life SCIENCES

In the *central South*

Southern Policy Centre

An economically strong region with a world-class natural environment and an innovative and collaborative life sciences sector

Foreword

The Southern Policy Centre and the central South

The Southern Policy Centre (SPC) is an independent think tank and policy forum for central Southern England, founded in 2014. In promoting a regional public policy debate, the SPC has sought to make the case for a regional approach to economic and social policy. Based on the current strategies of local authorities and Local Economic Partnerships it has been possible to identify a strong and coherent region: the central South. Stretching from Portsmouth to Bournemouth, Christchurch and Poole (BCP) and spanning the Isle of Wight and Hampshire, the central South can boast three coastal cities (Portsmouth, Southampton and BCP) with complementary economies, strong links to the rest of the UK, Europe and the world, strong universities, attractive culture, rich heritage and tourism. All are set within a superb natural environment with two national parks, areas of outstanding natural beauty and an ecologically rich coastline.

Our first report on the central South was published in September 2019. Since then, the Southern Policy Centre has worked with local authorities, higher and further education, business and environmental organisations to set out the challenges and opportunities of the region. Details of our work on the future of our city centres, a GreenPrint for green recovery, and the central South's case for 'levelling-up' can be found on our website.

In this report, produced in collaboration with partners across the region[1], we examine one of the central South's unsung stories: its strength in fostering and promoting the life sciences. We hope it will be useful to the region's political and civic leaders in telling the story of the central South; to central government in understanding what the region has to offer the UK, and to those engaged in the region's life sciences in recognising the importance of what they do.

Southern Policy Centre

[1] Sponsors of the report include: National Biofilms Innovation Centre, NIHR Clinical Research Network Wessex, University of Portsmouth, University Hospital Southampton NHS Foundation Trust, University of Southampton, Wessex Academic Health Science Network. We are grateful to over 30 businesses, NHS Trusts, universities and other organisations across the south for contributing expertise to this report.

Front cover Image 1: View of the Spinnaker Tower, Portsmouth. Credit: iStock by Getty Images, skyice11.
Foreword Image 2: Winchester Cathedral. Credit: iStock by Getty Images, raylipscombe.

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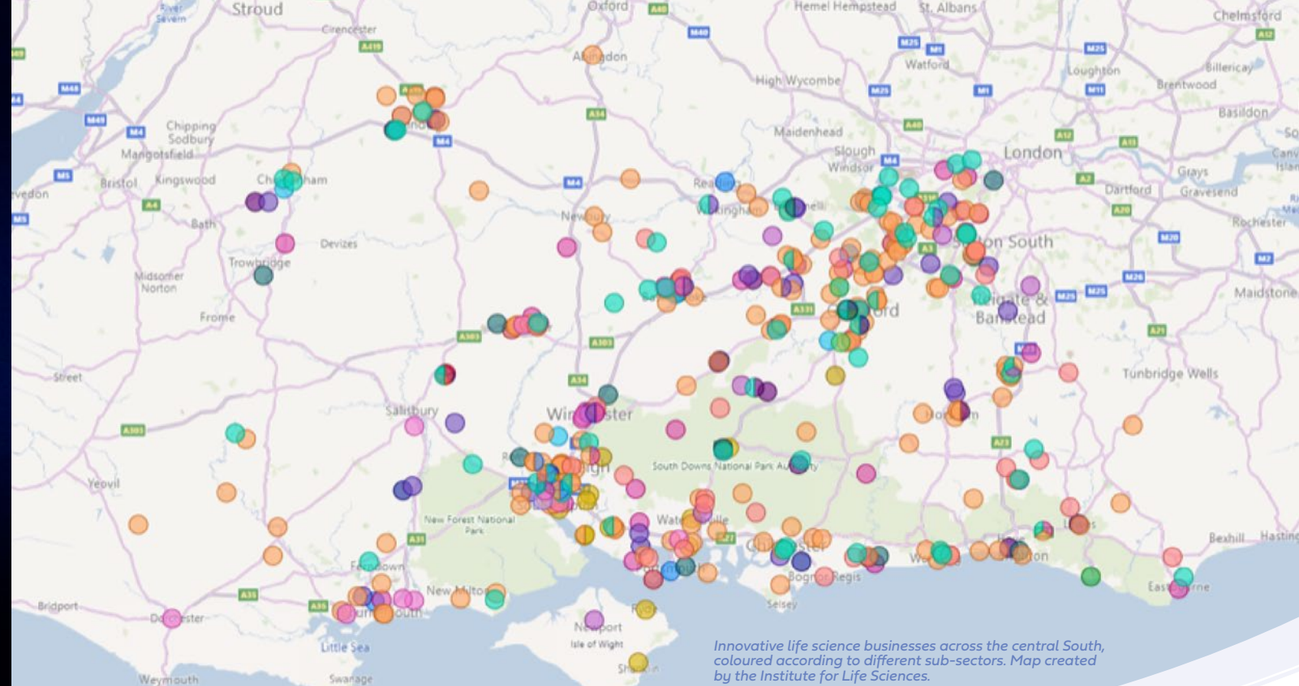
Executive SUMMARY

Image 3: First-of-a-kind soft tissue-optimised micro-computed tomography (µCT) scanner in Southampton for 3D X-ray histology, courtesy of the Biomedical Imaging Unit and µ-VIS X-ray Imaging Centre.



Innovative life science businesses across the central South, coloured according to different sub-sectors. Map created by the Institute for Life Sciences.

With a population of 2.4 million, the central South punches well above its weight in life sciences. This is a region rich in assets, with unique strengths and the intellectual firepower to tackle the concerns of the future and drive prosperity.

Equipped with some world-class facilities and the imagination to capitalise on advances in science and medical research, the region nurtures a unique combination of specialist expertise. Universities, NHS trusts, internationally acclaimed institutions and a vibrant private sector work together to tackle the most pressing health and wellbeing challenges.

Activity in life sciences here is closely aligned to the 2021 vision outlined by the government's Office for Life Sciences (OfLS). Its 2021 vision declares: "our opportunity now is to...use the drive and ingenuity of the private sector skill and intellect of UK academia and scale and expertise of the NHS to make meaningful progress." Tomorrow's problems will only be solved by tight collaboration today across disciplinary, academic and commercial boundaries - and the central South excels at reaching out in the spirit of discovery and enterprise.

Based on in-depth collaboration with many of the leading public and private sector partners in life sciences in the region, including more than 30 interviews, this report highlights how unique regional initiatives are making strides towards the OfLS's vision - in tackling dementia and ageing, in keeping the UK ahead in vaccine science, in managing and preventing long term conditions, developing immune therapies and understanding mental health - and how to improve it. We also want to tackle entrenched health inequalities - another government priority.

This report outlines unique assets, expanding facilities and clusters of expertise. But the region can claim more than a string of individual research strengths or innovative companies. Its real power lies in partnerships - and it's these that researchers, clinicians and entrepreneurs want to nurture. Partnerships ensure that ground-breaking research can be translated into innovation and become part of clinical practice, to the benefit of as many people as possible.

There are clear cross sector strengths and pioneering initiatives in medical technologies, data and artificial intelligence, and biomedical research.

Collaborators know how to nurture innovators, and how to get the best out of medical communities that elsewhere in the country sit side by side with industry and the public, but don't always communicate. There is a many layered approach to innovation, from the germ of an idea to widespread adoption. Networks here have outperformed their peers at a national level - the region benefits from an extremely successful Academic Health Science Network.

We look too at opportunities - new innovation parks and hubs, new capacity to trial health technologies, new cross-disciplinary research collaborations. Businesses here can grow; universities can work hand in hand with enterprise, and innovators can achieve a national impact.

Most importantly, this report explains why the central South stands out - it's collegiate, collaborative and brimming with ideas to meet future challenges.

Professor John Denham
Director, Southern Policy Centre
September 2022

The ideas pipeline:

The central South supports life science entrepreneurs to unlock innovation.

At a national level, strength in life sciences is rooted in the research of UK universities and in the ingenuity of entrepreneurs. But to harness discoveries, the sector needs patience, cash and space to experiment; early stage technologies might take up to a decade to reach mainstream adoption.

> The central South offers facilities and professional support to help life science innovators realise their ideas and has a healthy track record in enabling adoption.

For an invention, an app or medical technology to flourish beyond the lab - in hospitals, communities and the environment - it needs to be needed, it needs to work, and it must make financial sense.

Innovators in the central South are amply catered for, with access to expanding space, new business parks and dedicated support - more than 220 health and life science companies prosper in the immediate vicinity and around 500 innovative life science organisations are within an hour's drive of BCP, Southampton, and Portsmouth[2]. Universities in Hampshire and Dorset work together rather than compete, small businesses with big ideas are nurtured and medical teams engage with researchers - who have access to leading clinical trials facilities.

"We have some amazing assets in the central South," says Bill Gillespie, chief executive of a key regional innovation arm within the NHS - Wessex Academic Health Science Network (AHSN). "Over the last two years [2020-2022] we have supported over 250 life-science business owners, helped create or safeguard 180 jobs and secured more than £56 million in investment, grants and contracts."

