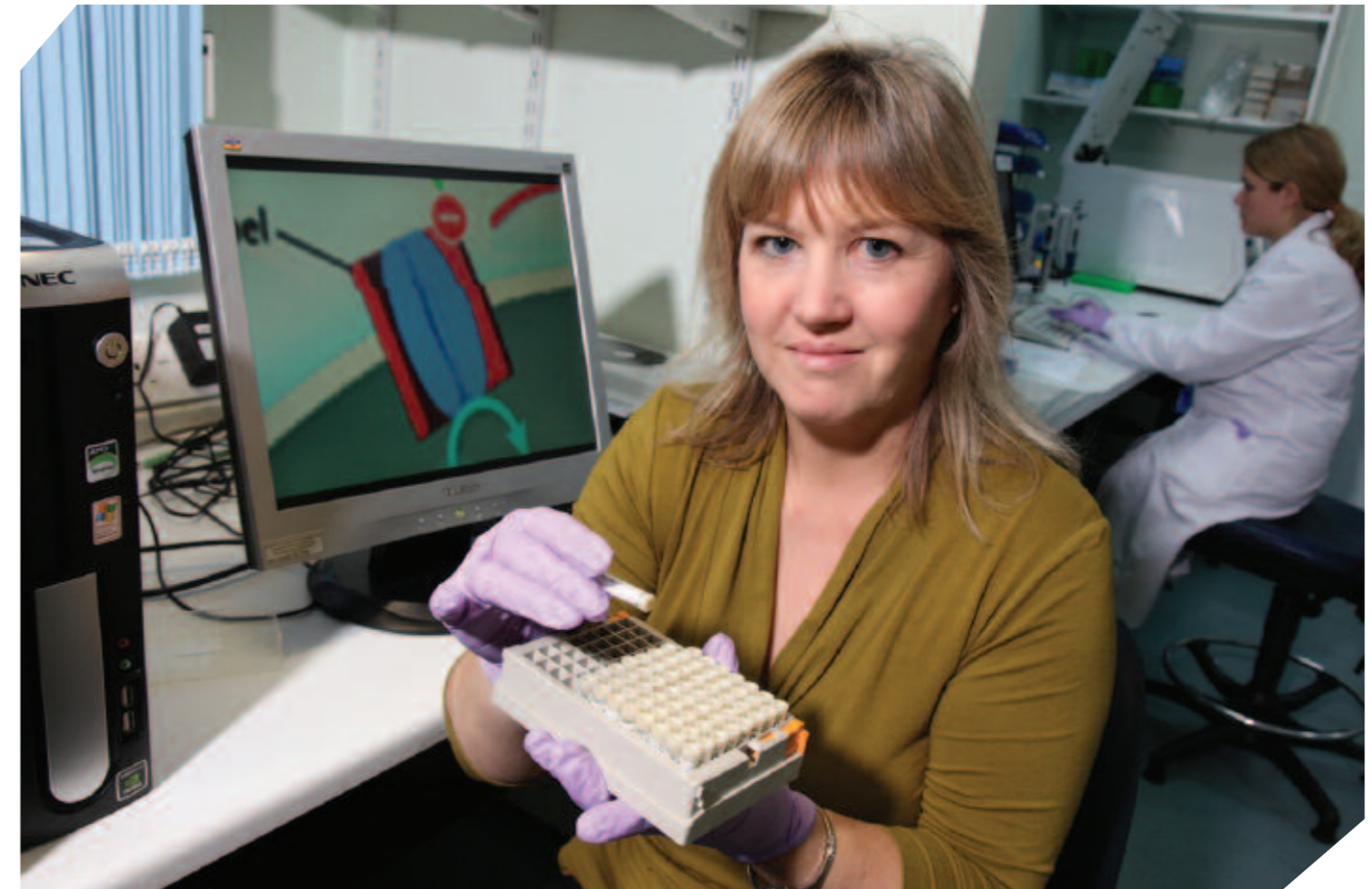
Simon Halsey is a design engineer working for Bath Institute of Medical Engineering (BIME), a design and development charity working in the fields of medicine, health care and assistive technology for disabled people. BIME is based within the Royal United Hospital Bath and works closely with the NHS as well as with a wide range of commercial companies.

Simon's degree was in mechanical engineering including a research masters, and he went straight into a job with an industrial engineering company. But it didn't give him the job satisfaction he craved, so he rethought his career and joined BIME. The charity bridges the gap between one-off design solutions for individual patients and mass retail, and comes up with, and sometimes manufactures, products that are desperately needed by patients but which have a limited market.

Simon really enjoys what he does. 'This job allows you to see a whole engineering project through to completion and also involves people'.

Design engineers help come up with solutions to problems. For instance, orthopaedic surgeons wanted something that kept finger bones stable after a break but which did not obscure the bone during the frequent X rays taken to check the progress of an injury. So Simon developed a novel plastic device to do the job. Other NHS requests include designing instruments for keyhole surgery. BIME works with NHS Innovation Hubs which champion the cause of healthcare innovation and identify, develop and commercialise innovations and intellectual property created by NHS staff.

The project that has given Simon most satisfaction has been designing a paediatric wheelchair called Wizzybug, which is aimed at very young children. There is growing evidence that independent mobility is key to a child's development in early years. But in the past, pre-school children have had very limited access to mobility devices because of the problems they had in controlling them. Designing something they were able to manage was a real challenge but Wizzybugs are already a big hit with children around the country.



Professor Sian Ellard
Molecular Genetics

One day, Sian Ellard, an academic researcher in a university genetics lab in Wales, spotted an advert asking for someone to set up a genetics laboratory at the Royal Devon & Exeter Hospital in Exeter. It changed her life – and that of hundreds of children as well.

Aged 30, Sian arrived in Devon to find a colleague was interested in one particular type of diabetes, known as MODY (maturity onset diabetes of the young) which affects between 10-20,000 people in the UK. Many of these are misdiagnosed as type 1 (insulin dependent) diabetes and start on insulin injections which will be lifelong. The Exeter team showed that MODY patients with mutations in a specific gene can be treated with daily pills of a drug called sulphonylurea. It allows many to throw away their insulin after years of needles.

The lab testing for MODY is now a UK NHS service and Sian's research has extended to a very rare form of diabetes that affects around one baby in 100,000, which she has shown is also caused by a genetic mutation. The exciting thing here is that use of the right drugs may allow some babies to return to normal insulin function and certainly means that control of their diabetes is much improved with fewer long term side effects. For some children, the mutation also affects their speech, concentration and movement, but the switch from insulin injections to another sort of tablet improves this too.

Sian is lab based but many of the patients whose lives have been changed by her work get in touch. 'It's brilliant to know that a diagnosis that you've made has changed someone's quality of life so much. It's really rewarding to have feedback from families throughout the world'.

All the while, Sian has been involved in the daily round of providing a genetic service for people in the South West as well as a UK wide specialist service. She thinks that researchers and NHS staff working side by side is great for everyone and loves watching how basic research translates into improved clinical care.

“It's brilliant to know that a diagnosis that you've made has changed someone's quality of life so much”

Professor Sian Ellard
Royal Devon and Exeter NHS Foundation Trust

“I remember thinking when I got my very first Chief Executive job when I was 30, ‘can I do this?’”

Ian Cumming OBE
NHS West Midlands



Ian Cumming OBE

Chief Executive, NHS West Midlands

Ian Cumming started his career as a healthcare scientist but is now the Chief Executive of one of England's largest Strategic Health Authorities, NHS West Midlands.

Like a stick of rock, NHS is written right through him. This is not just because he is so passionate about the health service but also because he was born into what he calls 'an NHS family', with a health visitor mother, a GP father and two out of three siblings working for the NHS too.

Given this heritage, it perhaps isn't surprising that the young Ian was good at science at school. He recalls wanting a career that combined science with people and being a healthcare scientist seemed a natural choice. His elder brother Tony was already a clinical scientist at the Manchester Royal Infirmary, working in haematology and he followed him there, also developing a career in blood sciences. Ian later specialised in blood coagulation disorders such as haemophilia and began the service providing antenatal diagnosis. At one point in the late 1980s, he and his brother shared a laboratory, which must have been a bit confusing especially since they sound alike on the phone.

After six years in the lab, he had become increasingly interested in management and leadership having had a taste of it through running the leukaemia unit's appeal fund. He wanted to do something different and someone wisely counselled him to spend some time outside the NHS. 'So I had a gap year, managing a hotel and being a ski guide in the Alps'. On his return he was offered a temporary job as an Assistant Manager covering for someone's maternity leave. Since then he has moved steadily up the management ranks.

He became Chief Executive of Lancaster Acute Hospitals in 1995 and was involved in the merger of three Acute Trusts then becoming CEO of the resulting University Hospitals Morecambe Bay in 1998. What he loves most is the extraordinary variety. 'You never know what's going to happen from one day to the next'. As an example he cites getting a call on a quiet Friday afternoon in late July in 2002 from a colleague saying that they had identified two cases of Legionnaires Disease. It was the start of the UK's largest ever outbreak of the disease. 'Within hours I was in front of 14 TV cameras at a press conference and it didn't stop for six weeks'.

He has a particular interest in the development of leadership skills in clinical staff and is an honorary professor in the Leadership Centre at Lancaster University Management School where until recently he chaired the Board of the Health Leadership Centre.

Of course there are scary moments in management. 'I remember thinking when I got my very first Chief Executive job when I was 30, 'can I do this?' In my view, the day you get a job and don't have self doubt about whether you can do it, is the day you've become too arrogant to do it properly'.

'Does my science bring something to what I do? Of course. I'm a firm believer that good management is a mixture of both art and science. My science brings analytic understanding to the job but also the understanding of what patient care is all about.' Ian has been in the top job in the West Midlands since June 2009.

David Ramage

Medical Illustration and Clinical Photography

People are sometimes surprised to learn that the NHS employs photographers. In fact medical photographers play a vital role in a wide range of clinical services, particularly in dermatology, plastic surgery and ophthalmology.

David Ramage heads the medical illustration department at the Royal Preston Hospital. His team includes a medical graphic artist creating images for use in teaching and patient information and a number of clinical photographers. Medical photographers require tact and sensitivity and must be scrupulous in their respect for confidentiality. Their services may be called upon at any time. 'You never know quite what's going to happen next and the thing I love about this job is its variety'.

In Preston, about 38,000 images are added to medical records every year and the department has a web based archive to help call up images for clinicians. Images form part of a patient's medical record and have to accurately chart the course of disease. Unless pictures are accurate, and taken in the same way, every time, no matter how many years apart, the patient could either receive unnecessary treatment or no treatment. Photos are also required to help plan reconstructive surgery and to document its results. They may be needed for legal reasons or for teaching purposes.

Another major part of medical photographers' work is in the diabetic retinal screening programme. People with diabetes can develop problems with their eyes which can lead to blindness unless detected and treated early. The preventive programme uses photography. 'We screen 4,000 patients a year, taking pictures of both eyes'. David's job also includes using optical coherence tomography, a procedure which produces images of underlying structures of the retina for use in diagnosis of eye diseases.

"You never know quite what's going to happen next and the thing I love about this job is its variety"

David Ramage
Lancashire Teaching Hospital NHS Foundation Trust



Helen Gillan

Tissue Banking

Helen Gillan heads the largest tissue bank in the UK. Located in Speke near Liverpool, this world class state of the art facility collects and supplies human tissues for therapeutic use. It does work that is both life saving and life changing.

Like organs, tissues can be donated after death. Donated skin for instance is used to save the lives of people who have severe burns. Donated bone and ligaments are used in orthopaedic surgery such as hip and knee replacements which allow people to walk without pain once again, whilst donated sections of arteries and heart valves are used for those with heart disease. Donated corneas restore sight. The tissues are collected within 48 hours of death from donors across the country and are processed and preserved at Speke. There are about 6,000 potential donors each year and their families are supported by a team of 11 specialist nurses.

It is an extraordinary exercise in logistics which involves hundreds of people, including 80 reporting directly to Helen at Speke. Her job is an all encompassing one requiring organisation, planning, strategy, finance, management and leadership. 'But my scientific knowledge is a critical part of everything I do'. And there is always a need for innovation and new products to meet new needs. One is artificial tears for people with dry eyes.

Helen never imagined when she took her degree in microbiology and genetics that she would end up doing what she does now. She got into tissue banking almost by accident, starting off her career as a research technician in a tissue bank after replying to a job advert. She gradually realised that she had a creative side which expressed itself in not only being able to organise efficiently, but also think up creative solutions to overcome challenging problems.

'When you're working here on a daily basis, you just get on with the job. It's only when you're out of it or talking to other people that you realise how special it is'.

"It's only when you're out of it that you realise how special it is"

Helen Gillan
Head of Operations, Tissue Services NHS Blood & Transplant





“I love the challenges I face in this job, not least creating the Regional Microbiology Network”

Dr Christine McCartney OBE
Health Protection Agency

Christine McCartney OBE

Exceptional Scientist

Christine McCartney is a human dynamo who has already made a difference to most peoples' lives in this country as she created and now leads the Health Protection Agency's Regional Microbiology Network, a major force in public health. And from dawn until well into the night, she is in almost perpetual motion, planning, organising and persuading to further improve public health.

Christine originally wanted to be a doctor, but astonishingly given what she has now achieved, lacked the confidence to apply to medical school. Instead she studied microbiology, the study of microscopic, often disease causing, organisms that include bacteria, viruses, fungi and parasites. Ironically, when it came to taking her membership exams for the Royal College of Pathologists, she sat the same exam as doctors and passed with flying colours. Thereafter she had a medical consultant equivalent post in Glasgow and lectured in microbiology. She was the microbiologist in the team responsible for establishing the Scottish heart and lung transplant unit and advised clinicians on antimicrobial therapy for this vulnerable group of patients.

But in 1992, she decided to move to England and to the Public Health Laboratory Service, the forerunner of the Health Protection Agency (HPA). She became Deputy Director of the Centre for Infections in Colindale before being given the job in 2006 to create the new network of the many laboratories involved in public health across England. The HPA Regional Microbiology Network (RMN) has a budget of £65 million and close to 1,000 staff. It includes eight large regional microbiology laboratories (Newcastle, Leeds, Manchester, Birmingham, Bristol, Cambridge, Southampton and King's College London) plus a further 36 collaborating laboratories and 11 Food, Water and Environmental Laboratories. It plays an essential role in safeguarding the health of the population. For instance, without such laboratories, there would be no early warning of disease outbreaks and no surveillance of healthcare associated infections, blood borne virus infections, gastrointestinal infections and antibiotic resistance to name a few examples. Creating the network involved a mountain of work. 'I love the challenges I face in this job, not least creating the RMN'.

The laboratories share technology and ensure that services continue to be delivered 24 hours a day, 7 days a week, no matter what happens. And despite extensive planning, there are always surprises. The existence of the network ensures a rapid response is always possible, even if demand is overwhelming for some. Its value was proved emphatically during the swine flu outbreak. The West Midlands was particularly badly hit during the initial wave and at one point the Birmingham laboratory received 900 samples in one day. Sharing work across the network allowed them to deliver the flu diagnostics as well as cope with their normal heavy workload.

Christine tackles her job and its pressures with enormous enthusiasm. She is above all a people person and has legendary communication skills, in writing (her book on microbiology is a standard textbook for undergraduates), with her staff and indeed, as a public communicator. It is Christine, as the HPA Lead on healthcare associated infections, who provides many of the HPA press briefings on MRSA and Clostridium difficile infections. Her many achievements for public health were recognised by the award of an OBE in 2007.

She is still a woman with a vision. Not only does she want to further enhance the profile of public health microbiology but she also wants to increase the amount of research undertaken in this important area of health. There is no doubt that this remarkable healthcare scientist will do both.



“There’s more variety than you would possibly think”

Chris Bates
East and North Herts NHS Trust

Chris Bates
Renal Technology

Chris Bates always hankered after ‘something in the medical line’ following his degree in electrical and electronic engineering but initially found a job in military avionics. So when he got an opportunity to work with a company that manufactured dialysis equipment, he took it. He then joined the NHS, at first looking after the complex machinery of intensive care units but then working with kidney dialysis equipment as a renal technologist who make sure that it is operating safely and effectively. And that was it, smitten.

There are relatively few renal technologists in the NHS (less than 300) but it is a very stable community. ‘There’s definitely something about the kidney dialysis field that makes people stay in it’. It is not only the fascination of dialysis machines, the only machines that are able to replace the function of a major organ, it is also the relationships developed with those on long term dialysis. ‘It means that you get to know them as people rather than patients’. Add to this infinite variety and advanced problem solving and it is perhaps understandable why it is such a satisfying job.

Chris looks after about 100 dialysis machines and associated equipment (such as water purification plants), spread over several sites including peoples’ homes. ‘NHS dialysis machines work very hard. They are used up to four times a day and can have up to 60,000 hours service on them. Most machines perform a heat or chemical disinfection several times a day. Pressures, flows and temperatures have to be just right and renal technologists need to understand the treatment in order to ensure that every one of thousands of treatments per year is safe. And it’s not just a question of fixing a machine if there is a fault but ensuring the system is safely adjusted to suit an individual’s needs. ‘There’s more variety than you would possibly think’. It is also a team effort, with renal technologists, doctors, nurses and clinical scientists all involved in a patient’s care.

Dr Josephine Barlow
Principal Lecturer in Clinical Sciences

The first reason for a switch in Jo Barlow’s career was not being able to explain something. She originally applied for a student place in cardiology in her native Manchester with the equivalent of 5 GCSEs and had then gained further qualifications ‘on the job’. But it was when she was appointed to a surgical investigation unit that she became intrigued by patients who complained of angina like chest pain, yet whose heart investigations were normal.

She suspected it might be a gut problem and set about adapting new technology and developing techniques to better define the cause of pain. She discovered that it was triggered by the degree of stretch in the upper part of the gut. Patients were reassured that it wasn’t a life threatening cardiac problem and that the specific cause for their pain could now be alleviated with appropriate treatment. From then on, gastrointestinal rather than cardiac physiology claimed her. She also did a great deal of research on the swallowing difficulties experienced by stroke patients whilst at the same time being involved in the assessment, diagnosis and care of a wide range of patients with specific problems with their gut function.

Whilst she was doing this, she decided to take some science based Open University modules and then subsequently got a degree followed by a doctorate, researching sensitivity in the gut. And then it was time for another switch. This time the reason was the offer of a challenging academic opportunity. She is now a programme leader of the Bachelor of Science Honours degree in Clinical Physiology and Clinical Technology at De Montfort University in Leicester. She teaches students and assesses them in their places of work, but she still keeps up her clinical skills providing a paediatric service in both Manchester and Liverpool. ‘I may be in one of the hospitals in the morning and teaching in the afternoon. No two days are ever the same and you have to like living on the edge and taking the unexpected as a challenge rather than an obstacle.’

“You have to like living on the edge”

Dr Josephine D. Barlow
Faculty of Health & Life Sciences, De Montfort University



“I love the variety of different ways that I can use my scientific training”

Gordon Hosker
Central Manchester University Hospitals NHS Foundation Trust

Gordon Hosker
Exceptional Scientist

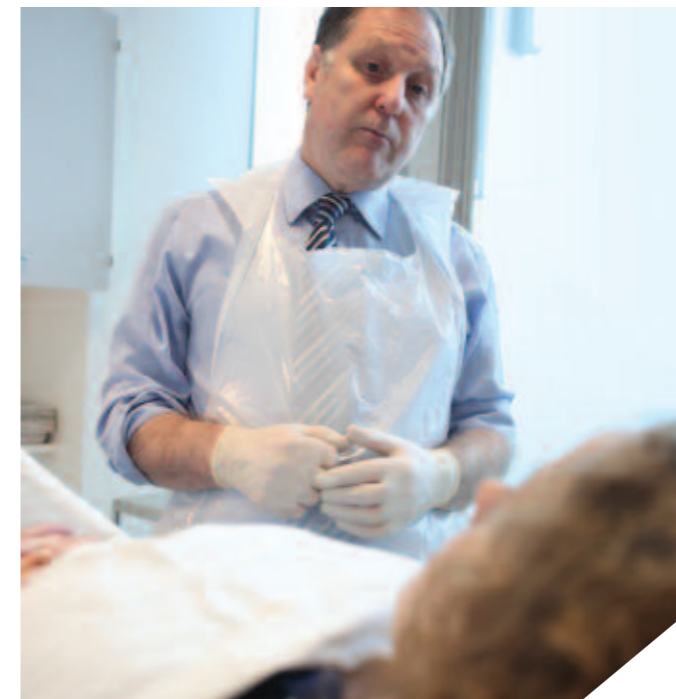
If Gordon Hosker is asked what he does for a living, he usually says simply ‘I work for the NHS’ without further elaboration. This is because he investigates and diagnoses health problems which people find very hard to talk about openly, yet which affect the majority of us at some time in our lives.

Abnormalities of bowel and bladder control can be miserable afflictions, causing social isolation and enormous distress. They can occur at any stage of life. Urinary problems for example are particularly prevalent in women following childbirth and in their years after the menopause. Symptoms can be significantly improved, often with surgery, but for the best treatment results, accurate diagnosis is essential. And that’s where Gordon’s work is so important.

Gordon originally studied physics at university and became interested in low temperature engineering, taking a Masters in cryogenic engineering. He went to work for a surgeon who was using freezing to destroy diseased tissue and for six years, Gordon worked in cryosurgery. Essential to this work was knowledge about pressures and flows – exactly what was required when he made a move to Manchester to undertake research in womens’ urinary problems.

Since his move to St Mary’s Hospital, Manchester, Gordon has established an international reputation in urodynamics, a small but vitally important field. He is a leader in research, particularly in developing new measurement techniques. He initiated and published a survey showing the lack of quality training in urodynamics which prompted the development of a training course run ten times a year for healthcare professionals. He also travels all over the world, lecturing and teaching and chaired an international committee which set guidelines for the use of urodynamic and other physiological studies. He is proud that these will be the world standard until 2012. ‘I love the variety of different ways that I can use my scientific training’ says Gordon.

But at the heart of Gordon’s work lies daily contact with patients requiring particular tact, skill and understanding to put them at their ease. And that is an art.



“You do care that there’s a person at the end of this”

Carol Turnbull
Belfast NHS Trust



Carol Turnbull
Histopathology

Carol Turnbull’s work will never be seen by patients, but her painstaking attention to detail and her skill will have had a profound influence on their care.

During operations, such as cancer surgery, the tumour is removed as well as samples of surrounding tissue and other material like lymph nodes. The job of a histopathologist is to prepare, consider and report on all these samples. For instance, if a woman is having an operation to remove a breast cancer, have cancer cells spread to the lymph nodes and what type of breast tumour is it? The answers provided by histopathologists from examination of tissues and whole organs removed during surgery are critical to subsequent treatment and prognosis, not just for cancer but a wide range of diseases.

Carol has an additional level of skill in that she also dissects specimens, such as a whole kidney or ovarian tumour, making sure that representative tissue is obtained for further analysis. This important job, which in the past was done only by doctors, carries a high level of responsibility. It also requires considerable practical skills and knowledge. Carol was in fact the first non-medically qualified scientist in the whole of Ireland to be awarded a new diploma in specimen dissection. ‘We’re always thinking of the patient. We know that if we get it wrong, someone might have radical surgery that is unnecessary. Getting it right means a good outcome for the patient’.

The job requires phenomenal numerical accuracy because of the many numbered specimens that come from each patient. Histopathologists usually work in pairs so that information is cross-checked. Carol’s job includes the prioritisation of work in the lab but she admits to working many extra hours to make sure that patients get their results quickly. ‘You do care that there is a real person at the end of this’.

Christopher Green

Neurophysiology

In the past, what Chris Green achieves for patients with neurostimulation would have been called miraculous. And even though science can explain and indeed enables what he does, ‘miraculous’ still comes pretty close as a description of its effects.

Chris is lead clinical physiologist in neurophysiology at Barts and the London NHS Trust. His department is one of the largest in the country, serving several hospitals including two very large ones, St Bartholomew’s and the Royal London. The Royal London is a major trauma centre and has a large and extremely busy intensive care unit. Chris’s team of 12 clinical physiologists and specialist medical staff offer a wide variety of neuro-diagnostic services for adult and paediatric epilepsy and peripheral nerve and muscle disorders. Additionally they offer an ‘at bedside’ assessment for very sick patients of all ages. They also work in theatres during spinal surgery.

