FEATURES
Innovation District
Ovarian Drug Discovery

FEATURES
Transforming Gastric Conditions
Model Solutions to Bone Disease

SPOTLIGHT
Improving the Quality of Life
Discover opens the door to a world of innovation and invention, where researchers at the University of Sheffield and their partners in the private, public and third sectors are collaborating to find real world solutions to real world problems. From the local to the global, these partnerships are where the energy, enterprise and drive of the wider community is harnessed to the cutting edge talents of the University’s academic teams: discovering solutions together.

Inside this issue
This edition of Discover features many of the private, public and third sector organisations we collaborate with including:

- BBC (pg.7)
- Yorkshire Cancer Research (pg.12)
- JRI Orthopaedics (pg.14)
- Hull & East Yorkshire Hospitals NHS Trust (pg.15)
- Sheffield City Council (pg.16)
- GlaxoSmithKline (GSK) (pg.18)
- GE Healthcare / GEO Specialty Chemicals (pg.22)
- National Civil War Centre (pg.26)

Follow us on Twitter twitter.com/ResearchatSheff

Discover opens the door to a world of innovation and invention, where researchers at the University of Sheffield and their partners in the private, public and third sectors are collaborating to find real world solutions to real world problems. From the local to the global, these partnerships are where the energy, enterprise and drive of the wider community is harnessed to the cutting edge talents of the University’s academic teams: discovering solutions together.
Welcome to the sixth edition of Discover, a magazine that celebrates how the University of Sheffield collaborates and engages with the private, public and community sectors to enhance the lives of people in our city, the wider region and across the world. The University is determined not only to pursue cutting edge research but to do so in a way that translates this knowledge into real world solutions to real world problems.

Sheffield is a University founded on the principle of public benefit and, as this issue of Discover pays tribute, it is from the community of academics, and their external partners, that this benefit chiefly derives.

Take the work of Dr Helen Bryant. She and her team of chemists and biologists have, with the unstinting support of Yorkshire Cancer Research, discovered a novel inhibitor that is transforming the life chances of tens of thousands of female cancer patients around the world. Her discovery, patented here at the Medical School in Sheffield, has given birth to a beneficial field of research which spans the globe. This will almost inevitably lead to the creation of other, equally effective, cancer therapies.

But Helen is not alone. As this issue shows, when Sheffield’s research teams reach out for partners beyond their own disciplinary niche, the impact they can have is increased immensely. The inventive genius of polymer chemist Professor Steve Armes – no stranger to making beneficial discoveries and patents – is being magnified in his collaboration with reproductive biologist Professor Harry Moore. The combined talents of their disciplinary niche, the impact they can have is increased immensely. The inventive genius of polymer chemist Professor Steve Armes – no stranger to making beneficial discoveries and patents – is being magnified in his collaboration with reproductive biologist Professor Harry Moore. The combined talents of their discovery, patented here at the Medical School in Sheffield, has given birth to a beneficial field of research which spans the globe. This will almost inevitably lead to the creation of other, equally effective, cancer therapies.

What we have created at Waverley over the last decade is visionary and remarkable, but it is not yet a northern powerhouse. So what comes next? Glimpses of what a real northern powerhouse looks like can be seen in the development plans, now being circulated amongst our Sheffield City Region colleagues, for an Innovation District to sit along the M1 corridor.

But our vision is bigger and more ambitious than that. It embraces the city which gave birth to a University in which the pursuit of the public good and civic engagement were seen as defining values. It is to make a difference to the region, the UK and globally, producing the economic benefit and social change of which we are capable.

Whether it be in our work with companies or in re-imagining high-level skills and training, we are showing that this University is prepared to think in new ways about what the UK needs to thrive economically and socially.”

Professor Sir Keith Burnett, CBE, FRS, FLSW
DEVELOPING FOOD Security Solutions

Multidisciplinary research teams across eight northern universities are to work together on an £8 million initiative designed to bring the best and brightest brains to bear on the problems of food security, agricultural sustainability and plant resilience.

Researchers at Sheffield Sustainable Food Futures (SheFF) and the Plant Production and Protection (P³) Centre of Excellence for Translational Plant and Soil Science will receive a £2 million boost of the Engineering and Physical Sciences Research Council (EPSRC) as a result of joint Higher Education Funding Council for England (HEFCE) £17.8 million funding boost to eight northern universities.

The multidisciplinary initiative involves the N8 universities – Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York – and will combine crop and livestock research to create a single research programme focused on ensuring the stability of national and global agri-food supply chains.

Steve Banwart, Professor of Environmental Engineering Science said: “This investment transforms our ability to tackle the enormous challenge of food security. The necessary diversity of expertise from environmental, social sciences, agri-technology and health sciences is enormous. To have this research power harnessed within a single, concerted effort to develop solutions to the food security challenge is inspiring.”

Duncan Cameron, Professor of Plant and Soil Biology and Co-director of P³, said: “This is an extremely exciting opportunity that will position Sheffield and our N8 collaborators at the very forefront of food security research in the UK.”

@P³_PlantScience

TACKLING THE Energy Crisis

A team of industrialists, senior policy makers, engineers and research scientists with a unequalled breadth and depth of energy-related skills is developing a test bed facility in Sheffield which will enhance Britain’s ability to meet demanding carbon reduction targets.

“Our first step is to build our talent pool of resources,” said Jon Price. Head of the University of Sheffield’s Energy2050 project. Already the team he is assembling reads like a Who’s Who of the energy sector and includes Tata Steel’s Bruce Adderley, senior civil servant Matthew Billson with expertise on carbon capture and storage, and Professor Mohamed Pourkashanian and his 40-strong research team who have an unrivalled expertise in developing low carbon solutions for industry.

Price said: “The key to success, given the scale of the global energy challenge, will be a national facility that will enable us to work collaboratively with research groups, industry and international government agencies, pushing the boundaries of innovation and technology. This will help de-risk the investment of finance required from industry and governments which will in turn allow us to make a major influence on our future energy security, affordability and sustainability.”

@Energy2050

FROM WOLF HALL To Twirlywoos

Catherine Fletcher may not be visible on the set of BBC Two’s hugely successful period drama, Wolf Hall, but her research skills are everywhere to be seen – from the props on the set to the ethnicity of the royal court.

