Towards a better future

York researchers fighting disease and improving healthcare
These are challenging times for everyone involved in health research. Over the next few years, the Government’s proposed reforms of the NHS will produce a radically new environment for us to work in. While the proposals to transfer responsibility for commissioning healthcare to general practitioners may have captured most of the headlines, there are both potential threats and potential benefits in the wider proposals for those involved in research. When legislation is enacted, based at least in part on the Government’s White Paper on NHS reforms, this new landscape for researchers will emerge.

It will contain some of the potential threats, including the emphasis on cost-cutting and competition between providers, which could reduce investment in research and development. R & D inevitably costs money but does not necessarily lead quickly to savings - there can be a long time gap between basic science research and changes in patient care. Furthermore, some services such as hip and knee replacement surgery could be hived off to organisations unwilling to invest in research and development.

Nevertheless the reforms may have benefits too – they could stimulate health researchers to evaluate new initiatives such as near-patient testing in general practice rather than hospitals, medicines management initiatives to reduce prescribing, and more integrated services such as psychological treatment teams based in practices. The Government’s proposals could also stimulate research to support commissioning, including the better assessment of health needs and more focused searches for cost-effective interventions.

We can be reassured that some safeguards are built into the Government’s plans. The NHS Commissioning Board and the independent regulator Monitor will have an obligation to promote research investment by NHS service providers, and funding for the National Institute for Health Research and Medical Research Council has so far been protected. Meanwhile, the comprehensive spending review has committed to reducing bureaucracy that delays research.

Comment

TONY KENDRICK, PROFESSOR OF PRIMARY CARE AND DEAN OF THE HULL YORK MEDICAL SCHOOL, ASSESSES THE GOVERNMENT’S PROPOSED NHS REFORMS AND THEIR POSSIBLE EFFECTS ON RESEARCH AND EDUCATION

The Government’s healthcare reforms also pose a challenge for those of us involved in education and training. Separate proposals will establish new 'skills networks’ among NHS employers, which will have the responsibility of agreeing regional educational and training arrangements and target numbers for the healthcare professions locally. While the aim is to increase the responsiveness of education and training to the needs of NHS employers, there are risks that locally agreed arrangements might fail to reflect the need for training of specialised healthcare workers represented in very small numbers in any one area.

As with research, the emphasis on cost-cutting and competition between providers is a potential threat to investment in education. Independent sector providers may not wish to take on the costs of hosting students and trainee doctors and other healthcare workers. On the other hand, since...
trainees themselves provide services while training, an incentive remains for providers to take part, at least in postgraduate training.

In responding to the Government’s consultation, strategic health authorities (SHAs), universities, the Medical Schools Council and postgraduate deaneries all emphasised the need for national oversight of training numbers for both medical students and specialist medical trainees. In particular, there was a recognition of the importance of ring-fencing the multi-professional education and training budget and that all providers of NHS services should take part in education and training.

It is possible the proposals could stimulate the development of new types of professionals for more integrated services based in the community, and there is likely to be a need for more education and training in commissioning. Instead of employer-led skills networks, the latest proposals foresee Local Education and Training Boards, including representation from higher education institutions, replacing the SHAs. They will have the responsibility of promoting more multi-professional and interdisciplinary education and training. Postgraduate deaneries will be preserved, and remain within the NHS, rather than move into universities, though we await more detailed proposals.

The next few years will be fascinating times. Most interesting will be whether the proposed changes stick for any length of time. The NHS has been reorganised around 15 times within the last 30 years, and the only constant has been its organisational instability. Fundholding and practice-based commissioning were not around long enough to see their full impact. GP commissioning consortia will need time to make improvements to services and it is hoped that research and education will not suffer in the meantime.

Professor Tony Kendrick was appointed Dean of the Hull York Medical School (HYMS), in autumn 2010. His brief was to attract leading researchers who can make a real contribution to science and a real difference to patient care in the future. Before he joined HYMS, Tony was Associate Dean for Clinical Research at the University of Southampton and co-director of a research network in Hampshire and the Isle of Wight. His research over 20 years has been influential in changing how primary care practitioners address mental health issues. Then, as now, he continued to practise part-time as a GP.
Finding answers to the tough questions

York leads the way in applied health research, yielding real benefits to society

The University of York is recognised as one of the premier universities for applied health research and our expertise is used by governments and agencies across the world. Trevor Sheldon, Professor of Health Services Research, traces York’s journey, from the inception of the pioneering Centre for Health Economics, to our current position as a world leader in numerous areas of health research.

Governments spend billions of pounds on healthcare, but this doesn’t necessarily translate into improved health. Are these vast sums well used? Do they make as much impact as they could? Are the treatments which are provided effective, safe and worthwhile? Are health services well organised and efficient? Is the distribution of benefits fair? How can we better use these resources for the health and well-being of society?

This is the stuff of applied health research at York, where we ask these tough questions and carry out the research to provide answers – evidence for policymakers, practitioners, providers and patients to make better-informed decisions. With almost 200 researchers, from a variety of disciplines, working in collaboration across departments and supported by our new medical school (HYMS), York is recognised as one of the premier universities for applied health research. We won a 2007 Queen’s Anniversary Prize for the contribution we have made to the way society thinks about healthcare over the past 25 years and York was rated top in the UK for health services research in the most recent Research Assessment Exercise.