But in addition to the management of his team and services, Chris jointly runs a neurostimulation clinic with neurologists and neurosurgeons. Neurostimulation involves a programmable device, similar to a pacemaker, which delivers an electric impulse through one or more electrodes which are implanted surgically. The Royal London was one of the pioneering hospitals in the use of neurostimulators. Vagus nerve stimulators are used to help to control epilepsy in patients in whom all drug treatment has failed. Another type of stimulator is used to control pain, with multiple electrodes being placed on the spinal cord itself. In the right patient, both procedures can be very effective for people for whom nothing else has worked. Deep Brain Stimulation (DBS) is used to treat a number of neurological diseases, principally those causing tremor and Parkinson’s. The electrode is placed in the brain surgically and Chris must then programme the device to give exactly the right level of stimulus. The combination of right spot and right stimulus produces an extraordinary effect. Shaking simply stops and Parkinsonian symptoms disappear. ‘I’ve seen patients transformed from shaking uncontrollably to being able to drink a glass of water without spilling it,’ says Chris. ‘I get a great deal of pleasure from this work because it makes such a dramatic difference to patients’. It is his skill in programming and monitoring neurostimulators that makes this work possible.



“I’ve seen patients transformed from shaking uncontrollably to being able to drink a glass of water without spilling it”

Christopher Green
Barts and the London NHS Trust

Dr Brendan Cooper

Exceptional Scientist

Brendan Cooper was forever getting into minor scrapes as a child. But his many visits to A&E turned into an investment for the NHS. 'I really liked hospitals and wanted to work in one when I grew up'. His degree was in physiology but it was an inspirational lecturer who fired his enthusiasm for his current role in respiratory medicine and its sub-discipline of sleep studies.

Initially his career focused on research, although he also undertook clinical work. Initially he worked at the Freeman Hospital in Newcastle just as it was beginning its lung transplant programme. It was a very exciting place to be at the time. His career became more and more research oriented but when a job in came up running lung function and sleep services in Nottingham, he jumped at the chance. But for the last seven years, he has headed one of the biggest departments of lung function and sleep services in the country in Birmingham.

Sleep disorders are one of the most fascinating areas of medicine. There are many different types and diagnosing the precise type requires overnight observations of many different variables, from breathing patterns and heart rate to brain waves. These are carried out by respiratory physiologists. Sleep apnoea is one of the most common disorders and is associated with heavy snoring and dangerous daytime sleepiness but it can be treated very successfully with a device called CPAP. The effect on patients and their partners is transformational. 'Hearing people say 'you've all changed my life' is an amazing experience' says Brendan.

Research continues to thrill him. 'The excitement when you look at new data and realise there's a pattern or have a hunch and follow it up to find it's right. I still absolutely love this'. An example was the realisation that a simple screening test might accurately identify most cases of sleep apnoea without the need for a full sleep study, which takes many hours. He is also widely known for his expertise in evaluating equipment and devices for use in research.

Recently he has spent a great deal of time working with other respiratory physiologists both in the UK and across Europe, through his professional body, empowering and enthusing them. The NHS has clearly had a good return on its initial investment in Brendan Cooper.



“Hearing people say ‘you’ve all changed my life’ is an amazing experience”

Dr Brendan Cooper
University Hospitals Birmingham NHS Foundation Trust

“I know it makes such a difference to peoples’ lives”

Nicky Fleming
Innovator



Nicky Fleming

Healthcare Scientist developing services in Primary Care

Nicky Fleming is a woman on a mission, using her science in the community to make people's lives easier.

Nicky entered the NHS as a junior laboratory technologist, gaining hands on experience across all pathology disciplines whilst studying, and is now a consultant biomedical scientist. Whilst her background, in what she calls, 'a lot of 'ologies' (principally microbiology), laid the groundwork of her present career, it was a visit to the GP soon after the birth of her first child that was the trigger. She was told that it would take ten days to get the results of a simple urine test back from the hospital lab and that in the meantime, she would need to take antibiotics as a precautionary measure. She discovered that 50 patients a week were in the same boat. She offered to set up a screening service for urine samples in her GP's surgery. Within a fortnight, her 99% accurate on the spot testing meant patients were getting the right treatment immediately, with only one visit to the surgery.

Nicky then turned her attention to the problems of people taking anti-coagulants. The dose needs to be just right, too much and there is a risk of haemorrhage, too little and thrombosis might occur. Dosing is calculated following the results of a clotting test on a sample of blood. Many people attend hospital for these tests, sometimes waiting two hours to have them and then several days for the results. It isn't very patient friendly. Nicky has shown how a five minute testing and dosing consultation can be done locally in the surgery. Next, Nicky helped establish a sexual health service, again providing an immediate consultation. Nicky has applied her science to ensure that these safe high quality 'one stop shops' are as effective as hospital based services. 'It's so rewarding bringing science to the patients. I know it makes such a difference to people's lives, improving their access to both diagnosis and treatment.' Nicky is based in Somerset but sets up services round the country, training people to follow this patient centred approach.

Now, she has a new passion. She leads on the life sciences aspects of the Modernising Scientific Careers programme, bringing her brand of innovation to a new generation of healthcare scientists.

“We were constantly trying to innovate and change. Change is always a fantastic opportunity”

Dr Ian Barnes
Department of Health

Dr Ian Barnes

National Clinical Director for Pathology

Ian Barnes relishes the excitement and opportunities that change brings, which is just as well given the speed and impact of technological advances in healthcare, particularly in his own specialist field, pathology.

Ian is the Department of Health's National Clinical Director for Pathology, a field that people imagine to be about the investigation of suspicious death, but which actually covers more than a dozen disciplines central to the diagnosis and management of disease including haematology, immunology, microbiology and genetics.

Ian's working life began in the West Country as a paediatric biochemist. He specialised at a very young age, becoming an expert on mucopolysaccharide diseases, devastating inherited conditions, each caused by a different enzyme deficiency. By the 1980s, he found himself in charge of a very large diagnostic unit in Bristol, with a particular strength in hormone assays.

It was when he moved to Leeds that he discovered his talents as a manager. He quickly became head of the biochemistry department and shortly thereafter operational director for all Leeds pathology services. It was a time of extraordinary change in laboratory sciences, with new molecular techniques in particular radically changing tests and how quickly they could be done. But whilst the technology was changing, the way services were organised had not. Ian realised that service change was inevitable but that here was an opportunity for science professionals to create the service that they wanted ahead of imposed change. 'I knew that transforming services from within was the best route'. Collaborating with colleagues in Bradford and Leeds, he created a so called 'managed network', across 8 sites in Bradford and Leeds, serving 1.3 million people, reconfiguring services so that all pathology staff had a single employer, with a single set of quality standards and integrated IT. It was an exhilarating time, with everyone working together to create the best possible service for patients and creating a unique model which was adopted as the template for all future services.

Ian became full-time director of pathology in Leeds, with 1000 staff. 'We were constantly trying to innovate and change. Change is always a fantastic opportunity'. It was perhaps inevitable that Ian became involved in change at a national level, first through his work with professional bodies and then in working on the Department of Health modernising pathology programme.

There is more change ahead: as healthcare needs alter particularly with an ageing population and with increased expectations of services by patients who want results faster. Changes in technology with the availability of self test kits and handheld test devices is driving laboratory testing into primary care settings. And then there is the change wrought by financial recession. Each one an opportunity for Ian Barnes. He very nearly became a professional footballer when he made the England Under-18 team. But one suspects life as a professional footballer would have been rather less exciting than a life in pathology.





Matt Rutter
Respiratory Physiology

Matt Rutter was diagnosed with leukaemia when he was 15. A bone marrow transplant saved his life but left him with a serious lung condition. He needed frequent breathing tests and it was the time he spent in the lung function lab at Addenbrooke's Hospital that decided him on a career in respiratory physiology. He was intrigued by the technology that was used. 'But I didn't want to be a person sitting in a room with a computer. I wanted to interact with people'.

He started work at Addenbrooke's in 2002 and today, it is what he can do for patients that gives him his greatest job satisfaction. 'To get accurate test results you have to be good at communicating with people. It's one of the key components of the job. It gives me a real sense of satisfaction to know I've done a good test'.

He joined with A levels. Now at 26, he is studying for a degree in clinical physiology and doing research with immediate practical benefits. Matt is one of the people with lung problems who need to have extra oxygen when they fly. This is because pressurised plane cabins contain less oxygen than normal air. Matt suspected that for some lung conditions, the guidelines which identify those who will need this help might be wrong. After gathering more data, he proved this and was invited to Stockholm to present his research findings to other scientists.

There was another reason for his career choice. 'I wanted to give something back to the NHS because it saved my life'. He is doing it every day.

"I wanted to give something back to the NHS because it saved my life"

Matt Rutter
Cambridge University Hospitals NHS Foundation Trust



"You have to be able to approach people in the right way"

Joanne Marchant
Mid Cheshire Hospitals NHS Foundation Trust

Joanne Marchant
Phlebotomy

Joanne Marchant works in the community as well as in hospital, managing a team of nearly 50 phlebotomists right across GP practices in mid and East Cheshire as well as services for wards and outpatients in Macclesfield and Leighton Hospital. But she also continues to take blood herself and very much values the contact she has with patients.

The basic principles of venepuncture are the same as those in hospitals but whereas hospital phlebotomists are often dealing with very sick patients that they may only see once, community phlebotomists get to know their patients and become part of their lives. They deal with an enormous range of people, from teenagers to the elderly. 'You have to be able to approach people in the right way. We only have a five minute appointment slot but we can't appear hurried and we still need to give as professional service as possible'. In both GP and outpatient clinics, phlebotomists are taking a sample every 3 minutes. To be able to work at such speed, safely and effectively, requires a great deal of skill and experience. 'It takes a minimum of 6 months to become really proficient at venepuncture'.

Joanne came to phlebotomy via social care and then as a healthcare assistant in the University Hospital of North Staffordshire. Taking blood was part of her daily duties and she found that it was something that she was really good at, managing to get blood even when others found it difficult. She became a full-time phlebotomist and is now managing a large team in the community. Managing the people and the rotas, particularly at holiday times is a major challenge.

Providing a quality service for patients requires skill and Joanne is proud to have developed a venepuncture learning package alongside the clinical skills lead for her trust and the learning development officer for her primary care trust which enables the professional skills required to be rolled out in a systematic and effective way, to the benefit of patients.



“It’s a brilliant job. I love applying the knowledge from my degree in physics and using it to solve problems”

Dr Charlotte Platten
The Newcastle upon Tyne Hospitals NHS Foundation Trust

Dr Charlotte Platten
Clinical Measurement

If you were shipwrecked on a desert island, you couldn’t do better than to be marooned with Charlotte Platten. For her field is clinical measurement and her speciality is coming up with ingenious practical solutions for novel problems.

Healthcare scientists like Charlotte provide scientific and technical expertise for a wide range of different types of clinician but what each one does varies depending on the speciality of their particular workplace. Charlotte works at the James Cook University Hospital Middlesbrough which is a regional centre for spinal surgery. Surgeons manipulating the spine during surgery to correct twisting need to know what is happening to the delicate spinal cord. An anaesthetised patient can’t say what they are feeling so an electrical stimulus is applied behind the patient’s knees. Charlotte then monitors the transmitted electrical signal much higher up the spine. If the signal stops or becomes weak, she tells the surgeon who must quickly alter any pressure on the spine or risk permanent damage. Without Charlotte’s measurements in theatre, the surgeon would not know that anything was amiss until the patient was conscious several hours later by which time damage could be irreversible.

In her hospital, she also sets up, records and analyses measurements of pressure inside the skull of people who have a build up of fluid (hydrocephalus) and she also manages the design and construction of medical devices to improve patient care. She has recently devised an aid to help a wheelchair bound patient and has a patent pending on the device design.

Very often clinicians approach her knowing what they want measured, but not how to do it and Charlotte is the person who has to come up with a solution, usually using or adapting devices developed for another purpose or developing software for analysing data in a new way.

Charlotte came to this field via a physics degree and then a PhD in sleep studies. ‘It’s a brilliant job. I love applying the knowledge from my degree in physics and using it to solve problems. It’s great to be able to solve problems for people, whether it’s for clinicians or for patients’.



Peter Evans
Maxillofacial Prosthetics

Peter Evans loves his job. He is a maxillofacial prosthetist – someone who rebuilds faces with prosthetics for people born with deformity or for those who have had their faces damaged in accidents or by cancer.

Of all the healthcare science professions it is probably the one that is closest to an artistic craft. Peter had always been a sculptor but was studying to be a dental technologist. Larking about one day in class, he made himself a false nose out of dental wax. His lecturer immediately spotted his potential as a prosthetist and he hasn’t looked back since. Today, the profession requires much more than craft skills, combining as it does science and cutting edge technology. Recently Peter’s team won an award for the way in which they had used CAD-CAM, the computer software used by designers in manufacturing, to make facial prostheses, more reliably, in a third less time. This is important not just for UK patients, but worldwide, because facial deformity is a major global problem desperately in need of cheaper, more effective solutions. His unit in Morriston, Swansea, one of the leading centres in the UK, was also amongst the first to use a 3D virtual environment to plan complex surgery involving the skull. Doing it this way means that the implant screws needed to hang prosthetics from the skull are selected in exactly the right length prior to surgery, ensuring a much better result for the patient.

Despite all the high tech equipment, it’s a job that requires novel thinking. Every patient is different and some of their problems are very challenging to overcome.

People like Peter spend a great deal of time with patients, fitting them for new devices or working with them prior to complex surgery. The relationship can endure for many years. ‘Being able to make a difference to peoples’ lives is the greatest pleasure, enabling people who might not like to be seen in public to return to a normal life’.

“Being able to make a difference to people’s lives is the greatest pleasure”

Peter Evans
Abertawe Bro Morgannwg University NHS Trust

“I’m constantly looking for new areas of research and seeing it through to a clinical service. It’s one of the things I most enjoy about my job”

Professor Ian Swain
Salisbury NHS Foundation Trust



Professor Ian Swain

Exceptional Scientist

From wanting to do something practical as a 22 year old to changing at least 10,000 peoples’ lives and setting up a highly profitable company – is the journey taken by Professor Ian Swain through science within the NHS.

Ian’s degree was in electronic engineering at Southampton University. He became intrigued by research on artificial limbs at the University and soon found himself working in the Wessex Neurological Unit trying to find engineering solutions for the problems that occur through nerve injury or damage. His guiding principle was that no matter how complex the engineering, the controls should be easy to use.

In the 1980s, there was hope that electrical stimulation of muscles might enable people with spinal cord injuries to walk. In reality, only a handful of patients were able to benefit from it, leaving many others without help, such as the tens of thousands of patients who develop problems with walking because of paralysis in the leg and foot muscles following a stroke or through multiple sclerosis (MS). They typically have ‘dropped foot’, where the foot is dragged during walking, rather than placed. It makes getting about very slow, awkward and prone to falls. And once people have lost their confidence walking, they can quickly become isolated and depressed.

So Ian, by now working at Salisbury District Hospital, led the team that developed the Odstock Dropped Foot Stimulator (ODFS) for these patients. It’s a foot switch controlled electrical stimulator. Electrodes are placed on the skin just below the knee and a switch placed in a sole insert which is put in the shoe. A small strap-on box provides the electrical pulses and control. As the foot touches the ground, a particular nerve is stimulated via the electrode which draws the foot up and round. ‘It was developed after years of collaboration between clinical engineers, doctors and patients’, Ian explains.

The ODFS, developed initially with a Department of Health grant, was the subject of a randomised controlled trial that showed stroke patients walked faster and with less effort and in 1996, the ODFS was recommended for widespread use in the NHS. Later studies of users showed stroke patients walking 27% faster, with reduced tripping and increased confidence. And a variation of the device for MS patients with two dropped feet, showed a 48% increase in walking speed.

In 2006, Odstock Medical Limited was established as an NHS owned company by Salisbury NHS Foundation Trust. The company, of which Ian is clinical director, will continue to develop and improve functional electrical stimulation devices and make them available worldwide. Over 3,000 people have been treated using OFDS in Salisbury and some 7,000 worldwide. Nearly 2,000 professionals have also been trained in the use of OFDS. NICE approval for the device was obtained in 2009.

Watching film of a woman with MS hobbling slowly across a room with the aid of crutches before she gets her device and watching her 3 months later, striding confidently with only a walking stick is extraordinary testament to the power of such devices to change lives.

What next for Odstock Medical? ‘We’re working on upper limbs. I’m constantly looking for new areas of research and seeing it through to a clinical service. It’s what I most enjoy about my job’.



Exceptional science.
Exceptional innovation.
Exceptional discovery.

Dr Brian Campbell

Cardiac Physiology

Brian Campbell spent the early part of his career working as a cashier in a large company in Newry. Through his interest in sport he became a qualified coach, and fed up with his job, decided to completely change direction. And that was when he first discovered the heart and began his journey as a cardiac physiologist working in the NHS.

He was particularly intrigued by the reaction of the heart to sports training and by the way that it constantly adapted to fit the needs of the individual whilst tirelessly continuing to beat - every minute of every hour of every day of life. Soon Brian was gripped by heart physiology and wanted to do more. 'At the time I had no idea that there even was such a job as a cardiac physiologist.' At the ripe old age of 30, he took a degree in clinical physiology, sitting alongside 18 year olds. 'It did make me feel old, but I soon got over it!' He gained a first.

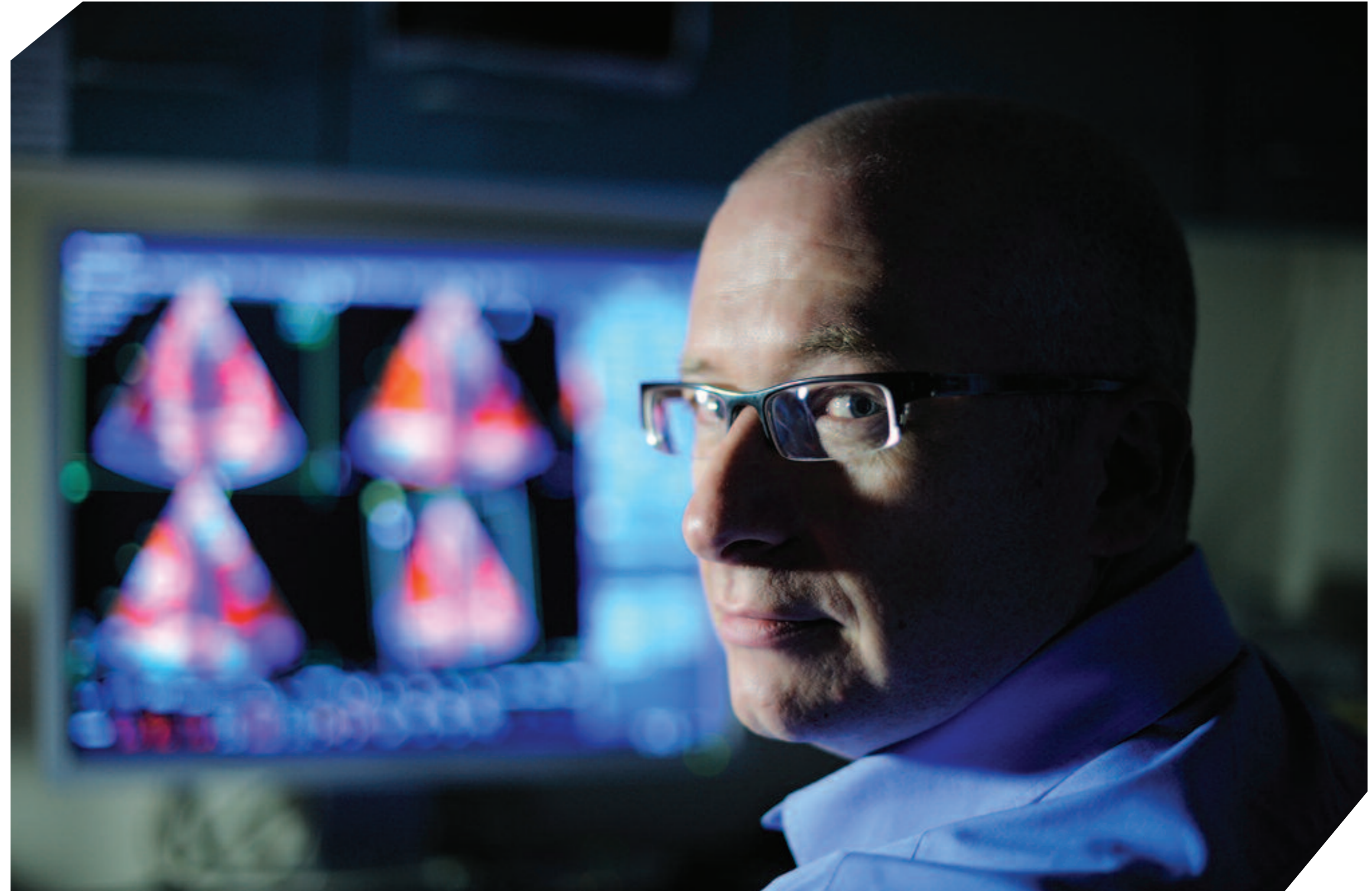
He began research for a PhD in Belfast, working in a type of ultrasound called Doppler, which is conventionally used in echocardiography to assess blood flow within the heart. His research was in 'tissue Doppler echocardiography', which assesses the activity of the actual muscle of the heart. This newer technique, which has now become standard, provides important additional diagnostic information, particularly in the assessment of heart failure.

He returned to Newry, this time to work in front line services at the local hospital, where he had the opportunity to put the research into practice, further developing and expanding existing echocardiographic services. He sees the entire range of heart conditions, from simple to complex. Accurate diagnosis is critical. 'What gives me greatest pleasure is getting it right for patients' he says.

Brian has become heavily involved in his professional body, particularly in education and the setting of standards. 'The same level of treatment and standardised level of work should be available to every patient, right across the UK'. And he's still cross that so few people know about this fascinating and rewarding career.

"I had no idea that there even was such a job as a cardiac physiologist"

Dr Brian Campbell
Southern Health and Social Care Trust



Lucy Handscomb

Hearing Therapy

Lucy Handscomb is a hearing therapist working at St Mary's Hospital in London. She does not diagnose hearing problems or cure them. She helps people cope with them.

Lucy knew nothing about hearing therapy until she happened to read about it while she was at University taking a languages degree. She knew only that she wanted to work with people and do something interesting. Hearing therapy ticked both boxes.

Loss of hearing causes profound change to someone's life, even if they can have some hearing restored with a hearing aid. Coming to terms with these changes, such as not being able to have a natural conversation with a group of friends, can be very difficult. Other conditions such as tinnitus (a constant ringing or buzzing noise in the ears or head) cannot be cured and people have no choice but to live with it. Hearing therapists show them how to do this successfully and in doing so, make an enormous difference to their lives.

'I help them to adjust over a series of up to six one hour appointments and give them a better understanding of their problem. For instance, tinnitus can become more intrusive if people are stressed so I teach them relaxation techniques. I show people with hearing difficulty how they can change their situation by using good communication tactics and assertiveness skills, which is important if you constantly need to ask people to repeat what they said. I provide counselling which can also involve other family members and I also show people how to use devices like sound generators for tinnitus and assistive living devices like loop systems, for hearing in public places'.

Lucy is also involved in teaching and in research and since she became a hearing therapist has gained an MSc in Rehabilitative Audiology as well as an applied psychology qualification. For her, science has come later in her career. 'It's a very people focused career and when you see a patient's confidence increasing, it's very rewarding'.

“When you see a patient's confidence increasing, it's very rewarding”

Lucy Handscomb
Imperial College Healthcare NHS Trust



Becky Clarkson

Urology and Urological Measurement

From astrophysics to medical physics is a big step but it is one which early career scientist and dance fanatic Becky Clarkson has not regretted.

She might have started by imaging the galaxy but somehow, no matter which aspect of physics she studied, Becky always seemed to gravitate to medical applications. 'The fact that I could apply my knowledge in a healthcare environment appealed to me and I really liked doing things with patients'. She joined the Institute of Physics and Engineering in Medicine training scheme which involves rotation between three attachments each representing one of 15 different aspects of medical physics. It was while she was involved in the physiological measurement element that she was offered a PhD working in urology. 'It sounded interesting, so I said yes'.

She is currently undertaking development work on new aspects of a patentable device which measures bladder pressures non-invasively. Many older men develop urinary problems because of an enlarged prostate gland. Weak slow flows cause frustration, not to mention frequent trips to the bathroom. These difficulties with bladder emptying may also result in urinary infections. Some men will benefit from surgery but for others, surgery will do little. One of the key deciding factors is their bladder pressure. The normal way to measure it is with a cystometrogram (CMG) which involves catheterisation of the bladder. It's not a whole lot of fun for men which is why a non-invasive method is so important.

