

Insight

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Intelligent solutions

Why the British Life Sciences sector deserves close examination

By **Mike Cowley**

THE BRITISH ARE COMING” TO BOSTON but this time Paul Revere can rest easy in his grave in the Granary Burying Ground on Tremont Street. Nor will Longfellow be around the celebrate the event with a poem on the ‘Midnight Ride’

This time it is not the British Redcoats who are heading to put down troublesome militias but the cream of the UK Biotech industry looking to do business with their opposite numbers in the leading life science corridor in the US at Bio 2018.

Nor will tea be an issue as it was when it sparked the American Revolution – although it may well still be the drink of choice for many of the 200 British companies who are there to fly the flag – but the event reflects the increasing importance of Boston on the global life science stage.

Led by the UK Government’s Department for International Trade, the Brits are there to demonstrate the high concentration of talent “across the pond”, offering significant opportunities for the US to create value through partnering, deal making and, of course, investment.

While Boston is now recognized as the world’s top region for biotech and life sciences, the UK is not far behind. It leads Europe in health and life sciences inward investment and ranks just behind San Francisco and Boston for the amount of life science finance raised.

The UK offers a unique data-driven biomedical ecosystem, which is anchored by the world’s largest integrated health service (the NHS). Turning 70 in July, it is thanks to the NHS that diseases such as polio and diphtheria have been all but eradicated and treatments like the world’s first liver, heart and lung transplant

have been pioneered. And the NHS continues to drive innovations including mechanical thrombectomy, improvements to stroke survival, bionic eyes to restore sight, and surgical breakthroughs such as hand transplants.

Today, the UK is doubling down on its strengths in life sciences innovation, investing over \$100bn in R&D over the next 10 years. Through the recently-published Industrial Strategy (see *NHSA report on page 3*) the UK plans to tackle challenges such as the aging society, and is creating a world-leading cluster for artificial intelligence (AI).

Meanwhile, the UK is making a major contribution to global public health agendas, taking a lead in tackling the policy and practical challenges in areas such as antimicrobial resistance, dementia, and neglected and tropical diseases (see *Drug Development Unit, page 2*) And all this can be found mirrored in the UK

Pavilion at Bio 2018 where leading companies such as Benevolent AI, a \$2bn drug discovery company leveraging AI, can be found rubbing corporate shoulders with PsiOxus, the developer of cancer-killing viruses, the Wellcome Trust, Britain’s largest biomedical funder investing \$1bn a year, and with new kids on the block such as Exploristics, which has developed software to run virtual clinical trials (see *more on exhibitors on page 2*).

Life sciences in the UK was at one time dominated by companies in what is known as the Golden Triangle – Oxford, Cambridge and London – but Bio 2018 now reflects the buoyancy of the sector across the country with strong contingents from across the rest of England, Scotland (see *page 4-5*), and Northern Ireland.

Now it is a case of “All the Brits are coming” – even though history now tells us Paul Revere never actually used the original call to arms.

Positive results for British biotech

The British presence at Bio 2018 represents a formidable range of academic and industry expertise that underpins the UK life sciences sector

By Mike Cowley

THE UK CONTINGENT AT BIO 2018 is far removed from the once traditional image of the British business brigade complete with stiff upper lip or the bowler hatted, umbrella wielding London city gent stereotype (although some still exist).

For the UK life science sector today is cut from the same cloth as its American cousins "over the pond", dynamic innovators, ready and willing to run out the red carpet in order to do deals.

The overall message they bring is that they represent a well-established sector which is making a significant contribution to economic growth in the UK – annual turnover of nearly \$64bn, exports around \$30bn – from over 5,000 companies employing 233,000 people.

And there is little doubt that British science has a history of changing the world with more than 80 Nobel prize-winning discoveries underpinning many of today's leading biomedical products, technologies and applications.

Yet the UK is not resting on its laurels as what is known as "Bold Science" is thriving today. The UK Biobank for one is a unique data and research asset for the world with more than 500,000 participants. Meanwhile the 100,000 Genomes Project is paving the way for genomic medicine in the UK's National Health Service (NHS) and the NHS's own longitudinal patient data opens up a world of possibility for innovators.

When you add the fact that fiscal incentives make the UK one of the best places in the world to undertake R&D, clinical development and manufacturing, it makes a compelling case to do business with the UK life sciences sector.

Leading UK life science companies who are in Boston to do business include BenevolentAI, a world leader in Artificial Intelligence enabled drug development with a valuation of \$2bn, with the majority of investors already



Research at the The Industrial Biotechnology Innovation Centre (IBI) in Glasgow, Scotland

The UK Biobank is a unique data and research asset for the world with more than 500,000 participants

coming from the United States.

The company's current drug development portfolio demonstrates it can cut early stage drug discovery by four years and potentially deliver efficiencies in the entire drug development process of 60% against pharmaceutical industry averages – an industry that spends \$180bn a year on R&D.

Its AI technology is being used to develop treatments to unmet patients' needs across a wide range of diseases, including Motor Neuron, Parkinson's, Glioblastoma and Sarcopenia.

Also part of the UK line-up is PsiOxus, the world leading cancer

gene therapy company. With \$75m in funding from investors including Imperial Innovations, it is in the Sunday Times Hiscox Tech Track 100 league table which lists Britain's private technology businesses with the fastest growing sales.

PsiOxus has developed viruses that can deliver medicine to cancer patients. Revenue from licensing its IP has grown by 120% to almost \$12m in 2016 after securing a deal with Bristol-Myers Squibb.

The company's success is based on discovering and developing innovative gene-based immuno-oncology

treatments for solid tumors using its proprietary intravenously administered T-SiGN virus platform.

UK exhibitors who will be using Bio 2018 as a platform to launch new products include Exploristics which has made its name by simulating clinical trials on its software platform.