At the heart of a large part of our work is the discipline known as health economics, pioneered at York. It provides an intellectual toolkit for those concerned with making difficult decisions about the choice of treatments and the way services should be organised, funded...
and monitored. York’s Centre for Health Economics (CHE) is the largest and best known group in the world, founded almost 30 years ago. Working with colleagues in the Department of Economics, CHE remains at the forefront of the development of new methods and their application for the benefit of society.

York health service researchers developed the first ever national cancer guidance which has helped improve quality of life and reduce death rates from common cancers. Researchers also informed the development of national clinical guidance in areas such as mental health services, wound care and substance abuse. The dissemination of research showing unnecessary operations for glue ear in children and extractions of wisdom teeth led to dramatic reductions in these procedures. York’s work has also led to cost-effective interventions being more widely provided such as the introduction of flu vaccination for all those over 65, the increased use of cognitive behavioural therapy (CBT) and other psychotherapies for anxiety and depression, CBT and graded exercise therapy for chronic fatigue syndrome, and compression bandaging for venous leg ulcers, so improving the lives of many thousands of people.

We also need to ensure that healthcare organisations are using resources wisely and performing well. York health economists have made a central contribution to the measurement of health service performance and productivity, advising the UK government, the World Health Organisation and the OECD. Early work, for example, led to service improvements such as reduced waiting times. Recently we showed that, if the NHS was as efficient across the country as in the best-performing area, then it could save £3.2bn without reducing the level or quality of care.

Many of York’s healthcare and public policy research groups are located in the Seebohm Rowntree building.

RESEARCH FUNDING

- Over half of York’s competitively won research funding is related to health and medicine.
- In 2009/10, the University of York received research funding from around 50 health-related sponsors, including government departments, major national and international charities and healthcare companies.

STAFF

- Around a quarter of York’s academic staff work on health- and medicine-related research.

GLOBAL RECOGNITION

- York’s work on the economic evaluation of medicines (pharmaco-economics) has the highest number of articles and citations globally.
- Three quarters of the research published by York in the fields of health economics, health sciences, nursing and midwifery is classed as either ‘world-leading’ or ‘internationally excellent’.

AWARDS

- The Centre for Health Economics is proud to be the recipient of a Queen’s Anniversary Prize for the contribution to the way society thinks about healthcare over the past 25 years.
- Health Sciences was voted the top department in the country for nursing in The Good University Guide 2011 rankings.
- York was rated top in the UK for Health Services research in the most recent Research Assessment Exercise.

York's Vice-Chancellor, Professor Brian Cantor, and former Director for the Centre for Health Economics, Professor Peter Smith, receive the Queen's Anniversary Prize in 2007.
Publicly-funded healthcare systems should use their limited resources fairly as well as efficiently. York has played a prominent role in developing the mechanisms to ensure a fair allocation of central government healthcare funding to localities. Formulæ based on our work are used to allocate the bulk of NHS funds, ensuring that areas with greater needs receive adequate resources. CHE is currently investigating the determinants of individual patient expenditure to inform how funds are allocated to GP practices.

In order to help ensure that the powerful analytical tools of health economics are used more widely in the healthcare sector, the University established the York Health Economics Consortium (YHEC). Celebrating its 25th anniversary, YHEC provides consultancy and research in health economics to the NHS and the pharmaceutical and healthcare industries.

The twin issues of ‘what works’ and ‘what is worthwhile paying for’ lie at the heart of most applied health research at York. Clinical practice and health policy often reflect tradition, fashion or vested interest, resulting in poor or inefficient care. York has been a leader in promoting evidence-based healthcare, in which policy and practice are more explicitly informed by the evidence base. Researchers in the Centre for Reviews and Dissemination, the Hull York Medical School and the Department of Health Sciences conduct systematic reviews, taking stock of the knowledge base so that policymakers, practitioners and patients can get access to comprehensive and unbiased information.

The York Trials Unit in the Department of Health Sciences carries out rigorous randomised controlled trials to evaluate a wide range of clinical and social interventions (in areas such as addiction, wound care, mental health services, maternity services and complementary therapies) and runs a research design service for the region. A key feature of applied health research at York is the priority attached to influencing thinking and changing practice through the dissemination of approaches and findings. In the 1970s, we pioneered the development of health economics in the UK and internationally, and played a leading role in fostering a wider national interest in the topic. Almost 30 years later, the University remains at the forefront of applied research, teaching and policy applications of health economics and other aspects of health services research, with a distinguished national and international reputation.

The Centre for Health Economics

York’s interest in health research began with the founding of the Centre for Health Economics in 1983, now led by Professor Maria Goddard. “Health economics used to be thought of as a form of accountancy and health economists as heartless people obsessed only with cost-cutting,” she says. “It was viewed with suspicion, especially by doctors, and its sphere of influence beyond academia was limited. However, it has come a long way and has emerged from the dark to take a leading role in decision-making in key areas of policy and practice.”