A technique which provides 'snapshots' of bladder pressure non-invasively is available commercially but Becky's new device provides a continuous bladder pressure measurement which is important for more accurate diagnosis. Becky spends time 'playing in the sink', working on the bladder models used to test the device and on data analysis. A very important part of her work is communication, both with patients and with her peers at meetings and conferences. 'Although the majority of my work takes place in front of a computer, I have close links with the patients I am aiming to help and that's a great feeling'.

“Although the majority of my work takes place in front of a computer, I have close links with the patients I am aiming to help and that's a great feeling”

Becky Clarkson
Newcastle upon Tyne Hospitals NHS Foundation Trust



“What I enjoy most is that it is such a team orientated job”

Stephen Robins
Royal Wolverhampton Hospitals NHS Trust

Stephen Robins Clinical Perfusion

Clinical perfusionists make today’s heart surgery possible. Their job is little known but quite extraordinary. They are members of the open heart surgery team and they use complex machinery to temporarily bypass the heart and lungs, circulating and oxygenating a patient’s blood for them, outside their body.

The work of perfusionists enables cardiac surgeons to work on the heart and ensures that even though the heart is temporarily not beating, the rest of the body continues to function normally. This is important to the patient but also the surgeon because it gives them more time in which to undertake surgery, without harm to the patient. About 90% of clinical perfusionists, like Stephen Robins, work in cardiac surgery but others are involved in specialist intensive care units supporting adults and children with damaged lungs. Their machinery takes over the patient’s lung function until they have recovered. This technique, called ECMO (ExtraCorporeal Membrane Oxygenation) is very specialised treatment used only for small numbers of the most severely ill, including recently for example patients with H1N1 pandemic flu. Perfusionists are also involved in heart failure support and assist devices as well as artificial heart implantation. In some cases, particularly those involving children, perfusionists cool patients in order to gain enough time for heart surgeons to undertake lengthy, highly complex procedures. ‘We make a surgeon’s job easier to do’.

Stephen started his career in the NHS as an operating theatre technician but wanted to be involved in more hands on clinical science, returning to education in order to gain the qualifications he needed to become a clinical perfusionist. ‘What I enjoy most is that it is such a team orientated job and carries a unique level of autonomy and responsibility.’ Clinical perfusionists literally have people’s lives in their hands during surgery. ‘No-one really understands what we do for those few hours during surgery but when you explain, people are amazed by the responsibility we have’.

Stephen spends half his time in operating theatres, putting in an 8am to 8pm day but the other half in management. He has been involved in setting up two new cardiac units, in Brighton and in Wolverhampton where he is now based. He also does a great deal of work with his professional body on a national level.

“What I love about my job is the diverse range of responsibilities and the ability to make things happen”

Professor David Harper CBE
Department of Health

Professor David Harper CBE Director-General, Health Improvement and Protection and Chief Scientist

David Harper has had an exceptional career in science, and has been involved in some of the most exciting scientific developments of recent years.

He can remember exactly when science became an abiding passion ‘It was when as a child family friends gave me a chemistry set. I couldn’t wait to use it’. Sciences at school were followed by a degree in microbiology from Dundee and a doctorate from Birmingham University which was home to the British School of Malting and Brewing. It was about microbial contamination in beer dispensing systems. It required him to take a great many samples from public houses in the area, not all of which were strictly scientific. ‘And yes, my friends were green with envy’.

He then went to work in the Metropolitan Police Forensic Science Laboratory. He was the only microbiologist amongst a multi-disciplinary team. His work was the stuff of CSI: Crime Scene Investigation, investigating for example, post-mortem alcohol levels and being involved in the early days of DNA profiling. ‘It was hugely exciting’. After 8 years, he joined the Department of Health, working in the microbiology pathology services area and in biotechnology, then an emerging field of enormous implication both scientifically and on a wider societal level. It was another fascinating job. It found him acting alongside a colleague from the Health and Safety Executive as the secretariat for the Scientific Advisory Committee on Dangerous Pathogens. ‘Within a month I was in Brussels involved in negotiations which provided the basis for the current regulatory framework’.

By 1996, David had become Chief Scientist of the Department. This important post means being head of profession for its scientists, a job that involves professional leadership as well as pastoral support. Today David is a Director General and leads a Directorate of six broad divisions within the Department of Health including health protection and emergency preparedness. For the last few years, he has been intimately involved in planning for a flu pandemic and in the response to H1N1, which thankfully was not as severe as had been feared. ‘What I love about my job is the diverse range of responsibilities and the ability to make things happen. It’s very busy but very exciting and I get to cover all the areas which I feel passionate about.’ His friends are still green with envy.





“Finding solutions to problems is what keeps me ticking and makes life interesting”

Professor Alan Murray
Newcastle upon Tyne Hospitals NHS Foundation Trust

Professor Alan Murray
Exceptional Scientist

Alan Murray excels at problem solving, the trickier the better. And his ability to find solutions has made major contributions to both heart medicine and patient safety, not just in Britain but worldwide.

Alan is Professor of Cardiovascular Physics and Head of the Freeman Hospital Medical Physics Unit in Newcastle. He started life as an engineer but became increasingly involved in medical engineering particularly in relation to the heart and cardiovascular system. And when a colleague became Professor of Cardiology in Newcastle and invited him to join him there, his career was set. He hasn't looked back since. He was in Newcastle as the Freeman was conceived and built, helping develop it as the major specialist heart hospital of the North East, with an international reputation for heart medicine.

Over a long career, Alan Murray has made many significant contributions to healthcare science. For instance, he not only set up an ECG Holter service – that's 24 hour cardiac monitoring as a patient is moving about – but then also developed techniques for editing the vast amount of data that was generated. These techniques were adopted internationally and are still used today. He has provided elegant solutions to problems in cardiac electrophysiology, the evaluation of abnormal heart rhythms, the assessment of angioplasty and stenting procedures and in remote patient monitoring, publishing extensively.

He provides expert advice to the Department of Health on electromedical devices and chairs the British Standard Institute's group on blood pressure measurement. Blood pressure is actually measured in millimetres of mercury with the familiar cuff of a sphygmomanometer being attached to a mercury containing device but a decade or so ago, Alan realised that a ban on of the use of mercury, long recognised as highly toxic, was inevitable and that this would present a major problem. Although electronic versions have long been available, they are normally less accurate because they are much more difficult to calibrate accurately. It's the main reason why the mercury version has persisted so long. So Alan developed an accurate self-calibrating mercury free electronic device called the Green Light 300 which is now manufactured and sold all over the world. 'It's the thing that I'm most proud of and it gave me a big feeling of reward to get it off the ground'.

Alan Murray has never lost his ability to put himself in other peoples' shoes. He has always understood that although engineers and technicians understand how medical devices work, they are not in general the people who end up actually using them. Fatal accidents occur with medical devices every year and he long wanted to find a way of showing how things go wrong, simply and without preaching, for people who did not have technical skills. He discovered that a Swedish medical engineer had produced a book of case studies of real life accidents and thought that they might be adapted for a British audience. Together they collaborated to write 'Medical Devices: their Use and Safety', which manages to effortlessly convey safety information through example. It was a first in patient safety and has sold thousands of copies.

There are many strands to his life as a healthcare scientist but he is clear what gives him greatest pleasure. 'Finding solutions to problems is what keeps me ticking and makes life interesting'.

Dr Gail ter Haar
Team Leader, Reader in Therapeutic Ultrasound

Gail Ter Haar wasn't sure whether to study science or languages as she loved both at school but she was lucky enough to meet Nobel prize winner Sir Hans Krebs who told her to 'study the science and use the languages'. And that's exactly what she's done. Gail studied physics but has used her love of languages to develop collaborations with research teams all over the world.

Gail's PhD research concentrated on the biological effects of ultrasound, then best known as an imaging technique in pregnancy. When she went to work in a world famous cancer hospital, the Royal Marsden, she found herself surrounded by cancer doctors, frustrated by their lack of ability to treat patients as quickly and safely as they wanted, with the minimum of side effects. She began to develop an experimental technique, first used in research in the 1940s, called high intensity focused ultrasound (HIFU) to see whether it could selectively destroy cancer cells non invasively. 'We work on all aspects of HIFU from basic lab studies, pre-clinical testing and trial testing. No two days are the same. Most of my team are young and it's wonderful to work with such talented people'.

'You test in various lab situations but then you get to try it in patients and seeing the first patient response is wonderful. We treated a man with a kidney tumour using ultrasound – no operation, no X rays – and his cancer has still not returned. Even if he were the only patient we were able to help it is a huge privilege'. Today Gail has an international reputation and HIFU is in clinical use as a cancer therapy, helping people all over the world.

“We treated a man with a kidney tumour using ultrasound. No surgery, no chemotherapy and his cancer has still not returned. Even if this were the only patient we were able to help it is a huge privilege”

Dr Gail ter Haar
Institute of Cancer Research



Professor Stephen Smye

Exceptional Scientist

Professor Stephen Smye is one of the people in charge of the future in the NHS. Holding a budget of £220 million, he leads a network of research centres involved in clinical trials to inform future care in all areas of disease and need within the health service.

Stephen Smye began his career in physics which he loved for its elegance and big ideas. But he soon realised that there were probably only 100 people in the whole world making any money from big ideas in physics. 'And I wasn't one of them' he says ruefully. He got a post in a medical physics department in Cambridge and later in Barnsley, ending up in Leeds where he became head of medical physics and engineering at the Leeds Teaching Hospitals. The department is very large with over 200 staff, providing a wide range of scientific, clinical and technical services.

During this time he had acquired an additional two degrees to add to his original one, including a PhD in applied maths. Although physics and maths were his disciplines, he was interested in their application to medicine and biology. His own research encompassed work on mathematical modelling of the properties of the membranes that surround cells to better understand how kidney dialysis could be improved or how cancer drugs penetrate tumours and what might be done to increase their penetration.

In 2008, his own hands on research took a back a seat when he took on two jobs. The first was Director of Research and Development at the Leeds Teaching Hospitals NHS Trust which is closely linked with Leeds University. His role encompasses leadership, management and developing strategy and funding streams for research. There is also an element of scientific marriage broking; setting up and cheering on relationships between medical staff and University scientists from a huge range of disciplines to encourage research collaborations and midwifery and delivering the resulting research and innovation from those relationships. A particular passion is what's called translational research – the sort of work that turns a piece of basic science discovery into practical, effective benefits for patients. A major achievement for Professor Smye was the award of a £5 million grant to set up an integrated knowledge centre in Leeds, involving scientists from many disciplines, with a focus on tissue engineering and regenerative medicine, which is perhaps the most exciting and fast moving area in medicine at the moment.

His second job also focuses on research. The National Institute for Health Research (NIHR) provides the framework for world class research within the NHS. Professor Smye is director of the NIHR's comprehensive clinical research network and responsible for 25 local research networks. He has a budget of £220 million and this is used to ensure that patient and healthcare professionals of every type and from all over the country can take part in, and benefit from research. It means ensuring that there is a good research infrastructure and making sure that patients are able to take part in trials of new medicines and treatments if they want. Some 300,000 patients have already done so.

'The NHS provides a terrific environment in which to flourish and if you are open to new opportunities, it's an incredibly rewarding career. If I had my time again, I'd do it all over again'.

"If you're open to new opportunities, it's an incredibly rewarding career. I'd do it all over again"

Professor Stephen Smye
Leeds Teaching Hospitals NHS Trust





“I discovered that management can be as intellectually rigorous and challenging as research”

Dr Russell Hamilton
Department of Health

Dr Russell Hamilton

Director of Research and Development

Researcher, practising healthcare scientist, manager. Unusually, Russell Hamilton has been all these things in his career. But it has been this diverse experience that has equipped him to do his current extraordinary job - Director of Research and Development for the Department of Health. With Dame Sally Davies, Russell has been responsible for creating a system within the NHS, the National Institute for Health Research (NIHR) which supports world class research, focused on the needs of patients and the public. With an annual budget of £1 billion, its continuing work is an awesome task. Yet, says Russell ‘My job is perfect. It was made for me’.

Russell is Australian by birth and with a passion for language, could have been a writer but science and the passion to improve peoples’ health won out. By the age of 19 he had published his first research paper which was about the possums who lived on Magnetic Island off Queensland. He took a degree in biochemistry and then worked in an academic health centre in Adelaide before coming, like so many Australians, ‘to have a look’ at the UK. He has been here ever since. He got a job as a clinical scientist in Charing Cross Hospital in London where he specialised in respiratory physiology. It was an academic department and it was expected that he would both look after patients and undertake research. He was soon doing a PhD. Later the hospital sent him off to do an MBA. It proved a transformative experience. ‘I discovered that management can be as intellectually rigorous and challenging as research’.

‘I also realised that I could make a greater difference to people if I made the change from doing research at a local level to managing research on a larger scale’. At first, this was at a regional level (the South West) and then national. He played a central role in developing and writing the 2006 strategy ‘Best research for best health’, the blueprint that transformed health research in the NHS and social care through the creation of NIHR’. He has indeed made a difference but to thousands if not millions of people.

Amanda Scappaticci

Critical Care Science

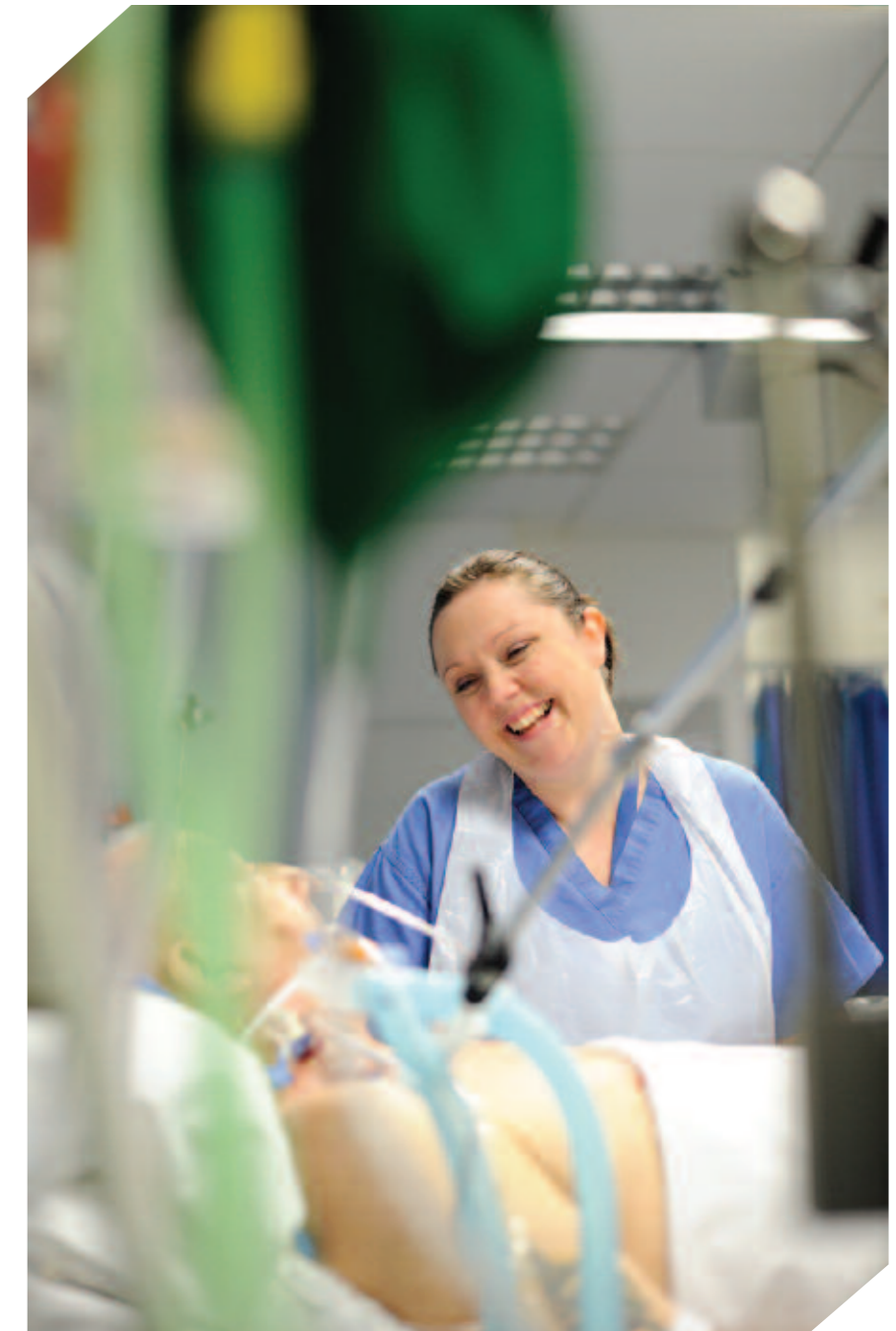
At first Amanda Scappaticci didn’t really know what she wanted to do. She started a degree in Chemical Engineering but decided it wasn’t for her. She worked in manufacturing and even as a school science technician before deciding to return to degree studies. She then spotted an advert for a job as a scientist working in critical care but thought it wouldn’t be for her because she didn’t want to ‘work somewhere so miserable’. But she went along for an interview and found critical care ‘light and bright and full of smiling people’. It is very serious but it’s not what you think’. Six years on, she wouldn’t be anywhere else.

She works in the regional intensive care unit at the Royal Victoria Hospital in Belfast. This unit receives trauma victims from all over Northern Ireland including road traffic accidents, fires and civil disturbance. One aspect of her job involves taking critically ill patients to theatre or for imaging. It’s a major exercise and means taking the patient off bedside life support, removing chest drains and pumps and moving the patient safely using portable equipment. Her role also involves a great deal of complex monitoring of heart function and also intra-cranial pressures for patients with head injuries, together with checking that equipment is functioning properly. Without critical care scientists, intensive care units couldn’t function and it annoys Amanda that TV viewers never see people like her in depictions of ICU on Casualty or Holby City. ‘When I watch I usually see that the ventilator is in standby mode so I sit there yelling at the screen saying ‘no wonder he’s dying, switch that ventilator on’.

‘Leaving work at work is difficult to master especially if you genuinely care about the work you do and the people you meet. And it makes you count your blessings. Most patients just went out to work one day as normal but ended up here but I love my job – coming here is the best thing I ever did’.

“I love my job. Coming here is the best thing I ever did”

Amanda Scappaticci
Royal Victoria Hospital Belfast Trust



Dr Rebecca Cardigan

NHS Blood & Transplant

When Rebecca Cardigan saw a job advertised by NHS Blood & Transplant for a research scientist she thought it was her perfect job. It was interesting, worthwhile and what's more, she was qualified to do it. She got the job and is now the proverbial round peg in a round hole with the additional satisfaction of knowing her research has a real impact on patients.

Rebecca was always interested in understanding how the body works and what goes wrong in disease and opted for a degree in this area. When she left University she wrote to every pathology director she could, looking for a pathology laboratory in which she could undertake her PhD. It was chance however that took her to haematology, the study of blood. She found it fascinating.

Her perfect job was in fact working in the blood components laboratory at NHS Blood & Transplant in Brentwood, and she is now their National Head of Components Development, with a research team of 13 people, a very senior position for someone of her age. One of her jobs is devising and implementing research to ensure that any new procedures for donated blood, such as the recent decision to filter blood to remove white blood cells, do not adversely affect its quality. Another is to assess new techniques such as means to remove prions from donated blood. These are the agents that might potentially cause vCJD if they came from someone who unknowingly had the disease in its early stages. She gained particular satisfaction from developing a new blood product, enriched with infection fighting white blood cells, in response to requests from doctors caring for very sick patients with infections. This product is now in clinical trials. 'It's very rewarding to think that you've done something which is going to directly help those who are seriously ill'.

Rebecca has a young family and finds that the NHS is a very good employer in terms of work life balance. Doing what she loves and having time for those she loves makes for a very satisfying job.

"It's very rewarding to think that you've done something which is going to directly help those who are seriously ill"

Dr Rebecca Cardigan
NHS Blood & Transplant



"I owe my job to 'the weakest link'"

Hannah Marsden
Liverpool Women's Hospital NHS Trust

Hannah Marsden

Clinical Embryology

Some people think of science as technical, dry as dust even. Hannah Marsden's science takes her for a ride on a wild emotional rollercoaster. There are tears of joy but also of despair, times of hope but also of sorrow - and all this in a single day, perhaps even in a single hour.

Hannah is a clinical embryologist at the Liverpool Women's Hospital. What she does is an essential part of providing assisted conception to infertile couples. As part of a multi-disciplinary team, she is involved in collection of eggs, preparing sperm, checks on fertilisation as well as embryo culture, freezing and transfers. The services she provides are directly linked to the success of IVF procedures.

Embryologists have direct contact with couples throughout their treatments. Sometimes it falls to embryologists to break bad news.

'This can be very difficult because you are dealing with a very vulnerable group of people' says Hannah. She has had training to do this but confesses that she like other embryologists will sometimes burst into tears once the couple have left the room, or she has put down the phone after giving out results, such is their involvement in the couple's hopes. Embryology is demanding both scientifically since it is a very fast moving, technologically challenging field, as well as emotionally but Hannah is not daunted. 'My job never feels like a chore, every day is different'. During her training she was able to contribute to research, presenting work on critical temperature fluctuations that occur, despite constant monitor readings of embryo culture fluids. This work is already in practical application.

She owes her job, of all things, to 'The Weakest Link'. She never knew that there was such a thing as a clinical embryologist until someone appearing on the show said that this was her job. Hannah was in the middle of a science degree at the time and decided that was what she wanted to do, rigorously researching the requirements for the job and adding to her CV before making a job application. 'I so totally love it. It's perfect'.

Professor Graham Holder

Exceptional Scientist

Graham Holder is a healthcare scientist with an international reputation in his chosen discipline – the electrophysiology of vision.

He runs the clinical electrophysiology service at Moorfields in London, Britain's best known specialist eye hospital which sees an exceptional range of patients, some with very rare eye disease. He is also involved in the very successful ongoing gene therapy trial at Moorfields for the childhood blinding disorder, Leber Congenital Amaurosis, a trial which could transform the lives of many others with blinding conditions in the future.

The retina is a large sheet of nerve tissue that covers the back of the inside of the eye. The innermost layer contains photoreceptors – the familiar rods and cones – which turn light stimuli into electrical signals. Cells in other layers of the retina then transform these signals into a digital form which is transmitted to the brain via the optic nerve, miraculously turning light into sight.

Electroretinograms (ERGs) are a means of recording signals produced by the retina in response to a set stimulus. The signals vary in size and shape depending on the condition affecting the eye. Professor Holder's department routinely performs over 1,500 ERGs a year. The resulting electrophysiological data is used to diagnose and assess the severity of inherited retinal conditions. In patients who have inflammatory conditions it also gives information about when to treat patients and whether the treatment is working. One group of patients for instance appear to have mild inflammation yet their ERGs tell a different story. In these cases aggressive early treatment can prevent them from developing a chronic condition.

By adding 'bells and whistles' to the range of stimuli used in ERGs, Professor Holder has been able to group people with inherited eye disease according to similarities in the characteristics of their electroretinograms. This has given invaluable clues about the malfunctioning genes which are common to a range of apparently quite different inherited conditions.

The gene therapy trial started at Moorfields in 2007 with three patients effectively blind from birth because of a genetic condition called Leber Congenital Amaurosis. 'Our role is to confirm the initial diagnosis and then to monitor for efficacy and safety. It is fascinating to be involved in this groundbreaking work and very exciting'.

How did Professor Holder get into this field? 'Science was the only thing I was good at when I was at school'. He did a degree in biochemistry and then got into brain research where his interests were in vision. 'I found myself gradually progressing up the optic nerve and when I got to the retina, I stopped and that's where I've been ever since. It's so interesting.'

Like many exceptional healthcare scientists, he regards himself as privileged. He travels and lectures across the globe and the interactions that he has with clinicians and scientists from all nations give him a great deal of pleasure. He also enjoys teaching. He gets a great sense of satisfaction from being able to provide an expert quality diagnostic service to patients. But perhaps above all is the excitement of working at the cutting edge and the feel of being able to contribute something useful to the world.

"I found myself gradually progressing up the optic nerve and when I got to the retina, I stopped and that's where I've been ever since. It's so interesting"

Professor Graham Holder
Moorfields Eye Hospital NHS Foundation Trust



Professor Malcolm Richardson

Mycology

There are only half a dozen people like Malcolm Richardson in the UK although many more are needed. He is a clinical mycologist – someone who specialises in diseases caused by fungi. This is not as some might think, poisoning caused by eating toadstools. Medical mycology is actually concerned with infection caused by microscopic fungi, principally moulds and yeasts. Some of the illnesses caused are familiar: ringworm, thrush and athlete’s foot. What is less well known is that these sort of fungi are responsible for a significant amount of allergy and can kill, particularly if people have other medical problems such as lung disease or are recovering from a bone marrow transplant.