In the following sections we take a closer look at some of the strengths that make the central South an attractive region for investment in life sciences.

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> Bill Gillespie, chief executive of a key regional innovation arm within the NHS - the Wessex Academic Health Science Network (AHSN).

[2] Institute for Life Sciences company data set, February 2022.

Image 4 (above right): West Quay and Southampton Old Walls, Southampton. Credit: iStock by Getty Images, Kim Jackson.

The ideas pipeline:

Assets

Wealth of talent in industry, HEIs & healthcare

Collaborative ethos

Interdisciplinary culture

Innovation space

Innovation support

Large clinical trials capacity

World-class facilities Research supports clinical need

Sector Strengths

Medical technologies

Data & artificial intelligence

Biomedical research & implementation

Challenge Areas

Mental & adolescent health

Healthy ageing

Microbial impacts

Health & environment

Health inequalities

Intellectual Capital

- > 220 Businesses
- Five Universities
- Research-active Primary & Secondary NHS Trusts
- Two integrated care systems
- NIHR Applied Research Collaboration Wessex
- National Biofilms Innovation Centre
- National Centre for Computer Animation
- National Oceanography Centre
- Future Photonics Hub

Testing & Evidence

- Substantial trials capability across two Integrated Care Systems
- NIHR Research Design Service South Central
- Portsmouth Technology Trials Unit
- NIHR Southampton Biomedical Research Centre
- NIHR Southampton Clinical Research Facility
- Southampton Clinical Trials Unit
- Southampton Emerging Therapies & Technologies Centre
- Wessex Investigational Sciences Hub

Commercial & Adoption

- Dorset Innovation Hub
- SETsquared
- Southampton Science Park Catalyst Programme
- Future Worlds
- Innovation Parks
- Solent freeport

Ideas | Applications | Evaluation | Innovation | Adoption & Spread

Wessex Academic Health Science Network

NIHR Clinical Research Network Wessex

Supporting Innovation and Growth in Healthcare Technologies (SIGHT)

Opportunities

Fertile environment for investment & growth

Build on successful regional health data partnerships

Training for purpose in the local workforce

Deliver opportunities for highly skilled interdisciplinary life scientists

Scaling up our innovative businesses

Test bed for innovation & adoption

Create models to deliver national impact in health, society and environment, and economic benefits

AGILE WAYS OF WORKING

The region has demonstrated its ability to pull together and forge new ways of working in the face of urgent health challenges - notably during the pandemic.

A swift and resourceful response to the pandemic demonstrated the region's versatility and ability to pull together in the face of pressing need, by leveraging existing networks between hospitals and universities and common strengths in technology and biomedical science. This is a region already accustomed to working across boundaries.

"We've been working as a regional network for many years, but the pandemic has given us the opportunity to develop, to build more trusting relationships," says Professor Saul Faust OBE, Director of the Southampton NIHR Wellcome Trust Clinical Research Facility. "If we have a finite resource, we just work out collectively how to manage it for the benefit of industry, the NHS and patients."

With this track record[3], the central South stands poised to build on strong relationships forged across the region and ready to change tack swiftly to meet emerging and unexpected challenges.

> We were responsive, collaborative and attuned to the needs of local people. COVID-19 accelerated the regional collaboration that was already underway.
>
> Professor Gordon Blunn, a bioengineer and Director in health and wellbeing at the University of Portsmouth.

[3] See Appendix 1.

Building on solid foundations

The central South already excels in areas such as data, medtech and digital health, and biomedical research. Now the region is on the brink of consolidating its strengths as institutions, businesses and communities begin to work together more closely.

The central South is a data powerhouse.

Information about people's health is immensely valuable - patient datasets have a collective value and can reveal triggers and patterns in long term conditions, or the impact of health interventions, environment, lifestyle or disadvantage. "Data saves lives," says Christine McGrath, who is Director of Strategy and Partnerships at University Hospital Southampton NHS Foundation Trust (UHS). Accelerated growth in digital health technologies over recent years has generated increasing levels of data. "Southampton is a powerhouse in terms of ideas," says Professor Michael Boniface, a computer scientist at the University of Southampton, "and it benefits from one of the world's most powerful super computers, Iridis 5."

As a region the central South offers researchers rich demographic variety. Rural and inner-city communities live side by side. UHS alone serves 3.7 million as a specialist centre - one of the largest in the country. Some unique data initiatives have emerged in the region - the longitudinal Southampton Women's Survey, the data sharing Care and Health Information Exchange and the patient record platform mymedicalrecord[4].

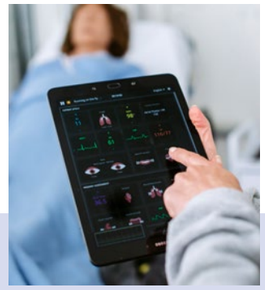
The region has recently won funding from NHS England to develop a secure digital location where researchers can request access to sensitive but anonymised health data – a Trusted Research Environment (TRE) – where patient information will be closely guarded. "Our patients own their own data, we are just the gatekeepers," says McGrath. "It remains under strict governance". Led by UHS, the "Wessex Regional TRE" is one of only four sub-national pilots for the NHS. And the University of Southampton will also develop and govern its own TRE capability in order to work with a range of partners from different sectors and locations.

"People are understandably concerned about privacy," says consultant neurologist Dr Christopher Kipps. "But if you treat data properly and put it in a safe environment, you can start to ask questions. How hospital admissions link with data on pollution, or lifestyle, or temperature for instance. You can start to understand what's driving health issues and how they are linked to broader societal problems. This helps drive a learning health system - where the future way you deliver care is enhanced by what you've learned from the past."

In Dorset there are opportunities to gain insights from data to improve the health of a population more than a decade older than the average in England and Wales - the county offers a unique window on the future. Some 29 per cent of Dorset's population is 65 or over, compared with 19 per cent in England and Wales - the county has reached where the rest of the world will by 2050[5]. Potential collaboration between Bournemouth University, hospitals and communities to meet challenges of healthy ageing is attracting interest from researchers and the private sector.

The central South is home to some unique data initiatives

- A longitudinal study, the Southampton Women's Survey begun in 1998 is the only one of its kind in Europe to follow women before they became pregnant, and to monitor their children over the years, revealing influences on children's health as they develop.
- Another initiative aims to cross reference GPs' patient records with a selected group of people born at the same time. This uses information from a secure system based in the south - the Care and Health Information Exchange (CHIE); a National Institute for Health Research (NIHR) pilot scheme which shares information across a range of health services. "CHIE is a major regional asset offering population scale and potential for highly networked data," says Professor Michael Boniface.
- The region is home to one of the nation's most digitally advanced tools for managing patients' health records - mymedicalrecord, developed by UHS, which allows patients to share their own health data via an open but secure platform.



CASE STUDY 1

National Early Warning Score (NEWS)

Patients' vital signs - pulse, blood pressure, temperature etc - used to be written on charts kept at the end of their beds. But these didn't flag when a patient might deteriorate.

Once hospitals began to record these digitally, computer scientists at the University of Portsmouth were able to use anonymised data from Portsmouth Hospitals University NHS Trust to give a simple score according to variations from the norm. Above a certain aggregate score spelled danger - warning medical staff that a patient was at risk of going downhill. "Statistical and artificial intelligence analysis revealed which combinations of vital signs would most likely lead to bad outcomes," says Professor Jim Briggs at the University of Portsmouth, whose team helped develop the predictive model. These insights are now embedded in a national system launched in 2012 by the Royal College of Physicians as the National Early Warning Score (NEWS), updated in 2017 to NEWS2, and now widely adopted across hospitals and ambulance trusts.

"Working in such close harmony with clinical colleagues from Portsmouth Hospitals has meant we learned how data is collected, processed and used. Our analyses aim to answer the questions that clinicians are asking," says Briggs.

[4] See Appendix 1. [5] World Health Organisation https://www.who.int/health-topics/ageing#tab=tab_1

Image 5 (above): Digital Medicine, University of Portsmouth. Credit: Helen Yates.

Bold innovation within medtech and digital health

Within the closely regulated and competitive medical technology (medtech) sector, the South is a hotbed of ideas, according to a 2017 science and innovation audit[6] - which looked at eight counties from Dorset through to East Sussex and Kent.

More than 500 medtech and biopharmaceutical small businesses are based across the region, which excel in this field. At a national level, companies in this steadily growing sector make up 65 per cent of total life science businesses, accounting for more than half (52 per cent) of employment. The lion's share of jobs are found in the south east, which accounts for 23 per cent of UK medtech employment[7].

"We come across some fantastic ideas and innovation at a local level," says Nigel Clarke, chief executive of Hampshire based Morgan Innovation & Technology which develops medical devices and technology. But ideas need solid support and collaboration to get beyond proof-of-concept, he says, and the well-established family firm lends a helpful ear to newcomer entrepreneurs.

Medtech is far more than wearables and gadgets, and the region hosts a strong community of digital health entrepreneurs who are leveraging new technologies to boost patient care, limit health inequalities and help people stay healthy.