When scientists at the Yorkshire Cancer Research Unit in the Department of Biology discovered a novel method of isolating prostate cancer stem cells, it represented a significant step forward in tackling a disease which is diagnosed in 36,000 men a year in the UK leading to more than 10,000 deaths annually. The Unit is now a world leader in reliably isolating these cells directly from prostate cancer patients, and its work has been validated by a panel of international cancer experts.

Prostate cancer stem cells are widely regarded as the ‘root’ cause of all prostate cancers in men. The new method of isolating them allows scientists in the YCR Cancer Research Unit to explore the exact molecular properties that allow prostate cancer stem cells to ultimately survive, spread and resist treatment.

The YCR Cancer Research Unit team, led by Director Professor Norman Maitland, is studying the DNA sequence of prostate cancer stem cells to discover important missing pieces in the cancer jigsaw. Yorkshire Cancer Research, which supports the Unit, has awarded the University £2.15m to fund the research programme for a further five years.

This image of a 3D mini-organ demonstrates how a stem cell can give rise to a secretory cell in the prostate gland. The original stem cells are not red, but have been engineered to contain a jellyfish gene. Only when the cells become secretory do they express the jellyfish red fluorescent protein. This is known as ‘lineage tracking’ and can now be carried out in the YCR Cancer Research Unit’s laboratory to model the process inside the body.

Photo by Dr Davide Pellacani

Professor Maria Goddard

Photo by Dr Davide Pellacani
In co-operation with York-based drug development company, Pro-Cure Therapeutics, the Unit aims to make a new generation of drugs to specifically target prostate cancer stem cells.

“We have developed the means to obtain stem cells specifically from prostate cancers, now the most commonly diagnosed cancer in men,” says Professor Maitland. “The properties of prostate cancer stem cells do indeed suggest that they form this treatment resistant core. Instead of blindly applying current treatments, and hoping that some of them will hit the stem cells, our biology-driven approach seeks to develop treatments based on understanding the cancer stem cells.”

Professor Maitland says his team employs several different strategies to explore the molecular properties that allow the cancer stem cells to survive and resist treatment.

“We are using the knowledge gained from the human genome project to look at the DNA sequence of the cells and, more importantly, to find any missing pieces from the sequence. We are also examining the arrangement of the proteins that coat the DNA and how they are modified – a gene control mechanism known as epigenetics,” he says.

Working alongside Professor Maitland is Dr Anne Collins who was instrumental in isolating the cancer stem cells. She is now developing laboratory models of prostate cancer to test current and new treatments including radiation and drugs on cancer stem cells. Using these methods the team hopes to identify survival mechanisms of the cancer stem cells so it can develop a new generation of treatments to undermine and kill them.

“Based on our stem cell technology, these models are much more representative of real human disease than those currently used to develop therapeutics. They offer the prospect of patient-specific medicine to predict exactly how individual patients will respond to often toxic treatments,” explains Professor Maitland.

Yorkshire Cancer Research Science Liaison Officer, Dr Kathryn Scott, says, “Ultimately, these findings will result in new therapies to target these persistent cells. It is no wonder that the independent review from a panel of international experts rated parts of this work as truly outstanding, a rating given to only the top one to two per cent of research applications.”
Raising Artemisia

Traditional farming meets plant science to develop an anti-malaria wonder plant
York researchers are gearing up to deal with a massive surge in demand for Artemisia annua, the medicinal herb that could help eradicate malaria.

More and more African countries are gathering momentum to tackle malaria, the disease which claims almost a million lives every year — and now experts predict an imminent spike in demand for artemisinin, the medicinal compound which is integral to the fight against it.

“We’re working to really tight deadlines, which can be very demanding,” says Professor Dianna Bowles, Co-Investigator on the project being carried out in the Centre for Novel Agricultural Products at York. “We can’t afford to take it easy, because demand for malarial treatments is higher than ever and we’re anticipating a peak in the next two years.”

Artemisinin is extracted from the medicinal herb Artemisia annua. But while demand for treatments has soared in recent years — from 11 million in 2005 to 229 million last year — yields remain low and planting areas for Artemisia have declined.

Options for synthetic manufacture are being explored, but the process is slow and the need is urgent. So the focus of Professor Bowles and her colleagues is in developing new varieties of the plant which are better able to meet the needs of African countries in the coming months and years.

Traditional plant breeding techniques have long been used to identify desirable traits and produce new, more successful hybrid plants. Since 2006, scientists at York have been accelerating and enhancing these traditional techniques based on an increasingly detailed understanding of the Artemisia genome.

A major breakthrough came last year, when the CNAP team published the first genetic map of Artemisia annua in the journal Science. The map plots the location on the plant’s genome of genes and markers associated with high performance, enabling scientists to target valuable traits at an early stage based on each plant’s DNA.

As a result, progress on the project is accelerating dramatically with the planned distribution of hybrid seed in time for the 2012 growing season. “We aim to get high-yielding seed to farmers in the next two years,” explains Professor Bowles, “and we couldn’t do that without this kind of in-depth understanding of Artemisia genetics.”

With the help of the map, the York team is now able to choose the most promising individual plants for breeding experiments according to their genetic profile as well as traditionally identifiable characteristics such as biomass. For example, plants are selected if they have positive scores for key traits such as leaf area and artemisinin content.