Professor Richardson became intrigued by fungi during his undergraduate microbiology degree and has since become a world leader, taking jobs around the world but finally settling in Manchester where he is Director of the Regional Mycology Laboratory. He specialises in aspergillosis, a chronic lung disease caused by *Aspergillus* a very common mould to which we are all exposed, particularly in homes which are damp. Most people are not affected by it, but each year it kills many people with impaired immune systems and infects about 5% of those with asthma.

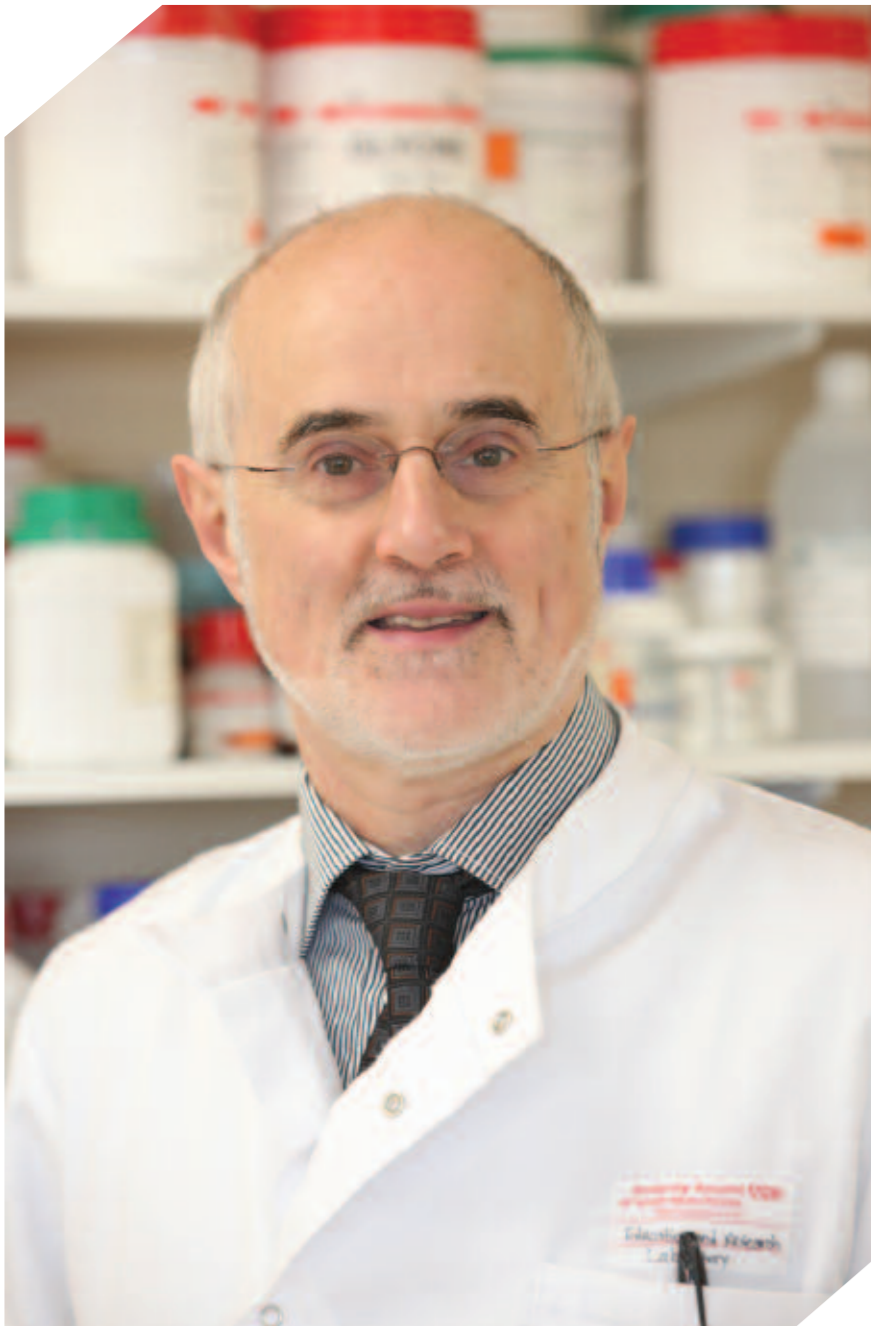
Professor Richardson’s expertise is widely sought. ‘One of the things I really enjoy is applying my diagnostic skills to very difficult cases of invasive fungal infection’. Early symptoms of fungal infection may be confused with those of bacterial infections and the right early treatment is critical. Malcolm Richardson has been responsible for introducing many new diagnostic methods, which have taken diagnosis beyond traditional microscopy and into molecular methods, including antigen detection systems.

His work has revealed that fungi are responsible for much more disease than previously thought. For instance, chronic rhino-sinusitis is a widespread problem. His work has shown the extent of involvement of common environmental moulds in its cause and maintenance. This opens new treatment options for patients.

One thing is certain. Malcolm Richardson will continue to be a mycological evangelist.

“One of the things I really enjoy is applying my diagnostic skills to very difficult cases of invasive fungal infection”

Professor Malcolm Richardson
University Hospital of South Manchester Foundation Trust



Dr Elizabeth Lindley

Renal Science

It was chance that led Lizzi Lindley into work with kidney patients but fascination and satisfaction that has kept her in this field.

Working in renal medicine was not part of her life plan. Being good at maths at school propelled her into a physics degree and then a PhD in metal alloys at Grenoble, which she admits she chose because it was handy for skiing. Flicking through job adverts on her return it was a choice of working for the gas board, or cancer research at the Christie Hospital in Manchester. She chose the Christie and became a medical physicist. Later, when a job came up in Sheffield that meant a cut in her journey time, she applied. It involved evaluating equipment for kidney dialysis. It changed her life as well as shortened her commute.

‘I was amazed that such basic technology could provide life support and that connecting people up to a machine three times a week could keep them alive. But I knew that although the dialysis did a good job, it could do a better one and I became very enthusiastic about that’. She has been hooked ever since. Part of the fascination was that the dialysis machine did the same thing for everyone yet each patient responded in a different way. For instance, patients tolerate different degrees of dehydration with dialysis. Lizzi measures their fluid status using a technique better known for detecting body fat content. In doing this, she develops a rapport with patients whom she sees on a regular basis, often for years.

She now works in Leeds. She also helps train renal technologists and nurses in use of the complex equipment on dialysis units and advises junior doctors about data and analysis. A great deal of her work is about problem solving – for instance, predicting the medication requirements of patients with anaemia due to kidney failure. She’s supported in this by the UK and Europe wide networks of experts in which she is involved, and finds that a problem shared is often a problem solved – or at least one seen from a different perspective. ‘What gives me most pleasure is doing something to help improve the care of an individual patient or a service provided by the unit’.

“What gives me most pleasure is doing something to help improve the care of an individual patient”

Dr Elizabeth Lindley
Leeds Teaching Hospitals NHS Trust

“I still get a kick out of doing what I do”

Professor Kevin Spencer
Barking, Havering & Redbridge University Hospitals NHS Trust

Professor Kevin Spencer

Exceptional Scientist

As a consultant biochemist, Kevin Spencer oversees the 7 million test results that leave his department each year but he also has another life; as a scientist with an international reputation for his pioneering work in antenatal diagnosis.

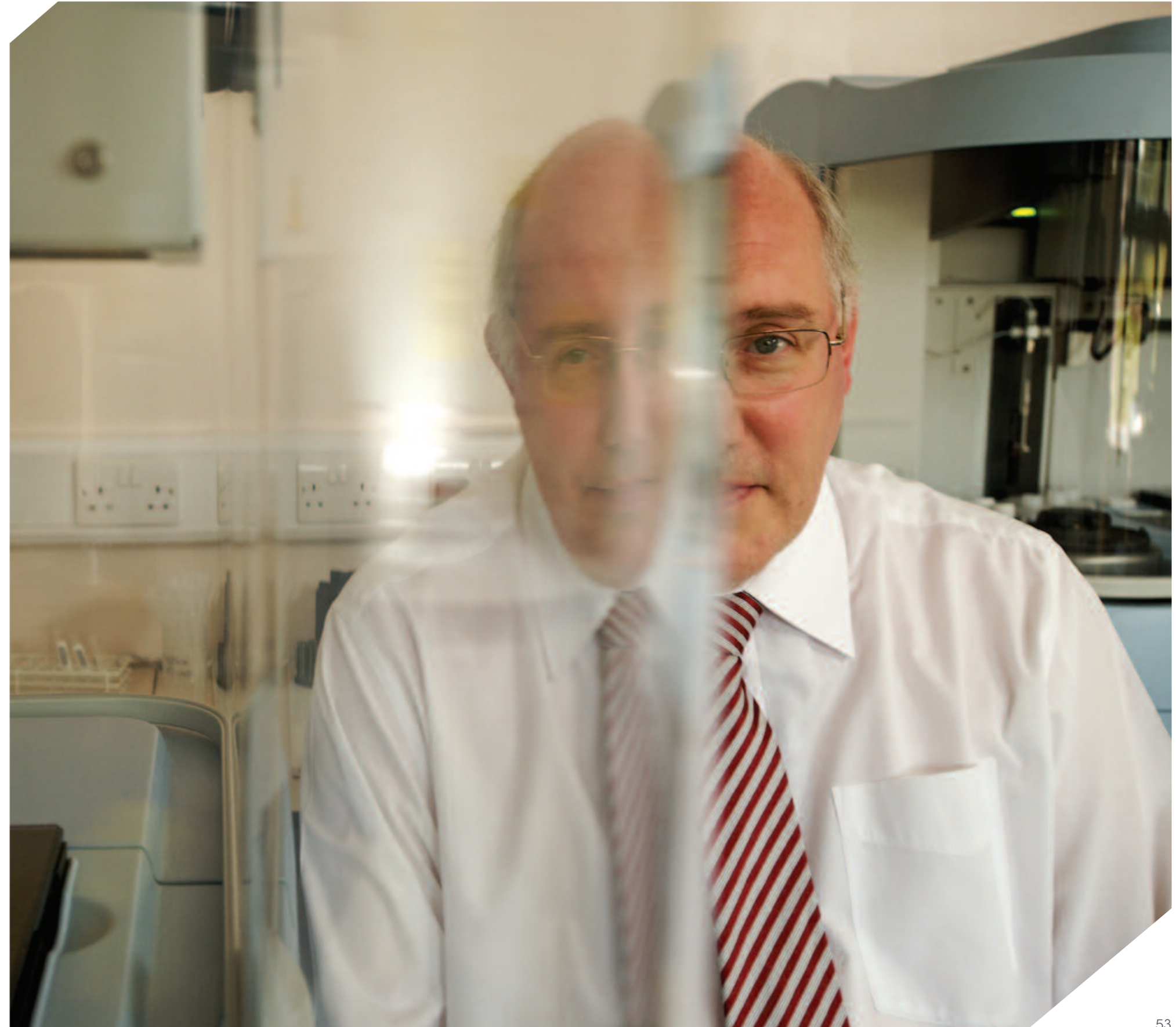
In 1981 he took a biochemist's job at the Oldchurch Hospital in Romford, Essex. 'They wanted someone to set up regional screening for neural tube defects'. At the time, there was no national screening programme for antenatal diagnosis of spina bifida and anencephaly. These conditions (collectively called NTDs) are caused by abnormal development of the neural tube. It means the brain or spinal cord is exposed instead of being protected causing death or disability. These conditions can be detected by measuring levels of a chemical, alpha fetoprotein, in a sample of the pregnant woman's blood. For Kevin Spencer it marked the beginning of a lifelong passion for patient centred research in maternal and fetal health.

It wasn't a popular area for research but his interest, as is so often the case, was sparked by personal experience. The first baby of close friends had Down's Syndrome and it led him to look at, and then challenge, what was then said in the literature about screening and early detection for Down's Syndrome. Unlike NTDs, not just one but several markers need to be used. Which markers and in what combination was a subject of considerable disagreement but Kevin Spencer was determined to find the best and most accurate combination. So he collected together a huge database of population statistics – beginning with 12,000 women but eventually including over 35,000, in order to develop a robust method of risk prediction.

Professor Spencer included variables that no one else had previously considered such as weight, ethnicity and smoking. He collaborated closely with obstetricians when a method for screening for Down's with ultrasound called nuchal translucency assessment was introduced in the mid 1990s. Using ultrasound and his particular version of biochemical screening, he demonstrated a detection rate of 90% with a 1 in 20 chance of a false positive diagnosis, considerably better than most areas of the country.

But Kevin Spencer is clear that the focus of his research should be on patient benefit. He spends many hours listening: with midwives, with women with normal pregnancies and with those whose needs are complex. Knowing that many pregnant women find antenatal testing extremely stressful, even if no problems are found, he developed the OSCAR clinic concept. This is a one stop clinic for the assessment of risk for fetal anomalies. Women have blood tests and ultrasound scans and are told the results, in person, on the same day, so lessening the trauma of testing. This service is enormously appreciated by patients and Professor Spencer's research has been very influential in shaping screening policies both nationally and internationally.

He continues research to find biochemical markers for earlier identification of other major complications of pregnancy such as poor fetal growth and pre-eclampsia. 'I still get a kick out of doing what I do'.





Professor Heather Cubie

Exceptional Scientist

When Heather Cubie began researching a seemingly obscure virus and got nothing but negative results, many would have counselled her to switch research fields. But she stuck to it and now that obscure virus – human papilloma virus (HPV) – occupies global centre stage, having been shown to be the cause of cervical cancer. Better than that, there is an excellent cervical screening service, specialist HPV testing and now an HPV vaccine to help prevent this cancer which kills hundreds of thousands of women a year across the globe.

Heather went into microbiology partly because she was enthused by stories of Pasteur but also because her brother had leukaemia while she was a student and she wanted to find out if human leukaemias were associated with viruses just as some animal leukaemias are. Initially Heather worked in paediatric pathology but as she says ‘virology was calling’. Warts and verrucas are tumours, albeit benign ones, and Heather became intrigued by them and by the virus that caused them – HPV. But at the time only dermatologists showed any interest in her work because there was then no known association with cervical disease.

Heather’s HPV research began with PE students with veruccas on their feet. They weren’t allowed to swim and it restricted their training. She investigated the link between the development of antibodies in their blood and HPV. Although she developed serological assays, for the life of her, she could not develop an HPV model to study the disease. Strings of negative results meant that this painstaking work could not count towards her PhD. In fact, her negative findings did prove to be useful and ironically were later often cited by other scientists.

“I’ve waited my whole career for effective interventions and now we have them”

Professor Heather Cubie
NHS Lothian

During the 1970s and 1980s, Heather’s principal work was in a diagnostic virology lab in Edinburgh, where she helped develop and introduce new molecular techniques to diagnose and track viral infection. But she still kept up with HPV. Whispers of its involvement in cervical cancer began to appear but doctors flatly refused to believe it. Heather returned to HPV research with female kidney patients as it had been noticed that those taking immunosuppressive drugs had more warts and had more cervical disease than healthy women. It’s now known that the immune system is one of the key elements of how cervical cancer develops. Heather finally got her PhD, late in her career at a time when she had to combine her research with looking after three small children.

The 1990s and early 2000s, when HPV’s role in cervical cancer was widely acknowledged, have been an exhilarating time for those like Heather who had been involved from the start. As Director of R&D in NHS Lothian she could see the need and facilitated the transition from research to service changes in many areas of clinical medicine. Heather was responsible for HPV work needed to complement the introduction of the new HPV vaccine and is a member of the HPV National Steering Group. She couldn’t be more thrilled – she says she glows with pride – that Scotland has achieved over 90% uptake of the vaccine in schoolgirls. She anticipates a reduction in early stage disease quite quickly.

Heather has taken up a new position as Director of the new Scottish HPV Reference Laboratory delivering HPV surveillance, clinical testing, quality assurance, research and training. She still gets a thrill from what she does which has been instrumental in saving the lives of many women.

“I’m really glad I chose MRI”

Christie McComb
NHS Greater Glasgow & Clyde

Christie McComb

Magnetic Resonance Imaging

Christie McComb works at the Royal Hospital for Sick Children in Glasgow. Her job involves both research and providing clinical support and advice when children are having scans.

Magnetic resonance imaging – better known simply as MRI – is a way of seeing inside the body and uses magnetic and radio waves rather than exposing the patient to radiation like X ray or CT scans. MRI is used particularly to see inside areas surrounded by bone, like the brain or spinal cord. To get a good image, people need to lie still whilst MRI scans are being done, so small children need an anaesthetic, and Christie provides safety training and advice for the anaesthetists and nursing staff working with kids. She also analyses the data from certain types of scan and writes a report to assist radiologists with their diagnosis.

Christie is involved in research. Sometimes patients are given a special dye prior to scanning which makes areas of interest show up better but it isn’t suitable for those with kidney problems. Some studies indicate that breathing pure oxygen might help do the same job as the dye and as part of her PhD studies, Christie is trying to find out whether this technique might work when scanning the heart too.

Christie spent five years as a system engineer in the defence industry following her graduation with a physics degree but the idea of medical physics was always in the back of her mind. She got a place on the Scottish Medical Physics Training Scheme which exposed her to many different areas of medical physics but it was MRI that she found most interesting.

‘The thing I most enjoy about my job is the variety, especially in the research and I enjoy being able to contribute to patient diagnosis. I’m really glad I chose it. The technology is still advancing very quickly and there are so many opportunities for the future’.



Jacqui Doran
Cytopathology

Jacqui Doran's lab based job in the NHS has encouraged her to travel to Guyana and given her a passionate interest in womens' health.

She started her career as a part time auxiliary nurse but spotted an advert for a full time job in cervical cytology. This service checks the cervical smears taken from women through the national cervical screening programme. Having always enjoyed science at school, she applied and has since become totally hooked.

The laboratory in Edinburgh where she first worked processes 70,000 cervical smears a year taken from women in Edinburgh and the Lothian's area. Around one in ten of these will have an abnormality. Jacqui knew that if the most severe grade of abnormality was missed, it could inevitably progress to cervical cancer without treatment. All work is double-checked and misses are rare but it was still a huge responsibility. 'I sometimes woke up in the night thinking, 'Did I miss something'.'

She did an Honours degree funded by the NHS and during her last year began to look at the global impact of cervical cancer. She became a volunteer for Remote Area Medical, a charity offering free healthcare to those needing it. She is the surgical team leader for RAM's womens' health team and travels to Guyana in South America twice a year. RAM travel into the mountain, savannah and jungle villages to identify women at risk of developing cervical cancer and carry out lifesaving hysterectomies on women with disease. 'The typical women we see are in their thirties with five or six children. The women do everything, farm, cook, look after the children and if they are taken away by cancer, the whole family collapses'. Jacqui has developed a passionate interest in global womens' health and inequalities and this work has given her 'the big picture' as far as cervical cancer is concerned. She has now left screening to work in the HPV reference laboratory in Edinburgh. HPV is the virus that causes cervical cancer and several different types infect the cervix. Future healthcare will increasingly involve the detection and typing of HPV. A career in research now beckons for Jacqui.

"The women do everything, farm, cook, look after the children and if they are taken away by cancer, the whole family collapses"

Jacqui Doran
Royal Infirmary of Edinburgh NHS Lothian



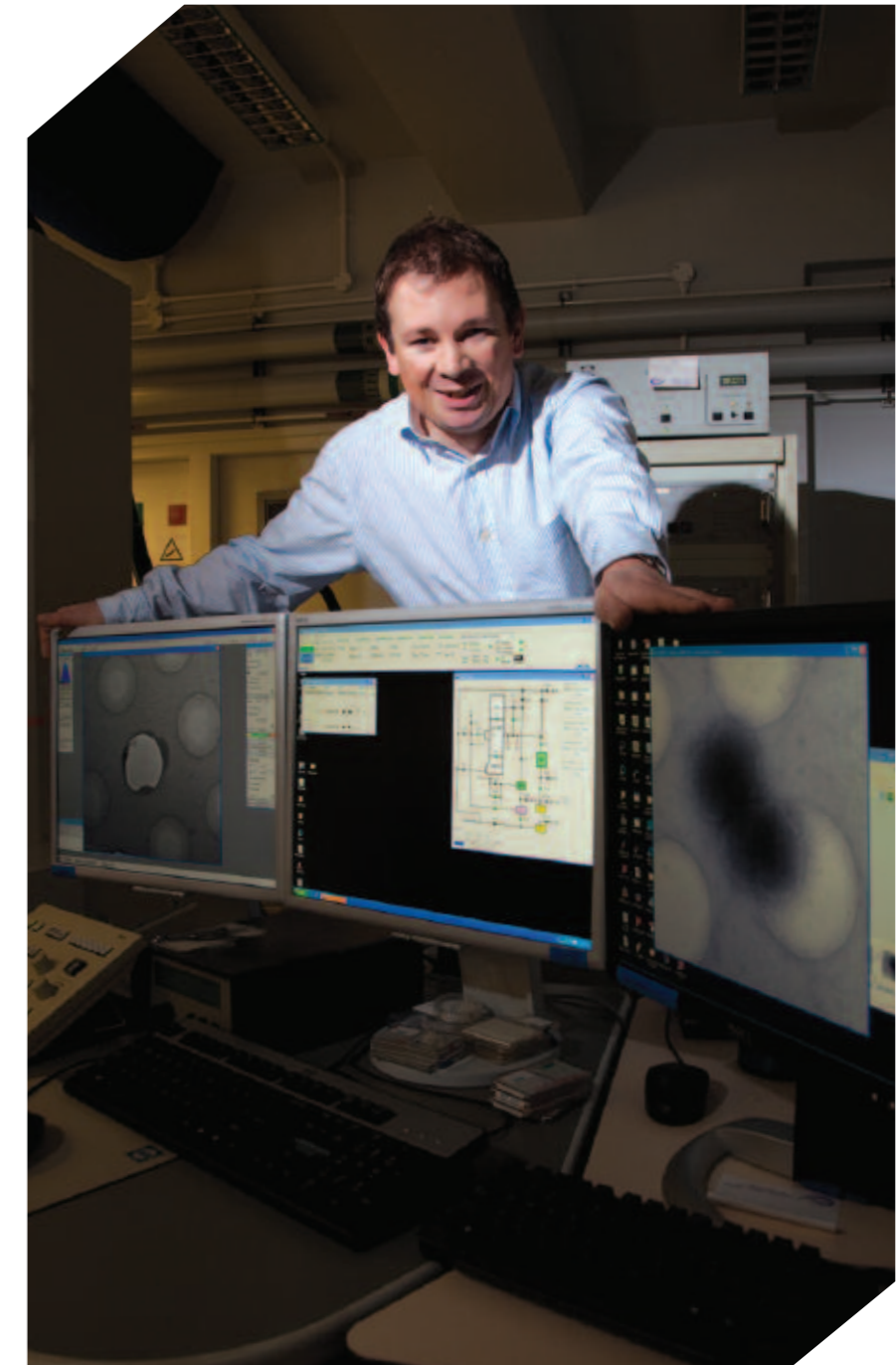
Dr Roland Fleck
Electron Microscopy

Roland Fleck's work helps the NHS ensure that today's medicines are safe and that tomorrow's medicines can be properly tested.

Roland leads the imaging unit at the National Institute of Biological Standards and Control (NIBSC), a unique British institution located in South Mimms which is part of the Health Protection Agency. NIBSC is both guardian and creator of 95% of the world's biological medicines and reference materials. They make the standards against which over 600 biological products are manufactured, including hormones, vitamins and vaccines. This ensures for example, that all insulin, wherever it is produced in the world, matches the strength and quality of the reference standard made and held by NIBSC.

Roland's specialism is electron microscopy, a means of magnification a thousand times more powerful than a conventional microscope which produces digital photographic images. There are only a handful of electron microscopes serving the NHS and Roland's are the only 'cryo-EMs'. They can image live microbes flash frozen in milliseconds, ensuring an exact 'as life' image in 2D or 3D. Some of the complex samples investigated recently by Roland and his team of four in this way, include current vaccines such as mumps, flu and human papilloma virus and the parasite that causes malaria. 'Cryo-electron microscopy studies are technically demanding and very satisfying when the first image is produced. They are beautiful too.' His team also uses a range of other types of microscopy in the quality control of standards including one allowing 'real time' dynamic imaging of the freeze drying process. Knowing if damage occurs and at what temperature is critical for the long term storage of NIBSC's standards.