The company has chosen Boston

to launch Kerus Cloud, the second generation of its software, which has already reduced development costs for one small biotech by \$20m and slashed development time by up to five years.

And that's why, the UK along with Boston and San Francisco, make up the top three global life science hubs.

Baroness Fairhead, Minister of State for the UK Department for International Trade, said:
"The strength of our life sciences sector continues to make the UK a compelling destination for inward investment and global talent. With more than 5,000 life sciences companies, and a vibrant culture of scientific innovation, our exceptional offer to the world as a global partner for trade and investment is clear. I am looking forward to leading a strong delegation to Bio Conference 2018, showcasing our world leading capability to the United States of America – our single largest trading partner."



Dundee bridges the gap between academia and drug development

Universities have always played a unique role in the life science sector either providing the research behind the innovations or acting as incubator for spin-out companies which constantly add to its numbers.

The Drug Development Unit (DDU) at the University of Dundee which will be partnering at Bio 2018 is unique in the UK in that it operates as a virtual standalone "biotech style" small molecule drug discovery organization, working across multiple disease indications, whilst coming under the umbrella of the university as a legal entity.

This makes it the only DDU of its type in the UK which, in turn, enables it to work in unfashionable areas such as tropical diseases, with one major delivery to date being a clinical candidate for malaria which is now in development with Merck KGaA.

Dundee DDU has also developed preclinical candidates for visceral leishmaniasis in partnership with GSK; three partnered projects with GSK and Pfizer; and assets licensed to enable the creation of three spin-out companies – Pacylex Pharmaceuticals, Omet Pharma (recently acquired by Merck & Co.)

and HepaRegenIX GmbH.

To underwrite this work, over the past 12 years the DDU has secured more than \$142.6m funding from research grant/charitable funders and industry partnerships. This, in turn, allowed the DDU to attract management from senior positions in the pharmaceutical industry and build a team of over 95 translational scientists (medicinal chemists, DMPK scientists, computational chemists, and biologists) dedicated to the development of innovative medicines.

The state-of-the-art infrastructure for preclinical small molecule drug

discovery has seen the DDU work in partnership with multiple academic institutions and industry partners including the University of Oxford, MRC Laboratories of Molecular Biology (LMB), University of Cambridge, GSK, AZ, Pfizer, Bayer and AbbVie amongst others.

The DDU's strategic priority to 2020 is to continue to develop its position as a partner of choice for biopharma, product development partnerships (PDPs) and academic partners by continuing to deliver high-quality preclinical data packages and the de-risking of novel

drug targets for diseases of unmet medical need.

"What happens is that we develop assets to a certain stage then either license to BioPharma or spin-out biotech companies to do the further development of them," explains Dr. Julie Brady, who is in charge of business development for the DDU. "Essentially we bridge the gap between academic innovation and pharmaceutical development"

"Going to Bio2018 will allow us to talk to pharma and biotech companies about partnerships and enable us to look for VCs as investors."

A growing and worrying resistance to many of our most prescribed antibiotics poses a major challenge – but British pharma is fighting back



The importance of England's research into antibiotic resistance has been endorsed by the 2018 BIO International Convention

Resistance is facing a new battle

By Mike Cowley

WITH 10 MILLION PEOPLE due to die unnecessarily each year by 2050 as a result of growing resistance to antibiotics, it is a potential disaster that is not only casting a giant shadow over the world's health but has now by necessity finally forced its way to the forefront of the life science sector agenda.

Despite the now well recognized dire threat, until recently big pharma companies had not invested heavily in the R&D of new antimicrobials because of the number of antibiotics available which have worked perfectly well to date. Every industry is based on supply and demand and until recently there has been no demand.

Now all that is changing and the fight back is well underway. And it is being led by centres like the Antimicrobial Resistance Centre based in Alderley Park in the north of England, which is acting as a business catalyst for companies with novel antimicrobials, supporting them from concept through to development.

Nor is the AMR Centre alone in this work in the region as is also home to Evotech, the largest contract research organization in Europe focused on AMR, and a clutch of leading universities and health bodies active in the sector supported by the Northern Health Science Alliance (NHS) health partnership.

A significant milestone in the north of England's AMR story came recently when Liverpool's renowned School of Tropical Medicine and the University of Liverpool joined together to create a global centre of excellence for AMR research. Meanwhile the University of Manchester is gathering data on the use of antibiotics to tackle excessive

dispensation by primary care physicians. The unrivalled importance of this AMR research – and the region where it is located – has been endorsed by the 2018 BIO International Convention who are dedicating a major seminar which is being delivered by leaders from the north of England on the value of addressing AMR on Wednesday morning. Separately the NHS is facilitating a linked pre-event breakfast briefing today for 140 delegates from Boston and BIO.



Dr. Peter Jackson, Chief Executive of the AMR Centre in the north of England

Both events will provide a platform for what are now recognized as the world's leading experts in the field including Dr. Peter Jackson, Chief Executive of the AMR Centre, all of whom come from the north of England.

The British speakers have been sponsored by the UK Department for International trade in association with the Northern Health Science Alliance (NHS), a driving force behind the booming life and health science sector in the region under Dr. Hakim Yadi, its CEO who is leading the delegation. Whereas the UK is acknowledged as leading the world in warning about AMR thanks to the work by Professor Dame Sally Davies and more recently by Lord Jim O'Neill, it is the North that has effectively stolen the march on the rest of the country and the world in terms of action.

However the US is not out of the loop when it comes to AMR with its Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator (CARB-X) initiative led by Boston University to test promising antibiotics which is backed by the US Government in the form of BARDA and NIAID and by the UK including the Wellcome Trust and significantly the high profile AMR Centre in the north of England.