Selected plants are crossed to produce experimental hybrids, the best of which can then be chosen for extensive field trials in Africa and Asia. In these regions, Artemisia is an important income source for tens of thousands of small-scale growers, so that countries at the forefront of the fight against malaria can contribute to their own national health. Trials are run in partnership with local artemisinin-producing companies, and the Swiss not-for-profit organisation Mediplant is also field-testing hybrids identified at York.

Early results have demonstrated that the best plant lines from the Centre for Novel Agricultural Products outperform both local and elite varieties. “It’s important that we roll out this technology to developing world countries as rapidly as possible,” says Professor Ian Graham, Co-Investigator on the project and Director of CNAP.

“These new plants can make a major and lasting contribution to effective malaria medicines — and our work is an excellent example of how modern plant science can benefit society.”

Artemisia can be grown in rotation or inter-planted with subsistence crops, providing a vital source of extra income to small-scale farmers. Because it needs few inputs and does not require rapid or refrigerated transport, it is suitable for growers who are poorly resourced or located in areas that are remote or have less well developed infrastructure. These farmers often have very few cash crop options. Artemisia production in these regions also enables malaria-endemic countries to contribute to their own national health by producing the active ingredient for the world’s most effective malaria drugs.
Scientist’s nanoscale fight against fatal lung disease

Using gene therapy to take on cystic fibrosis
Over 2m people in the UK carry the faulty gene that causes cystic fibrosis.

If two carriers have a child, the baby has a one-in-four chance of having the disease.

Only half of those living with cystic fibrosis are likely to live past their late 30s.

Over 9,000 people in the UK suffer from cystic fibrosis, an inherited condition that causes chronic lung infections and a life expectancy of just 37 years. Therapies under development at York could transform the lives of people who suffer from this cruel genetic disorder and the vehicle used to deliver them is only a couple of nanometres across.

Professor David Smith’s research focuses on synthetic nanoscience, deepening our understanding of how substances interact at scales smaller than the size of a human cell, and building molecular devices so tiny that four thousand of them could lie side-to-side across the width of a single strand of spider’s web silk.

Professor Smith’s research team in York’s Department of Chemistry has been working on one particular challenge: fixing the genetic defect that leads to cystic fibrosis.

“We know that anomalies in the information encoded in our DNA give rise to a whole range of genetic defects,” explains Professor Smith. “There’s one particular gene that contains instructions for making an essential protein. If that gene is faulty, as it is in people with cystic fibrosis, the resulting protein stops working and so mucus starts to build up around cells. It’s particularly problematic when mucus starts to clog the lungs—they become far more vulnerable to damaging infections.”

As a result, life expectancy for the UK’s thousands of cystic fibrosis sufferers is just 37 years, and current treatments are limited. But Professor Smith thinks we can do better. Recent parallel advances in the sciences of chemistry and microscopy mean that chemists can now design and synthesise nanoscale materials, building unique, self-assembling chemical systems. The aim is to harness these advances to improve treatment for genetic diseases.

“Ideally, if a patient has a particular faulty gene which is causing problems, we should simply be able to insert a replacement fragment of DNA into the patient’s cells with a healthy copy of the gene,” says Professor Smith. “With cystic fibrosis sufferers, for instance, that would prevent mucus build-up and lung damage. But the big challenge is actually figuring out how to deliver the healthy DNA to the target cells.”

Oddly enough, one of the challenges of working on the DNA scale is that it is, on a molecular scale, really rather large. After all, the bonds which are familiar to chemists are just a tenth of a nanometer long—so manipulating systems 20 times this size is never easy.

But the team has already had some significant success. Its recent results, reported in the journal Angewandte Chemie, use chemical synthesis to programme small molecule building blocks with key pieces of information. These molecules assemble into nanostructures with multiple arms which bind to fragments of DNA. These structures effectively bind and protect DNA and then act as vehicles to carry it into living human cells. And the vehicles now being tested at York are far more effective at doing this than the best of their predecessors.

“Having cleared that hurdle,” adds Professor Smith, “the problem we’re now facing is that our systems bind to the DNA too well, and won’t release it properly once they’re inside the target cell! So we’re working on designs which are programmed to degrade when they reach the target. If this approach works, the vehicles break down into small, harmless molecules once they’re inside the cell, and the healthy DNA can get to work.”

This research has been supported by EPSRC and BBSRC and Professor Smith is also the vice-chair of a pan-European highly multidisciplinary research network which focuses on developing synthetic nanosystems with applications in medicine. Within this network, which is part of an intergovernmental framework for European co-operation in science and technology, he has extensive collaborations with research teams in Italy and Germany.
On the brink of a vaccine

Fighting a neglected tropical disease

York’s new Centre for Immunology and Infection has its sights set on leishmaniasis which causes untold misery to hundreds of thousands of people every year.

Among the world’s shanty towns, slums and poverty-stricken rural areas, leishmaniasis, a parasitic disease transmitted by sand flies, causes devastating disfigurement, disability and death in the communities in which it breeds. Leishmaniasis infects 15 million people across 88 countries and results in 100,000 deaths every year. However, because the disease occurs in impoverished environments, and rarely affects high-income people from wealthy western countries, it has been a low priority for drug development companies to find treatments or a cure and attempts to vaccinate individuals have met with little success.