Much of Roland's time is spent on research. For instance, NIBSC is the home of the UK stem cell bank and he is working on ways that stem cells might be used in medicine. 'I'm developing the groundwork for the bioassays of the future'. Another important aspect of his work is developing the skills and career potential of young researchers. 'Watching a PhD student develop into an expert in their field and develop their independence is very rewarding'.



"The images I produce are scientifically interesting but beautiful too"

Dr Roland Fleck
NIBSC, Health Protection Agency



“Knowing I am providing patient benefit is what keeps me going”

Professor Malcolm Sperrin
Royal Berkshire Hospital NHS Foundation Trust

Professor Malcolm Sperrin

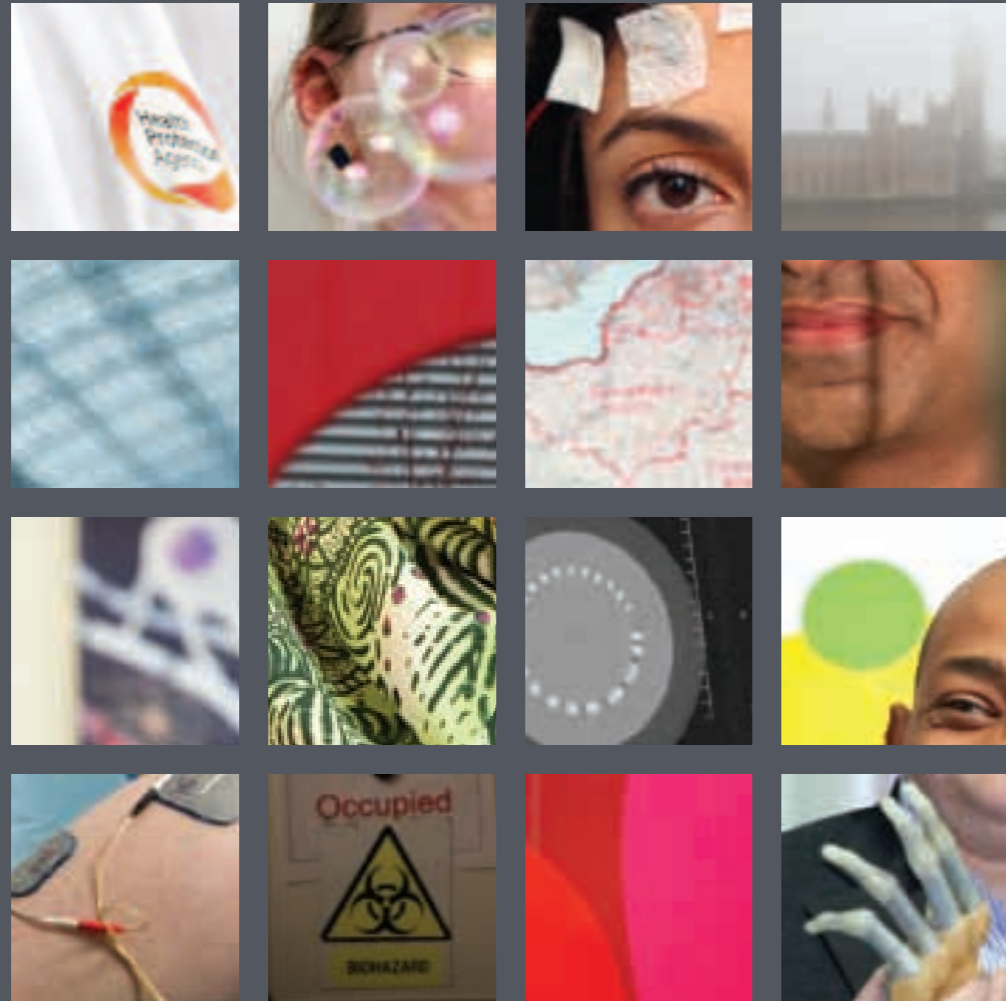
Exceptional Scientist

It would take a whole book to cover a week in Malcolm Sperrin's life. His career involves cutting edge science, the management of four medical physics departments, a medical role with the Territorial Army, not to mention a James Bond climbing, flying, mountaineering and canoeing alter ego.

As director of medical physics and clinical engineering at the Royal Berkshire Hospital, Reading, he has a team of 50 people including scientists, technicians and administrative staff and enjoys creating a framework within which individuals can blossom. Many scientists with such a demanding management role would have left hands on research behind them but research is Malcolm's passion, combining as it does practical benefit to patients with complex problem solving and he continues to find as much time as possible for it.

He is the author of many publications across a wide spectrum of medical physics including cutting edge papers on lithotripsy. Lithotripsy uses externally generated ultrasound waves to smash kidney stones, which are a cause of acute pain. It is extremely effective for smaller stones but surgery is still required for larger or more awkwardly shaped ones. Malcolm's work aims to better understand this remarkable process, using modelling techniques to show how stress builds in the stone following the ultrasound shock. His findings have already been used to fine tune lithotripsy, so extending its use to the larger stones. He discovered that urine surrounding the stone can be 'doped' to make treatment more effective and has developed the use of a device introduced into the body to deliver the shockwave nearer to the stone.

His role in the Territorial Army is two fold. On a medical level, he is responsible for radiation protection work in a range of army settings, from X ray equipment in field hospitals to assessing the radiation impact of compasses. But he has also qualified as a joint services instructor and trains service personnel in a wide variety of outdoor pursuits, most of which his patients would simply call 'hair raising'. But the thing that gives this daredevil most satisfaction of all is providing patient benefit.



Working in every part of the NHS.
Working with people.
Working with patients.

“I love liaising with people keeping them on a path to providing the best public health microbiology service we can”

Dr Tim Wreghitt OBE
Regional Microbiologist, East of England, Addenbrooke's Hospital NHS Trust

Dr Tim Wreghitt OBE

Exceptional Scientist

Feverish grannies, transplants, pigs. You might think there is no link but for microbiologist Dr Tim Wreghitt, there is – a single virus.

Although all microscopic disease causing organisms are on his watch, viruses, tiny, ever changing and sometimes lethal microbes, are his speciality. His interest stems partly from tragedy; his twin sister died at the age of 3 from the measles virus.

He owes a world first to grannies. One of his wife's older friends became ill and feverish. Tests revealed that she was infected with a virus called CMV (cytomegalovirus) but where had she got it from? On a hunch, Tim also tested her newborn grandson and discovered he was CMV positive too. Suspecting that this virus might be causing more widespread disease, he collected and then published 120 other cases of CMV infection, detailing the long lasting symptoms of fatigue and fever. Tim is most proud of what this did for patients. 'Before this, many were ill for up to 9 months and because no-one knew what was wrong, despite multiple investigations, they imagined the worst. My research stopped them worrying'.

Tim's career has also encompassed investigation of transplant-acquired infection, which can cause the failure of precious donated organs, such as kidneys. CMV is a major problem here too but he also described transplant problems caused by a tiny parasite called *Toxoplasma gondii*, normally found in cats.

If a pandemic takes hold, we will all benefit from Tim's work. He is the national lead at the Health Protection Agency for flu testing. Over the last five years he has set up a network of laboratories for flu testing, on call day and night, with tests that can be completed in just four hours. This service was prepared with H5N1 avian flu in mind, but the same technology can be applied to H1N1 swine flu, which has made Tim a very busy man of late. 'I love liaising with people keeping them on a path to providing the best public health microbiology service we can'. It is work that has earned him the OBE.



Dr Kimberly Gilmour
Clinical Immunology

‘Boy in a bubble’ is a phrase coined to describe children who have to live in a sterile environment. These children have defects in their immune defences and have to be shielded from the outside world. Many end up at Great Ormond Street Hospital where Kimberly Gilmour is responsible for diagnosing exactly what’s wrong with them.

Kimberly is British by birth but grew up in the States. She was inspired by science teaching at school and took a science degree. After that, while she considered her career options, she spent two years teaching science to children in Western Samoa as a volunteer. Her PhD focused on genetics but was undertaken in an immunology lab in the US. She then moved to an immunology lab at Cancer Research UK but four years later when a job came up at Great Ormond Street Hospital which would turn her knowledge into diagnostic tests, she jumped at it.

“Each of their own children is their own little puzzle”

Dr Kimberly Gilmour
Great Ormond Street Hospital NHS Trust

The hospital sees patients with rare immune disorders from all over the world. All the children lack resistance to infection but this similarity is deceiving for each has a specific and often different genetic cause of their condition. Some are completely new to science. ‘Intellectually it’s very exciting, each one is their own little puzzle’ says Kimberly. She first tests their blood to check what elements of the immune system are present or absent. Then she searches for proteins in their blood. This helps narrow down the hunt for the one altered gene amongst thousands that the geneticists must find to make an exact diagnosis. ‘I love what I do. There is great satisfaction in diagnosis especially when what you have done means these children go from just lying in a bed with tubes coming from them to making the nurses run after them. It’s very important information for the family too’.

Kimberly is involved in ward rounds and provides clinical advice not only nationally, but internationally. ‘Every year I’ve been here we’ve come up with another new test and these are now being used all over the world. It’s a great job’.



Dr Rob Low
Audiology

“What I do actually changes lives”

Dr Rob Low
Brighton and Sussex University Hospitals NHS Trust

Sometimes there seems to be a conspiracy of coincidences which steer people down a particular path in life. For audiologist Rob Low, it started with a place on an unusual degree course with joint honours in physics and psychology, the perfect combination in fact for a career that combines science and people in equal measure as audiology does. And then it turned out that this same University was carrying out fascinating research on the physics of hearing which was to form the basis of modern hearing screening techniques. A further influence was that his father was profoundly deaf. ‘I never thought this steered me but I think it must have sensitised me to the problems of hearing loss’.

Once the young Rob got involved in hearing research, he was hooked but, needing funding for his MSc, became a clinical audiologist in the NHS, specialising in children’s services. His intentions to go back into academia never materialised however as he found his NHS work gave him both the ability to do research as a clinician as well as a constant variety and interest in helping children and their families. The combination of science with ability to communicate is particularly important in audiology. ‘If you don’t have scientific rigour, you can come unstuck, but if you have no people skills, you’re likely to come unstuck too.’

Now working in Brighton and more widely as an adviser to the Department of Health, Rob Low rates the ability to make change to people’s lives as one of the most enjoyable aspects of his job. He cites the case of a young woman with a real flair for foreign languages who now has a budding career as an interpreter. When he first met her, she was a baby of just 4 months old, recently diagnosed as having profound hearing loss. At the time, a job dependent on hearing, like that of an interpreter might have seemed unattainable. But she was fitted with a cochlear implant and has never looked back. ‘Her life has been shaped by my input’ says Rob. ‘What I do actually changes lives’ Not many people can say that about their work.





Pritee Ruparelia
Neurophysiology

Pritee Ruparelia uses her science to help diagnose problems with brain function or nerve disorders.

Whilst ECGs measure the function of the heart, EEGs (electroencephalographs) measure the function of the brain. EEGs play a vital diagnostic role in a wide variety of neurological conditions, including stroke, dementia, epilepsy and brain injury. Pritee can be asked to perform EEGs in patients of all ages and abilities, from tiny premature babies to heart patients in critical care or trauma victims in intensive care, in any of the three University hospitals in Leicester.

EEGs are used extensively to pinpoint the cause of fits (seizures) which are symptoms of a range of neurological or psychological disorders and to monitor or assess the effectiveness of treatment in people with epilepsy. These EEGs are usually undertaken by Pritee in an outpatient setting and differ depending on what diagnostic information is needed. Pritee also runs a nerve conduction clinic once a week for those suspected of having carpal tunnel syndrome. This is a painful condition caused by compression of a key nerve in the wrist which can have a major impact on quality of life, particularly for older people. If it is identified, simple surgery can alleviate it.

There is constant interaction with patients, from tiny babies to the elderly and Pritee enjoys this aspect of her job enormously. But the job also involves analysis of the data obtained from each EEG followed by writing up a technical report. 'It's a really good combination,' she says of science and people.

'It's one of those jobs that you don't really hear about,' says Pritee Ruparelia of her career in neurophysiological measurement. 'So it was chance that I saw an advert for it. But when I started doing it, I'd just be going on and on about how wonderful it was to anyone I met'. Six years on, she still feels the same although thankfully her friends and relatives are now spared the long version. She hopes to continue to develop her technical skills for the benefit of patients.

Dr Keith Ison
Exceptional Scientist

New materials for surgical implants, getting an MBA, teaching phonetics, being a union rep, computing, managing medical equipment, getting involved in fields as diverse as orthodontics, acoustics, radiology and nuclear medicine, inventing new surgical tools for urologists, devising strategy at local and national levels, running a medical physics department with 100 staff, being Chairman of the Federation for Healthcare Science, encouraging and mentoring others.

All of these extraordinarily diverse activities have been possible in Keith Ison's career because he is a scientist within the NHS. 'If you are prepared to roll up your sleeves, the opportunities are there. It's been great to go into all these different avenues.'

The one constant theme in Keith Ison's career has been his strong sense of values and purpose. 'I want to help people and you realise that you can do a lot of good in an awful lot of areas working with the NHS. And especially if you live locally to your hospital as I do, there is the added satisfaction of knowing that you are serving the people you know and love'.

Keith came from a family with a strong engineering background. As a child he wanted to know how everything worked and Dreamt of building space ships. His degree was in physics and materials science. It was when he took a post-degree year out to work as the handyman at a youth club in Bermondsey that he realised that helping people was central to what he wanted to do in life and combining his science with his physics could achieve this. He began basic medical physics training in Hull. He moved to London and worked in a phonetics department on a cochlear implant project, then in the Institute of Urology and at the Royal National Throat, Nose and Ear Hospital, at UCL and King's College Hospitals, before becoming Head of Medical Physics at Guy's and St Thomas' Hospital. All these posts gave him an opportunity to see a wide variety of other healthcare scientists at work, which he found fascinating.

"If you are prepared to roll up your sleeves, the opportunities are there"

Dr Keith Ison
Guy's and Thomas' NHS Foundation Trust

He discovered that he was an exceptional manager and leader of people and of projects and could use his scientific analysis to get to the nub of problems. He developed an interest in strategy, which led to him being involved in national debate and policy development such as Agenda for Change which was the biggest overhaul of NHS pay, terms and conditions in more than 50 years. He helped to write many of the 'profiles' (descriptors of different jobs within the NHS) for scientists and his hospital became one of the scheme's pilot sites.

His broad knowledge and interests made him a good choice to become Chairman of the recently formed Federation for Healthcare Science in 2004. It brings together all healthcare science specialisms under one umbrella, allowing them to speak with one voice. 'Their diversity is fascinating but there is a commonality too'. A career in the NHS has given Keith Ison opportunity, enormous variety and above all, the ability to help people. 'I never have to think why I am going to work. That's a great feeling.'



"It's one of those jobs that you don't really hear about"

Pritee Ruparelia
University Hospitals of Leicester NHS Trust



“Freedom to act, meeting people, helping others. What more could anyone want from a career”

Dr Graham Beastall CBE
President, International Federation of Clinical Chemistry
and Laboratory Medicine

Dr Graham Beastall CBE

Exceptional Scientist

Sometimes one act of chance decides a whole career. Graham Beastall's first proper job as an academic biochemist happened to be in Glasgow in a university department where staff had joint NHS and academic appointments and which also had a reputation for steroid biochemistry. It meant he was able to switch easily into a wholly NHS career, rather than the academic one he had envisaged and that the measurement of hormones (of which steroids are an important family) became the area on which he was to build his considerable reputation.

The new techniques pioneered by Glasgow at the time brought accurate measurement of steroids such as testosterone and oestrogen and as a result, a completely new understanding of puberty and infertility. The measurement of peptide hormones like prolactin and growth hormone, present in the blood in vanishingly small quantities, followed. Glasgow became a pioneer in the field of biochemical endocrinology and in 1979, Graham Beastall became head of the first department in the UK dedicated to the measurement of all hormones.

He made many significant discoveries. For instance, one cause of higher than normal levels of prolactin is a tumour in the pituitary gland requiring urgent surgery. Today, an MRI scan would give an immediate answer but this wasn't available in the 1980s. Graham's research made it possible to identify whether the extra prolactin in the blood came from a tumour or another cause. In another ingenious piece of research, he led a series of research projects based on measuring parathyroid hormone throughout the day and night. He discovered a pronounced daily rhythm in normal subjects which disappeared in women who had developed osteoporosis after the menopause. This change was enough to turn a bone building hormone into a bone destroying one. Daily injections of parathyroid hormone are now known to be an effective therapy.

Graham would be counted exceptional for his science alone but he has done much more. He introduced, way before it became recognised as important, multi-disciplinary team working. 'We found that the patient benefited most if everyone talked to each other'. Building clinical links became a passion. He became an active member of the Association for Clinical Biochemistry and continued to bring scientific disciplines together. He became the first non-medical Vice President of the Royal College of Pathologists. He became involved in the moves to develop a single unifying curriculum for healthcare scientists whilst continuing to recognise that if the NHS is to be great, it must also be able to accept scientists from outside conventional training routes, who can enrich its practice. Today he has a unique role. No longer leading a department but advising on the life sciences aspects of the Modernising Scientific Careers programme.

And there is yet another strand to his life, which is of immense importance to both him and to patients worldwide. He is President of the International Federation of Clinical Chemistry and Laboratory Medicine and leads on policy formulation and implementation, working on the one hand with the United Nations and WHO on global standardisation and on the other, with the introduction of basic quality control into rudimentary laboratory medicine in Africa. It is a voluntary position and it makes him proud that he can call on 200 plus other volunteers, all over the world, to help him with this task. 'Freedom to act, meeting people, helping others. What more could anyone want from a career'?



Professor Marion Scott

Exceptional Scientist

When Marion Scott was thinking about a career in the health services, her school could not have been clearer. It was doctor or nurse. Scientist was a distinctly second best option. Nevertheless Marion still chose science and as a result has had a distinguished career in which she has made major contributions to health through her work on blood for the NHS.

Marion's elder sister worked in London in the Wright Fleming Institute, of penicillin fame, where she let her little sister help plate out cultures. Marion knew at 14 that science was what she wanted to do and after her degree went to work in a forensic science lab. Blood groups were then the key way to identify (or eliminate) suspects and blood stains, spatters and spots were the bread and butter of forensics. Marion became fascinated by blood and worked out how to deduce blood groups from saliva samples, which became the subject of her PhD thesis. After this she worked in academia, first in Cambridge, then in Oxford working on the membranes of red blood cells, the extraordinary little biconcave discs that transport oxygen round our bodies.

She then took a job in the transfusion service, based first in Oxford and subsequently in Bristol, eventually becoming head of R & D for the whole of the NHS blood service. She still maintains her own research group and has a special interest in blood grouping and compatibility testing prior to transfusion. Many compatibility tests involve the use of blood products derived from specific donors but over many years, Marion's group has created many cell lines which produce blood group products in a laboratory, without the need for donors. Having these products readily available has greatly improved the speed and accuracy of pre-transfusion test procedures.

As director of R&D, Marion Scott both oversees the extensive NHS Blood & Transplant research programme and also commissions research from specialist scientists across the country. Her job now involves a great deal of administration but it is research that drives her. 'I still put science first and what gives me particular pleasure is reading up on new areas, digesting the results and then working out what experiments remain to be done, and then designing them and making them work'.

Recently she has taken over the Chair of the Federation for Healthcare Science during a period of major change. Trying to get consensus from all the many healthcare science specialisms is not always easy but creating a flexible workforce that can adapt to the sweeping technological advances already on the horizon is essential. Above all she hopes that by the time she retires, teachers will know that science should be the first, not second choice for their brightest young people and that there is no better place to do it than the NHS.

“Science should be the first, not second choice for the brightest young people and that there is no better place to do it than the NHS”

Professor Marion Scott
NHS Blood & Transplant



Steve Halloran

Clinical Biochemistry

Screening guru, device assessor, service manager and editor of one of the most visited medical sites on the net are just some of the many strings to Steve Halloran's bow. He protests that 'one thing just seemed to lead to another' but the fact that his achievements are so diverse is testament not only to his commitment to the NHS and the people it serves but to the opportunities available for scientists in the NHS.

He certainly started out in a conventional way with a degree in chemistry and entry into biomedical science. In 1989 he found himself in the clinical chemistry laboratory at the Royal Surrey County Hospital being asked to evaluate point of care testing devices. His advice then became sought by the Department of Health in relation to procurement and what was basically a one man device testing and reporting service then turned into the Guildford Medical Device Evaluation Centre with a staff of eight. In the same way that people might look at a 'Which' report before deciding on a TV, scientists and service managers look at the Centre's reports before buying. They cover an ever expanding range of assays, tests and devices used in biochemistry, haematology and immunology.

Meanwhile, still in consumer champion vein, he was co founder and medical editor of LabtestsOnline (qv Mike Hallworth) which has over 2000 pages of information for the public about lab tests and which now has 150,000 visitors a month.

When the pilot bowel cancer screening programme was announced, Steve was asked to evaluate the various tests available for early detection. His evidence based choice was controversial (and cheaper). He then got asked to become the screening hub not just for his health authority but all 14 million people in the South of England. And that turned into developing the guidelines for tests for bowel cancer screening for the whole of Europe. Early diagnosis of bowel cancer can turn a 5% survival rate into a 95% survival. 'It's the sharp end of making life better for people' he says. And it makes him very happy.

"It's the sharp end of making life better for people"

Steve Halloran
Royal Surrey County Hospital NHS Trust

Francis Pillai

Radiation Protection and Monitoring

Francis Pillai is dedicated to ensuring peoples' safety. He is one of a small number of scientists working in radiation protection and if any premises in the East Anglian region is using radiation, it's his job to ensure that patients, staff or visitors to those premises will be safe and exposed to the minimum amount possible.

'Radiation' includes both ionising radiation such as X rays or radioactive isotopes used in treatment and diagnosis as well as the non-ionising forms of radiation such as lasers or ultraviolet light. Understandably, it is a highly controlled and regulated field and Francis' reports are signed off by the area Radiation Protection Adviser, a person invested with legal authority who can order premises to be shut if there are problems.

It's a fascinating area of science where attention to detail is paramount. Take a simple X ray of a broken finger. An X ray of the whole hand would cause too much scattering of radiation, so special finger shields need to be used. The room where the X ray is taken must be carefully designed so that no X rays can bounce off walls or other surfaces. Receptionists working near the X ray equipment must be adequately shielded since they will be exposed for 8 hours or more a day. There are many other questions to answer. Where does the operator stand when taking the X ray? Is everyone properly trained? How is the patient dose assessed? Are local rules in place? Have they been updated recently?

Francis must then enter data for each premises and file a report. He is also involved in radioactive waste management across the region and in planning for radiation emergencies. 'I meet different people almost every day'.

It's a far cry from his original science – entomology, the study of insects – in his native Kerala in Southern India. But he has not regretted his switch from bugs to beams.

"I meet different people almost every day"

Francis Pillai
Addenbrooke's NHS Trust



Dr Paul Harrison
Haemostasis and Thrombosis

Paul Harrison developed his career in haematology more by accident than by choice. He originally trained as a toxicologist but when he couldn't get a job in that field, found his way into research. He then discovered haemostasis and became completely fascinated. Now he combines specialised clinical assays with research and development.

Haemostasis is the complex highly regulated but balanced process that prevents bleeding or thrombosis. Normally cells called platelets rush to the site of an injury to play an important part in clot formation. Paul measures special platelet function and other tests in patients with either bleeding or symptoms of thrombosis. Improving, researching and developing more accurate diagnostic tests for these patients is an important part of Paul's job.

Of late, platelets have taken a bit of a back seat as Paul and his research colleagues investigate the mysterious nanoparticles also found in blood. In the past these were simply thought to be debris but now it appears that they are actually doing something, although quite what is still not fully understood. Their measurement may become important as a biomarker of various diseases including cancer, heart disease and stroke. Of special interest is their function within pregnancy when they are produced by the placenta in huge quantity every day. There is evidence suggesting that they might be involved in a dangerous pregnancy complication called pre-eclampsia, but the first task has been how to measure and identify them accurately. It's involved Paul in collaborations with the obstetrics department, oncology and nanotechnologists elsewhere in the University as well as industry.

Paul has a very diverse life as a clinical scientist and many things about his job are enjoyable. The thrill of being able to diagnose a rare bleeding disorder, developing useful new tests, coming up with new ideas and being able to take them from conception to funding and then discovery. He particularly enjoys the training and teaching of students. 'It's a privilege being a practising scientist'.



“It's a privilege to be a practising scientist”

Dr Paul Harrison
Oxford Radcliffe Hospitals NHS Trust

Tabinda Rashid-Fadel

Cardiac Physiology

Tabinda Rashid-Fadel was thinking about a career in a hospital lab when her father died very suddenly from a heart attack at a young age. It was a traumatic experience for her family bringing the need for heart disease prevention into sharp focus. It prompted her to focus on cardiac work where the combination of her science and her emotional involvement has been a powerful one, delivering benefits to many hundreds of families in the Bristol area.