With expertise in the politics and diplomacy of the 15th and 16th centuries, the University of Sheffield’s Dr. Fletcher was invited to be one of the historical advisers on the adaptation of Hilary Mantel’s novel, Dr. Fletcher worked with the art team as they tried to ensure that props and sets reflected what we know of Tudor material culture, particularly when it came to religion. Catherine’s research explores diplomatic and court culture in relation to liturgical ceremony – however from her discussions with the Wolf Hall team it brought home to her “just how many gaps there are in our visual record of the past.”

One of her longest discussions on set involved whether a crucifix – unseen on camera – would feature Christ with crossed legs or straight. “There are viewers who will be very well informed about the period,” she said. “The key is to make informed decisions about the best way of filming, rather than people thinking they are mistakes.” With her knowledge she enabled the producers to avoid many of the pitfalls suffered by other TV period pieces.

Catherine goes on to explain, “Some degree of imaginative guesswork, some degree of painting in the missing elements, is necessary. If the question is whether screen history engages with what we do know in the case of Wolf Hall, the answer is certainly yes.”

@cath_fletcher

When Anne Wood – the brains behind the BAFTA award winning Teletubbies show – read about the successful adaptation of Hilary Mantel’s novel, 15th and 16th century Tudor material culture to the screen history, she was inspired to develop ideas for her new programme she wanted it to have an even more powerful educational message.

“Educational ideas were present in Teletubbies and Twirlywoos but much more subliminally,” Wood said. “By contrast our new programme, Twirlywoos, takes in the latest educational research and builds a comedy around it – whereas in the past I’ve made a comedy and just by chance some of these ideas happened to be embedded within it.”

To achieve this Wood turned to University of Sheffield’s early childhood learning specialist, Professor Cathy Nutbrown, for advice and inspiration. “This was the first TV programme I’ve been involved with. The thought and care that has gone into it is quite incredible,” said Professor Nutbrown. “The educational element was built in from the beginning.”

Head of the School of Education, Prof Nutbrown added: “A central characteristic of the programme is movement. A programme might be based on ‘up and down’ or ‘round and round’. This can help children learn to write. They have to feel what it’s like to go round and round before they can represent that in a mark on paper. And three basic marks – up and down, round and round, back and forth – are all children need to write most letters.”

For Anne – awarded an Honorary Doctorate of Letters by the University in 2015 – Cathy’s advice was invaluable. “She advised us on the age-appropriateness of the stories at every stage of the production.”

@SheffSocScience

DISCOVER — Issue 06 — July 2015

Economic and societal benefit through research and collaboration

BRIEFING — News & Views

One of her longest discussions on set involved whether a crucifix – unseen on camera – would feature Christ with crossed legs or straight. “There are viewers who will be very well informed about the period,” she said. “The key is to make informed decisions about the best way of filming, rather than people thinking they are mistakes.” With her knowledge she enabled the producers to avoid many of the pitfalls suffered by other TV period pieces.

Catherine goes on to explain, “Some degree of imaginative guesswork, some degree of painting in the missing elements, is necessary. If the question is whether screen history engages with what we do know in the case of Wolf Hall, the answer is certainly yes.”

@cath_fletcher

When Anne Wood – the brains behind the BAFTA award winning Teletubbies show – read about the successful adaptation of Hilary Mantel’s novel, 15th and 16th century Tudor material culture to the screen history, she was inspired to develop ideas for her new programme she wanted it to have an even more powerful educational message.

“Educational ideas were present in Teletubbies and Twirlywoos but much more subliminally,” Wood said. “By contrast our new programme, Twirlywoos, takes in the latest educational research and builds a comedy around it – whereas in the past I’ve made a comedy and just by chance some of these ideas happened to be embedded within it.”

To achieve this Wood turned to University of Sheffield’s early childhood learning specialist, Professor Cathy Nutbrown, for advice and inspiration. “This was the first TV programme I’ve been involved with. The thought and care that has gone into it is quite incredible,” said Professor Nutbrown. “The educational element was built in from the beginning.”

Head of the School of Education, Prof Nutbrown added: “A central characteristic of the programme is movement. A programme might be based on ‘up and down’ or ‘round and round’. This can help children learn to write. They have to feel what it’s like to go round and round before they can represent that in a mark on paper. And three basic marks – up and down, round and round, back and forth – are all children need to write most letters.”

For Anne – awarded an Honorary Doctorate of Letters by the University in 2015 – Cathy’s advice was invaluable. “She advised us on the age-appropriateness of the stories at every stage of the production.”

@SheffSocScience

ONE OF HER LONGEST DISCUSSIONS ON SET INVOLVED WHETHER A CRUCIFIX – UNSEEN ON CAMERA – WOULD FEATURE CHRIST WITH CROSSED LEGS OR STRAIGHT. “THERE ARE VIEWERS WHO WILL BE VERY WELL INFORMED ABOUT THE PERIOD,” SHE SAID. “THE KEY IS TO MAKE INFORMED DECISIONS ABOUT THE BEST WAY OF FILMING, RATHER THAN PEOPLE THINKING THEY ARE MISTAKES.” WITH HER KNOWLEDGE SHE ENABLED THE PRODUCERS TO AVOID MANY OF THE PITFALLS SUFFERED BY OTHER TV PERIOD PIECES.

Catherine goes on to explain, “Some degree of imaginative guesswork, some degree of painting in the missing elements, is necessary. If the question is whether screen history engages with what we do know in the case of Wolf Hall, the answer is certainly yes.”

@cath_fletcher

When Anne Wood – the brains behind the BAFTA award winning Teletubbies show – read about the successful adaptation of Hilary Mantel’s novel, 15th and 16th century Tudor material culture to the screen history, she was inspired to develop ideas for her new programme she wanted it to have an even more powerful educational message.

“Educational ideas were present in Teletubbies and Twirlywoos but much more subliminally,” Wood said. “By contrast our new programme, Twirlywoos, takes in the latest educational research and builds a comedy around it – whereas in the past I’ve made a comedy and just by chance some of these ideas happened to be embedded within it.”

To achieve this Wood turned to University of Sheffield’s early childhood learning specialist, Professor Cathy Nutbrown, for advice and inspiration. “This was the first TV programme I’ve been involved with. The thought and care that has gone into it is quite incredible,” said Professor Nutbrown. “The educational element was built in from the beginning.”

