



Quarterly Journal - September 2017

NEWS COMMENT and ANALYSIS on SPINOUTS from UK HEIs

In this issue

This quarter, in addition to our usual summaries of new spinouts, recent exits, and recent investments, we are very pleased to welcome articles by a number of our project partners. These cover a wide range of issues of concern to the university commercialisation sector.

They include:

- UCLB's new licensing platform, *e-lucid*, aimed at making life easier for hard pressed TTO professionals while ensuring that all involved in the licensing of university IP are kept in the loop as transactions proceed (page 2);
- UMIP's account of how graphene isolated in 2004 by two researchers at The University of Manchester - and related 2D materials are being taken to market (page 6);
- Scottish Enterprise's report on successful progress with its High Growth Spinout Programme (page 13);
- Mercia Technology's account of how it works with its 18 university partners (page 4);
- Alta Innovation's report of a major investment deal for one of its spinout companies (page 14)

And last, but by no means least, an eloquent argument by Gregg Bayes-Brown of Oxford University Innovation, for a recognition by the Government and everyone involved in the Brexit development, of the importance of foreign founders and skilled immigrants to the sector. Although Gregg focuses on Oxford's own experience, the issue is of crucial concern to the sector as a whole, and needs to be publicised as widely as possible.

- Jonathan Harris
Editor

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What could express licensing do for your organisation?



Within technology transfer, licensing has traditionally been centred on patent exploitation and high-value exclusive licences—but there is a shift occurring.

As researchers become more enterprising and new online tools become available, opportunities are emerging to capitalise on research outputs that are of lower value but with a potential global market. Yet it is still new to many organisations and there are often some common blockers to getting started.



At UCL Business we developed an online licensing platform called E-lucid to mitigate some of these issues, focusing on automation and

creating a stack of intuitive tools geared towards tech transfer.

These are some of the pain-points E-lucid helps to solve. They might even sound familiar:

Back and forth with the legal team is expensive

Solution: Do the work up front, and make it as generic as you can. Commission a set of licences that can accommodate 80–90% of these non-exclusive use cases.

Someone has to manage the process of approving a licence

Solution: It is the back and forth between researchers, licensees, your legal team, their legal team and anyone else involved that is a real time sink for licensing. With E-lucid you can set-up automated workflows which kick in when the licensing process begins. It will email, in the order you define, everyone and anyone who needs to approve or be informed about a given order. All details can be quickly scanned and approvals given with a click of a button. It even reminds users who haven't responded, meaning you free up project management time.

Negotiations can be a drain on time and resources

Solution: You don't want to be haggling over something that costs £100. Publicise your licence up-front and with clear terms and in most cases it will reduce negotiations to zero.

Academics & researchers want to be in the loop

Solution: The approvals workflow allows the inventor/author to be automatically included in the licensing process. They can

be nominated to approve a process or simply informed of who is licensing their research and where they're from.

Where can I find your technologies?

Solution: This might sound simple but there is real benefit in having a place where people can read about the product, read academic references, supporting material and contact the people involved directly. The licence terms are easily accessible, with clear pricing and the interface is familiar to anyone who has ever purchased online.

How could E-lucid work in your organisation?

E-lucid allows you to create a long-tail licensing strategy that tidies up a lot of the loose ends. It helps build a manageable programme for engaging with projects and products typically not viable under your current model (but valued by your academics all the same).

It is also a long-term income source. The automated processes mean the burden is lifted from individual business managers and you have a central place to point to for licensing non-exclusive materials.

It opens doors to relationships with more of your academics—allowing you to provide value to a percentage of your organisation's population previously underrepresented in your portfolio.

For those organisations relatively new to licensing, it offers a manageable step into licensing and a channel for your technologies. It allows you to front-load and commission a set of reusable licences, saving money on legal fees. The platform is fully-hosted and technically-supported so little or no internal IT resources are required.

Finally, E-lucid can give you a visible (and transparent) dual licensing economy where open source or academic licences can be placed alongside income generating commercial licences. That's potential income and stats for your REF case studies—all in one place.

Find out about E-lucid's features at e-lucid.com

To arrange a demo or simply chat through your needs, email david@e-lucid.com.

New spinouts

There is further information on the companies featured below, and others new to the Spinouts UK database, in the listing on page 8.

IGEM Therapeutics

IGEM Therapeutics is an immuno-oncology company developing novel immunoglobulin E (IgE) antibodies to treat cancer, founded on the work of Dr Sophia Karagiannis of King's College London (KCL) in the field of IgE antibody platform technology based on protein and glyco-engineering.

Dr Karagiannis's team has demonstrated superior efficacy for IgE versus cognate IgG antibodies in a range of pre-clinical cancer models, and she believes that they are ideally suited to the treatment of solid tumours.

In June the company announced the closing of a £2 million Series A investment from Epidarex Capital, a specialist early stage life science venture capital firm. IGEM is now seeking further investment to complete the round. The funding will enable IGEM to continue to invest in pipeline development as it builds its portfolio of IgE antibody candidates, and will support the further development of the platform technology.

Azul Optics

Azul, a spinout from the University of Bristol, is developing a device that will enable eye health professionals to rapidly assess macular pigments as an indicator of eye health. The device will be affordable, fast, easy-to-use and compact, making it easy to integrate macular pigment density screening into regular eye exams. Macular pigments, which we get from our diet, play a protective role in the eye. Low volumes of these pigments are considered to be a risk factor for age-related macular degeneration (AMD), the leading cause of incurable blindness in the western world.

Qkine

Qkine, a recent spin-out from the University of Cambridge, has signed a licensing deal for Activin A production technology with Cambridge Enterprise, the University's commercialisation arm. The newly-licensed methodology, which was developed by one of the company's founders Dr Marko Hyvönen, will be used to manufacture proteins that are used for control of stem cell growth and differentiation.

Growing demand for Activin A and related growth factors, and an opportunity to use protein engineering techniques, motivated Hyvönen and co-founder Dr Catherine Onley, a translational scientist, to start Qkine.