Cardiac physiology involves assessing and measuring heart function with a range of procedures, as well as diagnosis and involvement in treatments such as defibrillator and pacemaker implants. Whilst she see some patients as emergencies at the Bristol Heart Institute, requiring rapid diagnosis and treatment, others, like children fitted with pacemakers are seen regularly over many years. Both involve developing a close personal rapport with people who may be frightened and in pain. 'I always think how would my mum like to be treated. My best days are always when I can help make patients better' says Tabinda.

In the past she was the first physiologist to deliver arrhythmia clinics and to introduce 'one stop clinics' for heart patients which made life much easier for patients and also developed the skills of her team of physiologists. She has become very involved in management, because she sees how important this is as a route to effect change for patients' services.

Tabinda's own background is strongly multi-cultural - Turkish, Syrian and Pakistan. She is passionate about equity of access, especially given the high incidence of heart disease in some ethnic groups. She has used her science to develop community work with a team of volunteers and they recently delivered a health awareness day for 456 people, of whom 132 had heart consultations. This work showed the barriers to access – for instance, 27% of women would delay seeking help for chest pain if no male family member could accompany them. If she manages to change services for them as she hopes, it will be a lasting personal achievement as well as meaning better health for this neglected group.



“My best days are when I can make patients better”

Tabinda Rashid-Fadel
United Hospitals Bristol Foundation Trust

Dr Peter Marsden
Radiation Protection and Monitoring

University College Hospital in London is a leading centre for research, particularly in imaging. It means that Peter Marsden, its head of radiation physics, has an unusually diverse job. 'No two uses of radiation are the same, there's a wonderful variety at this hospital'.

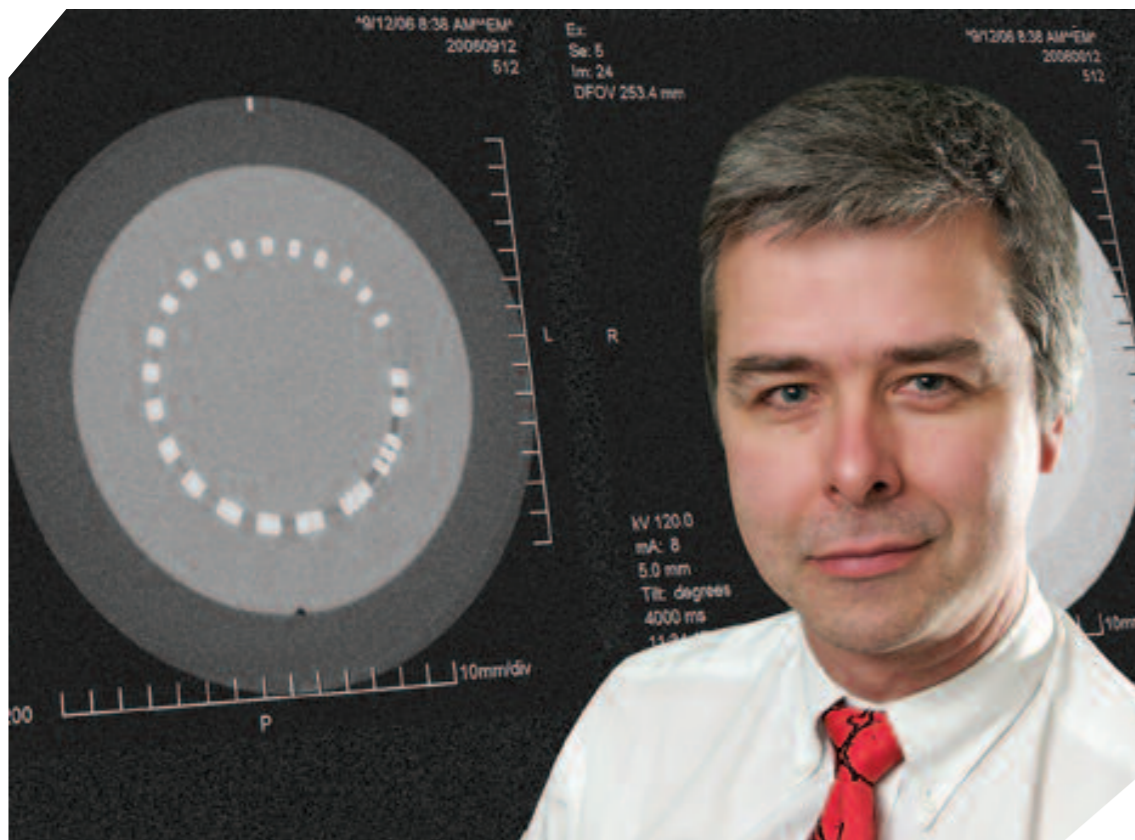
In addition to what might be called by the public, 'normal' use of radiation in X rays and radiotherapy treatments for cancer, X rays, are increasingly used outside X ray departments in areas such as cardiology, where CT scans (which involve X rays) are used to provide stunningly detailed images of the heart. Peter's team checks the intensity of X rays and of X ray equipment throughout the hospital, to make sure that it is safe and performing as the manufacturer intended. They also collate around 3,000 results a month from the film badges worn by staff who might be exposed to radiation.

Sometimes those involved in radiation protection are seen as the people who say 'no'. As far as Peter is concerned, his job is to find out what clinicians want to achieve and then try to help them achieve it safely. But there are many challenges in radiation protection. For instance, what advice should be given to the parents of young children being treated with radioactive isotopes about contact with them? 'I have to put risks in perspective' he says.

Peter's most difficult challenge came in November 2006 when Alexander Litvinenko, a Russian dissident, was admitted having been poisoned with radioactive Polonium 210. He died three weeks later. It was a very different type of radiation from that normally seen in the hospital and although the principles behind it were known, Peter's team had to rush out and borrow new equipment to test for it. A great many people were involved in Litvinenko's care and naturally many had serious concerns that their health would be affected. Peter had to repeatedly provide reassurance for staff members. The challenges did not end with Litvinenko's death as concerns remained as to how to dispose of items like linen, which he had used. Huge variety indeed.

"No two uses of radiation are the same, there's a wonderful variety at this hospital"

Dr Peter Marsden
UCL Hospitals NHS Foundation Trust



Eskinder Solomon
Biomechanical Engineering

Eskinder Solomon came to Britain when he was 12 years old from Ethiopia. English was his second language and he had to work very hard to catch up, yet remarkably, within a decade he had graduated with a first class degree in medical engineering. Still in his twenties, he is a rising star of his profession.

Eskinder comes from a family of scientists back home. His mum was a nurse and he used to go to her hospital and help. 'I've always been fascinated by how the body works'. At school here, he excelled in maths and physics and an inspirational physics teacher suggested medical engineering might be the career for him. He hasn't looked back since.

He started out on the clinical scientist graduate training scheme at King's College Hospital, London, gaining an MSc in medical engineering along the way and will become a registered clinical scientist during 2010. He works on Trust wide initiatives to support medical device management as well as research and development. He works with clinicians to provide technological solutions to medical problems and in some cases, to develop new devices. For instance Eskinder has recently been working in the Respiratory Medicine department and with a commercial company to develop a new device that detects when patients snore or stop breathing. The device then stimulates the muscles responsible for opening the airway.

Another project has been developing RFID technology (RFID tags are tiny electronic devices like those used in store security labels) to help track hand washing behaviour of clinicians between seeing patients.

He is a self confessed geek and loves working on novel projects which require him to learn new skills, such as programming, or scientific concepts. He is planning on a PhD next and has the post of consultant scientist firmly in his sights.

"I've always been fascinated by how the body works"

Eskinder Solomon
King's College Hospital NHS Foundation Trust

Tom Collins
Biomechanical Engineering

Tom Collins works with people with walking problems, using his engineering skills to help understand the exact nature of their difficulty.

He works at Queen Mary's Hospital Roehampton, which was set up as a specialist centre for the fitting of artificial limbs after the First World War. It no longer treats servicemen but Roehampton still specialises in work with the rehabilitation of amputees. Most of Tom's working day is spent in the Gait Laboratory, a big room which appears empty but actually has a range of high tech equipment, such as infrared cameras which digitise the movement of limbs as people walk through it. It's the same technique that was used to make Gollum so lifelike in the Lord of the Rings films. Tom records and then analyses this data, which is used to monitor peoples' progress or inform treatment options. 'It is intellectually stretching to try and work out what's wrong and it also requires a great deal of rapport with patients, especially with children who often need encouragement to walk in a straight line.'

Tom's degree is in engineering but he didn't want to work on big engineering projects. A tutor suggested engineering in healthcare, which offered many challenges, with lots of involvement with people and the potential to be able to help them, so he joined the clinical scientist training scheme organised by the Institute of Physics and Engineering in Medicine.

He is involved in research, tracking the progress of amputees as they go through the rehab service at Roehampton, and also some treatment as well. Functional Electrical Stimulation uses carefully placed pads on the skin to deliver brief electrical stimulation to muscles. It's an effective treatment for people who have a 'dropped foot' after stroke or injury which prevents them walking properly. 'It can make a very big difference' says Tom. 'Biomedical engineering has turned out to be a fascinating career with many options for development in the future'.

"It's a fascinating career with many options for development in the future"

Tom Collins
Wandsworth Primary Care Trust



"We forget about the normal things that other people take for granted"

Professor Adrian Davis OBE
Director of the NHS Newborn Hearing Screening Programme



Professor Adrian Davis OBE
Exceptional Scientist

Adrian Davis is both an exceptional person and an exceptional scientist. His greatest achievement has been the introduction of the newborn hearing screening programme in Britain. It gives children with hearing loss the best possible chance of normal development and speech and has already helped over 4,000 children by identifying their problems soon after birth. It is the envy of the world and no other country in the world has a programme of similar quality or reach.

Adrian Davis grew up in Cheltenham. After leaving school, he worked as a research chemist at the National Coal Board before beginning what he thought was his vocation, life as a Benedictine monk. That wasn't to be and so he turned his attention to mathematical statistics and psychology at Exeter, followed by a masters at Stirling University where he became fascinated with how people recognise symbols, faces and sounds and how they learn to communicate. He went on to a doctorate in mathematical psychology. He joined the MRC Institute of Hearing Research in Nottingham and in 1981, following the death in special care of his son Ben who had been born prematurely, pleaded to be allowed to evaluate hearing screening devices that might be used to help identify hearing problems in special care babies.

Premature babies are known to have a tenfold increased risk of deafness. There are three possible responses by a baby to a series of sounds. One is physical – moving the head for instance – which was then the only method in use for screening hearing loss, one is the electrical response of the brain to sound and the third is the faintest of acoustic responses, essentially an echo of the sounds, bounced back by the cochlear through the eardrum. At the start of his research, a device called a Linco Bennett cradle exploited the behavioural response as a screening device but by using it with an acoustic measuring device built at the MRC Institute of Hearing Research, Adrian and his colleagues showed that an acoustic method could be used as a screening tool. It also worked automatically, subsequent research showed. Its first incarnation, with a BBC computer attached, would seem very clunky however compared to the devices used today.

Just over a thousand babies a year in the UK are born with hearing impairment and research has established that the later deafness is diagnosed, the more likely children are to have poor language and cognitive skills. In the past, hearing loss was often not identified until the baby was two years old. Adrian published a review showing that extending screening to all newborns would be cost effective and found himself being asked to go away and write the case for doing just that for the Department of Health. It was agreed that it should be introduced but to get it working every day, in the same way, in every place, was a very big job.

A hallmark of the way that Adrian works is his networking. To ensure the success of this project in the real world, he involved a wide range of people, not just audiologists but midwives, managers, charities for the deaf and above all, parents. 'Involving parents has made a huge difference. It was hugely exciting to have a project where everyone was pulling together in the same direction.' One day he met a parent whose child had had their hearing loss identified early because of the programme. She wanted to tell him about her daughter's school report which remarked, 'she sings well in class'. It is the last thing that would normally have been said of a deaf child and it made Adrian intensely proud. 'We forget about the normal things that other people take for granted'. Early identification and appropriate interventions such as family support, hearing aids and cochlear implants improve language skills and add 10-15 points to hearing impaired children's IQ. The newborn hearing screening programme is a truly extraordinary achievement. 'But there remains much still to be done' says Professor Davis.

Dr Nigel Silman

Microbiology

Nigel Silman has an extraordinary job. He works with novel and dangerous pathogens at the Health Protection Agency's Centre for Emergency Preparedness at Porton Down and his job is – well – to be prepared for anything, maintaining laboratories and specialist containment facilities in anticipation of what he calls 'the weird and wonderful' happening.

Although his department keeps a watching brief on emerging pathogens right across the globe, they can never second guess what they will be working on next. For instance recently, a number of injecting heroin users developed septicaemia and became seriously ill. Was this a new disease? Was it something contaminating their heroin supply which might become more prevalent and most importantly, what was it? 'We forensically track these outbreaks to work out what might be causing them'. The answer was anthrax. In fact, anthrax has been much on their minds of late. Another piece of detective work was working out why a Scottish bongo drummer developed anthrax. The source of infection was quickly traced to the goat skins used to make his drums. Of greater concern was the fact that he had been giving drumming classes in a village hall to hundreds of people a year, potentially exposing many to this lethal pathogen. It meant tracing all of them and testing them for exposure. Luckily symptoms of anthrax usually only develop after exposure to tens of thousands of its spores, unlike plague (another of their preoccupations) where as few as 10 organisms can cause illness. A major research preoccupation at the moment is working out exactly how anthrax causes infection.

His department provides advice to the world on viral haemorrhagic fevers including Crimean and Congo, maintaining expertise in these rare diseases so that the communities they affect (which in general have poor access to medical support) can be helped effectively. Another key part of his work is running training courses on response to bioterrorism. The people who attend these courses praise them highly and find them immensely valuable. He has also been heavily involved in the response to pandemic flu. It is not a surprise to hear him say 'No two days are the same' or that he loves his job. 'I love meeting people and I get to talk to everyone'.

"No two days are the same. I love meeting people and I get to talk to everyone"

Dr Nigel Silman
Health Protection Agency Porton Down



Katherine Noble

Gastrointestinal Physiology

Katherine and less than a hundred people like her in the NHS offer a highly specialised service for a problem that is rapidly increasing. Katherine runs the oesophageal laboratory in Birmingham Heartlands Hospital which delivers diagnostic testing for people of all ages with gastrointestinal problems, from difficulties in swallowing, indigestion and heartburn to faecal incontinence and constipation. More people are seen with these problems, particularly acid reflux, than ever before, partly because of changes in the national diet over the last 30 years have made them more frequent, but also because many have become curable with surgery or other interventions.

Katherine had a degree in biology and entered this field almost by accident. Much of what she does involves testing the amount of acid or and measuring pressures at various points in the gut in order to inform diagnosis. When she first started, the equipment was very clunky. 'We used scratchy pen recorders, a bit like measuring an earthquake' she recalls. In the last decade, there has been a technological revolution enabling a much faster, more accurate range of tests and ensuring far greater comfort for the patient. For example, pH monitors (which are inserted into the gullet and stay in place to measure the presence of acid over 24 hours) are now tiny things. Despite these improvements in technology, many patients are very anxious when they come to see Katherine and think that they are about to have a deeply unpleasant experience. A key part of Katherine's role is communication. The combination of her reassurance with her skill and experience mean most patients finish their 90 minute sessions telling her 'It wasn't nearly as bad as I thought it was going to be'. 'Patients are very grateful for what we do for them'. Even better is the fact that once diagnosed, surgery can be curative and is much simpler than it used to be.

Katherine is involved in research, investigating for instance acid reflux disease in those with asthma or unexplained cough. She also plays a leading part in the development of her profession as Chair of her professional body.



"Patients are very grateful for what we do for them"

Katherine Noble
Heart of England NHS Foundation Trust

“I established the first NHS spin out company”

David Gow
NHS Lothian

David Gow

Exceptional Scientist

When David Gow was a young engineering student he saw an item on BBC TV's *Tomorrow's World* about state-of-the-art artificial limbs from Sweden. It inspired him to get involved in medical engineering. Today he is the inventor of the world's first fully articulating and commercially available bionic hand and the subject of many TV films himself.

David took engineering science as a degree and then began working on control systems in medical engineering at the University of Edinburgh. He soon found his research turning into a service commitment as patients came in, each with a unique problem. The department was involved in many innovative projects at the time, with a particular reputation for developing devices for children born with limb deformities as a result of thalidomide.

But David was frustrated. Research got done but relatively few patients were helped by these experimental devices. And one particular problem bothered him. People, especially children, who were missing a finger or thumb but who otherwise had a functioning hand were at a great disadvantage because only whole artificial hands were available. 'Without fingers or a thumb, these children couldn't grip'. The department managed to develop powered partial hands for adults, but still the youngest patient they could help was nine years old.

He realised that a solution to this was to develop powered digits, so having registered a patent for individual fingers in 1994, he decided to develop a partial and a whole hand solution in tandem, using the same technology platform. The i-Limb hand he came up with has five individually powered digits, giving the patient a far greater range of movements and a choice of natural grip patterns. It is manufactured using high strength plastics and looks and acts like a real hand.

The hand is controlled by an established and simple control strategy that uses one muscle signal to open and another to close the hand's fingers. Patients get the hang of it very quickly indeed. The hand is controlled using the electric signal generated by the muscles in the remaining part of the patient's arm. This signal is picked up by electrodes that sit on the surface of the skin. The powered digit or ProDigits™ was the first invention, then came the world's fully powered electric arm. This was made by scaling up the ProDigits™ idea with more powerful motors. In 2005 and 2006 David's powered shoulder was incorporated into another two world firsts, when the prestigious Rehabilitation Institute of Chicago fitted the world's most functional artificial arm to a man with no arms.

In 2002, David Gow established the first spin out company from the NHS, called TouchBionics to commercialise these devices which cost about £10,000 each. In 2007 the iLimb hand had a world launch. The company has already been very successful, supplying over 650 iLimb hands worldwide. The hands can be customised, with a special cosmetic finish matched to the patient. A feature is that if there is ever a problem with one of the digits, a spare one can be fitted and the damaged one can be returned individually for service meaning patients aren't stuck for weeks whilst their hand is away for service or repair.

David's story came full circle when he was asked to go to Sweden, to the very same department featured on *Tomorrow's World* all those years previously, to demonstrate and fit his partial hand inventions in the early 1990s.



“It has been an extraordinary journey”

Val Davison
West Midlands Regional Genetics Service
Birmingham Womens NHS Foundation Trust

Val Davison

Exceptional Scientist

When Val Davison began her career in the early Seventies, clinical genetic services were in their infancy. Antenatal screening was primitive and limited to detection of just a few chromosome disorders. Cancer genetics barely existed and PCR, the DNA amplifying technique that makes everything from gene sequencing to forensic science possible, had not even been invented. ‘Back then I could fit all my clinical work into one Tuesday a week’ says Val who heads the 160 strong Regional Genetics Laboratory in the West Midlands and also has a new appointment as Head of the National Healthcare Science School of Genetics.

In the last 40 years in genetics, one astonishing advance has followed another, including most famously in 2000, the first draft of the human genome sequence. ‘I’ve been there for most of it. I’ve seen the new developments at first hand, been able to introduce new genetic testing regimes, it has been an extraordinary journey’.

Val has always been a leader, passionate about the impact that genetics can have on patients. When the BRCA genes responsible for some forms of inherited breast cancer were identified, no money could be found in her region to further develop BRCA testing for all women at risk. By re-organising laboratories in the area, Val released significant savings which she then persuaded the NHS to re-invest in genetic services to allow further development of testing for breast cancer and other genetic services for patients.

As each new genetic advance has been made, Val has found herself in the position of saying ‘We have to do that’, explaining the science and its importance to those responsible for funding new services. She sees communication as being a key role for the new breed of clinical genetic scientists that are emerging through the genetics element of the Modernising Scientific Careers programme which she leads.

The old career divisions of cytogenetics (the study of chromosomes) and molecular genetics (the study of gene function at a molecular level) are being swept away, to be replaced by a new breed of highly flexible scientists and practitioners who will understand the science as it emerges and not only be able to translate its application to clinical care but be able to explain it to clinical colleagues and patients. This will be critically important given the overwhelming amount of information now emerging from sequencing studies.

The human genome sequence is already revolutionising genetics services. It heralds the advent of personalised medicine, where knowledge of an individual’s genes will inform prescribing or where knowing the genetic make-up of a cancer will determine which treatment should be given and when. And there is much, much more. ‘In the future, genetics will not be simply a specialised service, but will be at the heart of clinical care right across all of medicine. It’s turning services on their head’ says Val. For instance, if a toddler develops learning difficulties suspected to have an inherited cause, a geneticist will currently search a particular region of their genetic code where errors have been found in other children with a similar range of symptoms. These searches may not be successful as many conditions are rare. But soon a child’s whole genome will be able to be screened and rapidly compared to known ‘normal’ libraries, quickly and accurately yielding a diagnosis which will inform their diagnosis and treatment. Val Davison exemplifies a scientist as a dynamic leader, who can see where the future lies and using her communication skills, her enthusiasm and knowledge of her science can bring people together and introduce new technology to forge tomorrow’s services.

Dr Christopher Golby

Radiotherapy Physics

Chris Golby works at the Christie, Manchester's famous cancer hospital where he plans and checks radiotherapy treatments for people with cancer.

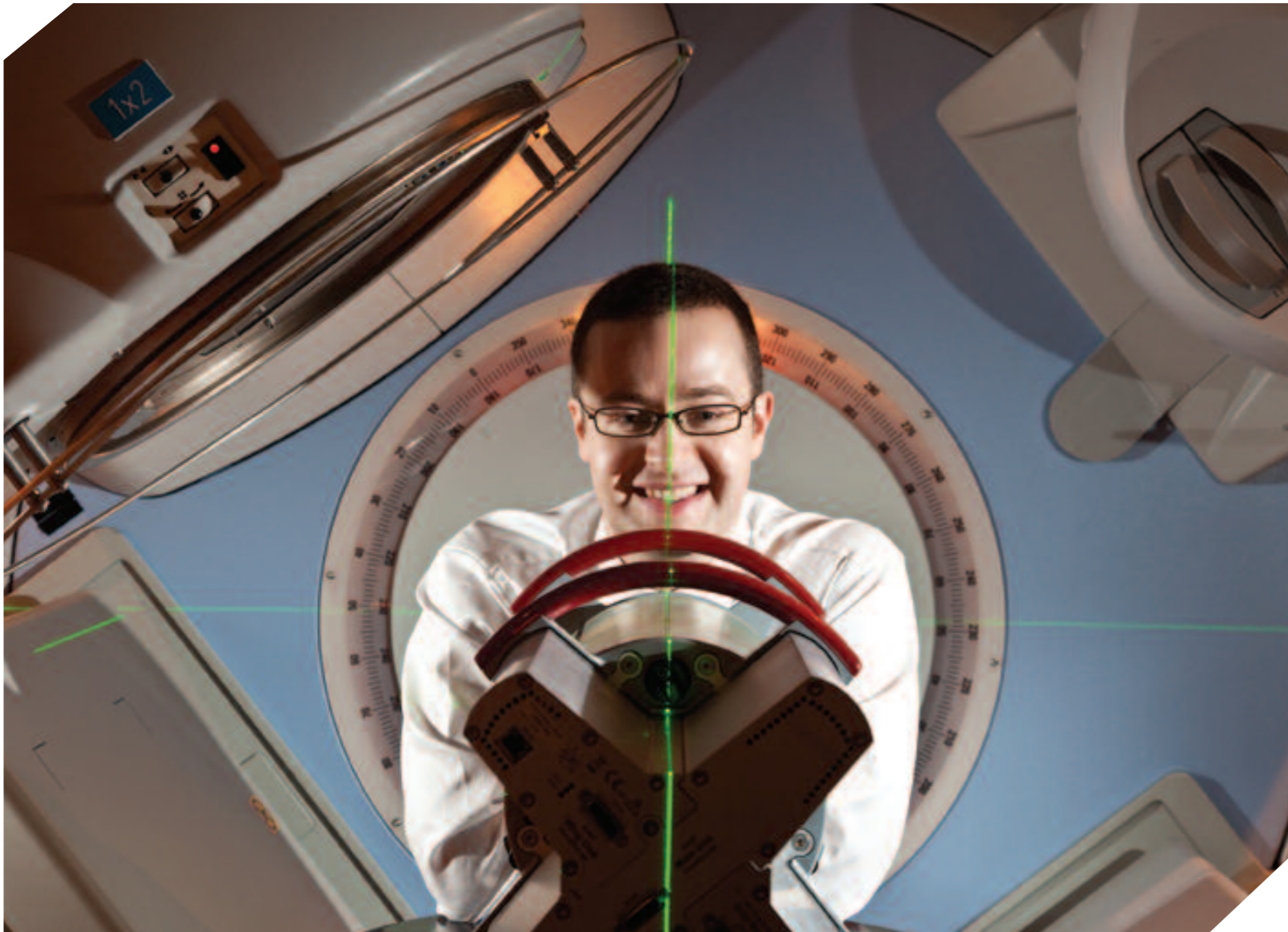
Chris works with million pound machines called linacs (short for linear accelerators) which deliver radiation to tumours. Radiotherapy is a careful balancing act; on the one hand cancer cells must be bombarded with enough radiation to kill them, but on the other, must avoid damaging any of the normal cells that either surround the cancer or through which the radiation beams must travel to reach the tumour. Chris works out how the treatments should be staged over a course of weeks or months in order to give normal cells time to recover before the next dose. He also uses software to carefully plan treatments so that each is bespoke to the patient. Linacs produce multiple beams and each one can be angled. The patient can also be rotated within the machine. Taken altogether, this means incredible flexibility in creating a 3D beam of radiation. 'The aim is to produce a 'beam's eye view' which matches the shape of the tumour as closely as possible'. Chris may also plan to include shielding if necessary to protect delicate areas like the spine and is involved in 'troubleshooting' if problems occur during treatments.