In a recent World Health Organisation report, WHO lists leishmaniasis as one of 17 neglected tropical diseases, among which leprosy, rabies and Chagas disease also feature. It cites these ‘invisible’ diseases as ‘promoters of poverty’ which weaken already disadvantaged populations and impede global development – and calls for the international community to take action. Momentum is growing and recent years have seen governments, donors, the pharmaceutical industry and other agencies make the development of new preventative and therapeutic measures against neglected tropical diseases a major priority.

The new Centre for Immunology and Infection (CII) at York is at the heart of a drive to find effective therapies against leishmaniasis. Professor Deborah Smith, Professor of Molecular Parasitology, Head of the Department of Biology and an OBE since 2010 for services to science, leads one joint project, funded by the Wellcome Trust, which combines the expertise of the pharmaceutical industry (Pfizer) with scientists from York and Imperial College in a new drug development programme. In a second project, Professor Paul Kaye, Centre Director, is leading the drive to develop a new vaccine, working in collaboration with Professor Smith and Professor Charles Lacey (also of the CII), together with colleagues in Germany, Italy and India.
As with leishmaniasis, the older, established drugs used against sleeping sickness are difficult to administer, costly and often have severe side-effects. And with all these parasitic infections, drug resistance is on the increase, hence the urgency to find more effective cures.

“Our research is underpinned by the focus of highly-trained molecular scientists who choose to work on neglected tropical diseases, not necessarily the most glamorous area of current scientific research but work that can really make a difference,” says Professor Smith. “It is this latter ideal that drives many of our research staff – they want to work on a project that they think is important to mankind.”

If their work to find ways to combat these two deadly diseases is successful, the benefits will be widespread and direct, making therapeutics available and affordable to those who need them most in the developing world.

“We provide an intimate link between biology and medicine, rarely seen in long-established medical schools,” says Professor Paul Kaye, Director of the Centre for Immunology and Infection (CII), created by the Hull York Medical School (HYMS) and the Department of Biology at York. CII extends beyond traditional boundaries and links structural biologists, plant molecular biologists, computer scientists and public health specialists. “The strategy is already paying dividends,” says Professor Kaye. “In five years we have won £16m of external research funding including multiple large-programme-style grants to continue this vital work.”

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“The most inspiring part of my work has been visiting these regions,” says Professor Smith. “It’s challenging to see first-hand the problems that come with diagnosing and treating these diseases, and seeing how the work we do can help to address these problems directly.”

In the Centre’s brand new state-of-the-art laboratories at York, Professor Smith spoke of the exciting moment when theory became a reality and the team first identified the unusual structural features of the proteins that could eventually become candidates for a vaccine. The enzymes that modify these proteins are also essential for parasite survival; inhibiting these enzymes opened the door to a new type of drug therapy. “These experiments finally showed that our theoretical plans for drug development could lead to small molecule inhibitors that might prevent disease,” she says.

Her team is also looking at ways to combat human African trypanosomiasis, commonly known as sleeping sickness, and another neglected tropical diseases on the WHO list. They are tracking down those compounds effective at killing the parasites (spread by the tsetse fly) which appear in the first stages of the disease. Also funded by Wellcome, the team is working with the University of Dundee Drug Discovery Unit and the University of Toronto’s Structural Genomics Consortium on this project.

The CII research teams also work in close collaboration with researchers and doctors in countries where leishmaniasis occurs – Tunisia, Ethiopia, Venezuela, Brazil and India to date. “The most inspiring part of my work has been visiting these regions,” says Professor Smith. “It’s challenging to see first-hand the problems that come with diagnosing and treating these diseases, and seeing how the work we do can help to address these problems directly.”

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Professor Deborah Smith

“Pictured far left: leishmania parasites. There are two forms of the disease which is transmitted by bites from infected sandflies. Cutaneous leishmaniasis affects the skin and mucus membranes, giving rise to an ulcer at the site of the sandfly bite which heals naturally, although can leave scarring (above). The more serious form causes fever and liver damage, and can be fatal.

“It’s challenging to see first-hand the problems that come with diagnosing and treating these diseases, and seeing how the work we do can help to address these problems directly”
Managing angina

York research group gets to the heart of the matter
Dramatic results have been achieved in rehabilitation programmes devised by York Cardiac Care Research Group to help patients improve their diet and lifestyle, and slow the progression of coronary disease.

“Our group’s main focus is to develop and evaluate methods of helping patients change their lifestyle, achieve effective self-management of their illness and reduce their risk of future heart disease”

Professor Bob Lewin

A recent review conducted by Professor Bob Lewin of York’s Department of Health Sciences found that over 5,000 more patients received cardiac rehabilitation in 2008 than in the previous two years. This increase is due to a large degree to the research group’s combined efforts to both raise patient awareness about this service, and to help monitor the cardiac rehabilitation levels of service through the annual audit and resulting report.

The group plays a leading role in developing rehabilitation programmes for cardiac diseases. The Angina Plan, a home-based rehabilitation programme, is now running across the UK and is promoted through NHS hospitals, GP surgeries and clinics. The programme includes a self-help goal-setting manual for patients and the distance training of nursing staff to support them as facilitators. The Angina Plan is currently used in 63 NHS facilities, ranging from primary care clinics to rapid access chest pain clinics, and around 1,000 facilitators are now employed on the project.