Digital technology makes up 16 per cent of Hampshire's life sciences sector[8], and the region's academic prowess in computing, AI, gaming, medical imaging and data science inspires new ideas and ventures. Regional networks strive to nurture medtech innovators with tailored advice, grant applications, finance and trials.

> ...Here in the South I've received significant support, guidance and funding...It's a fantastically supportive community
>
> Dr Ali Mosayyebi
> Biomedical Research Fellow, University of Southampton.

225
life science businesses in the central South

Medtech 38%

15% Therapeutics discovery & development

500
innovative life science organisations within an hour's drive of BCP, Southampton & Portsmouth

CASE STUDY 2
Sooba Medical

Urinary stents - hollow flexible tubes that help urine flow from the kidneys to the bladder - are used as a temporary solution to help bypass obstructions caused by kidney stones, tumours, strictures and more within the urinary tract. But most stents fail, partly because they're vulnerable to bacterial and crystal build-up, damaging patients' quality of life and costing the NHS an estimated £300 million each year.

Entrepreneur and biomedical engineer Dr Ali Mosayyebi - a former researcher at the University of Southampton - has worked with Southampton urologists and microbiologists to design a new stent less prone to failure from blockage and infection. "Research to market is a long journey and requires resilience and knowledge," he says. "But here in the South I've received significant support, guidance and funding and have built good relationships with clinicians and opinion leaders. It's a fantastically supportive community."

CASE STUDY 3
my mhealth

"I wanted to come down from my ivory tower," declares Dr Simon Bourne, founder and chief executive of my mhealth. As a respiratory consultant, he wanted to prevent lung disease and breathing difficulties from occurring in the first place. "My patients turned up towards the end stage of their disease, but we had no impact in preventing it." A simple educational website he founded more than a decade ago saw dramatic patient improvement - and his team has since developed technology to help people manage long term illness via tailormade interventions such as education and monitoring. These beat the average 15 minutes patients might spend with their clinical team each year, says Bourne.

Now based in Bournemouth, my mhealth, one of the UK's largest digital health platforms, was helped through the early days by the central South's support systems, from Southampton's science park to university innovation alliance the SETsquared Partnership. Bourne went on to become an NHS innovation accelerator fellow, supported by the region's AHSN and technology trials unit. my mhealth now works closely with Dorset's integrated care systems.

Today's expanded app helps people manage conditions such as heart disease, asthma, diabetes and COVID-19, and new products and international markets now sit in the company's sights.

[6] The Innovation South audit report.
[7] https://www.gov.uk/government/statistics/bioscience-and-health-technology-sector-statistics-2020.
[8] https://businesshampshire.co.uk/sectors/life-sciences/.

Image 6: mydiabetes, stock image.

Image 7: South Coast Genomics Medicine Centre, University of Southampton. Credit: Jon Banfield.

Biomedical research tackling national and global challenges

Universities that collaborate rather than compete.

The central South hosts several collaborative universities that have clear common strengths and complementary expertise within life sciences; these focus on health challenges and the interplay of health and environment, flagged by government as priorities.

Global challenges - infectious disease, an ageing population and climate change - require extraordinary academic collaboration between institutions, colleagues, health professionals and the public.

Home to one of the most cooperative environments in the country, the central South boasts a first-class balance of academia, health and industry. "The range and depth of life sciences expertise in this part of the country is extraordinary yet underappreciated," says Professor Peter JS Smith, Director of the Institute for Life Sciences (IfLS) at the University of Southampton. Rather than dwarf local communities and health services, universities work with the local population. "The whole of the South is far greater than the sum of its parts," says Smith.

Of the region's institutions in Portsmouth, Southampton, Bournemouth and Winchester, there are clear common strengths. Each institution acts as a catalyst for regional economic growth and welcomes new ideas from the private sector.

Universities in the central South have complementary specialisms within the wider life sciences and are helping to propel the region towards goals outlined in the NHS Long Term Plan. Together, they focus on meeting the needs of the population as resources become more stretched and demand for care increases. "There are clear areas where our research strengths align with clinical, health and societal need," says Smith.

All universities in the region contribute towards science and practice around lifestyle, nutrition, wellbeing, sport and exercise - essential in pursuit of the NHS target to prevent illness and tackle health inequalities.

Health science, social and primary care is another common strength, and the region excels in research and care around mental health, dementia and ageing.

There are notable concentrations of expertise in microbiology and anti-microbial resistance at Portsmouth and Southampton, where researchers work closely with the National Biofilms Innovation Centre (NBIC) and its global industrial partners to control and exploit biofilms. At the pioneering Centre for Enzyme Innovation (CEI), scientists working with bacteria are making breakthroughs in tackling plastics pollution and recycling.

Regional expertise in respiratory health, infectious disease immune responses and microbial research is supported by an established track record in understanding inflammation and lung diseases such as asthma, cystic fibrosis, tuberculosis, and lung cancer in Portsmouth's School of Pharmacy and Biomedical Sciences and Southampton's Faculty of Medicine. The Centre for Cancer Immunology is the first in the UK dedicated to fighting cancer using the body's own immune armoury.

Common strengths in physical sciences, maths, and engineering in the central South, combined with social sciences and a flair in arts, help bolster the reach and impact of life sciences in the region. "This interdisciplinary mix is the extra dimension that we do extremely well here," says Professor Blunn. The list of expertise is long - data analysis and visualisation, computer animation and virtual reality, artificial intelligence and machine learning, imaging technologies, biomedical engineering, e-health and app development.

Latest figures show that the universities of Southampton, Portsmouth and Solent are contributing more than £4.2 billion to the UK each year, while supporting 52,300 jobs, according to a study by Solent LEP. An economic impact study[9] found Bournemouth University generated more than £1 million a day in economic activity in the region and created 1,400 full time jobs.

£4.2bn
annual contribution to the UK economy by the Universities of Southampton, Portsmouth and Solent

£1m
daily contribution to regional economic activity by Bournemouth University

> The range and depth of life sciences expertise in this part of the country is extraordinary yet underappreciated.
>
> Professor Peter JS Smith, Director of the Institute for Life Sciences (IfLS) at the University of Southampton

[9] *https://www.bournemouth.ac.uk/about/our-regional-impact (2013)*

Image 8: Centre for Enzyme Innovation, University of Portsmouth. Credit: Helen Yates.

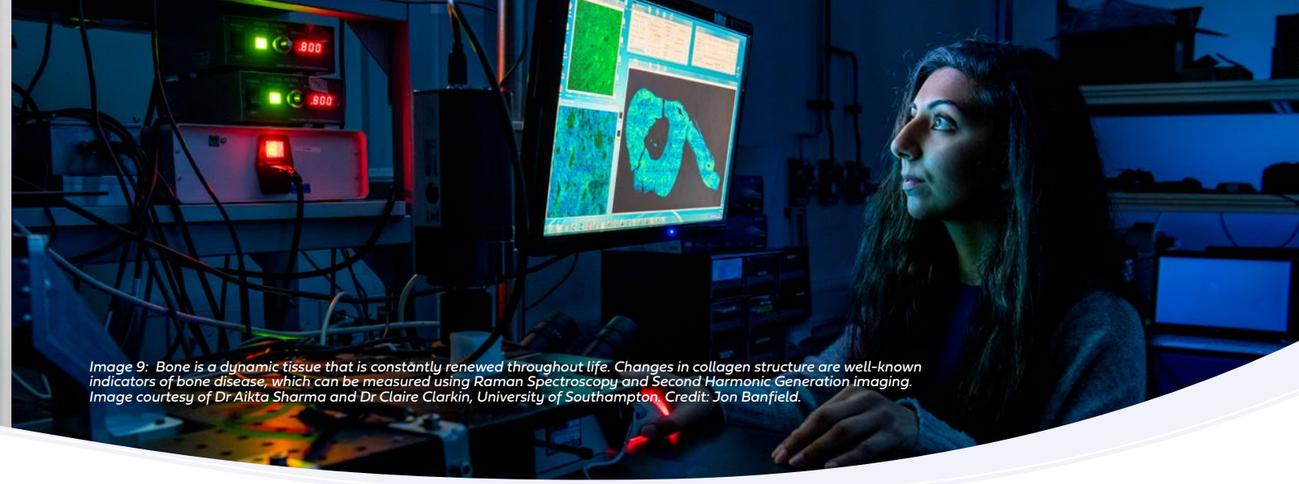


Image 9: Bone is a dynamic tissue that is constantly renewed throughout life. Changes in collagen structure are well-known indicators of bone disease, which can be measured using Raman Spectroscopy and Second Harmonic Generation imaging. Image courtesy of Dr Aikta Sharma and Dr Claire Clarkin, University of Southampton. Credit: Jon Banfield.

Outstanding clinical and health technologies, research facilities and expertise

The central South has extensive clinical research facilities serving both researchers and the private sector.

University hospitals in Dorset, Southampton and Portsmouth allow for tight collaboration between academics, clinicians and the private sector, and help enrich training and skills.