Head of the School of Education, Prof Nutbrown added: “A central characteristic of the programme is movement. A programme might be based on ‘up and down’ or ‘round and round’. This can help children learn to write. They have to feel what it’s like to go round and round before they can represent that in a mark on paper. And three basic marks – up and down, round and round, back and forth – are all children need to write most letters.”

For Anne – awarded an Honorary Doctorate of Letters by the University in 2015 – Cathy’s advice was invaluable. “She advised us on the age-appropriateness of the stories at every stage of the production.”

@SheffSocScience
This sentiment was backed up by a second report, this time in the influential Economist magazine. Like Katz, the author of Under the Bonnet also highlighted the role the AMRC is playing in driving productivity gains in British manufacturing.

“Technological advances, aided by collaboration between firms, universities and government, are making manufacturing more efficient,” the Economist wrote. “Rolls-Royce, an aerospace company, has halved the time it takes to manufacture fan discs and turbine discs used in jet engines, using methods developed at the AMRC at Sheffield University.

“The AMRC now forms part of a network of government-backed catapult centres, whose aim is to forge links across academia and industry.” The author quotes Hamid Mughal, Rolls-Royce’s Director of manufacturing, as saying that these links are crucial for success in manufacturing as they create a “sandbox” environment, allowing experimentation that would never be viable for a single firm.

The third report, Making it: The advanced manufacturing economy in Sheffield and Rotherham by the Centre for Cities, notes that: “R&D and industry-led innovation in Sheffield-Rotherham has been driven by the AMRC and led by the University of Sheffield, a UK leader in advanced manufacturing and research.”

The report’s author, Louise McGough, adds: “Many of the production plants in Sheffield-Rotherham specialise in high tech, bespoke or precision work destined for use in aerospace, nuclear, oil and gas and renewables that are highly dependent on the innovations and technologies developed at the AMRC.”

She concludes: “Supporting the university-business relationships and innovative firms that have driven the development of the AMRC and continue to power innovation on the Advanced Manufacturing Park-Sheffield Business Park site should be the focus of interventions as part of an Innovation District strategy in Sheffield-Rotherham.”

For those who are shaping Sheffield’s future, it is clear that the geography of the innovation district will need to include the city centre where so many of the district’s creative, entrepreneurial and innovative people live, work and play.

Harnessing these talents in a way that creates a more vibrant and dynamic city –and one that also complements and accelerates the growth in advanced manufacturing– will be the key challenge. In rising to that challenge, the University will be mindful of what Bruce Katz had to say about the success of the AMRC. “The development at the AMRC has been really organic – and that is just the way the world works. It has evolved in a very interesting way.”

www.sheffield.ac.uk/about/city
UK’s leaders in this area. Two universities are already seen as the critical mass in this field to lead Europe, if researchers that Britain now had the infrastructure companies, and Prescott told an audience of industrialists, symposium on field robotics - Professor Prescott recently returned from a trade visit to Japan.

Addressing the first ever national symposium on field robotics - Professor Tony Prescott told an audience of industrialists, infrastructure companies, and researchers that Britain now had the critical mass in this field to lead Europe, if not the world as Sheffield’s experts at the generation rail network will rely more on autonomous systems and robotics to improve safety and performance.

Delivering that technology will involve groups like Sheffield Robotics, a cross disciplinary partnership between Sheffield’s two universities with ambitious plans to develop field test bed facilities on the burgeoning Advanced Manufacturing Park, and next to the soon-to-be constructed AMRC Factory 2050.

“Our trade mission to Japan, and last month’s symposium, showed there is a real appetite for industry and academia to work together to build a network of talent and capacity in this field,”

Professor Prescott

“ Sheffield Robotics is ideally suited to be the hub of that network and will be dedicated to maximising the economic and social impact of robotics and autonomous systems across a range of sectors, from healthcare and meeting the needs of an increasingly elderly population, through to the use of robotics in hostile and extreme environments such as sub-sea oil and gas exploration, extraction and inspection and in nuclear decommissioning,” he added.

www.sheffieldrobotics.ac.uk

@ShefRobotics

Watch a short film about Sheffield Robotics

SUPPORTING MANUFACTURING Processes

A new secondment scheme to promote a more agile and joined-up relationship between the Advanced Manufacturing Research Centre (AMRC) with Boeing and academics who are researching longer term, fundamental issues, has been set up by the Faculty of Engineering’s Manufacturing Research Board (MRB).

The initiative has a broad set of targets and activities, ranging from joint research proposals to research publications and dissemination activities, along with the creation of teaching-related content.

“The research secondment has been the catalyst for creating our first two proposals,” says Dr George Panoutsos, the new scheme’s first post holder.

A Lecturer in Computational Intelligence in the Automatic Control and Systems Engineering (ACSE) Department, George has been working closely with the AMRC’s Head of the Process Technology Group, Dr Sam Turner, and Dr Richard France, Senior Business Development Manager for the MRB, on shaping the targets and acting on any opportunities.

“ But because we now have a much more joined up approach we are able to link our expertise in fundamental research with the AMRC’s expertise in advanced manufacturing, to identify joint funding opportunities where our research is complementary, therefore creating stronger proposals.”

For Dr Turner, the timing could not be better. Factory 2050, which is due to open later in the year “will be a highly interconnected and networked environment with complex, real-time data streams. Exploiting this high-volume of data will be a necessary but by no means a trivial task.”

He added that the smart use of this data will “enable us to better control and predict the end-product design and conformance.” This, in turn, will lead to plant-wide optimisation and enhanced productivity.

Close collaboration between the AMRC and ACSE will ensure the research team is able to combine its expertise in complex systems modelling, data mining and large data streams, along with manufacturing systems, equipment, health management and advanced manufacturing techniques.

The future the MRB aims to expand this scheme to the whole faculty, to establish long-term links between engineering departments and the AMRC,” said Dr France.

@TheAMRC
@SheffUniEng

In the past, we would have looked at similar EPSRC and EU calls and perhaps concluded that it was not relevant to us,” George added.

“In the past, we would have looked at similar EPSRC and EU calls and perhaps concluded that it was not relevant to us,” George added.

Economic and societal benefit through research and collaboration
An anti-cancer drug discovered by scientists at the University of Sheffield could bring hope to hundreds of thousands of women across Europe and America and net up to $2 billion a year for UK global pharmaceutical company AstraZeneca.