Commenting on the announcement, Hyvönen said "I have been providing growth factors to the Cambridge stem cell community for almost a decade. Demand is growing from labs outside

Cambridge, and forming Qkine will allow us to focus on producing the highest quality cytokines for these scientists and establish a unique UK-based supplier of one of the enabling technologies for regenerative medicine."

Keapstone Therapeutics

Keapstone Therapeutics is a new spinout from the University of Sheffield and Parkinson's UK to develop new drugs for Parkinson's and other neurodegenerative diseases. The company will work with different partners, including Synature Discovery, to ensure that if any drug development programme shows promise, it can swiftly move towards clinical trials.

Even though charities and academia have entered into research partnerships before, the partnership between Parkinson's UK and Sheffield is the first time a charity has approached researchers to launch a spinout company with the agenda to advance a particular research programme.

Arthur Roach, Director of Research at Parkinson's UK, said the new programme of work will enable it to act in a similar way as a small biotech company. Yet, unlike a commercial company, its primary goal will be the creation of new treatments to improve the lives of people with Parkinson's.

Keapstone will build on research undertaken at the Sheffield Institute for Translational Neuroscience (SITraN) and an international collaboration with the European Lead Factory, during which Dr Richard Mead of SITraN discovered novel small molecules which prevent the interaction between two proteins to increase the survival of neurons in both Parkinson's and MND. In collaboration with Synature Discovery, Keapstone Therapeutics will now further optimise these molecules to afford drug candidates with the potential to slow or even prevent the progression of these diseases.

MolEndoTech

MolEndoTech, a spinout from Plymouth University, has been created to commercialise the work of Simon Jackson, Professor of Environment and Human Health within the Peninsula Schools of Medicine and Dentistry.

The MolEndoTech team has developed a rapid assay to screen water for faecal contamination. Current tests on the market may take hours or even days to show results, whereas MolEndoTech's technology typically produces results in under 15 minutes. Rapid, point-of-use testing to determine water quality enables more informed decision-making about the use of water and significantly improves the ability to identify and track the pollution source.

A patent has been filed in relation to the technology which has already been granted in the US for recreational waters.

Frontier IP, which specialises in the commercialisation of intellectual property, has received a 20 per cent stake in the company.

The Vaccine Group

The University of Plymouth has launched a new spinout company which will address new vaccines for diseases which spread from animals to humans, and for use in infection control.

The Vaccine Group will exploit technology developed by Dr Michael Jarvis, Associate Professor in Virology and Immunology

at the University of Plymouth, who specialises in the creative design of herpesvirus-based vaccines for the control of disease. Initial work in The Vaccine Group will focus on herpesvirus-based platforms suitable for use in animals, to protect human health by targeting the animal species from which disease is transmitted to humans, for vaccination (termed zoonoses barrier vaccines). Target pathogens include avian influenza A, Ebola and Marburg viruses, MERS and SARS coronaviruses and Rift Valley fever virus. Future developments will include vaccines for use in humans.

Frontier IP has received a 21% equity stake in the company; its role will be to provide commercialisation services, industry expertise, and strong links to the pharmaceutical industry.

Exploring spin-outs with Mercia

Interview with Dr Nicola Broughton, Head of Universities at Mercia Technologies PLC



Nicola leads the University investment team, which works closely with Mercia's 18 university partners to fund and scale the research which they believe has the most significant commercial potential.

Nicola joined the Group in 2015 and has experience in both life sciences and university commercialisation, having founded her own IP commercialisation company working as a technology transfer, licensing and spin-out advisor to many universities across the UK. She also spent 10 years as a commercial director for a University of Leeds spinout.

What is Mercia and what does it do?

Mercia is a leading investment business, specialising in the commercialisation of UK technology companies with a particular focus on UK regions in the Midlands, the North and Scotland. With eight offices, 18 university partnerships and over 65 employees, the Group brings together a targeted and diverse skill set of industry expertise and venture capital discipline. We work with portfolio companies with high growth potential from seed investment through to scale up capital. Mercia's key areas of focus, include: Life Sciences & Biosciences, Digital & Digital Entertainment, Software & the Internet, Electronics, Materials, Manufacturing & Engineering.

How does Mercia work with its university partners?

Our specialist investment team works closely to build relationships with our 18 university partners and as well as managing a portfolio of spinout companies, the team also actively sources new university spinouts across all of our sectors. The team

builds relationships between the very different worlds of academia, commercialisation and tech transfer. Having had experience in all three, Mercia's strength lies in being able to play a leading role in bringing this process together to deliver attractive returns for all those involved.

Tell me more about the University Team?

Dr Brijesh Roy joined Mercia in 2015 and leads on building relationships with universities across the Midlands. He previously spent five years at Oxford University commercialising academic technology by negotiating dozens of licensing deals and creating new spinout companies.

Paul Devlin is based in Mercia's Edinburgh office and is building a team in Scotland to increase Mercia's deal flow. Paul previously led the Launch.ed start-up programme as company formation manager at the University of Edinburgh.

Dr Sandy Reid has also recently joined the team as an Investment Manager. Sandy has hands-on experience of working with early-stage companies, having been the founder and CEO of University of Nottingham spinout, Promethean Particles, for eight years.

What is involved in the spinout process?

For academics who have nurtured their work through trials and dissertations, taking the next step and commercialising that work can often feel overwhelming. This is precisely where technology transfer offices (or TTOs), alongside experienced investors such as Mercia, work together to support the transition from academia to a commercial proposition.

What is involved with the process of starting a new company?

In the simplest terms, it is purely a case of registering the business at Companies House and opening a bank account. However, for a university spinout the process begins long before this; the first step is to identify an exciting opportunity, ideally with a strong IP base, but definitely with a significant market to address. The next stage is to work this up into a viable business plan, paying particular attention to the route to market, any technical milestones that need to be achieved ahead of seeking investment and crucially, identifying a commercial team to run the business. Once all these pieces are in place it's time to pitch to investors. Once an offer of investment has been given, the final stage is to progress through the legals governing the investment, but it's worth bearing in mind that the relationship with your investors doesn't stop there, it will be a partnership over the lifetime of the company which extends over many decades.