UHS is typically in the top five in the country for recruiting to research studies and has played a leading role liaising with other regional hubs to coordinate vaccine research. “This has a legacy,” says McGrath. “It’s opened the way for more studies that reach a wider community - and this is attractive for innovators.” Research hospitals enjoy a culture of constant innovation, she says. “There is a mindset of wanting always to answer questions - how do we improve care? How do we produce a better drug? Individuals want to work in an organisation which supports this culture.” The UHS commitment to the future of research and innovation is demonstrated through significant investment in the Southampton Emerging Therapies and Technologies (SETT) Centre, focused on NHS needs in emerging areas.

Within Southampton’s hospital and university, clinicians, researchers and the private sector have access to a vast clinical trials infrastructure, with dedicated, well-equipped and staffed laboratory space. At Southampton’s National Institute for Health Research (NIHR) Biomedical Research Centre, experts collaborate on specific areas from looking at behaviour change to leveraging health data. And to help design trials, recruit people and handle data, there is a large Clinical Trials Unit, funded by both Cancer Research UK and the NIHR.

To meet the needs of emerging health technologies, Portsmouth has founded a new facility. Since 2018, the Portsmouth Technology Trials Unit (PTTU) - a collaboration between the university and the Portsmouth Hospitals NHS Trust - has helped entrepreneurs, small companies and researchers launch a range of health technology research and trials. “It’s a funnel for ideas,” says Professor Anoop Chauhan, Director of research and innovation at Portsmouth Hospitals NHS Trust. “People come to us with an idea. We help them develop and design a trial, seek funding and help with the data - the whole journey from idea to result. And this ability to cater for the whole research journey is, I think, a highlight of Portsmouth - it’s unique.”

Both Hampshire Hospitals (NHS Foundation Trust) and Solent NHS Trust are dedicated to improving patient care through research. Solent collaborates across care homes, playgroups and schools to include the young and the elderly in research projects. “It’s about bringing research to the community rather than the community having to go to the big hospitals,” says Jo Turpitt, senior research nurse for Solent NHS Trust. “We’re innovators in this field.”

> It’s about bringing research to the community rather than the community having to go to the big hospitals, we’re innovators in this field.
>
> Jo Turpitt, senior research nurse for Solent NHS Trust

Addressing Future CHALLENGES TOGETHER

How we age, the world that we live in, the quality of care that we receive and the wellbeing of everyone - particularly young people - are among some primary concerns of the NHS of the future. In the central South, research communities are striving to meet the requirements of the NHS long term plan.

“It’s important that we look at ways to collaborate on research across health and social care if we are to address societal challenges,” says Professor Vanora Hundley, former deputy dean for research and professional practice at Bournemouth University’s health and social science faculty. “An integrated approach is required to solve complex problems and ensure health and wellbeing for all.”

As a region, the central South possesses the breadth of higher education and professional training expertise to ensure the workforce continues to acquire up to date and relevant skills and development for the life sciences sector.

The following examples, on the next pages, illustrate how the central South is tackling societal challenges through research and enterprise.

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>
> Professor Vanora Hundley, deputy dean for research and professional practice at Bournemouth University

CASE STUDY 4

Drones to deliver medical supplies?

Could drones transform how urgent medical supplies and other goods are delivered to remote locations - and help cut emissions? In May 2020, an uncrewed fixed-wing drone, designed by engineers at the University of Southampton, made the first beyond-visual-line-of-sight crossing to the Isle of Wight, carrying medical packaging containers for St Mary’s Hospital as part of the COVID-19 emergency response. Now, the universities of Southampton, Bournemouth, Leeds, and University College London are collaborating with industrial partners to assess whether it would be feasible to use drones to transport chemotherapy medicines across the Solent region - potentially cutting costs, fuel emissions and speeding up services for patients.

Image 10: Professor Mary Barker, University of Southampton. Credit: Jon Banfield.

Spotlight on MENTAL HEALTH

The central South specialises in adolescent wellbeing with focused research underway across the region's universities.

Support for young people's mental health is a key government priority, and the NHS Long Term Plan commits to providing better access, awareness and training.

During the early stages of the pandemic, Southampton academics built on established community links to understand young people's anxieties in the wake of upheaval at school and home. Good engagement with schools was possible because of a pioneering scientific facility in the region dedicated to education. This is LifeLab, which offers school children and young people an extraordinary opportunity to get hands-on in scientific laboratories to learn about the science behind health. "LifeLab is run by a team of amazingly creative and interesting individuals - teachers and scientists - it offers young people an experiential science opportunity," says Mary Barker, Professor of psychology and behavioural Science at the University of Southampton. "It's very creative and exciting. And it has had amazing public engagement - it receives visitors from all over the world as well as the region."

> LifeLab is run by a team of amazingly creative and interesting individuals - teachers and scientists - it offers young people an experiential science opportunity.
>
> Mary Barker, Professor of psychology and behavioural Science at the University of Southampton.

Spotlight on HEALTHY AGEING

The central South is investigating healthy ageing, specialising in musculoskeletal health and lifestyle factors.

Universities of the central South specialise in the science and impact of nutrition, exercise and sport, offering some unique facilities and wide ranging research linked to exercise, health and rehabilitation. This regionwide expertise makes the region a national leader in healthy and active ageing.

A lack of physical activity is as deadly as smoking, research shows, and is a key NHS concern, costing the UK an estimated £7.4 billion a year - physical activity can help improve bone health, limit risk of disease and depression.

From a specialist clinic dedicated to improving life for stroke survivors and strong sports science expertise at Winchester to leading edge facilities at Solent's sports science laboratory, the region is as well equipped to keep top athletes healthy as it is to rehabilitate those recovering from illness or injury. Portsmouth's work around physical activity and health encompasses both the psychological and physiological factors that inhibit or encourage exercise. Medical teams in the central South have led national efforts to understand better care for patients before surgery and as they recover.

To the west, Bournemouth University houses one of the most advanced gait analysis labs in the world and helps forge commercial and academic partnerships beyond the region. And the university hosts the nationally acclaimed Orthopaedic Research Institute (ORI), which is pioneering robotic-assisted hip replacement surgery. Bournemouth University and University Hospitals Dorset share expertise around virtual reality and its potential use during surgery. Osteoarthritis, more common in older people, orthopaedic surgery and related devices are all areas of expertise within ORI, which brings researchers, clinicians and patients together. University experts are focusing on building environments which people with dementia can navigate more easily, and on boosting social inclusion and improving nutrition.

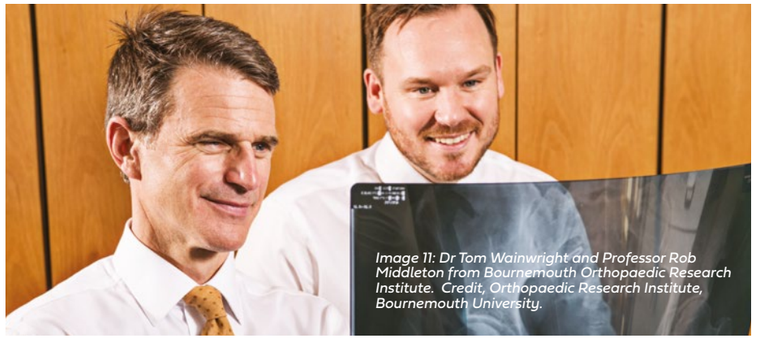

Image 11: Dr Tom Wainwright and Professor Rob Middleton from Bournemouth Orthopaedic Research Institute. Credit, Orthopaedic Research Institute, Bournemouth University.

In a bid to look back to the earliest factors that influence our health, scientists in a specialist Southampton centre are looking at maternal health before conception and other factors that may affect development before a baby is even born. At the Medical Research Council Lifecourse Epidemiology Centre, researchers are investigating how maternal health, genes, diet and other factors affect our lifelong health and conditions that grow more common as we age - with a view to intervening to keep people healthier for longer.

A new Bournemouth University study to test whether older people could learn to manage their own frailty will start in early 2022. Researchers will gauge whether individuals benefit from using their own devices and digital tools - supported by a health coach - to beat the most debilitating effects of frailty, which now affects one in ten over the age of 65. Tailored digital care delivered through a smart phone could help reduce falls and injuries and limit the burden on health and social care. "We want to support people live the healthiest, best life possible," says Professor Jane Murphy, co-lead of the Ageing and Dementia Research Centre at Bournemouth University. This research is funded by the NIHR Wessex Applied Research Collaboration (ARC), which acts as the national lead on applied research on ageing and dementia.

CASE STUDY 5

FortisNet - the power of partnership

Musculoskeletal expertise spans the regions' institutions, and the collaborative network FortisNet aims to tackle the burden of largely age related diseases with an approach that involves a range of sectors and helps build communities of knowledge. FortisNet has demonstrated how the region can channel expertise from a broad spectrum, including regenerative medicine, engineering, prosthetics, orthopaedics, rehabilitation, assistive technology and more - to focus on specific problems, yielding technology breakthroughs, spin-out successes and attracting substantial funds for further research. It offers a successful blueprint for future networks and showcases the potential of the central South's philosophy of strength in partnerships.