Chris has little direct contact with patients but his job is nevertheless very people focused as many people are involved in an individual's cancer treatment including doctors (oncologists and radiologists), nurses and radiotherapists. And, because the Christie is heavily involved in research, there is a great deal of interaction with other scientists and researchers.

Chris has always been physics mad 'why would anyone want to study anything else' but what attracted him most about this job was that it applied his knowledge of physics, not to diagnosis as is common with many other aspects of medical physics, but to treatment. 'Knowing when you are working on a solution to a difficult treatment case that it will be used to treat a patient the next day is stressful but very rewarding'.

"It's stressful but very rewarding"

Dr Christopher Golby
Christie Hospital NHS Foundation Trust



Dr Anna Barker

Histocompatibility and Immunogenetics

If Anna Barker gets a call in the early hours of the morning, life changing news may soon be winging its way to as many as seven people and their families in the North West.

Anna is best described as a scientific matchmaker. She works at the Manchester Royal Infirmary in histocompatibility and immunogenetics, the science that underpins not only organ transplants like kidney or heart but also the bone marrow transplants used to treat blood cancers such as leukaemia. 'Although I work in a lab, what I do has such a direct impact on peoples' care. Doing this job is a real privilege'.

The success of a transplant depends on specific elements of the recipient and donor being as similar as possible. People often call this matchmaking process 'tissue typing', although in fact it is only one element in the highly complex matching service undertaken prior to transplant.

For a successful kidney transplant, donor and recipient must first have a compatible blood group. Then using samples of blood, tissue typing (more properly called HLA typing) is undertaken. The results require very careful interpretation by the scientist. Finally there is a go, no-go test – called crossmatching which reveals if there are incompatibilities caused by previous pregnancy, transfusion or transplant.

Whilst recipients can usually be tested on a non urgent basis, donor testing is very different. It is a race against the clock, often in the middle of the night. Accuracy under extreme pressure is essential. For kidney transplants, tissue typing must be completed in just 4 hours. Donor details are then computer matched with potential recipients by NHS Blood & Transplant. Recently Anna has become very involved with giving expert advice for live donation, where a person donates one of their kidneys to someone in need, usually a member of their family.

Whilst doing this intensely rewarding, high pressure job, Anna has found time to complete a PhD, funded by the NHS. 'I never thought I would get as far as this. It has been a fantastic opportunity'.

"What I do has such a direct impact on care"

Dr Anna Barker
Central Manchester Foundation Trust

“I found it was the perfect job for me”

Dr Owen Crawley
Welsh Assembly Government

Dr Owen Crawley

Exceptional Scientist

Owen Crawley is the Chief Scientific Adviser for health for the Welsh Assembly Government. With support and advice from the Welsh Scientific Advisory Committee, he provides comprehensive objective briefing on all aspects of health related science and technology to the Welsh Assembly Government, to help inform policy on effective healthcare in Wales. It is a job of extraordinary diversity which exposes him to a very wide range of science and scientists.

It certainly wasn't in his original career plan. Physics was his destiny. Owen grew up literally surrounded by physics. He lived in Abingdon close to the Culham Centre for Fusion Energy where his father worked, and to Didcot, home of the Rutherford Appleton Laboratory. He was very good at sciences at school and it was no surprise that physics was his degree choice, or that physics teaching was what he did during VSO work in Ghana. But it was time spent on two medically related physics research posts that convinced him that health was where he wanted to use his physics and he joined the NHS as a medical physicist specialising in nuclear medicine.

When, by chance, Owen spotted an advert for a new post in the Welsh Office as Deputy Scientific Adviser he decided to apply, because it sounded so interesting. It was a case of a round peg in a round hole. 'I found it was the perfect job for me. I loved it'. Such jobs are rare and in one sense are a licence to be curious, given the constant exposure to unfamiliar sciences and the need to assimilate and synthesise them in order to brief ministers and others. 'People are incredibly helpful when I ask questions about what they do'. The range is however immense. 'One day I might be supporting the Health Minister in a meeting with an Assembly Member and constituents about health hazards of mobile phones, another I might be involved in planning expansion of radiotherapy capacity, or meeting audiologists to produce guidance on quality standards. Or all three on the same day.

In particular, he enjoys meeting the large number of able and creative scientists found in Wales since he needs to draw on his networks within NHS Wales, academia and professional bodies, establishing trust and co-operation. He is what he calls the 'Welsh Assembly Government's front door' for over 3000 healthcare scientists from right across the disciplines, and is a key liaison point between the Welsh Assembly and the scientific professions. Although the scientific disciplines are very different, he finds that there are surprising similarities in their concerns and in strategic issues. 'There is an increasing emphasis on the development of health science and research policy to support primary/community healthcare, public health and economic development objectives'. It all adds up to immense variety and job satisfaction and of course, considerable public benefit to the people of Wales.

Dr Phillip Morgan

Analytical Toxicology

As an analytical toxicologist, Phil Morgan is one of a very rare breed indeed because there are fewer than half a dozen toxicology units in the whole country. He works at the Toxicology Unit at King's College Hospital, London, the largest in the country, which processes over 20,000 samples a year. What he does is fascinating.

Analytical toxicologists measure any substance that causes harm in the body. This ranges from those things which we conventionally think of as poisons such as weed killer, household chemicals and drugs of abuse to overdoses of things that we normally think of as health giving like medicines.

Sometimes toxicologists know what they are looking for, and have just the right test on hand already. For instance, one of Phil's particular responsibilities is providing a service for the drugs rehabilitation unit at King's. Samples from those undergoing rehab are checked to make sure that patients haven't secretly returned to their particular drug of abuse. Or they might get a patient in Accident and Emergency who is known to have taken an overdose of paracetamol and Phil has to find out how much has been taken so that the appropriate dosage of antidote can be given. But equally they might be asked to investigate why someone has died and whether drugs or other poisons were involved. In these cases, they have to start from scratch, using a process of elimination to find out what the person took, or was given, to cause their death.

New drugs and chemicals are being developed all the time, which means Phil must constantly develop and evaluate new analytical techniques. His doctorate, undertaken whilst working, gave an insight into what test would work best when faced with analysing a particular family of chemicals.

One of the other mainstays of his laboratory is to measure concentrations of medicines in body fluids to make sure that a patient is getting the right therapeutic dose. He provides a constant source of advice, particularly on the interpretation of test results. The combination of the very technical, finding vanishingly small amounts of drug in a body fluid, along with the people side of helping clinicians understand test results is a very satisfying one. 'My work has a direct impact on the quality of life for patients'.

"My work has a direct impact on the quality of life for patients"

Dr Phillip Morgan
King's College Hospital NHS Foundation Trust



Alyte Podvoiskis

Clinical Engineering

Alyte is one of a small but critically important band of scientists who literally make the NHS work. Clinical engineers evaluate, manage and modify the complex life saving machinery used in hospitals. Alyte is responsible for tens of millions of pounds worth of electronic equipment in her hospital, ranging from simple infusion pumps that deliver medicines to defibrillators that shock peoples' hearts back into life.

Alyte, whose family hails from Lithuania, took an electronic engineering degree because it offered so many job opportunities but became hooked on medical applications when she did some research as part of her degree.

She now works as a clinical engineer in Southampton University Hospital. She evaluates equipment, working out which is most suitable and cost effective for a particular use and provides advice for clinical colleagues – a bit like a one woman 'Which' guide. She maintains a database of all of the hundreds of items of portable and reusable equipment in the hospital, ensuring that they are used safely and that each gets repaired and serviced appropriately. And there is also the trouble shooting needed, when a machine is working but still not doing a job properly. 'What gives me most satisfaction is knowing that I've done something to ease the burden on clinical staff by improving a process that's ineffective'.

She also has a development role. For instance, a problem with defibrillators is that they need to be pressed hard onto the chest to be effective. So Alyte's team has developed a training device that lights up when the correct pressure level is applied. Problem solving is part of her daily life. A recent example was a paralysed man who wasn't able to use the normal nurses call panel to get help. Alyte's department developed a shoulder switch for him to use.

"What gives me most satisfaction is knowing that I've done something to ease the burden on clinical staff"

Alyte Podvoiskis
Southampton University Hospital NHS Trust

“It’s more about knowing what something isn’t on the screen, than knowing what it is”

Teresa Robinson
University Hospitals Bristol NHS Foundation Trust



Teresa Robinson
Vascular Science

Strokes are the single biggest cause of disability in Britain. But they can be prevented. For instance, it is known that up to 20% of people who have a so called ‘mini stroke’ or TIA (which causes brief slurring and limb numbness) will go on to have a major stroke within 90 days.

Prevention for these individuals relies on a prompt response and on vascular technologists like Teresa Robinson. She arranges rapid evaluation of the patient’s blood flow, particularly in the arteries of the neck. If they are shown to be narrowed, they can then quickly be unblocked using surgery or other interventions, dramatically reducing the chance of stroke. Setting up a ‘one stop shop’ to make sure that every opportunity is taken to prevent a stroke for people who have experienced a TIA, has lately been a particular concern of Teresa.

Vascular scientists use ultrasound to work out what’s wrong with peoples’ circulation and besides looking for problems that might result in a stroke, they also investigate other circulatory problems like deep vein thrombosis and claudication (pain in the leg when walking). She leads a team of eight at the Bristol Royal Infirmary.

Teresa is actually an electronic engineer who was convinced that her future lay in the invention of new machines but she found herself hankering for a job with people. ‘What I do now provides satisfaction on multiple levels’. She loves her contact with patients but also relishes the logic and thinking skills she needs, as well as the science needed for interpreting scans. For many, ultrasound scans seem like a perfect snowstorm on a screen. ‘It’s more about knowing what something isn’t on the screen, than knowing what it is’. This is because ultrasound scanning produces many artefacts and can be misinterpreted without a sound knowledge of the underlying physics. Ultrasound is very widely used, not just by vascular scientists but by ultrasonographers and radiologists too and Teresa teaches both theoretical and practical ultrasound physics to a wide variety of staff groups. For her the job is a perfect mix of science and people.

“For me, it’s my ideal job because it involves patient contact and computing”

Aidan Laverty
Great Ormond Street Hospital for Children NHS Trust



Aidan Laverty
Sleep Physiology

Aidan Laverty uses his computing skills to help children get a better night’s rest. And his job as a sleep physiologist at Great Ormond Street Hospital for Children has even taken him up Everest.

Many of the children that come to this world famous hospital from all over Britain have rare diseases and some, like those with problems affecting their face or neck, have trouble with their breathing when they’re asleep. They may even briefly stop breathing altogether. This wakes them, preventing them getting the sleep they need for rest and growth. Aidan runs the sleep studies unit where each year over 1000 children are monitored overnight while they sleep. As at least 12 different bits of information, such as blood oxygen and heart rate, are collected continuously over an eight hour period – it’s a huge amount of data.

Making sense of all this information is critical, because a precise diagnosis must be made if a child is to be treated successfully. The sleep data also needs to be accessible to staff involved in their care and, because most of these children have been referred from other hospitals, needs to include their referral notes too as well as patient advice. Aidan devised a software package that does it all in one seamless, easy to use web based package. Without it, Great Ormond Street’s sleep unit couldn’t function or assess so many children. Aidan isn’t just locked in a room with a computer screen. ‘I see children every day. For me, it’s my ideal job because it involves patient contact and computing’.

Aidan is also involved with developing web based databases for children with rare breathing disorders and when someone was needed to make sense of data gathered by the Xtreme Everest expedition, including a group of children, Aidan was the man who travelled near to base camp and made it easier.

“We often follow children from a very early age and they stay with us as they grow up. We have a direct effect on their development which is both incredibly responsible and very rewarding. The same is true of adults”

Jonathan Parsons
NHS Devon



Jonathan Parsons
Audiology

Jonathan Parsons has been part of a quiet revolution, helping to transform hearing services for those with hearing problems. He heads an audiology department for NHS Devon based at the Royal Devon and Exeter Hospital but has a national role and influence as a clinical champion for people with hearing loss.

Jonathan entered an NHS training scheme straight from school. It involved rotations through various disciplines but audiology was an immediate attraction. ‘I felt very strongly that I was doing something useful.’ Audiology relies on patients explaining their experience of hearing as much as on specific measurements. Striking up a rapport with patients helps them to do this and audiologists very much enjoy this aspect of their job.

Jonathan’s research has been highly influential. It focused on the way that hearing aids were issued in a pre-digital age. Many patients waited for up to four years for their devices. But his rigorous analysis of a sample of patients from his hospital also showed that the routine practices of this era were not sufficient to ensure that aids were properly adjusted to individual needs in the years after they were dispensed. Taken across the UK, it meant that tens of thousands of people, dissatisfied with their devices, were putting them in drawers and not using them, whilst their hearing loss inflicted increasing social isolation on them. This research was published in an important audiology journal and proved to be a key piece of evidence in the subsequent adoption of digital hearing aids by the NHS. Audiology services became a major focus of the 18 weeks programme (a drive to complete GP referral to treatment in 18 weeks) which meant a great deal of hard work by Jonathan and others, reconfiguring services. Waits are now down to an all time low.

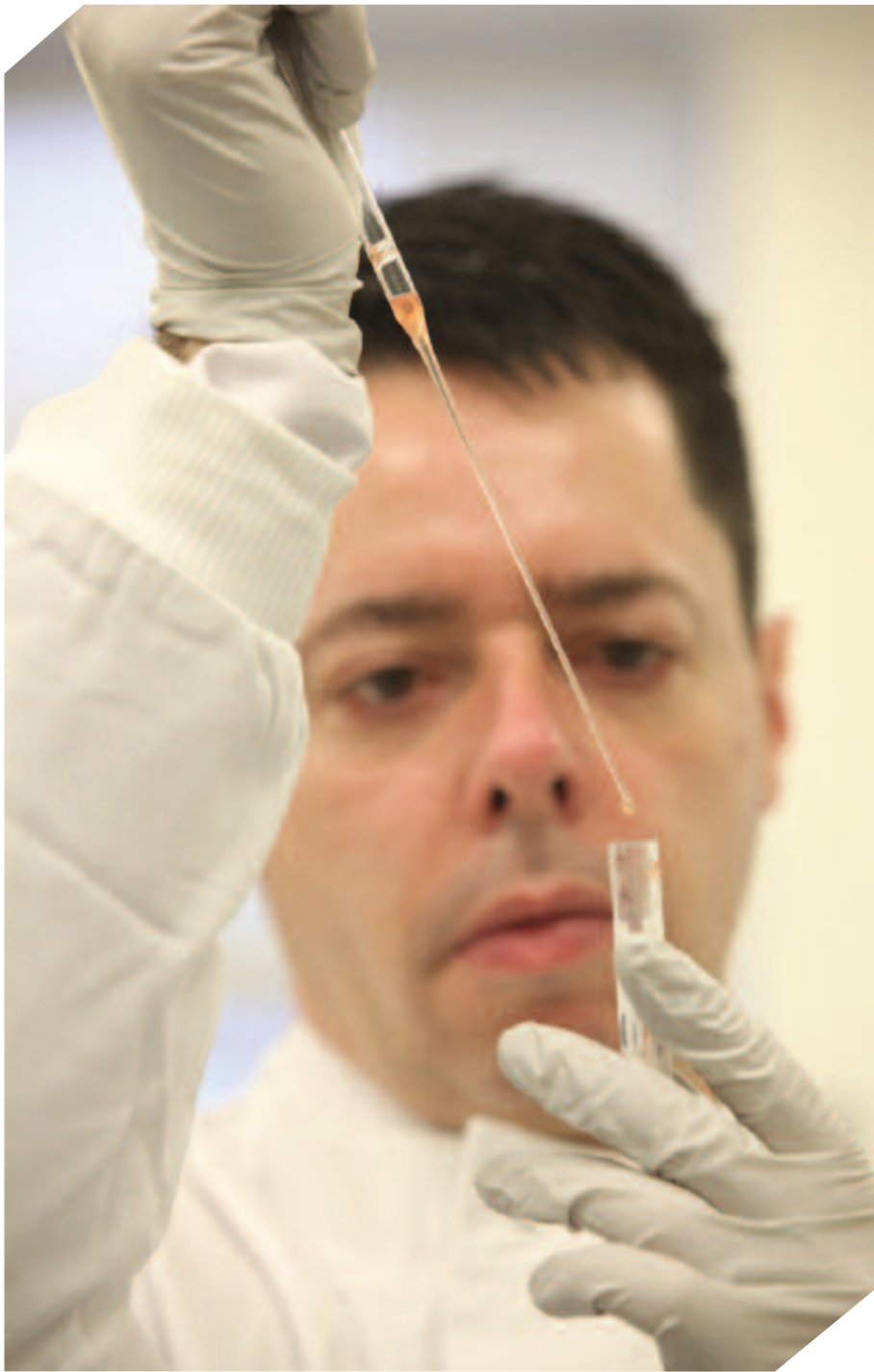
On a national stage, Jonathan is involved in national strategy in procuring digital hearing aids and has become an expert reviewer for NICE. But it is still the patient involvement that motivates him most. ‘We often follow children from a very early age and they stay with us as they grow up. We have a direct effect on their development which is both incredibly responsible and very rewarding. The same is true of adults’.

Dr Dominic Harrington
Haemostasis and Thrombosis

Dominic Harrington joined St Thomas’ Hospital in London when he was only 19. Luck placed him in a laboratory with an inspirational scientist who had become the first person in the world to be able to measure levels of Vitamin K in the blood. This vitamin has several roles but is particularly important in blood clotting. Newborn babies, the very elderly and those with cystic fibrosis are amongst those who may be deficient in Vitamin K and can become critically ill if low levels are not detected and corrected.

Dominic’s job, like that of so many healthcare scientists in the NHS, was to help turn a research finding into something that could be used for everyday patient care. He did this, gaining a PhD in the process. He then set up a ‘Nutristasis Unit’ (the word is his) to investigate and measure the effect of vitamin levels in diet on the function of blood. He and his team of six are constantly developing new tests in response to patient need. ‘For instance, taking blood for testing can be a problem for tiny babies, so we developed a way of measuring their Vitamin K levels in urine’. It was another world first for the unit.

His unit has a global reputation so every day, he spends time talking to clinicians from all over the world who ring for advice; a recent case involved a case where rat poison (which affects Vitamin K levels) was suspected as the possible cause of illness in some children. Their blood was sent to him and he proved that they had been poisoned. He has written many research papers. ‘I’m very proud of the research I’ve published. Your papers live on and they will still be cited and read long after you’ve gone’. He has a special interest in quality assurance – which means making sure that laboratories across the world perform vitamin measurements to the same high standard. ‘I’m very proud of our unit’.



“I’m very proud of the research I’ve published and of our unit”

Dr Dominic Harrington
Guy’s and St Thomas’ NHS Foundation Trust

Dr Sarah Woolley

Director of Healthcare Governance

The Heart of England NHS Foundation Trust serves half the population of Birmingham and is one of the biggest in England. Responsibility for clinical and corporate safety across all its many hospitals including the Birmingham Heartlands Hospital, Good Hope Hospital and Solihull Hospital rests with Sarah Woolley, its Director of Safety and Governance. Sarah is a healthcare scientist by training and believes that it is her science which has been key to her success in this high profile position.

Sarah was passionate about biology through school and university, ending up with a PhD. She became rather disillusioned with research and decided to train as a clinical biochemist in the NHS. But when she looked for a post at the end of her training, none were available in her local area. When she spotted a job advert – clinical governance facilitator – she applied, not really quite knowing what was involved. It turned out to be her dream job to which she was perfectly suited.

Clinical governance is about ensuring safe standards of care. It involves front line liaison with medical staff and requires tact, sensitivity and great people skills. Making sure patients are safe involves at its most basic level, putting systems in place, similar to the standard operating procedures used in a laboratory environment. 'I use all my scientific analytical thinking to do this, but in a different way. Science is the most amazing skill set to have if you're a manager'. Her work also involves recognising and registering problems and errors and conducting accident investigations so that lessons can be learned when things go wrong. Sarah gives an example; 'Hospital at Night' is a project which is about making care safer out of hours. She is working with a wide range of clinicians to improve working practices and implement technology to improve how they prioritise care and look after patients better during these times so they can minimise mistakes.

But there is far more to safety than systems and regulation (of which there is a great deal). It involves behaviour change, in which blaming and defensiveness is replaced by a recognition that only when staff have the confidence to acknowledge near misses (something that the aviation and construction industries do) will a true safety culture be instilled. 'It's an evolutionary process' says Sarah. Today, she actively recruits scientists to her team of 40. 'They have the skills we need'.



“Science is the most amazing skill set to have if you’re a manager”

Dr Sarah Woolley
Heart of England NHS Foundation Trust

“I saw the beginning and end of Meningitis C”

Professor Ray Borrow
Vaccine Evaluation Unit, Health Protection Agency

Professor Ray Borrow

Microbiology

Ray Borrow has an extraordinary job. He evaluates response to vaccines, not just in Britain but right across the world.

It all started with a degree in biology and a job in what was then the Public Health Laboratory Service laboratory in Manchester. The lab had a particular interest in Group C meningitis and Ray began work on the bacteria that causes it – *Neisseria meningitidis*. His research focused on how the body's immune system responds and then develops immunity to this bug. He spotted that there was an opportunity to form a Vaccine Evaluation Unit which, by looking at antibodies in the blood of vaccines, could show if a vaccine was likely to be effective in protecting them from a specific disease. At first the Vaccine Evaluation Unit consisted of just one person – Ray. Now he heads a unit of 33 people for the Health Protection Agency, based at the Manchester Royal Infirmary.

Seeing a vaccine emerge and go into use is deeply satisfying. 'The great thing was that I saw the beginning and saw the end of Meningitis C, from development of the vaccine to seeing the disease virtually eradicated in Britain'.

He has since set up serological assays for a great many other types of vaccination as well as for other bacterial and viral pathogens and his unit undertakes contract research for most of the world's vaccine manufacturers. He also acts as an adviser to the World Health Organisation and spends about a third of his time travelling the globe.

In Britain, long lasting protection against meningitis is provided by so called conjugate vaccines, such as Meningitis C. But in Africa most disease is caused by Group A bacteria, not Group B or C as in the UK. Because there is no commercial market for a Group A conjugate vaccine outside of Africa, the Meningitis Vaccine Project was set up by WHO and other partners to develop one. Over 250 million doses of conjugate A will be produced over 10 years to inoculate all individuals between 1-29 years of age in the continent. Ray has been closely involved from its inception and is set to evaluate its introduction in Burkina Faso next.



“It was what I wanted to do 15 years ago when I took my MBA and now I’ve achieved it”

Dr Diane Crawford
University Hospitals Bristol
NHS Foundation Trust

Dr Diane Crawford

Exceptional Scientist

Pioneering work imaging babies hearts, research, an MBA, evaluation of medical devices and today being one of the few women to head a medical physics department. These are all elements of Dr Diane Crawford's extraordinary life as a healthcare scientist.