How is Mercia involved?

Mercia's University team is often involved with university projects, sometimes two to three years ahead of them becoming spinouts, providing guidance and helping shape the opportunity. We actively engage with our partners, providing surgeries where academics and TTO staff can talk about projects over a coffee in an informal setting, as well as participating in

larger scale events where we talk about the process of spinning out companies and to raise awareness amongst academics.

What is different about Mercia?

Mercia has pioneered a hybrid investment model, the 'Complete Capital Solution,' in order to support the UK's leading technology companies. Through Mercia's wholly owned fund management businesses, the Group is able to provide seed and early stage rounds of £100,000+ followed by the provision of scale-up capital of up to £10.0 million using its own balance sheet capital. We have also been appointed by the British Business Bank to manage more than £108 million in new funds through the Northern Powerhouse Investment Funds.

The Investment Team offers a unique combination of venture capital skills with significant operational expertise as many of them have had previous experience of running their own businesses.

How should people get in touch with you?

If you're interested in finding out more about our University partnerships then please feel free to get in touch with the Mercia team at: universities@merciatech.co.uk



Recent exits

Virtu Biologics

In April Virtu, a company focused on the development of oncolytic virus therapy for the treatment of cancer, was acquired by NASDAQ-quoted Sorrento Therapeutics.

Virtu was originally incorporated as Crusade Laboratories, a spinout from University of Glasgow and Cancer Research Ventures, to develop variants of Herpes Simplex.

Virtu's lead product candidate Seprehvir® (HSV1716) is derived from a modified version of the virus HSV-1. Seprehvir® has the ability to specifically target and destroy tumour cells while also stimulating an anti-tumour T-cell mediated immune response. As part of its global clinical program, Seprehvir® has been administered to over 100 adult and paediatric patients in a variety of solid tumours including glioblastoma, mesothelioma, melanoma, head and neck cancer, paediatric sarcomas and paediatric neuroblastomas.

In consideration for the acquisition, Virtu equity holders received an aggregate of 797,081 shares of common stock of Sorrento based on a \$5.55 price per share, and will be eligible

to receive an additional approximately \$20 million in stock of TNK shares should TNK close a third party financing of at least \$50 million within 12 months of this transaction.

Additionally, Virtu will be eligible to receive two additional milestone payments of up to \$10 million based on the two first marketing authorisations of Seprehvir® to occur in the US, EU or Japan.

Oxford Gene Technology

In May, Sysmex, a Japanese in vitro diagnostics company, signed a deal to acquire all the shares of molecular genetics company Oxford Gene Technology (OGT).

OGT was founded in 1995 by Professor Sir Edwin Southern, a University of Oxford molecular biologist and microarray innovator. OGT acquired Sense Proteomic in 2009, and Cytocell in 2014.

Upon completion of the deal, OGT will become a wholly owned subsidiary of Sysmex. Further terms were not disclosed.

For the year ended 30 September 2016 OGT recorded sales of £19.7m primarily from its fully integrated molecular genetics product portfolio that grew by 30% in FY16.

Catapult Therapy TCR

Catapult Therapy TCR was formed by the Cell and Gene Therapy Catapult with UCL Business and Imperial Innovations, to develop a cell therapy approach to the treatment of acute myeloid leukaemia (AML).

It focused on the development of a gene-modified WT1 TCR T cell therapy, which targets AML and myelodysplastic syndrome (MDS) cells known to over-express the antigen WT1. This is a new approach in a therapeutic area where prognosis is often poor and therapeutic options limited. The WT1 antigen is also present on a variety of solid tumours, giving this treatment broader therapeutic potential.

The technology underpinning TCR was developed initially at Imperial College London and then at University College London by scientists funded by the charity Bloodwise. In 2016, TCR announced positive interim results from its phase I/II trial of its T-cell therapy.

In June, the company was acquired by Cell Medica, which had raised a £60 million funding round earlier in 2017. The

acquisition will enable the further development and commercialisation of the treatment. The development of next-generation T cells will be conducted by Cell Medica at CGT Catapult's cell and gene therapy manufacturing centre, following a grant awarded earlier this year by Innovate UK.

Geneius Laboratories

Geneius, a spinout from the University of Newcastle, provides fast, reliable laboratory testing for the food, beverage and other industries. The company has been acquired by SYNLAB, a Munich based provider of routine and specialist medical laboratory services.

Geneius was founded in 2007 by Professor Jerry Barnes and a team of senior microbiologists. The company is based on the ability to utilise and develop DNA technology to identify and investigate micro-organisms in foodstuffs with the highest level of reliability and accuracy.

SYNLAB focus on the implementation of laboratory medicine methods and on networking specialist diagnostic competences. SYNLAB will support the growth and development of the Geneius business model to deliver a continued high level of service with the additional advantage of being able to offer much wider portfolio of tests and services.

Building the graphene & 2-D materials innovation ecosystem at Manchester



The University of Manchester's approach to commercialisation of graphene and other 2-D materials has been guided by the concept of the innovation ecosystem.

This emphasises the need to nurture world-leading science, collaborate with and attract investment from industry, secure and commercialise IP, engage with well-regarded technology entrepreneurs, provide a supportive environment for start-ups and critically, to ensure that there are sufficient trained people to provide the necessary labour market to anchor the firms in the UK.

Within any innovation ecosystem there are key institutions which support the earlier stages of technology development. At Manchester, the capital building structure aspect of the ecosystem consists of The National Graphene Institute (engaging in academic-led industry collaboration with companies of all types and sizes), The

Graphene Engineering Innovation Centre (facilitating industry-led development with academic participation) and the research power aspect consists of some 200+ academic researchers on campus.

UMIP is driving the commercialisation of the University's graphene and 2-D material portfolio by the further development and management of its IP towards licensing or spin outs. Partnering is a key element to enable sector specific expertise to inform how a technology is best developed and positioned.

The University has an extensive graphene and 2-D material patent portfolio with applications across an enormous range of industrial sectors – reflecting the significance and

opportunities for these materials. Key UMIP activities are currently focused around the development of a platform spin out for transition metals membranes- providing opportunities in desalination, water remediation and nano-filtration; electrowetting screens; thermoelectric composites and reduced graphene oxide coatings as barrier layer materials.