[9] https://www.gov.uk/government/publications/physical-activity-applying-all-our-health/physical-activity-applying-all-our-health

Spotlight on health and the environment

Human health is strongly influenced by environmental factors and inextricably connected to the health of the planet. Leading environmental experts across the South are addressing pollution, climate change, the health of our oceans, and the impact of microorganisms on commerce and society. These all have direct consequences for human health, some of which are outlined below.

National Biofilms Innovation Centre

Biofilms (a slimy film containing microorganisms) are ubiquitous within the environment and our bodies. They harbour beneficial microorganisms such as the gut microbiome but also provide a 'hiding' place for bacteria and viruses contributing to the problems of multidrug resistance. Experts estimate that addressing the challenges posed by biofilms is worth some £45 billion to the UK.

Since its foundation four years ago, a Southampton-led international hub dedicated to managing and exploiting biofilms has grown steadily, working with universities in the central South and beyond, and with industry at a national and international level.

The National Biofilm Innovation Centre (NBIC) aims to exploit the UK's expertise by nurturing research and investment, and in the past four years has worked with more than 60 UK universities and institutions, engaged with more than 250 companies, and provided £5.2 million of research and innovation funding. "We pull academics and industry across sectors together to talk about different areas of biofilm intervention," says NBIC Operations Director Jo Slater-Jefferies. "Biofilms are everywhere you look," says Slater-Jefferies. "They can build up on medical implants and resist antibiotics and are far harder to kill than lone bacteria."

This is a field rich in opportunity - biofilms affect a vast range of industries from oil and gas through to technology, health, food and agriculture. Based on the doorstep of the central South's universities, NBIC has supported a host of research projects and local collaborations - from investigating whether ultrasound could prevent catheter infections to detecting and mitigating effects of biofilms on historic buildings. Partnerships with Dorset's leading agricultural college Kingston Maurward promise to develop research into disease and antimicrobial resistance - with impacts upon animal, crop and human health.

Centre for Enzyme Innovation

Plastics persist in the environment and can lead to immediate problems for human and animal health, and long term environmental degradation. Bioengineers at Portsmouth are building on regional advances in novel methods to speed up the work of bacteria that can recycle plastic. Scientists have created a cocktail of enzymes that can digest PET (polyethylene terephthalate) - one of the most commonly used plastics - up to six times faster than naturally evolved separate enzymes. Researchers hope this will pave the way for international adoption of techniques, usher in efficient, low-emissions methods of recycling and help tackle the global plastics problem. A pioneering facility has won nearly £7 million in awards to build on this work and develop new technologies. This is the Centre for Enzyme Innovation (CEI) at the University of Portsmouth, where new specialist laboratories will allow further enzyme research. Innovators and industries keen to collaborate and capitalise on advances in plastics recycling and synthetic biology will be able to join scientists at new dedicated facilities within the CEI.

Cleaner air and countryside make for healthier communities and the central South is rich in natural capital, with acres of protected parklands and scenic stretches of coastline. There are a host of initiatives dedicated to cleaning up the natural world, tackling the ubiquity of plastics and cutting NHS emissions, which account for four to five per cent of the country's carbon emissions[11].

In the region's port cities, experts in environmental pollution are beginning to investigate the impact on human health of airborne microplastics and particulates from shipping and dockside emissions.

With a view towards the ocean, the central South benefits from dedicated research facilities at the University of Portsmouth (The Institute of Marine Sciences) and in Southampton (The National Oceanography Centre and Ocean and Earth Sciences). At Bournemouth University, eco-engineers are collaborating with international experts to protect marine environments.

CASE STUDY 6

Dr Sam Robson, University of Portsmouth

Dr Sam Robson's sequencing skills have led him to some interesting detective work. "I use DNA and RNA sequencing to answer certain biological questions," he says. He's helped decipher the genotype of crew members of the Mary Rose from skeletal remains, and investigated the gribble - a sea creature which uses a key enzyme to digest wood. He's a bioinformatics expert at the University of Portsmouth, where a multidisciplinary team works with NBIC on biofilm research. He's currently investigating colonies of bacteria found in biofilms on infected prosthetic hip joints. "We are profiling infected samples to see what's building up on the implant and how that links to infection." In another NBIC-related project, he's also investigating the role of marine antifouling paints.

[11] NHS England https://www.england.nhs.uk/2020/01/greener-nhs-campaign-to-tackle-climate-health-emergency/

Image 12: Close-up image of the biofilm covering the scales of a Mirror Carp. Credit: Dr Mark Burton, University of Southampton
Image 13: Dr Sam Robson, University of Portsmouth. Credit: Helen Yates.

Opportunities

Strong momentum to collaborate further

The central South is ready to push ahead with new partnerships within life sciences and has great potential to help the government meet health priorities in the near future.

With world leading facilities, outstanding and collaborative academics and a distinctive and flourishing private sector, the central South life science sector stands poised to lead new discoveries and meet the health challenges of the future. By continuing to link and nurture clusters of complementary expertise, the region can drive imaginative new applications.

Fledgling networks are forming, linking different disciplines to transform the current approach to health problems, deliver better treatments and attract professional expertise. FortisNet - the network established in 2016 to coordinate expertise in musculoskeletal health - has demonstrated the ingenuity and regional willingness to perform. Now the region is on track to pull together experts from across clinical, community and research to focus on dementia care, with further networks in the pipeline.

Medical imaging advances to unlock potential

Universities of the central South already excel in imaging technologies, and focused collaborations will yield new approaches to solving challenges in health and biology. "We've made exciting optical developments," says Professor Smith. "There's progress in this area and it will gain momentum."

Scientists in the region have access to sophisticated imaging facilities and are developing brand new technologies, which spur on a wide range of discoveries from nano to macroscale. Imaging is at the heart of medical and biological research, leading to advances in areas such as cancer therapies, dementia and regenerative medicine. From access to state-of-the-art microscopes and scanning facilities at Southampton to medical imaging facilities and visualisation technology in Bournemouth, these assets help train and retain expertise.

Advances come from surprising quarters. Cosmologists more used to analysing supernovae and complex patterns from astronomical surveys can also turn their skills towards evaluating medical images. "We are exploring use of artificial intelligence to refine image analysis," says Professor Blunn. A newly created position of clinical professor in digital medicine will aim to develop clusters of expertise in both the hospital and university. "The idea of running complex queries on federated data bases is something that the hospital is extremely interested in learning how to do," says Blunn.

Public health screening

In response to the first wave of the pandemic, UHS, in partnership with the University of Southampton, was commissioned to develop a high-volume LAMP saliva testing programme to meet the unprecedented demand for fast and reliable COVID-19 testing. Through the pioneering use of robotics and technology, manual laboratory processes were automated to accurately identify asymptomatic cases of the virus at scale.

Over 375,000 swab-free saliva samples have now been processed at the world-leading facility based in Southampton, breaking hundreds of chains of transmission, preventing outbreaks and minimising absenteeism. During an initial pilot, participating schools benefited from 94% attendance rates, far exceeding national averages. The programme went on to provide reassurance to many frontline healthcare, social care, education and critical infrastructure settings across Hampshire and Isle of Wight.

Clinical evaluations by the NHS Test and Trace Scientific Validation and Assurance Group confirmed that LAMP saliva testing is accurate and sensitive enough to identify infectious cases early. Preliminary data suggests that saliva testing picks up the dominant Omicron variant 1-2 days earlier and more reliably than other swab tests, including LFDs.

> We pull academics and industry across sectors together to talk about different areas of biofilm intervention. Biofilms are everywhere you look. They can build up on medical implants and resist antibiotics and are far harder to kill than lone bacteria.

Professor Jo Slater-Jefferies, operations director, National Biofilms Innovation Centre, University of Southampton

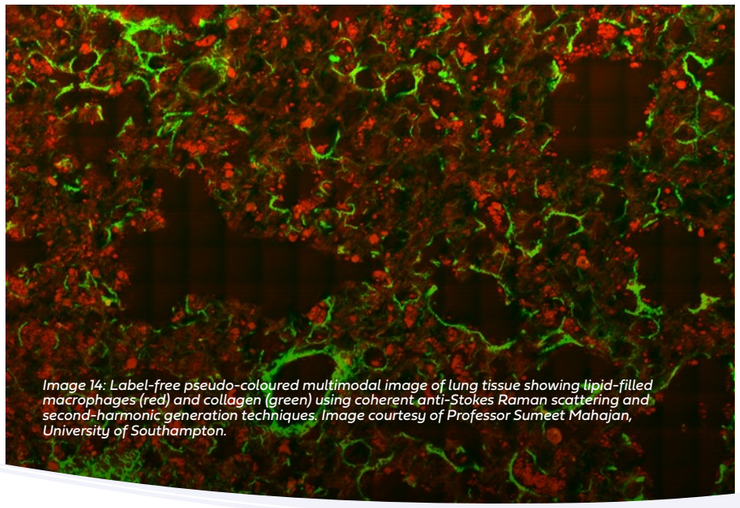

Image 14: Label-free pseudo-coloured multimodal image of lung tissue showing lipid-filled macrophages (red) and collagen (green) using coherent anti-Stokes Raman scattering and second-harmonic generation techniques. Image courtesy of Professor Sumeet Mahajan, University of Southampton.