Diane Crawford wanted to be a physics teacher but when her friend reported excitedly about the time she had spent in a hospital's medical physics department, she changed her mind. Not that long afterwards she found herself in Sheffield with a research fellowship undertaking work imaging the placenta using ultrasound. She then moved to London to Guy's Hospital, where she became involved in one of the most exciting ultrasound developments of the 1980s. With Dr Lindsey Allan, she helped pioneer the use of ultrasound for fetal heart scanning. What they did was widely believed to be impossible at the time. Their ultrasonic scanning was able to pick up malformations in the heart at about 16-18 weeks. They were able to develop clinical experience relatively quickly, despite most of the conditions they were seeing being rare, because more and more patients were referred to them, from all over Britain. 'I learnt a huge amount about cardiac physiology very quickly' says Diane. It was sobering work as the team often had to break bad news to parents. As the work progressed and their workload grew, the need to train others in the technique became paramount. Diane visited over 60 different hospitals, teaching radiographers, obstetricians and radiologists how to look at the fetal heart using ultrasound, 'I did get to teach after all' she says. Today the techniques that they pioneered are used throughout the world.



Her work in ultrasound technology was highly valued and Diane went to work at the Institute of Cancer Research, where she worked for a number of years developing ways to make ultrasound images 'less snowy'. This is important because ultrasound can sometimes be difficult to interpret. Whilst she enjoyed the intellectual challenge of the work, Diane missed the contact with patients and when, in a major re-organisation she was made redundant by the Institute, she not only opted to relocate to Cardiff but invested her redundancy money in getting an MBA.

For a while she worked outside the NHS for District Audit, part of the Audit Commission which promotes value for money for taxpayers, visiting a wide range of healthcare settings in Wales. 'I went out with district nurses, I went into A&Es, I pretty much travelled the whole of Wales in the process'. She then put this audit experience to good use when she took over (Clinical Engineering Device Assessment and Reporting), CEDAR. CEDAR evaluates medical devices for the UK Department of Health. Essentially it provides information and recommendations on emerging technologies, new devices and interventions, testing and reviewing them.

But the one thing that Diane had not yet done in her career was manage a large science department. 'It was what I wanted to do 15 years ago when I took my MBA and now I've achieved it'. Today Diane is Director of Medical Physics and Bioengineering for University Hospitals Bristol, one of the very few women in the country to hold such a post.

“What attracted me was the relevance of the work to individual patients and the variety of the day”

Mike Hallworth
Shrewsbury and Telford Hospital NHS Trust



Mike Hallworth

Exceptional Scientist

Mike Hallworth is a healthcare scientist who has reached out to the public, not just in the UK but across Europe, establishing the phenomenally successful LabtestsOnline UK which has become the definitive source of patient information on laboratory tests.

Mike's specialist interest has been in therapeutic drug monitoring – measuring the concentration of drugs in blood to help doctors get the right dose for every patient – and also in analytical toxicology, which deals with testing for drugs that have been taken in overdose to ensure that the right treatment can be given. Mike currently is a consultant in the department of clinical biochemistry at the Royal Shrewsbury Hospital but his life could have been very different. ‘Science as a career was a close run thing as I very nearly did arts A levels but I’d always been fascinated by the scientific approach right from doing chemistry set experiments in the cellar in my early teens’. At the end of his chemistry degree he spotted a leaflet from the Association of Clinical Biochemists. ‘What attracted me was the relevance of the work to individual patients and the variety of the day’.

Clinical biochemists spend a great deal of time explaining laboratory tests and interpreting the results both for patients and for other medical professionals. Understandably people are often anxious about test results and have many questions. But given that over a billion lab tests are performed each year in the UK, the need for information is far greater than could be supplied by clinical biochemists. So when in 2002 Mike spotted an initiative in the States involving an explanatory website, he realised the impact that it could have for British patients. He identified a core group of enthusiastic supporters, secured funding and, as Chairman of the project, ensured that its necessary editorial, technological, promotional and financial components were installed and supported.

It was a huge undertaking: for instance LabtestsOnline has nearly 2,000 pages of text, all of which had to be quality assured for accuracy. But it has been fab. Since its launch in 2004, over 6 million people have accessed the site which is constantly updated. The UK site has led to an Australian site and six sites in other countries in Europe being created.

If LabtestsOnline was the only thing Mike Hallworth had achieved, it would be enormously impressive but he did it while doing ‘the day job’ managing a busy department and planning the development of services and new testing strategies for his area. He has also played an important role in the promotion of healthcare science, starting out with ‘Speaking out for Clinical Science’ in the 1990s. He heads a number of important professional bodies and has become the first European to chair the American Association of Clinical Chemistry National Meeting, a conference on a vast scale involving tens of thousands of delegates.

Mike Hallworth was told clinical science would give him ‘variety every day’ back at the beginning of his career, it has certainly done that in spades. But his career also shows the important leadership role that can be played by healthcare scientists, not just on a UK but on a much wider world stage.



“I really enjoy the constant change and the opportunity to travel”

Jenny White
West Herts NHS Trust

Jenny White
External Quality Assurance

The NHS is committed to quality which ensures both safe and effective treatment and a good experience for the patient. This commitment to quality includes laboratory services and Jenny White is one of a small army of scientists and logistics staff within the NHS who assess and ensure this.

Jenny began her career in blood services and was the manager of a transfusion laboratory in London until her first child was born. She was asked if she would cover maternity leave in national external quality assessment for blood transfusion laboratory practice (BTLP) and eleven years on, she is still working at UK NEQAS (BTLP) in Watford, albeit with an expanded role that includes travel all over the world.

Jenny plans external quality assessment exercises on a regular cycle for the 475 blood transfusion laboratories in the UK and a further 200+ overseas, analysing the results from each and investigating the cause of any errors.

People assume that the most dangerous aspect of blood transfusions is transmission of infection. Actually this risk is tiny. The more likely, although still very low risk, is being given the wrong blood because of human error and a major part of Jenny's job is understanding why mistakes happen and researching and writing educational material that will help reduce their number even further. These materials are distributed to all participating institutions and are used by many other professional bodies involved in blood safety.

UK NEQAS collaborates with WHO and this has involved Jenny in organising and facilitating practical and theoretical workshops on blood group serology and quality systems for transfusion in many different developing countries. Jenny also provides external quality assurance to laboratories in other countries. In turn, UK NEQAS also gets quality assessed itself.

Pointing out and preventing errors requires tact and considerable people and collaborative skills. ‘I really enjoy the variety in my job and being able to use my knowledge and experience of blood transfusion outside the laboratory, as well as the constant change and opportunity to travel.’

“I can give a medicine to someone first thing and then be able to see the results by teatime”

Paul Maltby
Royal Liverpool and Broadgreen University Hospitals NHS Trust

Paul Maltby
Radiopharmacy

Paul Maltby is a scientist with a foot in two camps. He is a qualified pharmacist but specialises in radiopharmacy, which used to be the preserve of physicists. He makes and is involved in the clinical use of radiopharmaceuticals, drugs bound to radioactive isotopes which are used for both diagnosis and treatment of a wide variety of conditions.

Most radiopharmaceuticals are injected into patients in tiny amounts and are chosen for their ability to accumulate in an organ of interest, such as the thyroid gland. They later show up as bright spots on a picture produced by a gamma camera. Radiopharmaceuticals are made in aseptic conditions and because they only remain radioactive for a short time, have to be made up freshly. This highly regulated work is all part of Paul's job in the Liverpool Nuclear Medicine Centre. But he is also involved in clinical care, along with the rest of the nuclear medicine team, providing advice and support for the patient. Unlike other drugs, a scan shows exactly where radiopharmaceuticals have ended up in the body. ‘I can give a medicine to someone first thing and then be able to see the results by teatime’ say Paul.

He has been very involved in extending the practice of radiopharmacy and in developing further applications. Paul has become a leading practitioner on the treatment of little known cancers called neuro-endocrine tumours which can arise anywhere in the body. A radiopharmaceutical has been developed which homes in on a specific signature receptor of these unusual tumours. This ‘homing instinct’ is exploited to deliver radioactivity into the heart of the tumours, killing them without harming normal tissue.

Because of their rarity, these tumours and the strange symptoms that they can produce, may be misdiagnosed. Patients are often angry when they are finally diagnosed and receive treatment. The good news however, is that the use of radio pharmaceuticals, developed in this innovative department mean that very few will die as a direct result of their neuro-endocrine tumours.



“It wasn’t until I realised what physics could do for people and how many opportunities it offered that I got hooked”

Professor Wendy Tindale
Sheffield Teaching Hospitals NHS Foundation Trust

Professor Wendy Tindale

Exceptional Scientist

Professor Wendy Tindale started her life in the NHS as the most junior of junior technologists. Today she leads a highly respected large NHS department and also heads a pioneering team who aim to restore dignity to patients with long term health needs.

At 18, Wendy didn’t really know what to do with her science A levels but a chance encounter led her to a job in a department of medical physics in Sheffield, where she was paid the princely sum of £16 a week. ‘It wasn’t until I realised what physics could do for people and how many opportunities it offered that I got hooked’.

At first she was involved in engineering, designing and testing artificial heart valves (the subject of her PhD) but later moved to clinical research and the delivery of scientific services in nuclear medicine. This branch of medical physics uses radioactive isotopes called radionuclides to diagnose a wide range of medical problems. Radionuclides are bound to various chemicals and administered as drinks, injections or even inhaled. The radioactivity emitted is detected and measured over a period of time with a special camera. What nuclear medicine scans do best is highlight the function of tissues and organs, showing actively dividing tumours for instance as bright spots. For accurate location, MRI or CT scans are better. Wendy has been involved in research to combine PET scanning with other imaging to get the best of both worlds. Its called multi modality scanning and the machines that use it are now in use in the NHS. They produce stunning images which can be used to spot disease at a very early stage. They are set to revolutionise diagnosis in the coming years. ‘I’m proud that I was able to contribute to the introduction of multi modality imaging in the UK’ she says.

But it is recent developments that have Wendy most excited. ‘Healthcare scientists can maximise the impact that science can bring to patient care, both at the coal face and through the development of new technologies’. Recently money has been made available by the National Institute for Health Research to help patients with unmet needs; people with unglamorous conditions and chronic ill health, who are often older and poorer than others. ‘We want to deliver innovative medical devices that restore their dignity and independence’.

Wendy leads a pilot Healthcare Technology Co-Operative called Devices For Dignity. It’s opened her eyes to the everyday problems faced by patients such as washing, dressing and using the toilet. How do you wipe your bottom if you haven’t got full use of your arms? Appalled by the indignities this imposes on patients, she’s now a woman on a mission to develop not just a better bottom wiper but a whole range of other new pieces of equipment. Devices for Dignity uses all her skills: her science and engineering knowledge, her personnel skills in managing a large team and particularly her communication skills. She needs to involve patients in development, scientists in research and persuade manufacturers and health trusts to make their devices more widely available. She will succeed without doubt.

Nuthar Jassam

Clinical Biochemistry

Science came naturally to Nuthar at school and after a chemistry degree in her native United Arab Emirates, she worked in the pharmaceutical industry. But on a visit to Britain, she fell in love. She then married and came to live in Leeds. But her life as a stay at home mum to their two children changed dramatically when her husband developed a chronic heart condition and was no longer able to work.

She urgently needed a job so she took a diploma in medical laboratory sciences and started work as a trainee clinical biochemist in Leeds General Infirmary. It was a time of enormous pressure, because she was also caring for her husband. 'I rarely got more than four hours of sleep at a time'. She took exams to gain an MSc degree as her husband lay critically ill in intensive care, waiting for a transplant. He died not long afterwards.

Nuthar has now been working as a clinical biochemist in Leeds for eight years. She loves her job. 'Test results are often complex and my job is to interpret their meaning. People think scientists are locked up in laboratories but I attend ward rounds and spend a lot of time talking to doctors and to patients which I really enjoy. I'm a detective. I look for patterns and link them to information about symptoms from doctors to arrive at a diagnosis. It gave me great satisfaction recently when I was able to diagnose a very rare metabolic disease in a patient with puzzling symptoms. It saved the patient from having much more invasive tests. Even more satisfying was remembering two other patients with similar problems that we were able to prove had the same condition.' Her husband would be very proud.

"I'm a detective. I look for patterns and link them to information about symptoms from doctors to arrive at a diagnosis"

Nuthar Jassam
Leeds Teaching Hospitals NHS Trust



"I love the feeling that you are making a difference with what you're doing"

Dr Richard Billings
NHS South Central

Dr Richard Billings

Education Commissioning Manager

Richard Billings' job involves looking into the future. He has to decide what training programmes to put in place today to meet the needs of patients and the NHS in three or four years time.

Take one example. A rising birth rate means that there is a greater demand for obstetric sonographers – people who use ultrasound to look at the baby as it is developing in the womb. To meet this demand, more people must be trained to do this important job, which means more education courses. These must be developed with Universities so that they not only attract able students but also contain all the right training elements to students for practice when they finish the course in three or four years time. And of course, all the while, fast moving developments in technology must be kept in mind.

Richard Billings is perhaps uniquely qualified to do this tricky job. After a brief fling with agriculture, he found himself working as a scientist in clinical neurophysiology – the measurement of nerve signals in the brain and elsewhere in the body. A PhD followed but Richard moved from his clinical work into education and became a lecturer and then head of school at City of Westminster College, which is an Associate of Middlesex University. Under his direction, the school became the largest provider of clinical physiology degrees in the country. He also co-edited the standard textbook for neurophysiology technology, working with two legendary figures in the field.

But now, as an Education Commissioning Manager for one of England's ten Strategic Health Authorities, NHS South Central, he sits on the other side of the fence. Instead of putting on degrees, he is commissioning them. He works closely with Universities and has developed extensive professional networks which give him constant feedback on the skills of new trainees. This is vital information as commissioning is only part of the story. Maintaining high standards and ensuring that courses continue to meet needs is critical too. 'I love the feeling that you are making a difference with what you're doing'.



Dr Don Henderson

Exceptional Scientist

Don Henderson has a major role managing the diagnostic clinical immunology laboratories for the Imperial College Healthcare Trust, but he is also passionate about bringing science to young people.

Don came to immunology when it was a science in its infancy – which is not that long ago. He first became intrigued when working with trypanosomes, the parasitic single celled animals that cause sleeping sickness. Somehow, they manage to evade the body's defences whilst other organisms get pounced on immediately. How the immune system works – or is fooled – has fascinated him ever since.

For some years, Don worked in the NHS in his native city, Glasgow. Research formed the major part of his work, with only a small amount of clinical work. 'To be honest, there were relatively few services that we were able to offer then'. He remembers counting T and B cells (key components of the immune system) individually down a microscope. Today machines called flow cytometers count 10,000 immune system cells in a minute. He then left the NHS, first to work in cancer research and later in industry where he was involved in developing vaccines to prevent allergy.

He returned to the NHS and to one of the most exciting and vibrant places an immunologist could be at the time - the Westminster Bone Marrow Transplant Service. Its charismatic leader, Professor Jack Hobbs performed the first bone marrow transplant for inherited disease in Britain and also set up the Anthony Nolan fund.

Don, who has published extensively, has his own place in medical history. He and his colleagues introduced a service which allowed women who had HIV positive partners to conceive with a greatly reduced chance of HIV transmission to either them or their baby. It was called 'sperm washing' and none of the women who conceived this way were infected.

Today Don continues to undertake some research but also runs an immunology 'super site' which brings together all the immunology services of the different hospitals in the Imperial College Healthcare Trust. There are three principal laboratories each associated with an academic research department with an international reputation and each with a different specialist immunological focus. Hammersmith Hospital, for instance, where the histocompatibility and immunogenetics service is based undertakes kidney and bone marrow transplants. Charing Cross is the major centre in Britain for autoimmune rheumatoid arthritis, whilst the Chelsea and Westminster is known for its work on HIV infection and also with adults and children with inborn or acquired immune disorders. The laboratories are intensely busy, and Don and his team must constantly find new solutions to problems, developing cutting edge technologies and tests to answer patient need.

In 2003, Don was asked by his Trust to help in recruiting local people to work in the NHS scientific services. The focus was intended to be on adults but Don felt that a passion for science began in the classroom. And so began his annual school science conference, showcasing the work of healthcare scientists, with its hands on demonstrations and talks for some 400 local children. 'Every year I say I'm never going to do it again but the response is so positive and so wonderful that I think 'I must do it again'. The conferences are not only stimulating for young people but also for the healthcare scientists they involve, encouraging them to do more outreach work themselves'.

James Lowell

Anatomical Pathology

'When I tell people what I do, there are one of two reactions. Either they go all quiet or they can't stop asking me questions'. Perhaps that's not caring for the dead.

James never knew such a job existed until he happened to meet the man who was to become his head of department. He thought it sounded interesting and 13 years later, having done his training 'on the job', is now Operations Manager in the Directorate of Cellular Pathology at St Thomas' Hospital London. 'We're there for the deceased. We are their advocates,' says James. He assists during post mortems, undertakes intricate dissections for samples, removes and weighs organs during autopsy and prepares the deceased for viewing by people's families. Everything he does must be carried out with the utmost respect and dignity.

The other side of his job is working with the bereaved, answering their questions and sorting out the mountain of paperwork needed following a death. For instance, no less than nine Government departments have to be separately notified of a death. But now James' team is working on an innovative bereavement notification project which will mean someone like him can work with the bereaved to complete and submit just one simple online form instead.

There are many extraordinary aspects to his job. He occasionally works closely with the police and forensic pathologists in suspicious cases and has been involved with disaster response in London when there are many deaths, setting up temporary mortuaries and helping with identification. He has special training for dealing with hazardous examinations, typically necessary when people have been contaminated with large quantities of ingested toxic chemicals. Working in London also means that he and his team frequently have to liaise with airlines and embassies to assist with the repatriation of people who for example, have died whilst on their trip here.

'All death has its distressing points and you have to have the right psychological make up to do this job but it's a great job. You really feel that what you are doing is helping bereaved people'.

"You really feel that what you are doing is helping bereaved people"

James Lowell
Guy's & St Thomas' NHS Foundation Trust



"Every year I say I'm never going to do it again but the response is so positive and so wonderful that I think 'I must do it again'"

Dr Don Henderson
Imperial College Healthcare NHS Trust

“We know that we could have a massive impact and revolutionise the early diagnosis of disease”

Professor Nicholas Stone
Gloucestershire Hospitals NHS Foundation Trust



Professor Nicholas Stone

Exceptional Scientist

A revolution in diagnostics is on its way and Dr Nick Stone is leading the charge of the light brigade. His research area is biophotonics, an exciting technology which harnesses the power of light to diagnose and treat disease. Nick is unusual in that he locates his cutting edge research not in an academic department but in a district general hospital in Gloucester, something which testifies to the flexibility of careers in the NHS.

Whilst completing a degree in physics, Nick found himself working at British Aerospace but it wasn't what he wanted to do. 'I didn't want to spend my life building missiles. I wanted to do something more worthwhile'. He was interested in the application of physics to medicine and took a further degree becoming intrigued by the medical possibilities of non-ionising radiation which includes radiowaves, microwaves, heat and light which in low doses is harmless.

But how could light be used to diagnose disease? When light enters body tissue, some of it is scattered rather than reflected, a phenomenon called Raman scattering. The exact way that it is scattered depends on the type of tissue which has been hit by the light, with each tissue having a specific 'signature' of scattering. A device called a Raman probe can measure this effect and Nick and his team have built up a library of signatures which allows them to tell which, for instance, are cancer cells and which are normal cells at a particular point.

They have already been using their technology in people who have cancer of the oesophagus which is increasing and currently has a poor prognosis. The team are now working with local surgeons, using Raman probes during surgery on the oesophagus, to quickly check that all the cancer cells that should be cut out, have been cut out. But their main focus is on developing a way to check the oesophagus for the earliest signs of cancer by shining a light on the end of a long telescopic tube into it.

Another use is in breast cancer. Normally during breast cancer surgery, one of the lymph nodes in the armpit has to be removed and checked to see if the cancer has spread. This is invasive and takes time. Using light to check the presence of cancer cells in lymph nodes would be much quicker and non invasive. Early trials show that the technique works but months, and perhaps years, of checking and double checking their results lie ahead before it can be made more widely available.

'It may soon be possible to shine light through the whole body as a means of diagnosis' says Nick. The field is enormously exciting. 'We know that we could have a massive impact and revolutionise the early diagnosis of disease'.

Nick and his group are international leaders in this field. They have established a multi-disciplinary group of surgeons and scientists from a wide range of disciplines and attract many millions in grant funding. Nick also teaches at the Cranfield Post Graduate Medical School which has many links with his group. He does all this in the beautiful Cotswolds countryside. It's light years away from most peoples' image of the NHS.

List of Specialisms

The healthcare science workforce consists of some 45 different specialisms. All involve the application of science, technology, engineering or mathematics to health. Traditionally, specialisms have been divided into three broad areas: life sciences, physical science and engineering and physiological measurement. But rapid advances in science and technology and changes in patient needs are beginning to blur the lines between these divisions. Specialisms too are changing, with new ones emerging.

Specialisms involving biological sciences

Those applying **biological (life) sciences** may work in pathology and genetics clinical laboratories where they analyse blood, tissues, cells and other body fluids, describing abnormalities and interpreting what this means for people who are ill. They may work in services such as NHS Blood & Transplant where they provide a vital service in producing and quality assuring blood and blood products for use in transfusions or in the Health Protection Agency where they provide a specialist public health function, for example in monitoring infectious disease outbreaks or identifying responsible strains.

Specialisms include:

- Analytical toxicology
- Anatomical pathology
- Blood transfusion science
- Cervical cytology
- Clinical biochemistry
- Clinical embryology
- Clinical immunology
- Electron microscopy
- External quality assurance
- Haematology
- Haemostasis and thrombosis
- Histocompatibility and immunogenetics
- Histo and cytopathology
- Molecular and cytogenetics
- Microbiology including mycology
- Phlebotomy
- Tissue Banking/transplant
- Virology

Specialisms involving physiological sciences

Those applying **physiological sciences** work in services which assess the functioning of major organ systems such as the heart, brain and lungs and the impact that disease or treatment may have on them. They may also work in services that have a specialist restorative or rehabilitative focus for example, in taking over the work of the heart and lungs in open cardiac surgery, or in helping people who have respiratory failure, sleep disorders, hearing loss, or who have heart problems requiring pacemakers. Increasingly they may work in the community.

Specialisms include:

- Audiology and Hearing Therapy
- Autonomic neurovascular function
- Cardiac physiology
- Clinical perfusion
- Critical care science
- Gastrointestinal physiology
- Neurophysiology
- Ophthalmic and vision science
- Respiratory and sleep physiology
- Urology and urological measurement
- Vascular science

Specialisms involving physics and bioengineering

Those that apply **physics and bioengineering** may work in medical physics where they ensure that x-rays and other imaging services such as MRI and ultrasound are safe to use on people, and in monitoring levels of radiation to make sure they are kept within the correct limits. They also provide specialist treatment planning and protective moulds for radiotherapy. Others bring their knowledge of materials science, computing and engineering techniques to provide innovative individual patient solutions for those with disabilities or loss of function caused by invasive and degenerative disease, burns and strokes as well as in developing novel and innovative ways of measuring and monitoring disease.

Specialisms include:

- Biomechanical engineering
- Clinical engineering
- Clinical measurement
- Diagnostic radiology including MRI
- Equipment management
- Maxillofacial prosthetics
- Medical electronics
- Medical engineering design
- Medical illustration and clinical photography
- Non ionising radiation
- Nuclear medicine
- Radiopharmacy
- Radiation protection and monitoring
- Radiotherapy physics
- Rehabilitation engineering
- Renal technology and science
- Ultrasound

For more information on how to become a healthcare scientist working for the NHS go to:
www.nhs Careers.nhs.uk

For more information on healthcare science including Modernising Scientific Careers, please go to:
www.dh.gov.uk/cso

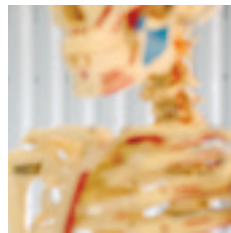
This is just a tiny snapshot of the extraordinary work of scientists within the NHS. What they do is always changing. Their work is constantly evolving as science and technology advance at an ever faster pace.

They are at the forefront of innovation providing newer, better, safer ways to care for the patients who are at the centre of everything they do. The future of the NHS is in their hands.

Many thanks to all who made this book possible:

Writer: Vivienne Parry

Photographers: Antony Medley, Jim Forrest, Giles Barnard, Michael Cooper and Claude Fisicaro



This gem of a book tells the fascinating, heartwarming stories of Britain's healthcare scientists. Extraordinary jobs. Extraordinary science. Extraordinary journeys.

Working behind the scenes in your NHS, they go the extra mile to make a difference for patients.

Ingenious, world leading and often unsung, their stories will inspire and humble.