Launched in May 2016, Graphene Enabled Systems Ltd, a wholly-owned University of Manchester subsidiary, has been busy building its business capability and working towards its mission of creating a cluster of profitable 'spin-out' businesses or joint venture businesses based on the University's Graphene patent portfolio and scientific know-how.

The company carries out analyses of selected graphene portfolio technologies and their associated IP, researches and characterises target markets, clearly defines competitive advantage and prepares financial and operational plans.

Having identified an opportunity capable of generating a spinout or joint venture business, Graphene Enabled builds a high-quality product demonstrator supported by a robust business plan. Graphene Enabled also works with sources of investment capital to provide early-stage seed funding for the spinout or joint venture.

Graphene Enabled is currently working on a number of projects:

- Graphene sensor and actuator spin-out
- Graphene sheet manufacturing spin-out
- Graphene materials enhanced textiles

- Graphene enhanced sports products JV
- 2D materials electronic devices JV
- Graphene enhanced elastomers spin-out

One example is a joint venture with a small Manchester based business, Rotite Technologies Ltd, which has developed an innovative type of fastener called a 'Rotite'. Rotites operate like a helical dove tail joint with an A part and a B part. They can be moulded, cast, machined or 3D printed from a huge variety of materials and their simplicity can help reduce weight and component count whilst improving efficiency and functionality.

Graphene Enabled welcomes discussions with potential investors of industrial partners from across the world to explore areas of collaboration.

Contact: Andrew Wilkinson,

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Website: www.graphene-enabled.com

Twitter [@GrapheneEnabled](https://twitter.com/GrapheneEnabled)



Recent spinouts

The following companies are new to the Spinouts UK database, irrespective of the date of incorporation. A selection of these companies are described in more detail in the article on p3.

company	university	sector	incorporated	web
IGEM Therapeutics	KCL	drug discovery	25-Jul-16	
Azul Optics	Bristol	medical devices	11-Aug-16	www.azuloptics.com
Qkine	Cambridge	biotechnology	09-Nov-16	qkine.com
MuMac	Manchester	healthcare	18-Nov-16	www.mumactd.com
Oxentia	Oxford	consultancy	22-Dec-16	www.oxentia.com
Keapstone Therapeutics	Sheffield	drug discovery	01-Feb-17	
Oxford Quantum Circuits	Oxford	quantum technology	05-Jun-17	
MolEndoTech	Plymouth	environmental technologies	29-Jun-17	
The Vaccine Group	Plymouth	therapeutics	29-Jun-17	

Recent exits

exit date	company	type	incorp	university	value	acquirer/market
28-Apr-17	Virttu Biologics	trade sale	08-Sep-99	Glasgow	\$25m	Sorrento Therapeutics, Inc
31-May-17	Oxford Gene Technology	trade sale	10-Apr-95	Oxford	n/d	Sysmex, Japan
20-Jun-17	Catapult Therapy TCR	trade sale	09-May-14	Imperial, UCL	n/d	Cell Medica
01-Jul-17	Geneius Laboratories	trade sale	02-Jan-07	Newcastle	n/d	SYNLAB, Munich

Database download, and subscriptions

The Spinouts UK online database of spinouts and start-ups from universities across the UK now contains over 2,500 companies. For details of how to subscribe to access the online database, or to download the complete database in spreadsheet format, please contact spinouts@ycf.co.uk

Recent investments

date	company	university	amount (million)	investors
27-Feb-17	Congenica	Cambridge	£10.00	Parkwalk, Amadeus, Cambridge Innovation Capital, BGI Genomics, Healthlink Capital
28-Feb-17	Phoremot	Cambridge	£2.00	Amadeus Capital Partners, U of Cambridge, Parkwalk
15-Mar-17	Fuel 3D Technologies	Oxford	£8.00	Parkwalk Opportunities EIS Fund, Parkwalk Syndicate
03-Apr-17	Cortexica	Imperial	£2.60	Touchstone Innovations
08-Apr-17	Azul Optics	Bristol	£0.31	University of Bristol Enterprise Fund I (Parkwalk)
26-May-17	UltraSoC	Cambridge, Essex, Kent	£5.00	Atlante Tech, Enso Ventures, Oxford Capital, Guillaume d'Eyssautier, Octopus Ventures, South East Seed Fund (FSE Group)
30-May-17	Zegami	Oxford	£2.30	Parkwalk (Oxford II) follow-on and OSI
31-May-17	EnteroBiotix	Aberdeen	£0.50	Equity Gap, SIB
31-May-17	Oxford Drug Design (InhibOx)	Oxford	£1.50	Busolantix Investments SA, O2h Ventures, IP Group, business angels
05-Jun-17	Scenic Biotech BV	Oxford	€ 6.50	BioGeneration Ventures, INKEF Capital, Oxford Sciences Innovation
13-Jun-17	Changing Health	Newcastle	£1.00	Northstar Ventures
15-June-17	Cytox	Birmingham	£2.60	Catapult Ventures, Perivoli Innovations, Rainbow Seed Fund, U of Oxford
21-Jun-17	Impression Technologies	Imperial	£3.00	Touchstone Innovations, Mercia Technologies
26-Jun-17	Yoyo Wallet	Oxford	£12.00	Touchstone Innovations, Metro Group, Woodford Investment Management
27-Jun-17	DiffBlue	Oxford	£17.00	Oxford Sciences Innovation, others
29-Jun-17	NightstarRx	Oxford	US\$45.00	Wellington Management Co, Redmile Group, Syncona, New Enterprise Associates (NEA)
30-Jun-17	IGEM Therapeutics	KCL	£2.00	Epidarex
03-Jul-17	Creavo Medical Technologies	Leeds	£13.40	Parkwalk, IP Group, other private and institutional investors from Europe, the USA and China
07-Jul-17	3F bio	Strathclyde	£0.46	EOS, SIB, U of Strathclyde, DCVC, private investors
11-Jul-17	Cycle.Land	Oxford	£0.36	Parkwalk
12-Jul-17	YASA Motors	Oxford	£9.29	Parkwalk Opportunities Fund
14-Jul-17	Eight19	Cambridge	£1.30	Lucros Investment (Netherlands), IP Group, Clarium, Providence
18-Jul-17	Cutitronics	Stathclyde	n/d	Croda International
20-Jul-17	Nandi Proteins	Heriot-Watt	£1.00	new & existing investors [Frontier IP]
20-Jul-17	Gyroscope Therapeutics	Cambridge	n/d	tbc
21-Jul-17	Tissue Regenix	Leeds	£40.00	placing
26-Jul-17	Zeetta Networks	Bristol	£1.30	IP Group
03-Aug-17	Causeway Therapeutics	Glasgow	£1.00	Mediqventures, SIB
08-Aug-17	Freeline Therapeutics	UCL	£13.52	n/d
09-Aug-17	Inductosense	Bristol	£1.10	U of Bristol Enterprise Fund (Parkwalk)
21-Aug-17	Oxford Genetics	Oxford	£7.50	Mercia Technologies