Opportunities *(continued)*

Image 15: Professor Rob Middleton with the robotic arm developed at Bournemouth University Orthopaedic Research Institute. Credit, Orthopaedic Research Institute, Bournemouth University.

Operating theatre 4.0

In the operating theatre of a Bournemouth hospital, a pioneering robotic arm assists orthopaedic surgeons as they perform hip replacement surgery. While a surgeon conducts the entire operation, a robot, informed by feedback loops, guides the procedure and prevents any mistakes. Surgeons here in Bournemouth have completed more robotic hip replacements than in any other theatre in Europe, says Bournemouth University's professor of orthopaedics and leading surgeon Professor Rob Middleton. He worked with scientists in London to design a prototype orthopaedic robot back in the 1990s - work which has led to robots being used today. Dorset, with an ageing population more in need of joint replacements, has scope to pioneer further advances, he says. "The road ahead is clear," he told a regional medtech conference. "We've got clear evidence that partnerships in the UK between universities, government funding and industry are successful. What we've done here in Dorset is repeatable around the country. If we can take our ideas and prototypes to market, then there's no reason why the UK cannot be a global leader in medtech."

A visionary grassroots data initiative

Close relationships between civic and health organisations have inspired a radical approach to involving communities in their own health and social care. This is the country's first ever Social Data Foundation, founded by computer scientists in the central South, with the aim of using insights from health information to transform health and social care in the city and beyond.

As a new partnership between the hospital, council and university, the foundation aims to tackle the issue at a grassroots level, by engaging with local communities. This might mean better management of how patients with complex needs are discharged from hospital, or how those with complex long term conditions are best managed in the community - with insights derived from machine learning.

"We see this model potentially being scaled across Hampshire, the Isle of Wight and Dorset," says Professor Michael Boniface who, together with renowned computer scientist, Dame Wendy Hall, is behind the foundation. "We want to provide a space where data is stewarded so it can be processed for the benefits of the community but also for health providers." This is easier at a local rather than national level, he says because public trust is stronger and individuals understand the direct benefits.

> We see this model potentially being scaled across Hampshire, the Isle of Wight and Dorset.
>
> Professor Michael Boniface,
> Social Data Foundation
> University of Southampton

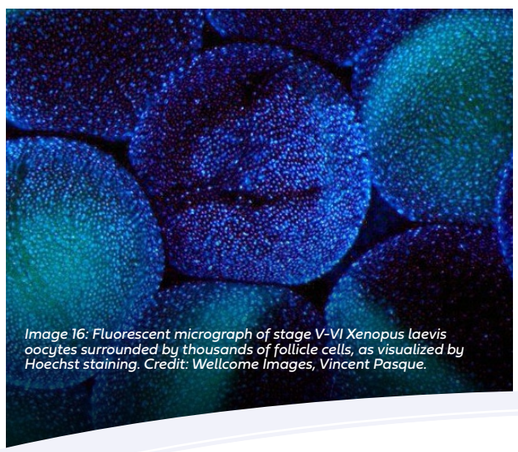

Image 16: Fluorescent micrograph of stage V-VI Xenopus laevis oocytes surrounded by thousands of follicle cells, as visualized by Hoechst staining. Credit: Wellcome Images, Vincent Pasque.

Future discoveries - genetic causes of disease

Could tadpoles help reveal the cause of certain diseases in humans? Genome scientists are working with geneticists and clinicians at the universities of Portsmouth and Southampton to investigate how changes to an individual's DNA cause rare genetic diseases. The Xenopus frog is an efficient and non-invasive model for investigating the function of normal and defective genes. By analysing links between genetic mutations and disease, scientists hope to understand more about cause and effect, and potentially design interventions to help patients. With project funding of just under £1 million, the cross disciplinary team in the central South has access to the largest research facility of its kind in the world at Portsmouth - the European Xenopus Resource Centre.

NEW SPACE AND OPPORTUNITIES FOR INNOVATORS

Image 17: University of Southampton Science Park.

In the central South, new medtech innovation parks are in the pipeline - offering up coveted locations beside hospitals and universities.

A new 14.6 acre business park is planned for Bournemouth and is well placed to capitalise on connections and promising to support a big data driven "living laboratory". A third of the land will go to University Hospitals Dorset, which plans to build cutting edge research facilities in partnership with Bournemouth University. This space could bring digital partners with life science and medtech expertise. "This site offers a great opportunity to develop the collaboration between health, education, research and industry," says Jim Andrews, chief operating officer at Bournemouth University. "Very rarely do you get such an opportunity right next to a leading NHS organisation that can support collaboration in quite an innovative and different way."

Further north, a new innovation park will emerge beside a planned new hospital in Basingstoke which is expected by 2030 as part of a £3.7 billion government funding package. "As regional centres in the South work towards creating capability for data analytics and trusted research environments, there is potential to develop further regional strengths in health data" says Shirlene Oh, Director of Strategy at Hampshire Hospitals NHS Foundation Trust. There are also huge opportunities to leverage the central South's expertise in health and environment - oceanography, plastics, mental health - to develop a regional focus on population health, reaching beyond hospital boundaries and into the community and environment. "Transport, the built environment, climate change and its impact on our health all link together," says Oh. "We could bring academics, clinicians and start-ups together to create a community with a strong focus, and this could put us on a competitive footing at a national level. Hampshire is very community-focused, very good at working in partnerships, and rich in natural assets."

To the north of Southampton, a new health and innovation campus (Adanac Health and Innovation Campus) is planned to provide clinical training and research facilities for University Hospital Southampton and with potential to house an innovation hub for the life sciences sector.

These will complement opportunities at Southampton Science Park, which hosts some 100 companies and also the nationally acclaimed university innovation incubator SETsquared. Promising startups have access to the park's bespoke catalyst programme, and larger pharmaceuticals firms such as Promega UK sit alongside university spinouts. Eight in ten businesses that have received incubator support are still trading - well above the national success rate, and the programme has helped businesses secure £20 million in grants and investment. In all the park's estimated economic impact amounts to £550 million a year, and venture capitalists enjoy close links. A new £14 million high tech innovation hub devoted to transforming towns into more sustainable and healthier places is in the pipeline.

"This region has a lot going for it," says Dr Robin Chave, chief executive officer at the park. "Universities have good relationships; there's a lot of collaboration." Set in 75 acres, with 27 acres of protected countryside, the park's rural location appeals to professionals seeking an alternative to urban spaces. "We're in beautiful countryside; we're low density, you can stroll in woods – yet we're only five minutes from the motorway network, 15 minutes from Southampton Airport and an hour from London by train - that's a big draw."

Skills and education

Skills feature prominently on the regional agenda - the central South produces high calibre graduates who go on to enrich the life sciences sector and the region has a strong base in further education and apprenticeships. Latest figures (2017/2018) from local enterprise partnerships (LEPs) show trainees successfully completed more than 20,000 apprenticeships in the central South and parts of Surrey combined. Across the central South's universities, 14,570 students qualified (2019/2020)[12] in a subject related to health, science, maths, engineering, technology and social sciences at both undergraduate and postgraduate levels.

> Transport, the built environment, climate change and its impact on our health all link together....Hampshire is very community-focused, very good at working partnerships, and rich in natural assets..
>
> Shirlene Oh, Director of Strategy at Hampshire Hospitals NHS Foundation Trust