“It is almost ten years to the day that we were granted the biological patent on which the new drug is based,” says Dr Helen Bryant, whose team of multi-disciplinary researchers based at the Medical School were the first to discover the therapeutic potential of a little known chemical inhibitor – PARP.

The diminutive Bryant swells with pride at the thought that her discovery could save so many lives. “It’s an amazing feeling and an amazing legacy, to think that we will have had such an impact,” said the biochemist who first came to Sheffield from the Ludwig Institute for Cancer Research more than a decade ago as a young researcher.

Her ambition was to work with the founder of the Yorkshire Cancer Research funded project, Professor Thomas Helleday, who was pioneering fundamental research into cell replication and recombination. “What Thomas and the groups in Sheffield were doing was fascinating,” said Dr Bryant, whose interest in cells functions began as a young girl.

“I wanted to take a fundamental look at what went wrong in cancer cells so that we might be able to target them and kill them,” she said. “It was exciting because Sheffield was already thinking along these lines and gave me a remarkable research opportunity.”

With financial support from the charity Yorkshire Cancer Research, she headed a team that would explore the medical potential of PARP. “We were playing around in the lab, looking at various interactions between the cells and the inhibitor when we noticed something quite remarkable,” she said.

She and her team noticed that when PARP was suppressed, the cancerous cell was unable to grow and eventually died. “Here was an opportunity to use what causes cancer to kill the cancer, because we knew that certain types of ovarian and breast cancer had the genetic defect in the pathways we were looking at.”

The joy of discovery had to be tempered, however. “We wanted to tell the world about what we had found, but first we had to get a patent, and that meant keeping very quiet about our discovery,” she said.

“We just dropped everything and worked with IP Group (formerly known as Fusion IP) to get the patent sorted. It happened pretty quickly but we had to put a lot of effort in to making it happen,” she said of a process that will produce a substantial windfall for both the University and the charity.

Her ambition was to work with the founder of the Yorkshire Cancer Research funded project, Professor Thomas Helleday, who was pioneering fundamental research into cell replication and recombination. “What Thomas and the groups in Sheffield were doing was fascinating,” said Dr Bryant, whose interest in cells functions began as a young girl.

“The impact has been global,” she said. Approval for the drug in both Europe and the States just a short decade from the publication of that first article: “vindicates the value of fundamental research and just playing with ideas and being creative in the laboratory.”

Charles Rowett, Chief Executive Officer at Yorkshire Cancer Research, agreed: “We are incredibly proud that a treatment discovered here in Yorkshire with funding from our charity will make a difference to the lives of people across the world.”

www.yorkshirecancerresearch.org.uk
The search for innovative materials and production techniques is vital for global orthopaedic implants and surgical instrumentation firm JRI Orthopaedics Ltd, whose ceramic-coated total hip replacement was the first of its kind in the world.

“Our flagship product has been on the market for 20 years,” says Ed Draper the SME’s Executive Innovation Manager. “The biggest challenge we face now is coming up with the next generation of implants, which means looking at new materials and new manufacturing techniques. And that’s why The Mercury Centre is so important.”

“They have de-risked not only the technical elements of our research-led innovation, but also the financial. Without that, a lot of areas would have been closed to us,” Draper said.

A Knowledge Transfer Partnership (KTP) with the Mercury Centre - a research institute that works closely with industry to facilitate the use of new processes such as 3D printing – enabled the company to not only explore the use of new materials, but to do this in a more efficient manner.

“Traditionally one would select various materials and then implant them into an animal, which is very time consuming, expensive and has ethical implications,” says John Haycock, Professor of Bioengineering in the Department of Materials Science and Engineering.

“Instead, we devised a way of selecting the right materials based on human bone cells cultured in the laboratory. This increases the number of different materials we can explore, reduce the number of animal experiments and speed up the number of materials and samples we can look at. The KTP has enabled the development of a rapid and robust pre-clinical test method for screening bio-active surfaces with the potential for orthopaedic application.”

The Mercury Centre and JRI are also partners on a bigger project involving six other members as part of an £8.5 million Innovate UK initiative to promote university research in the use of additive layer manufacturing.

“This is of special interest to us,” said Draper, who, along with Sheffield-based Glass Technology Services, is now working with the Mercury Centre to see whether additive layer manufacturing using both glass and metal can produce an implant requiring less invasive surgical techniques, while promoting rapid integration with the bone.

“Putting a bio-active glass on the surface which gradually dissolves in the body should promote more rapid bone growth,” says the Centre’s Professor Mark Rainforth. But this presents technical challenges – not least of which is how the additive layer manufacturing process can be used in glass. “No one has done this before as far as we know, but we are confident it can be done.”

“You can’t overestimate the importance of these industrial relationships to academic researchers,” Professor Rainforth added. “You can sit in your lab, doing your experiments, going to conferences and understanding all the issues, but there is no substitute to talking to and working with someone like Ed Draper who has such a wealth of experience, both in research and manufacturing that makes a partnership so exciting.”

For his part, Draper says “the great thing about working with the Mercury Centre is they are feet-on-the-ground engineers and know exactly the problems I am facing.”

www.mercurycentre.org
@Mercury_PBM
Watch a short film about this research collaboration.

“GIVING PATIENTS THEIR VOICE BACK
A magnetic solution”

Ear, nose and throat surgeon Stephen Eli, has a dream: that one day he will be able to offer patients – many of whom have aggressive cancers – the chance to get their voice back.

“We are still working with technologies that date back to the late 1970s. These are less than ideal, they can create discomfort, stress and anxiety, and speech valves need replacing regularly at considerable cost to the NHS. Since my days as a junior registrar, I knew there had to be a better solution,” says Stephen.

It has taken years of hard work and set backs, but now the senior consultant at the Hull & East Yorkshire Hospitals NHS Trust believes he is on the brink of bringing that solution to patients in a groundbreaking pilot study. “I know the problem was complex and beyond the capacity of a single surgeon to find the answer. Complex problems are like complex shapes viewed in the dark – if you just have one light shining on it you don’t see all the hidden nooks and crannies,” he added.

His search for partners to throw new light on the problem led him first to Hull University and medical engineer Professor Mike Fagan. With the support of fellow engineer Dr. James Gilbert they began to develop a solution based on the use of magnetic implants on the lips and tongue and sensors to monitor the magnetic field as the patient ‘speaks’.