Not that the north of England's offering to the life science industry begins and ends with AMR. Far from it. What most life science companies

based in the US have yet to appreciate is that the north of England is creating the number one clinical test bed for the sector in the world.

This is because the UK is alone in the world in that its National Health Service (NHS) offers cradle to grave information based on all the population with records that go back 70 years. Unlike patients in the US who move between insurance companies and are therefore often difficult to track, UK patients are given one number at birth



Dr. Hakim Yadi, CEO of the UK's Northern Health Science Alliance

which remains with them for the rest of their lives – offering a unique Big Data mine as long as you can not only access it but get the necessary consent to do so.

Fortunately for the north of England, its universities and NHS regional

bodies are advanced in working with their populations to ensure that they gain the consent of individuals before providing access to data. This has all been done through a campaign that has now received independent and national approval called #DataSavesLives

More recently, the NHS has led the pioneering Connected Health Cities project across the north of England. By joining up health data with other forms of community and social data, the programme is creating Learning Health Systems. These advanced technical platforms ensure that NHS services are better connected, more efficient and focused on the needs of real patients as they move through and across health services.

"Along with the creation of learning health systems in over 15 disease pathways, Connected Health Cities has enabled us to open a new dialogue with our communities as to how their information can be used to better support them and the NHS," says Dr. Yadi. "In turn, this lead to the 'Data Saves Lives' slogan which has been taken up around the world.

Our collaborative approach across the north of England allows us to work with communities, academics, innovators, SMEs and corporates in a totally new way.

That is the key message from the NHS and it is bearing fruit. Last month, the NHS signed a strategic agreement with Israel and BIO 2018 will see it do the same with other nations during BIO However the US remains the big prize.

"The North is very much open for business and we would like nothing better than to build on the UK/US special relationship to develop 21st century healthcare after Brexit," says Dr. Yadi. "And this will include tackling the threat of AMR which currently hangs ominously over us all."

England's North in health science facts and figures

- Health science is \$23.35bn of the North's \$405bn output, forecast to grow by 44.6% by 2030. Of \$171bn public money spent in the UK on medical care, \$40.8bn is spent in the North.
- The Northern Health Science Alliance is a health partnership across the North's most research intensive universities, NHS teaching hospital trusts and four academic health science networks. These universities have a research income of \$1.6bn a year, generating \$16.3bn and creating 119,000 jobs.
- If the North were a country it would be the eighth largest in Europe.
- 570,000 people are employed in health sciences across the North, 48,000 jobs are supported in the private sector and its supply chain. Employment growth is forecast as 2.5%
- North Health services sector is worth \$41bn and employs over 500,000.
- The North is home to 1,165 companies in health sciences, 20.7% of the UK total and the sector accounts for 47,800 jobs. There are more employees in medical technology in the North of England than the South East.
- The North exports \$9.75bn worth of medicinal and pharmaceutical products yearly, 44% of UK exports in this category. In the last 10 years, the value of these exports from the North grew 53.8%

Scotland's life sciences sector is punching above its weight, recognized for its business base, research capabilities and international reputation

Small enough to manage, big enough to matter

By **Graham Lironi**

IN 1999, TIME MAGAZINE NAMED Sir Alexander Fleming in its list of the 100 most important people of the 20th Century. The Nobel-prize-winning Scottish physician, microbiologist and pharmacologist's best-known discoveries are the enzyme lysozyme in 1923 and the world's first antibiotic substance benzylpenicillin (Penicillin G) five years later.

But Sir Alexander is far from alone when it comes to the international impact made by drugs discovered by Scottish scientists and universities. Others include the top-selling skeletal muscle relaxant Atracurium, discovered in Professor John Stenlake's laboratory at the University of Strathclyde, while Sir Kenneth Murray, one of the founders of biotech firm Biogen, discovered the first hepatitis B vaccine in the 1970s in Edinburgh.

The next wave of innovation will be driven by Scotland's expertise in areas like regenerative medicine, cardiovascular disease, neuroscience, metabolic disease and oncology; boosted by having two – Glasgow and Edinburgh – of the world's top 50 universities in 2017 for life sciences and medicine.

In the north-east of Scotland, according to research from Clarivate, The University of Dundee was ranked ahead of global establishments such as MIT and Berkeley, as "the most influential scientific research institution in pharmaceuticals" over the last ten years.

Scotland, then, has a thriving life sciences cluster recognized as one of the most accessible, well connected and collaborative in Europe. Its key strengths reside in pharma services, regenerative medicine, translational and precision medicine, medical technologies and animal health, though there are emerging opportunities from enabling technologies within the digital health arena, such as data analysis and mobile health.

Home to a world-class research base with a reputation for pioneering medical advances, Scotland is an ideal location to source the right partners for major, international life science projects.

With 19 universities and higher education institutions attracting a significant percentage of UK academic biosciences research funding, Scotland is second only to Switzerland in Europe in terms of citation impact for life science publications.

Its extensive levels of industry-academia collaboration mean that new

ideas and research can be translated into successful businesses quickly and efficiently. About \$67m has been invested in several innovation centers focusing on stratified medicine, digital health, data science, sensors, industrial biotechnology and aquaculture – all developed to foster collaboration between Scottish academia and industry.

A key sector of the economy with a thriving community, Life Sciences in Scotland is recognized for the distinctive capabilities of its business base and research institutions, international reputation and potential for significant growth and creation of high value jobs.

The sector plays an important role in producing economic benefits for Scotland as well as its ability to improve the quality of care and health for people

records in providing innovative support for drug development.

One such company is Tepnel Pharma Services, a Livingston-based group, which has become a key player in pharmaceutical testing. Bought in 2009 for \$125m by Gen-Probe, which was itself acquired in 2012 for \$3.8 billion by fellow US firm Hologic, it offers partners regulatory compliant analytics in support of small and large molecule active pharmaceutical ingredients, investigational medicinal products and finished products.