A randomised controlled trial conducted among 142 patients with newly diagnosed angina, compared the self-managed Angina Plan with a routine, practice nurse-led educational session. Patients following the Angina Plan were found to have 43% fewer angina episodes as well as a reduction in symptoms, including anxiety and depression.

As a result of the study, the Angina Plan is now included in the clinical pathway for the management of stable angina, set by the Scottish Intercollegiate Guideline Network (SIGN). It is also referred to in the European guidelines for the management of stable angina as a programme shown to improve outcomes.

As a clinical psychologist with expertise in cognitive-behavioural treatments, chronic disease management and health behaviour change, Professor Lewin, who leads the British Heart Foundation Care and Education Research Group, has a unique approach to developing effective self-management programmes.

“Our group’s main focus is to develop and evaluate methods of helping patients change their lifestyle, achieve effective self-management of their illness and reduce their risk of future heart disease,” he says. Through various booklets, manuals and multimedia monitoring tools patients are encouraged to set realistic aims about introducing health improving behaviours in their lives, such as a more active lifestyle, better diet and deeper understanding of their condition for themselves and their carers.

Heart disease affects an estimated 2.6 million people in the UK. In response to demographic changes and the growing burden of chronic diseases associated with a western lifestyle, governments around the world have started to focus on improving patients’ self-management of their illness. As a result of this growing trend towards self-management, the research group is involved in both primary research and advising and supporting developments at national and international levels.

Working closely with the British Heart Foundation which is funding a large part of the research, the group has developed and evaluated chronic disease management interventions through randomised controlled trials. For example, another member of the research group, Jill Pattenden, is supervising two British Heart Foundation project evaluations. The first, Heart Matters, is an online lifestyle check programme which aims to support people in adopting healthy behaviour. Over 19,000 people have registered online and completed the check since January 2010. The second evaluation, Hearty Lives, is a major British Heart Foundation programme, designed to reduce health inequalities in 11 deprived areas of Britain.

The research group also runs the National Audit of Cardiac Rehabilitation, linking the majority of the cardiac rehabilitation programmes in England, Wales and Northern Ireland in a patient-level audit of processes and outcomes. It shows locally and nationally what these services are achieving and identifies any problems of inequitable provision for particular sections of the population.

According to Professor Lewin, “Using our data the British Heart Foundation has campaigned very successfully to bring an awareness of the problems of provision to Parliament and the Department of Health, resulting in a number of actions at the policy level; our audit will be able to record if any improvements reach the patients.”
Europe can lead the world on regenerative medicine – but only if we first overcome some significant challenges, argues Professor Andrew Webster of the University’s Science and Technology Studies Unit.

In recent years, biotechnology researchers in Europe have been at the forefront of developing ways to repair damaged organs and living tissues. But the rapid pace of change in the area of regenerative medicine – both here and around the world – is now presenting us with significant challenges,” says Professor Andrew Webster, who co-ordinates the international REMEDiE project.

Working with an international team of researchers from across the humanities and social sciences – the REMEDiE project set out to analyse Europe’s competitive position, the requirements for successful innovation and investment, and the Europe-wide policies that are needed to support them.

“Regenerative medicine is a complex topic, and recent developments are affecting national and international regulators and the scientific, corporate and clinical sectors, not to mention patients themselves. And we’re facing increased competition from China and India, while health biotechnology development is a growing priority for investment in the US.”

“Our REMEDiE project has also developed a unique database which details the patterns of activity within the field of regenerative medicine – one that’s much more robust and accurate than many provided by commercial consultancies. The database is now publicly available online so that policymakers and others can get to grips with the issues.”

The challenge, says Professor Webster, is how to bring together potentially competing political and scientific interests in a co-ordinated way. EU governance in this field is highly fragmented because of differences across member states and the multiple agencies involved.

“These problems aren’t specific to Europe – there are similar issues in the US too, where federal and state-based policies sometimes work in different directions. But within the European Union we’ve engaged with policymakers at national and international levels, including the European Parliament’s Science and Technology Options Assessment programme and the European Commission’s Directorate-General for Research and Innovation, to try to address the issues and what would be needed to develop a unified regulatory framework,” he says.

Data from the final report has been drawn on by the UK government’s Office of Life Sciences/Department of Health in their July 2011 review of regenerative medicine and, in light of this, what policy should be adopted for the future.

Professor Webster highlights the inconsistent procedures in various parts
of Europe governing stem cell and tissue transplants. “We should regulate so-called ‘stem cell tourism’ to Spain, India and China, which can complicate post-treatment monitoring and make it difficult to protect patient rights. In the same vein, we should also address the issue of direct-to-consumer web advertising, much of which is overly optimistic and unsupported by clinical evidence.”

Another question surrounds the level of investment to support innovation in the EU. Given that there is little or no commercial investment in embryonic stem cell technology and limited investment for more conventional cell therapies, coupled with the reduced availability of venture capital, there is a strong argument that public policy support is needed for the emergent European industry to keep it financially viable.