One of the big technical hurdles they had to overcome, was the conversion of sensory data from the magnets into acoustics at a speed (less than a quarter of a second between receiving the data and speech) and a level of accuracy hitherto unheard of. “It was a challenge we lacked the skills to deal with,” Stephen said.

But University of Sheffield Professor Phil Green had those skills. An internationally renowned computer scientist with interests in a diverse range of auditory research, Professor Green and his team at the Speech and Hearing Research Group, were intrigued by the challenge Stephen brought them. “This was new and exciting territory for us, we were keen to get involved,” Professor Green said.

A collaborative project was established under the banner Digital Speech Recovery from Articulator Movement – or DiSArM for short – with Jim Gilbert as lead investigator and a substantial grant from the National Institute for Health Research.

Professor Green said: “the challenge has been to take the sensory data from the implanted magnets and convert this almost instantaneously into acoustics and speech.”

Much of the advanced mathematics to translate sensor data to acoustics was carried out by Postdoctoral Research Associate Jose Gonzalez in Sheffield while Jim Gilbert and his colleagues in Hull have carried out the design of the implants and sensors.

“No one else has done this,” said Stephen. “I take my hat off and bow from the waist to the team at Sheffield. What they have achieved is remarkable.”
As part of an £8 million research project sponsored by three of the UK’s biggest research councils* homes that enhance the wellbeing and mobility of the elderly will be designed to show just what can be achieved when architects, planners, developers and social landlords engage with older people at key stages in the construction process.

A team of architects, town and regional planning specialists and health policy researchers from the University of Sheffield are working with Sheffield City Council and two of their arms length partners – property developer, Keepmoat, and social landlord Great Places – to develop new ways of making the design of homes and streets much more ‘age-friendly.’

A key part of the project is the participation of stakeholders (including older people’s groups and individuals) in the processes of brief-writing, design, and evaluation phases of the project. We are engaging with people from four very different and diverse neighbourhoods in Sheffield – from the affluent suburb of Dore to Parsons Cross, Sharrow and the city centre itself – to find out how they might become more involved in this process and what they want to see reflected in the design of homes and neighbourhoods for older people.

With councils and healthcare professionals under pressure to provide more and better services for less money, Professor Wigglesworth believes that a more participatory, customer-facing form of design is central to achieving that goal.

Her view was echoed by Paul McGarry – pioneer of Manchester City Council’s much-lauded approach to age-friendly design – who told a recent Dwell workshop that councils had to stop seeing older people as ‘needy’ or a ‘burden’ and learn to view them instead as citizens with rights and responsibilities.

Whether at city or local community scale, this idea of citizenship includes the right to participate in resource allocation and decision making processes. By developing a positive image around ageing, cities can engage with their older citizens more productively.

This approach has cost benefits, too. Dwell is looking at how government can reduce the spiralling cost of adult care by engaging with older people in the design and construction of homes and neighbourhoods that promote a sense of wellbeing, independence, healthy lifestyles, contact with nature and the seasons, communication with friends and family, and a feeling of belonging.

But such an approach will require new ways of thinking for architects, town planners, developers and social landlords. For this reason, the Dwell project is investigating how each stage of the process, from the very early design ideas to the official opening of a new development, could be refined in a way that improves the allocation of scarce public resources – ‘the right housing in the right places’ – and makes this kind of development much more attractive to private investors.

Professor Wigglesworth concluded: “I like to think that if we get the design of homes and neighbourhoods for older people right, we can turn the telescope round and use a similar approach for younger people to great effect.”

“Engineering and Physical Sciences Research Council (EPSRC), the Economic and Social Research Council (ESRC) and the Arts & Humanities Research Council (AHRC) under the theme ‘Design for Wellbeing: Ageing and Mobility in the Built Environment’.

www.dwell.group.shef.ac.uk
@dwell_Sheffield

*Engineering and Physical Sciences Research Council (EPSRC), the Economic and Social Research Council (ESRC) and the Arts & Humanities Research Council (AHRC) under the theme ‘Design for Wellbeing: Ageing and Mobility in the Built Environment’.
As one patient described the impact in an online forum: “I have gone from being a productive, full-time working mother, a loving wife, likeable friend and positive contributor to society, to becoming a highly anxious, depressed and housebound individual.”

Effective treatment for the condition did not come until Professor David Grundy developed a novel technique for recording the impulse traffic in sensory fibres sent from nerve bundles in the bowel wall to the central nervous system. From this he was able to identify a receptor that might have an influence on pain levels, which proved of real interest to what was then Glaxo Wellcome.

“What followed was a very productive collaboration between the University and Glaxo to investigate the effect a receptor antagonist might have on sensory signalling from the bowel,” said Professor Grundy. With Catherine Kozlowski, who was seconded by GSK into Grundy’s research group, the collaboration ultimately unlocked the hidden mechanics of the signalling.

“It was our data that enabled GSK to make a successful patent application for alosetron. It was also used in the successful submission to the Food and Drug Administration in the United States and in the generation of marketing material prior to the launch of the drug Lotronex,” he added.

Since its launch, the drug—which was briefly withdrawn because of concerns over potential side effects—has been safely used by tens of thousands of women around the world. Lotronex is the only drug on the market aimed specifically at the treatment of diarrheal IBS and has annual sales in excess of £34 million.

Tens of thousands of people who suffer from a debilitating gastric condition have had their lives transformed by a drug based on fundamental laboratory research carried out by a team of academics at the University of Sheffield in partnership with one of Britain’s most successful pharmaceutical companies—GlaxoSmithKline (GSK).

The condition—a particularly virulent form of Irritable Bowel Syndrome (IBS)—is thought to affect around 15% of the population in Europe and contributes to the suffering of around 40% of referrals to UK clinics.

The unpredictability, severity and urgency of the pain, along with the risk of incontinence, mean this is a condition that can have a devastating impact on the sufferer’s quality of life. It is estimated that by 2020 close to 34 million people over the age of 50 in Europe will suffer from some form of brittle bone disease.

The aim of MultiSim is to exploit the recent advances in computer power and improvements in screening and imaging technologies, to equip clinicians with a range of smart tools that will give them a deeper understanding of their patient’s condition. “We have good computer models that work individually at the cell, tissue, organ and body levels, the challenge is to join these models into a unified system,” said Professor Lacroix.