Innovation knows no borders

Nearly half of Oxford's spinouts since 2011 have a founder from another country and are pivotal to the University's innovation success.

- - by Gregg Bayes-Brown



One question that is often asked of universities at the heart of established innovation ecosystems – be it Cambridge, MIT, Stanford, or Oxford – is “what’s the secret sauce?”

In truth, there is no secret sauce. Even if there were, each ecosystem would have its own special blend; there is no one-sauce-fits-all model.

There are, however, common ingredients, and one of the most important of these is diversity.

Encouraging diversity comes in many different flavours: gender and sexual equality, supporting people from minority and lower economic backgrounds to get ahead, ensuring a level playing field for the disabled, welcoming people from all walks of life and backgrounds, and more. This also means healthy immigration policies. For ecosystems to succeed, they must have robust access to international talent through immigration.

Why this is pivotal for innovation is that diversity, in turn, encourages an array for skillsets, opinions, and approaches sourced from a plethora of backgrounds that innovators can draw upon. It supplies ideas and people from around the world. It gives them a critical mass of smart, capable people in the local area, who in turn attract more talented people and organisations. It gives them divergent thinking – the ability to think creatively outside of the box and find new solutions to problems – built into their projects, companies, and ecosystems.

There’s the oft-mentioned mantra regarding innovation that it’s a numbers game, which is interpreted by some to mean that if you have enough ideas, some of them are going to be winners. But if the success of Silicon Valley is to be considered, it’s not the number of ideas that has made it the international capital of innovation – it is the high number of incredibly talented,

forward-thinking innovators capable of taking those ideas forward that has made the difference.

Research by the National Foundation for American Policy in 2016 into the relationship between immigrants and unicorn startups (ie startup companies worth over \$1bn) found that immigrants have started over half (44 out of 87) including household names like Uber and StartX, and are key members of management or product development teams in over 70%.

EBay and Yahoo were created by foreign founders, and Instagram and WhatsApp both had immigrants as co-founders. One of the most recognisable university spinouts in history, Google, was co-founded by Sergey Brin, born in Russia.

The region’s ability to attract high calibre individuals in vast numbers, giving Silicon Valley a deep pool of quality ideas and concepts backed up by a wealth of talent, is core to its success. In short, Silicon Valley’s momentum is sustained by immigration.

In Oxford, the story isn’t much different. 45% of our spinout companies – ie companies with University intellectual property at their core – have foreign founders or co-founders. In the startup incubator, the figure is even higher, with 78% of our startups founded by an international innovator.

And yet, in the Government’s manifesto published before the General Election in June, amongst other punitive measures against immigration, plans were outlined to create a tax on companies that would increase to £2,000 per head for every employee not from the UK. For DiffBlue, launched in April 2016 and Oxford’s fastest growing spinout with a headcount of 50, this would amount to a £94,000 tax per year on a young company levied simply for attracting the talent it needs to expand.

For Oxford and other tech clusters like Cambridge and London to keep their edge against peer ecosystems, rapidly-expanding young companies like DiffBlue need to be encouraged, not penalised.

Without Oxford’s international innovators, Oxford University would – on paper - still be one of the top contenders in the UK for turning its ideas into technologies and companies which have a positive impact on the wider world. But that doesn’t count for all the researchers from other countries who help develop those ideas, the employees in startups and spinouts which have come

This is an abridged version of the original feature. To read the full piece, complete with interviews with our international innovators, please visit: <https://medium.com/oxford-university/innovation-knows-no-borders-398de580aea9>

Gregg Bayes-Brown is the Marketing and Communications Manager for Oxford University Innovation. You can follow him on Twitter at @GreggBayesBrown, and you can follow OUI for more blog posts and innovation news at @OxUInnovation.

to Oxford and are integral to their success, and the serendipitous innovation that stems from an internationally diverse group of people who have come together to make Oxford a top global hotspot for university innovation.

While Brexit and Britain's future are issues with many factors and facets to consider, the message from the ground of Oxford's

tech cluster is clear. If Britain is to keep a competitive, innovative edge, and embrace science and technology as a major part of its economy, then the UK must not allow itself to slip into isolationism, and maintain an open, welcoming and global outlook in the future.

Recent investments

This selection of reports from the deals listed on p9 includes some of the biggest and most unusual, and some from outside the 'golden triangle'

UltraSoC

In May UltraSoC completed a £5 million funding round led by Atlante Tech. The funding saw a strong line-up of new investors including Enso Ventures, Oxford Capital, and successful CEO and serial entrepreneur Guillaume d'Eyssautier, who joined existing investors Octopus Ventures and South East Seed Fund (FSE Group).

UltraSoC's semiconductor intellectual property (SIP) enables designers to easily and cost-effectively create complex SoCs (systems on chip) with built-in intelligence that continuously monitors and responds to real-world behaviour. This allows SoCs to optimise power consumption and performance and deal with security threats or safety breaches.