He concluded, “Overall, the potential impact of this field is huge, but there are no clear business or clinical models to make it work. There are uncertainties about how therapies will be delivered, on what scale, and which disease areas will benefit. Until these issues are addressed, progress in this important area of future healthcare will be uneven and its promise will remain unfulfilled, while European researchers will find their strong position in regenerative medicine eroding.”

Read the full report at: www.york.ac.uk/satsu/remedie
The Crescent of Sound allows clinicians to test patients’ spatial hearing in a clinic rather than in a laboratory setting. The apparatus adapts its tests to the ability of the patient — so it can be used for both children and adults, to participants with normal hearing, to users of acoustic hearing aids, and to users of the cochlear implants which are now provided to young deaf children.

Most importantly, the state-of-the-art software produces a report written in plain English, meaning clinicians no longer need to revert to the laboratory to interpret test results.

“One of the challenges of testing hearing in children so young is to keep their attention on the task,” explains Professor Quentin Summerfield, one of the lead researchers on the Crescent project. “To solve this problem, we added display screens to the system which present videos and three-dimensional images. These engage children’s attention and provide rewards when they respond accurately to the challenges presented by the system.”

The Crescent of Sound consists of a semi-circular arc of nine loudspeakers, seven of which have an associated computer-controlled video display. The speakers deliver sounds from different directions to measure the patient’s localisation skills, and can present speech from one direction together with noise from a different direction to create signals of different clarity at the two ears.

One of the main drivers for developing the Crescent has been a recent change in British healthcare policy. “Until recently, NHS guidance recommended that deaf children be given a single cochlear implant,” explains Professor Summerfield. “But now, we can offer them a choice between a single implant and the opportunity to test their hearing more accurately in a clinic.”

Leading UK hospitals are using pioneering technology developed by psychology researchers at York.
implant,” says Professor Summerfield. “But these implants have proven so successful in helping young children to learn language – which is crucial so that children can attend mainstream schools, for instance – that newly updated guidance recommends two implants for each child, one in each ear.”

The research at York was commissioned by Advanced Bionics, a leading manufacturer of cochlear implants for hearing-impaired children. As well as maximising the impact of research by working directly with industry, the development of the Crescent and locating it in hospitals is now providing an infrastructure for further clinical research using Advanced Bionics’s implants.

Unlike acoustic hearing aids, which work simply by amplifying sound levels, cochlear implants actually bypass parts of the ear that are absent or damaged and instead stimulate the hearing nerve directly with electrical signals. Children who have been provided with two such implants, one in each ear, can essentially learn to ‘hear in three dimensions’ – so they know where to look to see who is talking, where to move to avoid hazards and how to understand what’s said to them in noisy environments such as schools.

This change in policy means that clinicians who provide implants to children must measure emerging skills in spatial listening in young deaf children. Until the Crescent was developed, such tests often had to be administered or interpreted in specialist laboratories, rather than in clinical settings.

Production versions of the Crescent of Sound are now being installed at the Royal National Throat Nose and Ear Hospital, the Bradford Royal Infirmary, Addenbrooke’s Hospital, Crosshouse Hospital and St Thomas’ Hospital.
Shining a light on innovation

York’s flagship building, the Ron Cooke Hub, is home to a unique research centre which tackles some of life’s most complex problems.
A major part of the work of YCCSA is to develop novel mathematical, computational and analytical methods and tools for modelling complex systems, a field of enquiry that is crucial to modern healthcare.

Research in this area is characterised by building and refining intricate mathematical models. But reliable modelling of a complex system is an extraordinarily difficult task for an individual researcher or even an individual academic field to tackle. So the Centre brings together some 50 experts from the Departments of Biology, Chemistry, Computer Science, Electronics, Management, Mathematics, and the Stockholm Environment Institute – creating a multi-disciplinary research environment where the toughest problems can be tackled from a variety of perspectives. In this environment, the distinctions between disciplines are creating synergies as scientists learn about each others’ different ways of thinking and working.

Interdisciplinary work at York was recently given a massive boost with the creation of the Ron Cooke Hub, a multi-million-pound investment in infrastructure and resources that lies at the heart of the University’s new campus development at Heslington East. The state-of-the-art building was designed from the outset to encourage interaction and discussion.

“The boost it’s given to our activities is very striking,” reports Professor Reidun Twarock whose research investigates the geometric structure and assembly of viruses. “Now that we work side-by-side with researchers from a range of departments, our interactions are more efficient and more productive, and that sparks new ideas.”

Professor Twarock’s research aims to develop new theoretical tools that enable a better understanding of the mechanisms underlying the formation and infectivity of viruses.

Her team analyses these geometric features with a range of mathematical techniques, and combines the results with tools from biophysics, bioinformatics and computational chemistry to investigate their impact on how viruses form and infect their hosts. The overall goal is to use these insights to inform antiviral strategies that exploit the structural properties of viruses to inhibit their formation and infectivity.

Many stages of the viral replication process, such as the formation and structural transitions of the protein containers that encapsulate the viral genomes, are crucially dependent on the viruses’ geometric properties.

“Viruses have highly symmetrical external shells formed from proteins that encapsulate the viral genome. We have developed a method for encoding the structures of these protein shells that pinpoint the locations of the proteins and the bonds between them,” she explains.