For Simpleware application engineer, Steve Cockram, the chance to be involved in this event strengthens his company’s link with leading researchers. “Having MultiSim use our software provides not only a powerful endorsement, but gives us valuable feedback that allows us to continually improve what we offer in the market.”

www.multisim-insigneo.org
@MultiSimAward

MODEL SOLUTIONS To Bone Disease

Fifty young engineers from across Britain and Europe—one of the best and brightest of their generation—have been selected to take part in a gruelling, three-day ‘Modelathon,’ to see if they can overcome some of the most challenging problems facing the creation of a virtual human body that could transform medical science and healthcare.

The postgraduate and postdoctorate researchers will be put to the test under the scrutiny of advanced medical and software simulation engineering companies—including Smith and Nephew, Simpleware, Ansys, Nvidia, Materialise, and Dassault Systems.

“The idea of the three-day event comes from the hugely successful computer software hackathons,” says Damien Lacroix, Director of MultiSim, a £6.7 million Engineering and Physical Sciences Research Council (EPSRC) Frontier Engineering programme, which is part of Insigneo, the University of Sheffield’s Institute for In silico Medicine. “It will be a friendly competition between the teams who will be set a very difficult multiscale modelling challenge in the simulation of a musculo-skeletal problem in an individual patient,” he added.

The teams will be asked to provide an answer to the question of when ‘augmentation’ should be used in osteoporotic patients to reduce the risk of spontaneous fracture while walking.
BIG DATA,
Better Health

More than 15 million people across the North of England could benefit from a £20 million project involving experts at the University of Sheffield that will find smarter ways of using large-scale data to drive public sector improvements in health and social care.

Announced by the Chancellor of the Exchequer in March, the funding will establish four health and social care information projects, whose work will be delivered by the Northern Health Science Alliance (NHSA).

Professor Tony Woetman, Pro-Vice Chancellor for the Faculty of Medicine, Dentistry and Health said: “For a long time the University of Sheffield has championed closer integration between health and social care and this information sharing initiative could be the catalyst for transforming care for patients across the region.”

By analysing integrated information and feeding this back to NHS practitioners, service managers, commissioners, public health professionals, local authority planners, researchers and policy makers, the project teams will be able to identify variations in care and needs.

Research will focus on at least two of the following NHS priorities – families with obese children; anti-microbial resistance; late detection and irreversible damage from chronic kidney disease; breast cancer among high risk women; schizophrenia and unplanned hospital admissions among people with dementia.

SOURCE
The University of Sheffield Media Centre
www.sheffield.ac.uk/news

DEALING WITH THE
Obesity Epidemic

A more sophisticated approach to tackling Britain’s obesity epidemic could not only improve health outcomes for patients but also reduce the £6 billion annual cost to the NHS – according to new research funded by the National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care for South Yorkshire (NIHR CLAHRC SY).

Dr Mark Green of the School of Health and Related Research (ScHARR) shows the current ‘one size fits all’ approach fails to take into account the health of the patients, where they live, or the kind of lifestyles they lead.

“Our research shows that those who have a body mass index (BMI) of 30 or over fit into one of six groups – young males who are heavy drinkers; middle aged people who are unhappy and anxious; older people with physical health conditions who are happy; younger healthy females; older affluent healthy adults; and individuals with very poor health,” Dr Green says.

“Strategies to tackle weight loss by health policy makers should be tailored to which group the patient falls into,” he added. Messages to reduce alcohol consumption, for instance, could be especially effective with young males.

But that is not happening. Instead “policies often target individuals just because they are obese. This is not very efficient.” This approach will be more effective in helping individuals to achieve a healthier lifestyle.

“The groups we identified are likely to need very different services, and will respond very differently to different health promotion policies. In the future, we hope that a targeted healthcare approach to be more efficient use of NHS services,” Dr Green said.

USING 3D PRINTING
To Repair Nerves

Nerves damaged in traumatic incidents could soon be able to repair themselves using a 3D printed guide developed by scientists at the University of Sheffield.

The device, called a nerve guidance conduit (NGC), is a framework of tiny tubes, which guides the damaged nerve ends towards each other so that they can repair naturally.

“The advantage of 3D printing is that the conduits can be made to the precise shapes required by clinicians,” says John Haycock, Professor of Bioengineering.

“We’ve shown that this works in the lab, so the next step is to take this technique towards the clinic.”

Patients with nerve injuries can suffer complete loss of sensation in the damaged area, which can be extremely debilitating. Current methods of repairing nerve damage require surgery to suture or graft the nerve endings, a practice which often yields imperfect results.

Although some NGCs are currently used in surgery, they can only be made using a limited range of materials and designs, making them suitable only for certain types of injury.

The technique, developed in Sheffield’s Faculty of Engineering, uses Computer Aided Design to design the devices, which are then fabricated using laser direct writing, a form of 3D printing. Researchers used the 3D printed guides to repair nerve injuries over an injury gap of 3mm, in a 21-day period.

“Now we need to confirm that the devices work over larger gaps and address the regulatory requirements,” says Fiona Boissonade, Professor of Oral and Maxillofacial Medicine and Surgery.
A range of novel gels that will improve the quality, storage, transportation and reliability of stem cells is being developed by a team of polymer chemists and biologists at the University of Sheffield in collaboration with the global transformational medical technologies’ firm, GE Healthcare, and GEO Specialty Chemicals.

Just six months into the three-year Engineering and Physical Sciences Research Council (EPSRC) funded project, the Sheffield team have already made a number of discoveries with the potential to transform human stem cell research and aid the development of the next generation of healthcare technologies for a wide range of diseases and conditions.

“Human pluripotent stem cells offer tremendous possibilities for combating a range of medical conditions and diseases,” says Professor Steve Armes, Director of the Polymer Centre and the Principal Investigator on the project.

“However, a major challenge is to optimise stem cell manufacture with excellent reproducibility to meet the requirements of cell biologists, the biotech industry and clinicians. Well-defined and consistent conditions for long-term stem cell culture, storage and the easy harvesting of stem cells are essential to success.”