EnteroBiotix

EnteroBiotix, a start-up from the University of Aberdeen, is focused on using the body's own microorganisms to prevent and treat debilitating infections and diseases.

The company's lead product candidate is an orally administered microbial therapy for use in a medical treatment called Faecal Microbiota Transplantation (FMT). EnteroBiotix is using its manufacturing platform to develop allogenic (from a donor) and autologous (using a person's own bacteria) orally delivered therapies, using standardised, quality controlled and quantifiable processes.

EnteroBiotix has raised £500k in an oversubscribed seed investment round, led by business angel group Equity Gap and supported by the Scottish Investment Bank, the investment arm of Scottish Enterprise. The round includes £100k from a SMART:Scotland feasibility grant to allow the company to develop entirely anaerobic (oxygen free) GMP-compliant collection and processing capabilities.

"This investment and grant funding will be pivotal in furthering the objectives of EnteroBiotix as we develop the first orally available products for FMT in Europe" says James McIlroy, a final year medical student at the University of Aberdeen and CEO at EnteroBiotix.

Changing Health

Changing Health, a spinout company from Newcastle University and the Newcastle Hospitals NHS Foundation Trust, completed a £1m funding round in June from the Finance for Business North East Accelerator Fund, managed by Northstar Ventures.

Changing Health, which launched last year, uses evidence-based behavioural change techniques to improve the lives of people with Type 2 Diabetes (T2D). The platform provides users with educational content about managing T2D, healthy eating and exercise. Users can also track their personal data, set realistic goals and receive personal interaction with trained coaches.

Professor Mike Trenell, chief scientist at the spinout, and a senior researcher at Newcastle University, said "Diabetes is currently the single biggest health issue in the UK and the greatest cost to the NHS and other healthcare providers. Yet 70% of Type 2 Diabetes can be prevented or reversed with a healthy diet and physical activity. Changing Health addresses this need by reducing barriers to patients accessing the educational programme they need and for the first time making available evidence-based behavioural change tools that improve health outcomes and reduce delivery costs."

Impression Technologies

Impression Technologies is an aluminium forming technology business based on intellectual property developed at Imperial College London.

The company has raised a Series B funding round from Touchstone Innovations and Mercia Technologies, each committing £1.5 million. Touchstone led a £4m funding round in the company in July 2015.

Founded in 2012, Impression Technologies has developed a patented Hot Formed Quench (HFQ®) technology which allows manufacturers to form deep drawn complex shapes from high and ultra-high strength aluminium. The result is a high strength, low weight, cost-effective component for structures within car bodies, rolling stock and aircraft assemblies.

Yoyo Wallet

Yoyo, a start-up from the University of Oxford, is a mobile payment and customer loyalty platform. The company has secured a £12 million investment led by the digitisation and start-up investment arm of German wholesale retailer Metro Group, and supported by Woodford Investment Management, together with Touchstone Innovations.

Yoyo Wallet was first founded in 2013 by entrepreneurs from the credit card and payment industry, and the app was launched in 2014 across 32 food and drink outlets at Imperial College London.

Diffblue

Diffblue, a University of Oxford AI spin-out, has raised \$22 million in a Series A funding - one of the largest Series A rounds for an AI company in Europe to date.

Founded by University of Oxford Computer Science Professor Daniel Kroening and Dr Peter Schrammel, Diffblue develops AI for code. The company automates many traditional coding tasks: bug fixing, test writing, finding and fixing exploits, refactoring code, translating from one programming language to another, and creating original code to fit specifications.

The investment round was led by Goldman Sachs Principal Strategic Investments, alongside Oxford Sciences Innovations (OSI), and the Oxford Technology and Innovations Fund.

NightstaRx

In June NightstaRx, a late-stage biopharmaceutical company developing gene therapies for inherited retinal diseases, announced the completion of a \$45 million Series C financing transaction.

New investors Wellington Management Company and Redmile Group joined existing investors Syncona and New Enterprise Associates (NEA) in the round.

Nightstar is focused on developing and commercialising one-time treatments for patients suffering from rare inherited retinal diseases that would otherwise progress to blindness, and for which there are no other treatment options.

The Series C proceeds will be used for the upcoming Phase 3 trial of the company's lead programme NSR-REP1, an ongoing Phase 1/2 clinical trial of Nightstar's product candidate NSR-RPGR for X-linked retinitis pigmentosa, and a planned Phase 1/2 clinical trial of a gene therapy product candidate for an inherited form of macular dystrophy.

Creavo Medical Technologies

Creavo completed in July an oversubscribed fundraising of £13.4 million, strongly supported by existing shareholders, and new, private and institutional investors from Europe, the USA and China, including Parkwalk Advisors and Puhua Capital, a

leading venture capital firm in China with a strong presence in the healthcare sector.

The funding will be used to continue growing the Creavo business and moving towards a full commercial launch in Europe, by concluding its clinical study in the UK, building its US operation and associated clinical study, and conducting further research to expand the use of its technology into other applications.

Creavo, a spinout from the University of Leeds, has developed Vitalscan, a deployable diagnostic technology, using magnetocardiography (MCG) to measure, display and store electromagnetic fluctuations caused by heart activity, using extremely sensitive detectors.

The device works by conducting a non-invasive three to five-minute scan at a patient's bedside to rule out significant cardiac conditions, such as heart attacks. It is currently being trialled at four of the UK's largest emergency departments (Bristol, Nottingham, Leicester and Sheffield).

Creavo's core technology has a range of potential applications outside of emergency detection and diagnosis, and could play a large role in helping to better understand and predict the arrhythmias that can result in sudden cardiac death, as well as further diagnostics in other organs.

3f bio

3f bio's patented zero-waste process technology covers the production of protein (Food) alongside bioethanol (Fuel) and animal Feed, and addresses the global market for protein.

3f was founded in 2015, and spun out from the University of Strathclyde in April 2016. Since that time 3f has completed proof of concept and received validation from potential partners and a range of awards.

A recent investment of £461k was led by St Andrews based business angel investment syndicate EOS, and supported by Scottish Investment Bank, the University of Strathclyde, US based venture capital fund Data Collective (DCVC), and a number of private investors. The funding will enable the company to extend development activities, progress to pilot and industrial scale, and expand the scope of its technology to wider global potential for sustainable protein.