Tepnel's range of services for its customers on both sides of the Atlantic include batch release and quality control testing of medicines for release in European markets and further afield and its flexible service ensures a quick turnaround that shortens the

Through working together, Scottish companies are able to offer big pharma an end-to-end service

in Scotland and globally. It is a sector central to the Scottish economy; a significant employer with 37,400 people employed across more than 700 diverse organizations.

Scotland's world-renowned universities and cutting-edge biotechnology companies are recognized as life science leaders when it comes to drug discovery. However, in addition to early-stage excellence in research, the nation is home to over 150 pharma service and supply companies, of all sizes, that can provide services from hit discovery through to clinical trial supplies and have impressive track

period from product manufacture to availability to the patient.

David Scott, senior director at Tepnel, says that Scotland's life sciences sector enjoys a joined-up way of working and the collaborative approach between academia and industry is something of which other nations are jealous.

"There is a lot of cooperation going on and, by working together, Scottish companies can offer big pharma an end-to-end service," he said.

"This level of collaboration means that companies can work with one another to take full advantage of each other's expertise and offer a joined-up 'one-stop shop' for their pharmaceutical customers. Scotland is small enough to manage but big enough to matter."

And as part of a \$12.95m investment to life sciences, BioClavis has announced it will be creating a base in the Queen Elizabeth University Hospital in Glasgow. A research and development grant of \$4.4m has been provided by Scottish Enterprise to the firm to work in collaboration with the NHS and university researchers. BioClavis is a spin-out from molecular profiling company US-based BioSpyder. The grant money will be used to adapt BioSpyder's TempO-Seq platform technology into a diagnostic tool for precision medicine and will create more than 40 jobs in Glasgow.

Meanwhile, bluebird bio, Inc and TC BioPharm have agreed a strategic collaboration and license agreement focused on gamma delta CAR T cells. The companies will work together to advance TC BioPharm's lead CAR-engineered gamma delta T cell program into clinical trials as well as on additional hematologic and solid tumor targets.

Last month, US-headquartered Charles River hosted the launch of the latest Life and Chemical Sciences Skills Investment Plan. To mark the occasion, Life Sciences firm Charles River Laboratories welcomed Minister for Employability and Training, Jamie Hepburn to its site in East Lothian.



and companies at the cutting edge of research and innovation, Scotland already enjoys a global reputation in the Life and Chemical Sciences sector," said Mr Hepburn.

"We have ambitious targets for the future of the sector, however these can only be achieved by building and nurturing a pipeline of talent that meets the needs of employers.

"That is why we have developed a collaborative approach across government, industry and academia to help realize our ambitions. This Skills Investment Plan, which has been designed in partnership with industry, aims to deliver success and achieve our ambitious growth targets."

Scotland has a long and distinguished history in the area of drug discovery, across a wide range of therapeutic areas.

Its prospects look bright too, as new start-ups spin out of academia, more established companies continue to progress novel treatments for under-served diseases through clinical development and collaborations between universities and the biggest pharmaceutical companies in the world see Scotland play a prominent part in developing the innovative medicines of the future.

● Discover more about the latest innovations in Scotland's dynamic life sciences sector at *BIO 2018, Pavilion 1321*

Commercial partnerships with NHS Scotland are managed through NHS Research Scotland (NRS).

Interface
A government-backed free and impartial service that connects businesses from a wide variety of national and international industries to Scotland's 23 higher education and research institutes, matching business needs to the right academic expertise.

SINAPSE
Developing a world class future in medical imaging for Scotland by drawing on the combined expertise of seven Scottish universities. It is a strong, dynamic network that pools facilities, resources and skills, creating a shared environment for strategic research, education and knowledge transfer.

CMAC
The CMAC National Facility is an award winning, world-class facility for continuous manufacturing and crystallization research. Working in partnership with industry, its purpose is to transform current manufacturing processes into the medicine supply chain of the future.

Scots knowledge share is more than sum of its parts

WHAT SETS SCOTLAND ASIDE from many other countries in the field of pharmaceutical research and development is the level of collaborative working between industry, academia, the NHS and government, and the benefits which key collaborations can bring for commercial and public partners. Key collaborations include:

Division of Signal Transduction & Therapy (DSTR)

DSTR hosts a world-leading collaboration between Dundee University and a consortium of industry, including Boehringer Ingelheim, GlaxoSmith-



The University of Edinburgh had a reputation in pharmacology research by the 18th century

Kline and Merck Serono.

The Farr Institute @ Scotland

A collaboration between six Scottish Universities and NHS National Services Scotland with an aim to both improve the health of the Scottish population and place Scotland as a global leader in health informatics research. This is backed by a network across Scotland, and links into the wider Farr UK Network.

Stratified Medicine Scotland Innovation Centre (SMS-IC)
SMS-IC is a platform for collaboration linking Scotland's expertise, data assets and delivery infrastructure to accelerate the real-world adoption of Precision Medicine.

SMS-IC brings together industry innovators, clinicians and world-class researchers to collaborate on stratified medicine opportunities.

National Health Service (NHS) Scotland & Scottish Universities
These organizations work in partnership on world leading research projects in areas including cardiovascular disease, diabetes and metabolic disease, neuroscience and oncology.

Supporting growth



Committed to attracting, nurturing and supporting innovative businesses, Scotland is particularly keen to ensure that the Life Sciences sector continues to flourish.

Scottish Development International (SDI), which has an office in Boston, is a joint venture between the Scottish Government, Scottish Enterprise and Highlands and Islands Enterprise, bringing together the resources of these organizations to deliver support for companies investing in Scotland, whether a CRO considering Scotland as a location for providing preclinical and/or clinical research, a drug developer seeking innovative manufacture and formulation expertise or a company requiring access to Scotland's comprehensive supply chain services.