[12] Higher Education Statistics Authority

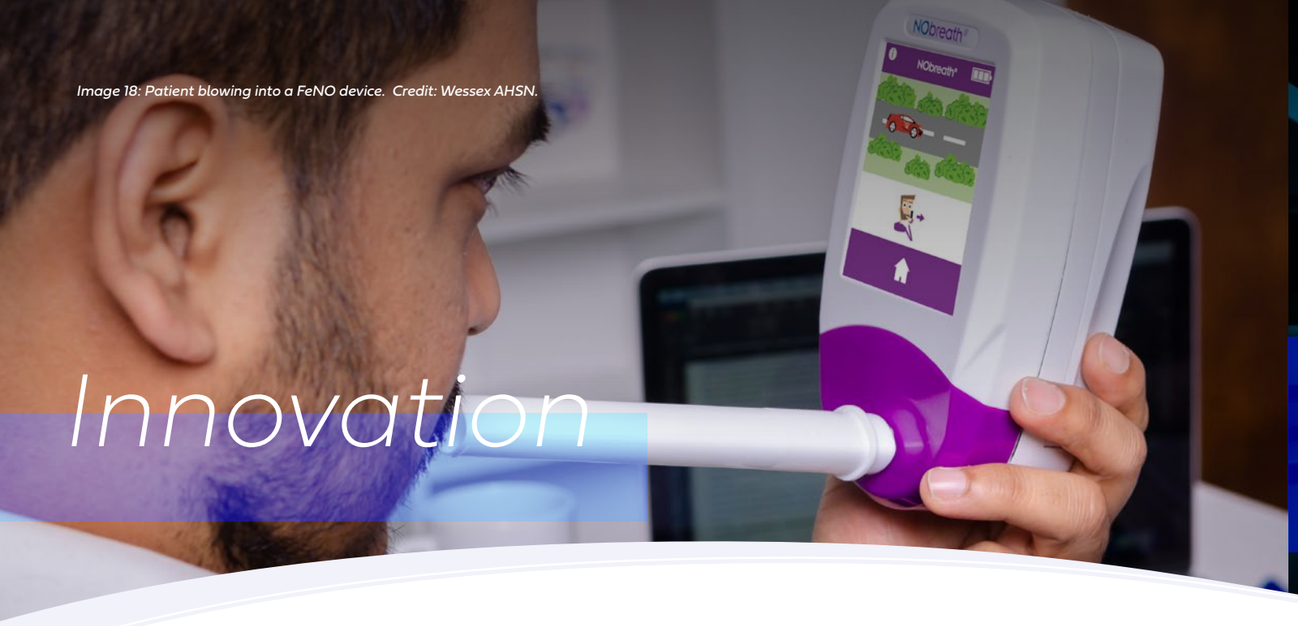

Image 18: Patient blowing into a FeNO device. Credit: Wessex AHSN.

Innovation

A host of new initiatives within health and the private sector promise to drive innovation.

Wessex Health Partners

A bold new partnership that unites the region's health, academic and innovation experts promises to reinforce the national impact of the central South and neighbours. This is Wessex Health Partners (comprising Dorset, Hampshire and south Wiltshire), which capitalises on the region's long history of collaborative research and expertise.

"It's a learning partnership," says Professor Smith, and one which will coordinate the vast range of expertise across the region. "We have tried and tested models for bringing people together to solve problems in health and social care. This umbrella organisation will deliver more to the community, maximise health and social care innovation and help us become more competitive on the national stage."

Solent freeport

Life science innovators will be boosted by the region's impending freeport status - Solent was selected in 2021 as one of eight new freeport sites around the UK. Companies within Solent freeport will enjoy tax and customs benefits - authorities behind the successful bid estimate the freeport will create 52,000 new jobs and unlock billions of pounds of investment. This is an opportunity for many sectors, says Professor Blunn, and could herald collaborations between life science and a mix of technology sectors, from satellites to additive manufacturing. With access to expertise at the central South's universities and research facilities, the freeport will nurture clusters of expertise - with benefits for local communities.

Integrated care systems

Joined up health and social care that keeps people out of hospital is part of the NHS masterplan to meet looming demographic problems of an older population more prone to complex conditions. These integrated care systems (ICS) unite different parts of the NHS to work more closely with communities and local services, cutting red tape and lowering barriers to services. This allows care teams and services to share digital information more easily. ICSs are a fundamental part of the NHS long term plan - and the government aims to install them across England. The central South reached ICS status on 1st July 2022.

A new health innovation hub

Dorset's status as a "living laboratory" - a test bed for an ageing population - has been cemented by the creation of a hub to help spread innovations - many of them in digital health - across the local health and care system. This is the new Dorset Innovation Hub, created after the region was selected by the charity The Health Foundation as one of four sites around the country to coordinate the uptake of proven health improvements in the wake of increasing health inequalities driven by the pandemic. The new hub will draw together health expertise across the region, from universities to hospitals, to encourage services to adapt and use new health initiatives and technologies - with a view to improving care.

> For innovation and entrepreneurship to thrive, you need the right talent, facilities and support. In the South, we have a rich ecosystem of innovative businesses, science parks, major universities and world-class healthcare assets. Alignment of those resources will for sure release the untapped potential we have.
>
> Dr Kam Pooni, Royal Society Entrepreneur in Residence at the University of Southampton within the Institute for Life Sciences and CEO Glyconics Ltd.

Image 19: Advanced, wearable e-textiles to ease joint pain in osteoarthritis. Image courtesy of Dr Kai Yang, University of Southampton. Credit: Jon Banfield.

Call TO ACTION

A regional powerhouse, the central South plays a pivotal role in developing national expertise in life sciences. A rich ecosystem of research and innovation offers a unique opportunity for investors.

Regional assets are linked by a web of interconnected networks powered by focused expertise - several pioneering initiatives to leverage public health data responsibly are promising to launch new insights, new tools and new ways of working with the public. Universities are partnering with local communities, and the clinicians who serve them - this is an area ripe for growth and investment.

An exceptional mix of universities are eager to work with incoming enterprise to continue to develop specific skills required by life science businesses. With combined strengths in biomedical science, healthcare, data science, engineering and design, institutions of the central South are confident in equipping workforces with tailormade skills for the future. People and talent are key to future success.

Ambitious life scientists here will continue to find rewarding collaborations across disciplines, internationally renowned research centres and world leading facilities - and crucially, a willingness to work together.

Networks of the central South have proven national champions at getting technology to market - innovators will discover some of the most collegiate support systems in the country and sophisticated networks with a track record of testing technologies in the real world. With a mix of prosperous and inner city communities and pockets of ageing populations, the central South offers a fertile testing ground for digital health innovations.

Facilities are expanding in several sites across the central South to offer precious space alongside hospitals and universities, with timely opportunities to take advantage of collaborative clinical and academic knowhow and shared ambitions.

The Government's Levelling Up White Paper rightly identified the Solent as a potential location for investment because of its port and maritime specialisms, its role in trade, and the universities of Southampton, Portsmouth and Solent. Our ambition should be to establish the central South in the minds of government as a nationally important centre for life sciences.

To realise this potential, life sciences in the central South need the recognition and the capital to help the private and public sector continue to meet national priorities such tackling health inequalities and embracing digitally enabled care. The following actions will help accelerate progress:

- Engage with local authorities and Local Enterprise Partnerships to ensure life sciences are included in strategic development plans
- Identify the needs of large corporates through the assistance of DIT, local authorities and LEPs so the central South can offer the skills base and research offerings that will attract investment
- Develop a regional policy around NHS data and access to take full advantage of regional strengths in data, medtech and digital health, and biomedical research
- Develop a heath data innovation hub/test bed alongside one of the major regional hospitals
- Offer tax incentives for companies to relocate to innovation spaces alongside regional hospitals
- Explore how to capitalise further on innovation assets such as NBIC, the Centre for Enzyme Innovation and the National Centre for Computer Animation for economic growth and job creation
- Engage regional MPs as champions for the central South life sciences
- In collaboration with local authorities, Local Enterprise Partnerships and MPs, advocate for regional development support