Armes, who is a fellow of the Royal Society has more than 500 published papers to his name, and 26,000 citations, believes the fundamental scientific research he and his interdisciplinary team are conducting will “play an important role in delivering affordable healthcare solutions for patients over the next 10-50 years.”

While Armes and his chemistry colleagues have been able to develop the novel polymer gels, the project’s success is built on close collaboration with Professor Harry Moore, Co-Director of the Centre for Stem Cell Biology in Sheffield, whose team also co-ordinate the International Stem Cell Initiative, a global consortium of laboratories that define standards in this field.

“Chemists and biologists talk very different languages,” says Armes. “But we have overcome the communication barrier and the team works really well together.”

Dr Nick Warren, a Postdoctoral Chemist, has produced the long worm-like strands that interact to form a soft, freestanding aqueous gel. This highly biocompatible worm gel undergoes delegation reversibly on cooling below ambient temperature and is easily sterilised by cold ultrafiltration. Human embryonic stem cells immersed in such gels can survive for up to 14 days at 37°C. Dr. Irene Canton, a Biochemist working with Moore, has found that human embryonic stem cells gradually ‘go to sleep’ when immersed in the gel, and slowly ‘wake up’ when removed from the gel.

“Our worm gel is a convenient and inexpensive medium for the long-term storage of human stem cells. It could potentially replace existing unsatisfactory animal-derived products and enable the acceleration of stem cell biology research, ultimately leading to new clinical therapies,” Armes said.

Although he is mainly focused on basic research, Prof. Armes is equally passionate about technology transfer—he is a named inventor on more than 20 patents, including a commercially successful anti-reflective coating for solar panels. His nanoparticle research has also inspired the development of dirt-shedding paints on the external facades of buildings.

Perhaps this ability to make the link between fundamental and applied science can be traced back to his school days? “I was fortunate to be taught by a very good Chemistry teacher, Mr. Bates, who had worked for an industrial textiles company before going into education,’ he said. ‘It was – and probably still is – unusual for teachers to have some industrial experience. While I don’t think that Health and Safety regulations would allow school teachers to inspire young students in quite the same way nowadays, he allowed me to take various chemicals from his chemistry stores to do lots of experiments in my bedroom, including making stink bombs, chemically-propelled rockets and loud bangs. This experience inspired me to consider Chemistry as a career.”

Four decades later, the promising school student looks like he could be making a very different kind of bang in the world of chemistry and medicine using a potent mix of polymer science and reproductive biology.

www.polymercentre.org.uk

“Human stem cells are at the forefront of biomedical research and clearly have enormous therapeutic potential for diabetes, age-related blindness, spinal cord injuries and Parkinson’s disease.”
“If I was 16 years old and I was given a hundred choices for careers, I would choose here every time,” said a recent visitor to a powerful partnership between global manufacturers and the University of Sheffield that is creating the young engineers of the future.

The visitor – one of the many industrial and political figures to have made the pilgrimage to the Advanced Manufacturing Research Centre (AMRC) with Boeing Training Centre in the year since it opened its doors to its first cohort of 150 apprentices – was none other than Dr Hamid Mughal, the Director of Global Manufacturing at Rolls-Royce.

Dr Mughal told the National Summit for Apprentices and Higher Vocational Education, held at the AMRC, that: “You cannot ask for a better environment than this for tomorrow’s engineers to create the complex, customer-oriented values and solutions for industry.”

Praise indeed. Now bidding to become the National College for Advanced Manufacturing, the centre has not only set benchmark standards for the quality of its training, but is also opening up new pathways for young people to make the transition from school to higher education. A foundation degree route is already available in mechanical engineering, but the centre’s ambition does not stop there. “We are making a funding bid for a full suite of learning that would open pathways to higher education for apprentices, from foundation degrees to Masters, in mechanical, electrical engineering and manufacturing technology,” says Kerry Featherstone, Head of Operations at the AMRC Training Centre.

The success of the centre has led government ministers and officials to base the new network on national colleges on the AMRC Training Centre model. “We are different because we began by working with a consortium of industrialists to develop our curriculum, and everything we do here is employer-led,” says Featherstone, a former Early Careers and Future Capability Manager for BAE SYSTEMS. From the hexagonal benches arranged in manufacturing cells and the use of lean working, engineering principles and production meetings through to oversight from an active Industry Board, the AMRC Training Centre has a work-ready culture at its heart.

If there is a gap to be filled, it is the lack of young women coming through the system – but even this is being addressed. A summer school for youngsters last year attracted record numbers of girls. “One of the groups was entirely young girls,” said Featherstone. The task now is to translate that enthusiasm into female apprentices. “We are doing the outreach work, getting into schools and making teachers, parents and pupils aware of what modern, advanced engineering is really like,” she added.

www.amrctraining.co.uk
@AMRCtraining

Rebecca Taylor was a student at Thomas Rotherham College when she applied to become an engineering apprentice. The evaluators could see that Rebecca had talent and promise. What they didn’t know was that manufacturing is hard wired into her DNA.

“I’m not the first in my family. A while back we used to own one of the biggest companies in South Yorkshire, Newton Chambers. My great grandad was in charge of a team of aeroplane engineers in the Second World War and my grandad was a fitter, so it just skipped a generation and we’re back on.”

Her talent was also spotted by ATI in Sheffield who recruited her as a trainee engineer. She says: “They do work for Rolls-Royce engines and there’s also a site like this, which is nice and clean, where they manufacture pipes.”

Of her training at the AMRC centre she says: “Half the time we are programming, and then we run our work downstairs. I enjoy it here, it’s varied and you can carry on to get a degree if you want, but your eggs aren’t all in one basket; you can go down a number of routes.”

And Rebecca has advice for girls, to look beyond the muck and oil if they are interested in a career in engineering. “Girls at school go to engineering firms and just see the dirt, but they don’t go to advanced manufacturing centres like this. The way to get girls into engineering is to have more facilities like this.”
At the click of a mouse, the residents of Newark could soon be able to discover whether relics and remnants of one of the most bitter and protracted sieges of the English Civil War might lie buried beneath their gardens, patios and lawns.

Using the latest geophysical and remote sensing technologies, archaeologists and historians from the University of Sheffield will be working closely with the newly opened National Civil War Centre in Newark to identify and map the exact location of a complex network of defences, fortresses and redoubts constructed during the six-month siege of Newark, more than three-and-a-half centuries ago.