Support for Research

R&D Grant Support – R&D funding – can substantially offset the cost of research and development projects in Scotland. This valuable financial support can cover the costs of everything from buildings and people to technology and equipment – along with any associated outsourcing expenditure.

Patent Box – The UK Government is committed to introducing a preferential regime for profits arising from patents, known as

the Patent Box. Companies can apply a 10% rate of corporate tax to worldwide profits derived from patents granted by either the UK Intellectual Property Office or the European Patent Office. The Patent Box is available to companies that are liable for the payment of UK corporation tax.

Support for Investment

Regional Selective Assistance (RSA) is the main investment grant scheme in areas of Scotland designated for regional aid under European Community law. RSA funding is available to create or safeguard jobs for both Scottish-owned businesses and inward investors, from large corporations to SMEs.

Scottish Investment Bank – The Scottish Investment Bank (SIB) activities support the delivery of the wider Scottish Enterprise business plan by stimulating the SME funding market in Scotland. It works with both Scottish SMEs and UK and international investors to stimulate deal flow in Scotland.

Talent Scotland – A project aimed at promoting Scotland as a premier destination for jobs in key sectors, including life sciences. The portal advertises the latest available jobs, employers, and information on relocating to Scotland. <http://www.sdi.co.uk/invest/sectors/life-sciences>



The University of Dundee's School of Life Sciences has gained top global rankings for its research

National Phenotypic Screening Centre (NPSC)
NPSC is a world-class facility for phenotypic screening run by an interdisciplinary team of scientists and engineers who collaborate to advance the use of complex biology and to drive innova-

tion. It is built on a core partnership between the members of the Scottish Universities Life Science Alliance and the University of Oxford. It strives to provide a platform for knowledge exchange with industry and train the next generation of discovery scientists.

Northern light for innovation



Inverness Campus is one of Scotland's most innovative projects, with an emphasis on life sciences and collaboration between academia and business

Scotland's Highlands and Islands region is proving a magnet for life sciences firms

by Chris MacDonald

THE NUMBER OF LIFE SCIENCES organizations operating in Scotland's Highlands and Islands region has doubled from 40 to 80 in just nine years. This has sparked a trend of inward investment and job creation for the sector that is set to increase.

The Highlands and Islands covers just over half of Scotland and its geography includes numerous inhabited islands and rural coastal settlements. With advances in digital technology, this geography is creating new oppor-



James Cameron is head of life sciences at Highlands and Islands Enterprise

tunities across all parts of the region. More and more organizations are recognizing and taking up these opportunities. Everything from multi-national businesses to start-up companies, as well as internationally recognized academia and pioneering healthcare providers, are involved in the region's life sciences growth.

James Cameron is head of life sciences at Highlands and Islands Enterprise (HIE), the Scottish Government's economic and community development agency for the patch. HIE has made life sciences one of its key priorities. Cameron attributes much of the sector's growth in the region to the excellent strengths and emerg-

ing opportunities in digital health and wellbeing, as well as marine biotechnology.

"Advances in digital healthcare are enabling new projects and services to be delivered for rural communities", he explains. "We are seeing many remarkable examples. One is a company using a camera capsule, which is swallowed by medical patients to investigate the lower gastrointestinal tract. This avoids the need for them to travel long distances for diagnosis."

The organization behind this initiative is Danish owned CorporateHealth International. CHI is investing \$7.6m in establishing a diagnostics centre in Inverness, and its technology is already being used in rural locations across the region.

Located at Inverness Campus in the capital of the Highlands, the company received support from HIE to set up its UK base and become a provider to the National Health Service, as well as financial support to help it develop in the region.

CHI UK co-founder, Dr. Hagen Wenzek, praised the region's progressive approach. "The Highlands and Islands region has proven to be a fertile environment for service innovation", he said. "It is receptive to solutions that serve patients better as well as having a welcoming pool of knowledge and expertise. And, thanks to the partnership with HIE, we are confident that planting our UK operations in that environment will grow CorporateHealth as expected."

Inverness Campus itself is one of Scotland's most innovative projects. Its development is being led by HIE with an emphasis on life sciences, collaboration between business, academia and research, and deriving

benefits for the wider region.

The Campus opened in 2015 and is already the base for nearly 800 employees, working across several organizations. It includes a strong research and development (R&D) presence with academics and companies working in digital health technology, disease management and animal health.

The site offers a high quality, vibrant location for innovation and business development, with excellent collaboration opportunities with four of Scotland's universities. Purpose-built life sciences and technology buildings offer office and laboratory space that can be fitted out to companies' individual requirements.

All of this is adjacent to a large teaching hospital, the innovative Centre for Health Science and LifeScan Scotland; a company that arrived in the region 20 years ago as Inverness Medical, and has grown into one of the country's largest life sciences employers with a workforce of around 1,000.

Complementing the more traditional life sciences sector profile, a strong network of technology expertise exists across the Highlands and Islands. Businesses are ideally placed

to pursue increasing opportunities for the development and deployment of innovative technology solutions and products for the health and wellbeing markets.

The Isle of Lewis, for example, is home to BASF Pharma (Callanish). This is a subsidiary of the BASF Group – the world's largest diversified chemical company headquartered in Germany. The expert team on Lewis produces highly purified omega 3-rich fatty acids, which are exported across the world. BASF is based on premises owned by HIE, which recently agreed further on-site investment to enable the company to expand and employ more people.

Chris Scarrott, BASF site manager, said: "The team at HIE has been supportive in everything from technology improvements, all the way through to product innovation and site development."