For further information, please contact **IfLSAdmin@soton.ac.uk**

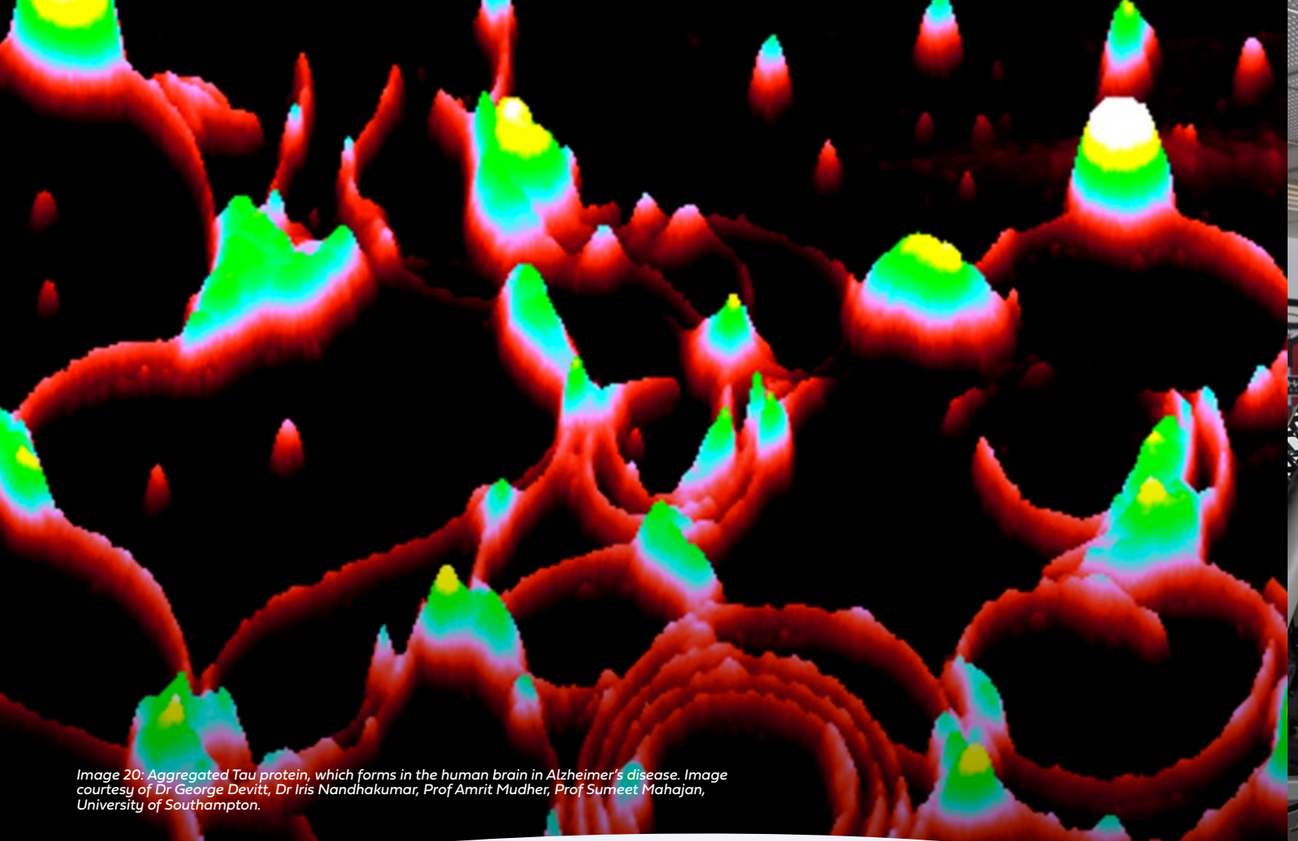

Image 20: Aggregated Tau protein, which forms in the human brain in Alzheimer's disease. Image courtesy of Dr George Devitt, Dr Iris Nandhakumar, Prof Amrit Mudher, Prof Sumeet Mahajan, University of Southampton.

Appendix 1

During the pandemic, medical scientists used the region's wide and varied clinical trials infrastructure to develop and test new therapies and vaccines. Engineers and entrepreneurs devised pioneering methods of protecting NHS staff, universities were among the first to offer testing on campus, and data scientists pitted their strengths against uncertainty.

- The central South emerged as a leading vaccine trial hub, contributing to the Oxford and AstraZeneca trials and leading the world's first booster trial that has shaped the UK booster programme.
- A pioneering saliva testing programme was rolled out to organisations across Hampshire and the Isle of Wight.
- Hospitals supported a trial to identify dexamethasone - the first drug to improve survival in COVID-19 patients and proved that hydroxychloroquine is ineffective at treating the disease.
- New collaborations between universities have borne fruit - Southampton and Liverpool have developed a non-profit clinical trials platform (AGILE). This has already led to the approval of a ground-breaking antiviral pill to treat vulnerable patients with COVID-19, and the platform is now poised to help speed up new treatments.
- A drug initially developed to treat a lung condition is in later stage trials for treatment of COVID-19 patients by the region's successful university spinout Synairgen.
- University and hospital teams demonstrated their ability to refocus at speed, shifting to contribute to national efforts to sequence the virus' genome.
- Regional strengths in data science came to the fore as experts from across disciplines produced forecasting tools to help hospitals and communities respond to new policies and developments - these have since been deployed nationally.
- Galvanised during the pandemic by the need to monitor COVID-19 patients at home for 'silent hypoxia' - a potentially fatal fall in oxygen levels with no obvious symptoms - the central South led the swift roll-out of life saving technology device - a small pulse oximeter worn on a finger. Some 16,000 COVID-19 patients were protected this way and the region has led the way for international adoption.

Image 21: Solent University purpose-built biomechanics laboratory boasts a range of up-to-date specialised equipment including a state-of-the-art motion capture system that allows athletes' movements to be captured in great detail and accuracy, recording at over 500 samples per second. Credit: Solent University.

Appendix 2

Innovation case studies

CASE STUDY 7

Covid Oximetry @ home

Galvanised during the pandemic by the need to monitor COVID-19 patients at home for 'silent hypoxia' -a potentially fatal fall in oxygen levels with no obvious symptoms - the central South moved swiftly to help lead the roll-out of life saving technology. By the end of 2020, all care commissioning groups in the south east and Dorset had introduced the device - a small pulse oximeter worn on a finger - which helps clinicians to monitor remotely their patients' oxygen levels. Some 16,000 Covid-19 patients were protected this way, allowing hospitals to admit and treat patients before their condition deteriorated. Success of this operation was down to close collaboration between the central South, peer networks and innovation arms of the NHS.

CASE STUDY 8

Ardia Health's app - myrenalcare.com

"Innovation in the NHS isn't easy," says Dr Nick Sangala who's devised an app to give his kidney patients direct access to the clinical team and monitor their condition. Now more than nine in ten say myrenalcare.com is easy to use and feel just as confident that they are being safely monitored. Six in ten say the app makes them feel more engaged in their renal health. "We built in a button patients could press if they ever needed to talk to someone," says Sangala. "That wasn't a receptionist or secretary - that was me."

A full time doctor, he credits the region's networks for sustaining his entrepreneurial journey. "I'm five years in, I could have quit many times - but because of support from people such as (Wessex AHSN and SIGHT), I've stood a chance. Their support has been pivotal."

CASE STUDY 9

Lifelight

Imagine pointing a smartphone at your face - within 40 seconds your camera has measured your pulse, breathing rate and blood pressure without the need for face to face contact or additional hardware. How? At every pulse, our skin changes colour - a "micro blush" which can be detected by simple device cameras.

Lifelight's algorithms convert these minute changes - picked up by camera - into information about a person's vital signs.

And this contactless monitoring - clinically proven and now under development by entrepreneurs in the central South - promises a revolution for the millions of people with long term disease who must currently submit to regular physical checks. And it offers a simple means for the wider population to keep on top of their own health and wellbeing.

But like the best ideas, it must be refined, tested and regulated - and the region's support systems have risen to the challenge.

It's been a long journey, says Lifelight founder Laurence Pearce. He received funding and support from Southampton's science park's accelerator programme. "We've learned so much there from other start-ups," while networks such as the Wessex AHSN helped him bid for more than a million pounds of funding to test the tech on some 8,500 patients - working through Portsmouth's technology trials unit. Sports science experts and data scientists at Bournemouth University advised how to optimise machine learning and refine algorithms.

Clinicians want to know that the tech can flag a deterioration, while health economists need to know if it saves money. "We've tapped into proactive research communities in the region from Portsmouth through to Bournemouth," says Pearce. "We now need more data from people with very low or high blood pressure."

Over the next two years Lifelight tech will be tested in the region's care homes - if deployed it could spare residents invasive monitoring and cut staff training costs. "Dorset is quite visionary in seeking future models of digital working. There's a vibrant digital community thanks to the university and entrepreneurial graduates."

Pearce's long term goal is to help people manage their own health with Lifelight and he's hoping to achieve medical approval here and in the US by summer 2022. "It's about giving people insights and nudges to help them be more self-reliant." Trials are underway in Dubai, Peru, the Philippines and Thailand - "countries with health inequalities."

Pearce likes the south so much he's relocated to Bournemouth from the capital's commuter belt. "I love the region. It's a myth that London is the nexus of all talent. Access to clinicians, to networks, to the start-up community here has been transformative. We have no problem hiring - whether engineers or creatives," - his company has grown to 25 staff. "They love the idea of a south coast job as it means escaping from London. It just makes sense."

CASE STUDY 10

GenomeKey

When bioengineers from the central South proposed to develop genome sequencing technology to be able to detect resistance to antibiotics and sepsis more speedily, they needed to know more. Specifically, they wanted to understand better how current methods operate, and local networks stepped in to help. The local innovation arm of the NHS (Wessex AHSN) introduced the entrepreneurs to Southampton microbiologists. GenomeKey went on to bid successfully for £6.5 million and credit the help they received with their success to date.

CASE STUDY 12

Edge

Starting life within a dedicated enterprise unit at the University of Southampton some two decades ago, Edge is now the go-to software for managing clinical research and is used across 80 percent of the NHS and extensively abroad. Co-designed with clinical staff, it owes its success to listening to those who use it. These systems allow researchers to collaborate and track and manage a project from start to finish, making for more efficient research.

CASE STUDY 11

FeNo - (nationwide adoption of a new medtech tool)

Respiratory diseases such as asthma affect one in five people in England and are the third leading cause of death. Asthma attacks kill three people every day and account for some 60,000 hospital admissions a year. But 30 per cent of diagnoses may be wrong.

A new device - a NICE-approved tool which measures the amount of nitric oxide someone exhales - promised to help provide better, faster diagnoses for asthma - helping cut costs and wrong treatments. Potential savings are sizeable - more than £1.1 billion of the NHS budget goes each year on treating asthma, while inhalers contribute three percent of total NHS emissions.

But even official approval by NICE doesn't guarantee GPs and clinics will start using new technology, so the central South and neighbours are leading nationwide efforts to inform, train and show primary care staff across England how and why to use it. "The technology is relatively simple, but building the wraparound support - training staff, monitoring care - is actually complex," says Joe Sladen who led efforts to coach staff to adopt the tool, bringing a specialist clinician and GP on board. "This is a large scale, significant national rollout - led by the south."

Acknowledgements

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