“One of the impacts from our collaboration will be a searchable digital reconstruction of what Newark was like during the siege,” says University of Sheffield Archaeologist Dr Rachel Askew. “So, if you are living in one of the suburbs of Newark and want to know what might be under your house, you will be able to click on the resource and find out.”

With the support of Arts Enterprise funding, Dr Askew has spent the last eight months engaging with the National Civil War Centre and a diverse group of local stakeholders to plot a four-year community Heritage Lottery Funded project that will combine the talents and skills of the University, the museum, and the wider population of Newark.

“By working with the University we get an academic rigour that adds value to our work, it will help shape and inform our exhibitions, and will enhance our reputation and standing as a centre with historical integrity,” said Michael Constantine the centre’s Manager.

For Bryony Robins, the centre’s project officer, the collaboration with the University will enable the centre to “connect with new audiences” by “bringing new ideas and exciting projects into the museum to reach out further than we have done before.”

There are benefits, too, for the University. Dr Hugh Willmott, senior lecturer in archaeology, says the partnership with the museum will “enhance the learning experience of our students” by giving them direct access to monuments and artefacts of the period.

But it is the community engagement side of the proposed project that most excites both the academics and the museum. “We want to reach out to groups that might not normally think about getting involved with a museum,” says Dr Askew.

Already she has established links with schools, scouting associations, metal detector enthusiasts, local historical societies and archaeology groups, through to English Heritage and the County Archaeologist.

While the most impressive surviving earthwork in the region is the star-shaped Queen’s Sconce, which once provided a platform for Royalist cannons to fire on the Parliamentary forces, Dr Askew believes there are many more ‘redoubts’ lying hidden beneath the earth.

“We know there are even more sites lurking in the landscape – half of the siege works identified in documentary evidence have been lost, including a major fort. Newark was also partly surrounded by trenches – a so called line of circumvallation, shown on surviving Royalist and Parliamentary siege maps. Six feet deep and twelve feet wide, only a small fraction of this trench network has been discovered,” she said.

“If we secure funding, skilled archaeologists and historians from the University will work with the museum and the wider community to locate, investigate, record and reconstruct what the siege looked and felt like for the three armies battling for supremacy, and for the people trapped inside Newark. The last time the siege works were scrutinised was in the early 1960s when a Royal Commission published a report. Back then, lasers and satellite imagery were science fiction. With new technology and the support of the community, there is lots more to be discovered.”

www.sheffield.ac.uk/archaeology/research/newark
www.nationalcivilwarcentre.com
@Arts-Enterprise
A DAY IN THE LIFE

Pam Shaw

Internationally renowned clinician and academic researcher, Professor Dame Pam Shaw somehow combines her role as consultant neurologist at Sheffield Teaching Hospitals with that of Director of Sheffield Institute of Translational Neuroscience (SITraN) and still makes time to fundraise and care for her orchids.

5.00 am
This is a good time for me, working from the study on the third floor of the house looking out across to Bradwell Edge. First there is an accumulation of emails to dig through. And then the final edits to a paper we are about to submit to a prestigious Journal. Below me, our two dogs are still asleep.

7.00 am
Downstairs for a coffee and some breakfast while listening to John Humphrys; it’s my time for catching up on the news. Europe is centre stage. As an academic clinician Europe is really important. A lot of our research funding comes from Europe, and a lot of our research students.

7.30 – 8.00 am
I love the drive into work through the Peak District. I listen to a Puccini opera. This is a good time for me, working from the car, with no distractions.

8.00 am
Breakfast. My PA has been in for half an hour, but I am one of the first people through the door. The orchids in the office are beautiful. Contrary to belief, they thrive on benign neglect.

8.30 – 9.00 am
Mentoring a PhD student who has viva the next day. We run through the questions he might be asked. It’s one of the great aspects of our work that we can nurture the next generation of academic neurologists and neuroscientists.

9.30 am
Conference call with a biotech company who want to collaborate with SITraN to develop a new treatment for neurodegenerative diseases. They want to do the same as me, meaning they will have beneficial neuroprotective effects.

9.35 am
My daughter, Sophie, rings on the mobile. She is doing her A-levels. Today she has her Psychology exam. She is a little nervous but confident. I reply to the organisers of a European Amyotrophic Lateral Sclerosis (ALS) meeting in Dublin. Agree to stay an extra couple of days to train people in how to do evaluations in clinical trials.

9.35 – 11.00 am
Walk to the hospital. I am the academic director for neuroscience within Sheffield Teaching Hospitals. Our research and teaching committee is reviewing all the applications for research funding: a strong consensus on which applications should go forward.

11.00 – 12.00 pm
Back to the office. Try to catch up on emails while listening to John Humphrys: it’s my time for catching up on the news. Europe is centre stage. As an academic clinician Europe is really important. A lot of our research funding comes from Europe, and a lot of our research students.

12.00 – 3.00 pm
Grab a smoothie and a sandwich for lunch. We are hosting a forum on motor neurone disease. Fifty doctors and healthcare professionals from around the region attend. I give the welcome address and then dip out to see how IT are doing with my computer virus. I’m trying to get a document done in time for a research leaders meeting to refresh our strategy within biomedical sciences. Just make the deadline.

3.00 – 4.00 pm
Research meeting is all about maximising the impact Sheffield has in neuroscience. Chat with Matthew Holley - Professor of Sensory Neuroscience - after the meeting about working together. There are excellent pockets of neuroscience in different parts of the University – ever since I came here I have wanted to bring the neuroscientist community closer together so we can help each other. This is a step in that direction.

4.00 – 5.00 pm
Host a visit to SITraN from one of my patients who has set up a charity to raise money for MND research. His donation is so welcome, but when he meets our scientists I can see how much it means to them to meet a young person with the medical condition they are working on. He writes to me afterwards to say – “It really makes me see how the work we are doing is so worthwhile.”

5.30 – 10.00 pm
Drive home. My husband, Paul, is a great cook. The dogs, Pepper and Goldie, are delighted to see me. After dinner Head upstairs for a couple of hours in the study. I think about using our gym. But it’s been a hectic day. Instead I open a novel. I’m reading I am Pilgrim by Terry Hayes. My mother-in-law who comes for dinner every Sunday gave it to me. Sophie calls to tell me that her exam went well.

www.sitran.dept.shef.ac.uk