In Argyll on Scotland's stunning west coast, is the European Marine Science Park (EMSP), another HIE-led development. With European funding (ERDF), HIE has developed the Park in partnership with Scottish Development International and the Scottish Association for Marine Science (SAMS).

Its growing cluster of marine science related activity now involves 12 firms, including micro-algae technology specialist Xanthella Ltd.

Douglas MacKenzie, Xanthella managing director, said: "The EMSP is fast becoming a renowned location for marine science. We have been able to take on an additional suite, now that our algal photobioreactor business has expanded, and HIE provided us with a laboratory and fit-out for our needs." Biotechnology company, Cuantec Ltd has also established a base within the on-site business incubator, hosted by SAMS. Their focus is on producing innovative packaging products from shellfish waste products.

Similar to buildings at Inverness Campus, the Park's Malin House is designed to accommodate the needs of a wide range of occupiers. It also follows the same ethos of encouraging collaboration between tenants and promoting links with education and research, here led by SAMS.

James Cameron said HIE's key focus at EMSP is to develop the growing cluster of companies by encouraging collaboration and attracting other businesses with similar interests. "There are excellent opportunities at EMSP," he said. "Businesses here reap the benefits of shared skills and knowledge and take advantage of the advanced scientific and marine facilities. This is building the marine sciences cluster and will continue to attract interest from other organizations thinking about locating here."



The European Marine Science Park in Argyll is a renowned location for marine biotechnology

HIE works with businesses active across the life sciences sector to capitalise on both digital advancements and investments in key infrastructure projects, including Inverness Campus and the European Marine Science Park. Visit invernesscampus.co.uk and europeanmarinesciencepark.co.uk



Glasgow's Queen Elizabeth University Hospital campus is the largest critical care complex in Western Europe

Tale of two cities is healthy news for life sciences sector

The Glasgow BioCorridor and the Massachusetts Life Science Corridor complement each other superbly in world leading research and innovation

SCOTLAND IS HOME TO THE second largest life sciences cluster in the UK and, with over 230 life sciences companies, the Glasgow BioCorridor is the powerhouse of Scottish life sciences.

A world-class life sciences business development environment consisting of state-of-the-art industry infrastructure and extensive R&D centres of excellence underpinned by a robust and innovative partnership of industry, academia and the public sector, the Glasgow BioCorridor spans less than 50 miles with Glasgow city and its universities, research institutes and hospitals sitting at the heart of the region.

Glasgow boasts a world-class talent pool. Of the UK's 10 core cities, Glasgow – the only metropolitan area in Scotland with the population of the greater Glasgow conurbation numbering 2.3 million – is ranked No. 1 for both the number of life sciences students and graduates – some 10,335 life sciences students with around 3,300 first degree life sciences graduates in 2017.

There are more than 10,000 life sciences employees within the Glasgow BioCorridor, which has attracted such high-profile investors as GSK, ReproCELL Europe, Aridhia and Vascutek. The largest critical care complex in

Western Europe, the \$1.35bn Queen Elizabeth University Hospital (QEUH) campus, puts Glasgow at the forefront of healthcare and innovation across the UK and Europe.

The QEUH campus includes the University of Glasgow's Imaging Centre of Excellence (ICE) and Clinical Innovation Zone home to the Glasgow-led, pan-Scotland, Stratified Medicine Scotland Innovation Centre. The ICE houses the UK's first ultra-high field 7 Tesla MRI scanner in a clinical setting and provides access to world leading imaging clinical research facilities and collaboration space for industry providing a nexus for academic, National Health Service (NHS) and industrial expertise into brain imaging, further strengthening Glasgow's position as a world leader in precision medicine.

The Clinical Innovation Zone is a UK Science Park Accredited Facility designed to bring academia, industry and the NHS together in an environment to support collaboration and open innovation. It is already a leading location for precision medicine, attracting companies developing early diagnostics, imaging technologies, data security and analysis of complex 'big data'.

The \$27m Stratified Medicine Scotland Innovation Centre enables the development of new products and services for a global market via its

platform for collaboration linking Scotland's expertise, data assets and delivery infrastructure to accelerate the real-world adoption of precision medicine including incubator units for industry.

These developments at the QEUH are collectively expected to create over 500 jobs and deliver added value exceeding \$134.5m over 10 years, while boosting Glasgow's reputation as a global centre of excellence for biomedical innovation.

Anne Murray, Head of Invest Glasgow, says there are real synergies between the Massachusetts Life Science Corridor and Glasgow, particularly a focus on research and innovation.

"Massachusetts is home to the world's largest cluster of Life Science and Biotech companies while Glasgow BioCorridor is home to international leaders in precision medicine, medical technology, clinical and translational medicine and pharmaceutical services," she said.

"Coupled with world-class universities and R&D centres, I have no doubt that companies from the Bay State will recognise the strengths of Glasgow's life sciences ecosystem and the potential to collaborate."

Professor Dame Anna Dominiczak, Vice Principal and Head of the College

of Medical, Veterinary and Life Sciences, University of Glasgow, says that the Glasgow BioCorridor can make a world-class contribution in health and life sciences.

"The sector here is drawing complementary strengths together in a way that is not happening anywhere else in the world," she said.



Anne Murray of Invest Glasgow highlights synergies between life sciences in the US and Glasgow

Indeed, the Glasgow University Innovation District is an internationally significant location for clinical and research infrastructure. The Interdisciplinary Innovation Zone at the University of Glasgow and the Clinical Innovation Zone on the QEUH campus are the focal point for smart campus, precision medicine and chronic diseases, the nano and quantum world, and cultural and creative economies.

Other R&D centres of excellence located within Glasgow include the Technology and Innovation Centre

(TIC), the University of Strathclyde's purpose-built facility where 850 academics work in partnership with industry tenants focusing on key themes including health technologies and disease management.