Another benefit of the YCCSA environment is the support it provides for large funding bids. One example is the new Doctoral Training Centre in Combating Infectious Disease through computational approaches in translational science – funded by the Wellcome Trust to the tune of £3.7m. This new programme will break down one major obstacle to developing infectious disease treatment – namely, the extraordinary complexity of disease processes at the molecular, cellular and organism level. The programme will provide PhD-level training to equip the next generation of interdisciplinary researchers with the advanced quantitative skills they will need to tackle these difficult issues. Researchers from Biology, Chemistry, Maths, Physics and Computer Science are all signed up to the programme, which will launch in October 2011 in the Ron Cooke Hub.

In the Ron Cooke Hub, the University’s magnificent new building on the campus expansion at Heslington East, the York Centre for Complex Systems Analysis (YCCSA) unites experts from across the academic disciplines to tackle some of the thorniest problems in medical research, using an interdisciplinary approach which is unique in the area.
Winning the waiting game

Mental health patients are experiencing shorter waiting times and faster recovery rates, thanks to a patient management system developed at York.

For people with mental health problems, being stuck on a waiting list for treatment can be deeply distressing. All the uncertainties associated with waiting can contribute to further deterioration, affecting a person’s health, relationships, work and schooling. The Government took action recently with its Improving Access to Psychological Therapies (IAPT) programme and has found that the York-developed Patient Case Management Information System (PC-MIS) is now the number one choice among health professionals for data collection, in terms of usability and data quality.

PC-MIS is the first evidence-based patient administration system developed in the UK. It is a web-based management information system, developed as a collaboration by the Department of Health Sciences Mental Health Research Group and Health Sciences IT Services with the specific purpose of managing high volume mental health patients, through ‘stepped care’. This process provides psychological therapy at the least intrusive level to the patient initially and, if unsuccessful, interventions are then ‘stepped up’.

PC-MIS was initially trialled at Doncaster NHS Trust as part of a Department of Health programme to provide mental health interventions to large numbers of people with common mental health problems such as anxiety and depression in an efficient and equitable way. A total of 3,996 referrals were managed in the first year and the programme has been shown to provide effective clinical outcomes and outstanding data completeness. Most significantly, waiting times for psychological therapies have been effectively reduced.

There are now more than 8,000 healthcare professionals licensed to use PC-MIS and over 300,000 referrals have been logged by over 60 NHS and other organisations. Following on from this success, a three-year psychological therapy trial using PC-MIS will start soon in Australia.

Byron George of the Department of Health Sciences Department says, “Our research shows that PC-MIS is a cost-effective and efficient tool in patient care. With the Department of Health supporting the programme, PC-MIS has gained a reputation as an excellent vehicle to help improve the well-being and health of the nation.”

A key feature of the system is evidence-based automated alerts which enable clinicians, supervisors and managers to overview clinical decision-making. This leads to safe, fast and efficient management of individual patient pathways through the stepped care process. PC-MIS also collects routine clinical outcomes such as depression and anxiety scores, including those supporting Young Persons, Older Persons, Employment Services and social disorders, processing data from workers and therapists to produce customisable data reports for national key performance indicators, benchmarking and local evaluation.

The team at York continues to adapt and license the product for a variety of organisations, providing an ongoing service of support and development. PC-MIS has demonstrated the ability to produce the highest recovery rates for patients accessing psychological therapy services and has proven to be a clinical success story.
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Research & Innovation
Issue 05 | 2011

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Professor John Local leads York’s research policy as Pro-Vice-Chancellor for Research.

“Our ambition is that research at York is of the highest quality and value to society and tackles questions and problems that are both important and challenging. We will not be constrained by traditional disciplinary boundaries but will continue to research in creative and innovative ways – and have fun while doing it,” he says.

John Local was previously Academic Co-ordinator for the Arts and Humanities and Professor of Phonetics and Linguistics in the Department of Language and Linguistic Science. His research and teaching centred on the organisation of sound systems in languages, speech synthesis and especially the phonetics of talk-in-interaction.

He has just completed an AHRC-funded project on the sequential and linguistic-phonetic design of indirectness in everyday talk and is working on a book on the phonetics of talk-in-interaction. He has collaborated with industrial partners in the UK and the US and served on research council panels and committees. In 2008 he was Chair of the Linguistics sub-panel for the Research Assessment Exercise.

Trevor Sheldon is Professor of Health Services Research and Deputy Vice-Chancellor. He trained in medicine, economics and medical statistics.

Over the last 20 years, he has been active in producing and promoting the use of research evidence in healthcare decision-making. He was part of the team at York’s Centre for Health Economics which developed the basis for formulae used to allocate the bulk of NHS funds, ensuring that areas with greater healthcare needs receive adequate resources. He established the Centre for Reviews and Dissemination, edited the Effective Health Care bulletins and led the production of the first national guidance on the provision of cancer services. Trevor was head of York’s Department of Health Sciences from 1999 to 2004 after which he became Pro-Vice-Chancellor and then Deputy Vice-Chancellor. He will be stepping down from that role to return to research and policy in Easter 2012.

Professor Sheldon has sat on a number of panels for national and international health research funding agencies as well as the 2001 and 2008 rounds of the RAE. He was elected a Fellow of the Academy of Medical Sciences in 2000 and currently chairs a panel for the election of new fellows.