Eight19

A £1.3 million investment in Eight 19 saw Lucros Investment (Netherlands) join existing investors IP Group, Clarium and Providence. The investment will help Eight19 accelerate its organic photovoltaic (OPV) business, and develop a new thin-film technology to improve the efficiency of Si photovoltaics.

"We are delighted to have secured the additional funding, which will allow Eight19 to accelerate commercial engagement with customers through the delivery of complete energy

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High Growth Spinout Programme (HGSP)

The Scottish Enterprise Venture Development team has a focus on creating new high-growth companies from the commercialisation of intellectual assets.

Initially through the Proof of Concept Programme and, since 2014, through the High-Growth Spinout Programme (HGSP), Scottish Enterprise has been providing support for the commercialisation of leading-edge technologies emerging from Scotland's universities, research institutes and NHS Boards for over 15 years.



Whilst our Programmes have evolved over this period, our aim has remained the same: to support the creation of new, high-growth companies with the potential to generate significant economic impact in Scotland.

The HGSP was introduced in November 2014 as part of a revised approach to commercialisation support by SE that places even greater emphasis on:

- early customer engagement to ensure a strong business and market focus from the outset;
- engagement with investors to understand the product value inflection point that needs to be reached in order to secure investment;
- building the management team and business plan necessary to secure investment;
- rigorous project management by SE and its advisors to ensure projects remain focused on hitting milestones;
- termination of projects if technical or commercial milestones are not being met in order to free up resources for new opportunities.

Entry into the Programme is preceded by an intensive project development and appraisal phase. Progression through the Programme is based on reviews by a panel comprised of investors, entrepreneurs and those who have held senior positions in industry. In Phases 1 and 2, funding is provided in the form of a grant to the host institution. In Phase 3, funding takes the form of a convertible loan to the new spinout company.

The HGSP supports a wide range of exciting, leading-edge technology projects and entrepreneurial talent to create companies, products and services with enormous potential both in economic terms for Scotland and in the wider societal benefits they can deliver. HGSP projects address sectors ranging from medical (developing a bacterial detection and diagnostic point-of-care device that will help the fight against antibiotic resistance by reducing the time taken for diagnosis of antibiotic susceptibility from days to minutes) through to marine (a decision support system that deploys highly expandable foam in the event of flooding events, significantly and affordably improving the survivability of the ship and those onboard) and construction (a brick that uses 90% recycled construction waste and does not require expensive firing in production or high carbon footprint cement).

Recent successes

Mironid

Mironid was spun out from the University of Strathclyde by a team led by Professor Miles Houslay of the Strathclyde Institute of Pharmacy and Biomedical Sciences, following a collaborative project with Heriot-Watt University. In June 2016, Mironid secured Series A funding of £4.3 million. The funding round was led by Epidarex Capital, with participation from the Scottish Investment Bank and the University of Strathclyde. Mironid received a further funding boost in November 2016, when it was successful in securing £424k of grant funding from the highly competitive Innovate UK Biomedical Catalyst programme. With operational sites in Edinburgh and Glasgow, Mironid is firmly on track to realise its aim of building up a strong portfolio of preclinical stage assets and securing Series B investment to move these assets in to clinical development and expand its portfolio via in-house R&D, licensing & acquisitions.

Causeway Therapeutics

Causeway Therapeutics is a new spinout company from the University of Glasgow, which has developed a patented microRNA replacement therapy for the treatment of tendinopathy in humans and horses. Research by the Causeway Therapeutics team uncovered the molecular mechanism that causes damaged tendons to develop tendinopathy. This insight led to the development of TenoMiR™ and EquiMiR™ that directly target the key features of the disease. Causeway has a clear and ambitious 5-year plan, which includes being recognised as a global leader in microRNA therapeutic development for tendinopathy. The company has recently secured Series A investment of £1 million from Mediqventures and the Scottish Investment Bank and is in discussions to secure a multi-million pound co-development deal with an international partner.

With approximately 80% of supported projects now resulting in a spinout company, and these spinouts securing an average of £800k per annum of new investment and grant funding, we believe that the potential for high-growth company creation from the wealth of world-leading technology with commercial applications housed in Scotland's vibrant university base has never been better.



Cytox raises £2.6m to launch predictive testing service for Alzheimer's disease

The investment will help commercialise Cytox's services for testing for Alzheimer's disease and grow the company as a leader in this area

University of Birmingham spinout Cytox, an emerging precision medicine leader providing genetic testing for Alzheimer's disease, has announced that it has raised £2.6m to fund the commercial launch and international roll out of its comprehensive testing service. The funding round was led by the GM&C Life Sciences Fund, managed by Catapult Ventures, alongside existing and new investors, including Perivoli Innovations, The Rainbow Seed Fund, The University of Oxford, and private investors.

Cytox has developed a genetic prognostic research test to predict with a very high degree of accuracy the risk of someone developing Alzheimer's disease (AD) many years before the first signs. Developed in collaboration with Thermo Fisher Scientific, Cytox's breakthrough approach interrogates over 130,000 single nucleotide polymorphism (SNP) biomarkers found on the research use variaTECT™ array used in combination with analysis by its proprietary SNPfitR™ interpretive software for polygenic risk scoring (PRS) for assessing AD onset risk, including those with negative ApoE4 genotypes. The test is available globally as a service for all pharma, biotech and research labs working in this area to stratify samples obtained from subjects who are pre-symptomatic or showing mild cognitive impairment (MCI) and are at risk of developing AD. Cytox recently presented data on two further PRS algorithms optimised for identifying true amyloid positivity and true amyloid negativity, thus offering the potential to match performance to the specific needs of a clinical research study.



The investment will enable the company to launch its genetic testing platform and services to those pharmaceutical and biotechnology companies developing the next generation of dementia drugs. The investment will also be used to validate and launch Cytox's AD test as a service within a CLIA approved laboratory and to expand the approach to include differential diagnosis and prognosis of dementia.