Strathclyde Institute of Medical Devices, meanwhile, brings together specialists in engineering, life sciences, physical sciences and the National Health Service to research and innovate future technologies. The institute also assists MedTech companies and their supply chain to enter the global MedTech market.

And the Industrial Biotechnology Innovation Centre is an industry-led consortium consisting of GSK, Ineos, Ingenza, Sustainable Solutions, Applikon, HGCA, SASOL, Lucite International and four leading Scottish universities led by the University of Strathclyde.

Glasgow Biomedicine facilitates and supports the initiation of over 600 new trials per annum and typically manages the annual operation of around 1500 trials with an average spend of \$21m by bringing together key partners and stakeholders from the National Health Service and academia creating an integrated interdisciplinary centre of excellence for the management and execution of non-commercial and commercial clinical trials research.

The UK's largest Medical Research Council funded Molecular Pathology Node is focused on the development and delivery of molecular diagnostics in partnership with industry.

The city's cluster of facilities and infrastructure includes the \$6.7m Glasgow Clinical Research Facility (GCRF) for personalized medicine trials in adults and children, which works closely with National Health Service researchers, academic partners, contract research organizations, pharmaceutical and medical device companies.

And based within a designated Enterprise Area, BioCity Scotland is a 130,000 sq. ft. site with specialist industry facilities, home to a growing number of dynamic, successful and growing technologies. MedCity, a subsidiary of the BioCity Group, offers the ideal environment for both start-up and established MedTech and digital health companies to grow.

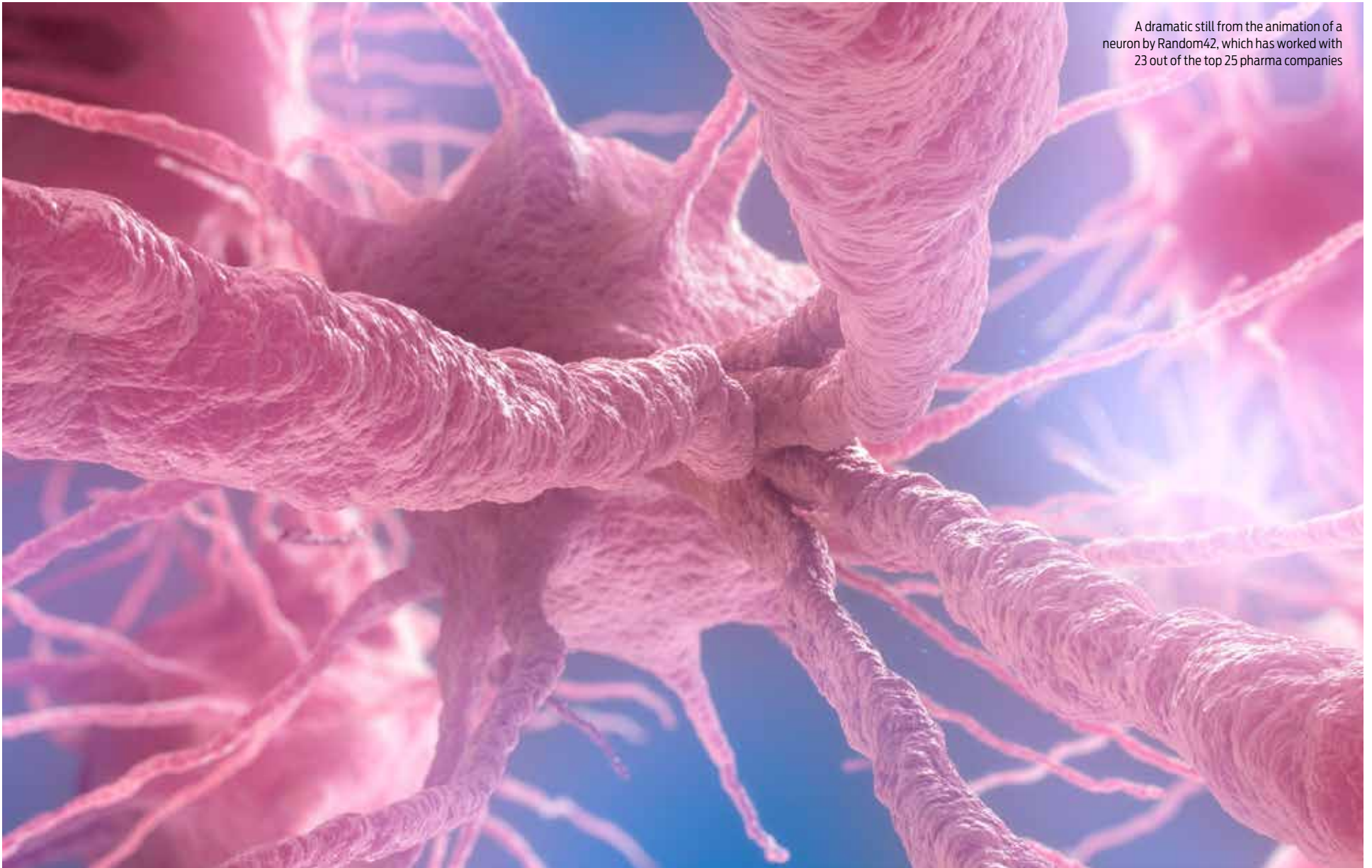
The 60-acre West of Scotland Science Park, meanwhile, is home to a wide range of companies operating across all areas of the life sciences and technology sectors including ultrasonics, pharmaceuticals, cleanrooms, pre-clinical drug discovery and optoelectronics. It is situated close to several leading research facilities, including the Beatson Oncology Centre, one of Europe's top cancer hospitals, and the new Translational Research Centre, the final element in the Glasgow Centre for Cancer Research.

And for any life science companies from the Bay State considering developing a transatlantic BioCorridor with Glasgow, it is worth noting that Glasgow offers a high quality of life, coupled with cost-effective business costs – labour and property costs are significantly lower compared to Cambridge, Edinburgh and London.

With a range of tailored solutions to meet business requirements provided by a well-established and sophisticated life sciences business support network, including access to extensive inward investment incentives such as job creation and R&D grants, low taxes, dedicated business support and much more, everything is in place to facilitate the successful exploitation of existing synergies between Massachusetts and Glasgow.

With world-class universities and R&D centers, companies from the Bay State will recognize Glasgow's strengths

How to bring life back to live



A dramatic still from the animation of a neuron by Random42, which has worked with 23 out of the top 25 pharma companies

By **Mike Cowley**

FOR A COMPANY NAMED AFTER a nod to chaos theory coupled with a reference to Douglas Adams's seminal *The Hitchhiker's Guide to the Galaxy* (where 42 is the answer to the ultimate question of life, the universe, and everything), one might be forgiven for assuming that medical animator Random42's presence at Bio 2018 can be put down to chance.

But such an assumption would be mistaken, for there is nothing arbitrary about Random42's decision to make an exhibition of itself in Boston. Rather, the company's return to Bio 2018, following a brief hiatus after its initial display as part of the UK Trade and Investment pavilion, is part of a quite deliberate strategy to further expand its share of the American market, which is already its biggest.

As Ben Ramsbottom, Random42 CEO puts it: "We first exhibited here six years ago and found it a great place to meet with some of the smaller biotechs. We found that we were able to secure business more quickly than at some other conferences where the big players tend to dominate.

"Around 70% of our business is in the US – it is our biggest market by a considerable margin – and at Bio2018 we will be exhibiting our core offering of scientific animation, virtual reality, augmented reality and interactive products.

"Of these four offerings, we find that augmented reality, in particular,

Random42, a pioneer in groundbreaking medical animation, is at Bio 18 to further expand its already significant share of the US marketplace

is generating a great deal of interest in the pharma sector at present with its applications in healthcare, both from a tablet perspective and for the next generation of headsets in the mixed reality space."

Founded in 1992, when its primary focus was on creating animations for the pharmaceutical industry – Random42 has worked with no less than 23 of the top 25 pharma companies – last month this London-based studio added a Queen's Award for International Trade for Outstanding Continuous Growth in overseas sales to an awards cabinet already groaning under the weight of 150 other accolades.

A pioneer of medical animation, being one of the first to develop animated sequences used to demonstrate the mechanism of action (MOA) of a drug or disease area, Random42 consists of scientists, artists, animators and programmers who collaborate to produce some of the most impactful and medically accurate scientific imagery, stories and interactive experience.

Its in-house team of PhD scientists lead every project, enabling clients to relay complex information that can be translated seamlessly into a deliverable that can elevate a product or

disease area to a whole new level.

The company's Augmented Reality (AR) apps use visual recognition technology, where users simply point their smart device at a tracker which activates an experience, such as, interactive animations, holograms, 3D models and games.

"Imagine bringing traditional marketing materials to life with digital content that is easily accessed by downloading an app, and simply scanning a page to activate content," said Mr Ramsbottom.

"This could include disease education videos, pharmaceutical MOAs, interviews with scientists, tours of R&D facilities and showing how a new device or diagnostic equipment works."

AR can be used in printed material such as product catalogues, brochures, flyers and business cards, and well as at congresses, conferences and exhibitions like Bio 2018 to bring banners or large backdrops to life with engaging content.

And the use of Virtual Reality headsets, such as the Oculus Rift or the Samsung Gear VR, has elevated Random42's scientific storytelling to a new level. It can now lead people into its 3D film sets and take them on a ride inside the human body.

"Users feel like they are actually in the scene of one of our MOA medical animation, watching red blood cells float alongside them or following a signalling pathway into the nucleus," said Mr Ramsbottom.

"Our storytelling format, combined with this state-of-the-art technology, gives users a detailed understanding of biological processes."

Meanwhile, 3D technologies powering modern-day video games are leveraged to bring compelling experiences to mobile platforms such as iOS and Android.



Ben Ramsbottom of Random42 is substantially increasing the level of business the company does in the US

"In our body explorer app, we combine high fidelity images of the human body with an intuitive multi-touch interaction often seen today on tablet and smartphone devices," said Mr Ramsbottom.

"It enables users to navigate around a transparent 3D human body, zoom in and out and view points of interest with information on various organs. Interactions such as swiping, tapping and pinching to zoom are integrated to maintain a sense of familiarity for new or inexperienced users."

Over recent years Random42's

offering has expanded substantially, with the advent of tablets, large touchscreens, virtual reality headsets and fast broadband streaming enabling it to elevate its visual storytelling to a new level.

"We believe that our knowledge in this space is unparalleled, gaining a huge level of experience across almost all therapeutic areas through the digital assets we have created for over 550 global pharmaceutical products," said Mr Ramsbottom.

"We have recently been worked extensively in the areas of consumer health, medical devices and diagnostics tests, as well as collaborating with the film industry to develop various documentaries that can be seen in IMAX theatres globally," said Mr Ramsbottom.

"We operate in a dynamic market and have taken advantage of that to expand substantially the level of business we do in the US. We are positioned to grow rapidly over the next five years and beyond, being a world-leader in science education, both from a pharma perspective but also the broader research community but also university students and beyond. And we see a lot of value-add that we can provide in those areas; not just classic drug launches but real disease education."

So, if you are in the pharma or biotech industry and in the market for cutting-edge and visually engaging digital solutions, don't leave it to chance: make a beeline for Random42 at Booth 2920 at Bio 2018.