In addition to the investment, Dr David Whitcombe, a Venture Partner with Catapult Ventures, will join the board of Cytox as a non-executive director. David co-founded DxS Diagnostics in 2000 to expand upon technology he developed at AstraZeneca, and sold the company to QIAGEN in 2009 for more than £100m.

Dr Richard Pither, CEO Cytox, said "I'm extremely pleased to welcome Catapult Ventures as a new investor in Cytox and David to the board. David's expertise in genetics, diagnostics and developing strong commercial partnerships will be extremely valuable to Cytox as we seek to commercialise our services for testing for Alzheimer's disease and grow Cytox as a leader in this area."

Dr David Whitcombe, Venture Partner with Catapult Ventures, added "Cytox is a very exciting company with a compelling offering in the assessment of individuals with dementia and Alzheimer's disease. Their genetic tests have demonstrated compelling results on the accuracy of prediction of developing the disease. I look forward to working with Richard and the team to fulfill the potential of their prognostic tests to better understand the disease and play a role in developing much needed therapeutics."

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Dr James Wilkie, CEO of University of Birmingham Enterprise said: "New technologies that can assess the risk of Alzheimer's developing is pivotal to the development of drug therapies. The technology transfer team has been working

with Dr Zsuzsanna Nagy, the academic innovator behind Cytox's technology for many years. We are delighted that the technology is now proving itself attractive to investors and moving forward to fulfil its potential."

Contact: 0121 414 9090

www.spinoutsuk.co.uk

Recent investments

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autonomous solutions utilising our flexible OPV”, stated Claudio Marinelli, general manager and VP Business Development. “The funding will also enable the company to accelerate the commercialisation of a recent technology breakthrough at the Cavendish Laboratory, Cambridge University that could enhance the efficiency of conventional silicon solar panels by up to one quarter.”

Nandi Proteins

Nandi, a spinout from Heriot-Watt University, is commercialising a technology which enables food manufacturers to reduce significantly the sugar, fat and additive content in foods.

The technology offers a range of potential benefits to multinational food companies, as consumer preference shifts towards healthier products and clean labelling, principally through the elimination of emulsifiers.

Nandi has raised approximately £1 million from new and existing investors, including Frontier IP, valuing the business at approximately £10 million.

The funding will provide Nandi with working capital to help fund its scale up, enable product trials and sample production, and recruit key personnel to steer growth.

Cutitronics

Cutitronics was established in 2014 as a spinout company from the University of Strathclyde by Dr David Heath, who identified a gap in the market for personalised, adaptive skin care. He sees Cutitronics as an engineering business, and indeed was the Royal Academy of Engineering’s ERA Entrepreneur of the Year in 2014.

The CutiTron™ technology provides consumers with an intelligent applicator for skincare products, which measures the user’s skin health then stimulates the skin to absorb the product much more readily. It dispenses the correct amount of the cream, and users can track the results and improvement in their skin health through use of the intelligent applicator via a mobile app.

The company’s customers are the brands which create skincare products, and can use the data from the Cutitronics applicators to improve products and provide information and advice on new products back to the consumer.

Croda International, a FTSE listed speciality chemicals business headquartered in Yorkshire, has the same skincare brands as Cutitronics as one of its customer constituencies, and has made an investment of an undisclosed sum in the company, setting up a collaboration combining engineering and chemistry which will benefit both partners.

Tissue Regenix

Tissue Regenix, a regenerative medical devices company based on science from the University of Leeds which floated on AIM in 2010, has raised £40 million through a placing and subscription of new ordinary shares.

The company intends to use the proceeds to finance the initial consideration for the acquisition of CellRight Technologies, accelerate growth, and provide working capital to support the on-going commercialisation of its existing programmes.

CellRight Technologies is a US regenerative medicine business focused on the development and commercialisation of a range of human tissue products based on proprietary bone processing techniques and soft tissue products for clinical applications in spine, dental, sports medicine and general surgery.

The acquisition was completed in August for a consideration of \$30 million.

Zeetta Networks

Bristol spinout Zeetta Networks has completed a funding round which secured a total of £1.6m, led by Bloc Ventures, together with existing investors IP Group and Breed Reply.

Since the foundation of the company in late 2015, Zeetta has secured well over £6 million of funding, with over £4m awarded this year alone including funding from Innovate UK and the European Commission. So far, the funding has been used to expand the team for the development of the company’s first product, NetOS®, and solidify the company’s intellectual property position with key patents in this competitive market. The focus will now shift in accelerating the commercial traction achieved in early NetOS® deployments with paying customers in the Enterprise and Network Operator markets.

Causeway Therapeutics

Causeway develops therapies for tendon injuries and disorders, collectively known as tendinopathies.

While working in the laboratory of Professor Iain McInnes at the University of Glasgow’s Institute of Infection, Immunity & Inflammation, Causeway co-founders Dr Derek Gilchrist and Neal Millar discovered that a single microRNA-miR29a plays a key role in regulating the production of collagens, the proteins that give tendons their strength. Causeway’s lead product, TenoMiR™, is a replacement for the natural miR29a that is depleted in tendinopathy.

In August Causeway received a £1 million investment from MediQventures and the Scottish Investment Bank, the investment arm of Scottish Enterprise. MediQventures is a biotech merchant bank and investment firm founded by successful entrepreneurs Jim Mellon, Gregory Bailey, and Declan Doogan in order to identify, finance, and develop promising technologies in the life sciences.

Project partners

Alta Innovations

is the commercial arm of the University of Birmingham. The company develops, promotes and commercialises the University's IP through licensing and the creation of spin out companies. It has recently secured a £5 million investment from the University to co-invest in spinouts and early stage companies.

www.birmingham.ac.uk/generic/alta-innovations



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www.ipgroupplc.com



Oxford University Innovation

is the technology transfer company of the University of Oxford; it promotes commercialisation of IP through licensing, consultancy, and formation of spinout companies. Isis was

ranked 1st in the UK for spinouts over three and ten year periods in the 2013 Annual Report for the Spinouts UK survey.

innovation.ox.ac.uk



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