SPINOUTS
FROM RESEARCH TO MARKET
POWERED BY Beauhurst

ISSUE 30

Quarterly Journal - March 2019

NEWS COMMENT and ANALYSIS on SPINOUTS from UK HEIs

Storytelling

Most of us involved with the technology transfer world are continually surprised, impressed, and excited by the promise of a better world, latent in much research.

We are close to the activity, and able to get a sense of potential progress, which can do much to counteract the pessimism about the future so often reflected in the press and elsewhere.

But how good are we at sharing these feelings? Gregg Bayes-Brown of Oxford University Innovation describes in his article on p 4 some of the difficulties which universities have in developing communications channels which do justice to the quality of the research in their departments, and argues for more collaboration to help the general public (and we hope our elected representatives and other policy makers) share some of the excitement.

There is also a need to explain some aspects of the process. Newspaper reports about the potential of new drugs often lead people to expect treatments which are still years away, and the same misunderstanding is prevalent about much technology development. It is crucial that people reading about research projects and spinout companies realise that not all will succeed, and this is a integral part of the process, not a form of failure. If we are trying hard enough, ie have enough ideas to test, not all projects will survive the proof of concept and proof of technology stages. Companies which progress beyond this stage can still fail during the long journey to market, not necessarily (maybe not even usually) because of any inefficiencies or incompetence, but because the world has changed quickly, and the market opportunity is no longer available.

On a practical note from the point of view of Spinouts UK, it can be very difficult to find out about new spinouts, successful exits, and other promising developments, and some universities and research institutes are not very forthcoming with their communications. We like to tell some of the stories, but we need to have the news to do so!

- *Jonathan Harris, Editor*

Organisations mentioned in this issue

Recent spinouts

Our research in preparation for the Spinouts UK 2019 Annual Report has found a number of spinouts and start-ups which were missing from our database. Further details of these companies are given in the table on page 8. In several cases, companies that were incorporated some time ago have been announced as spin-outs only in recent months.

IMPERIAL INNOVATIONS announced in December the launch of two spinout companies.

Accunea is developing a new device, RenoSure, to quickly detect acute kidney injury (AKI) in hospital patients. The technology is based on work by Dr Robert Learney and Jez Marston in Imperial's Department of Bioengineering.

RenoSure will enable clinicians to continuously monitor patients for early signs of AKI and take preventative measures. To achieve this, the device combines advanced bioanalytical hardware with artificial intelligence to analyse data in real time. The system tracks the level of creatinine, a key biomarker for kidney function, and provides timely alerts when these fluctuate to potentially dangerous levels.

Solar Flow aims to develop and commercialise a hybrid solar energy concept. The company was founded by Christos Markides, Professor of Clean Energy Technologies at Imperial College London's Department of Chemical Engineering.

The new solar energy concept integrates two existing technologies, photovoltaics (PV) and solar-thermal (ST), into a single panel. Hybrid PV/T panels use cooling fluids to remove heat from the PV cells. This thermal output can then be delivered for hot water or space heating provision.

Such hybrid PV/T panels already exist, but typically result in trade-offs between the two technologies and inefficiencies in the panels' overall performance. Prof Markides and colleagues have found a way to combine PV cells and an ST system to create synergies between the technologies.

Solar Flow was formed through Founders Choice, a pilot programme run by Imperial Innovations and Imperial College London to promote greater entrepreneurial engagement among scientists and engineers.

CITY, UNIVERSITY OF LONDON, has two recent spinouts:

Bestevidence develops a mobile app for students and healthcare professionals, providing access to a peer reviewed medical research database.

CityDefend develops a cloud based data storage system, an API, and a desktop app, allowing users to encrypt their data and search through it.

From EXETER UNIVERSITY comes **Concrene**, a new graphene-reinforced concrete that is greener and stronger than conventional concrete

The ROYAL COLLEGE OF ART has reported the recent formation of three companies based on IP developed at the College:

Graduate Jun Kamei has built a garment called **Amphibio** that functions like gills and allows the user to breathe underwater. The two-part 3D-printed accessory consists of a gill and a respiratory mask.

Olivia Moore operates a fashion label, using paint to decorate clothing.

Vocifer develops voice amplification technology that is inserted into glasses for people with Parkinson's.

The UNIVERSITY OF BRISTOL has seen a number of companies based on IP from the University incorporated since June last year:

Actuation Lab is harnessing the potential of complex structures to create powerful artificial muscles

Carbometrics is using its Biomimetic Glucose Binding Molecules (GBM) to develop a new glucose sensor chemistry for Continuous Glucose Monitors (CGM). The company was created by the team behind Ziylo, sold last year to Novo Nordisk. The original IP was assigned to Ziylo, who back-licensed it to Carbometrics at the time of the sale.

Simulitix Research is exploring opportunities for real-time simulation tools to accelerate academic and industrial nano-technology research.

Metasonics employs acoustic metamaterials that can seamlessly adapt the direction and power of sound waves, enabling miniaturisation of the technology and offering the flexibility to do more with sound.

Clifton Photonics is bringing bespoke optical solutions to in-situ analysis and robotics.

iCOMAT is commercialising continuous tow steering technology for the manufacture of complex composite shapes.

Recent spinouts from the UNIVERSITY OF CAMBRIDGE include:

Ikarovek, formed to commercialise certain orphan assets from Quethera, a spinout from the University of Cambridge, which

was acquired last year by Astellas Pharma Inc. Initially Ikarovek is working on early stage assets intended for the treatment of diabetic macular edama.

Poro Technologies, a spinout from the Cambridge Centre for Gallium Nitride (GaN), aims to exploit the capability and potential of porous GaN for transforming the LED industry.

Textile Two Dimensional was spun out from the University with support from the Royal Academy of Engineering, to develop graphene and other 2D material based inks for textile applications.

OXFORD UNIVERSITY INNOVATION announced the formation of seven new spinouts in the 4th quarter of 2018, bringing the spinout total for the year to 24. One of the new companies remains confidential. The others are:

Ni20 - Ni2o's KIWI™ is a small, self-contained, wirelessly connected, wirelessly charged, AI-driven implant for current deep brain stimulation (DBS) in neurosurgery

MacrophOx – macrophages for cancer treatment

sOPHIa, a spinout from the Department of International Development, has developed a multi-dimensional poverty index, which both measures poverty and provides workable solutions to eliminate it, and will be providing an accreditation service to businesses, starting in Central America.

Cortex Organics is developing a pure Cannabidiol CBD molecule.

OxStem Beta, and **OxStem Immuno**

OxStem Ltd is an Oxford University spinout developing regenerative medicine-based therapies. In October it launched two subsidiary companies, OxStem Beta and OxStem Immuno. Previously, since OxStem itself was spun out of the University in May 2016, it had established four subsidiaries, each with a specific disease focus: OxStem Oncology, OxStem Neuro, OxStem Ocular, and OxStem Cardio, which are developing treatments for cancer, neurological diseases, ocular diseases and heart disease, respectively.

OxStem Beta will build on this with its focus on the treatment of diabetes, while OxStem Immuno is seeking treatments for chronic inflammation and wound healing.

The UNIVERSITY OF STRATHCLYDE has added a number of spinouts and start-ups recently:

Maritime Safety Innovations chaired by Professor Dracos Vassalos, Professor of Maritime Safety, was incorporated in 2017, and IP from the University was transferred into the company in late 2018.

Clinspec Diagnostics is pioneering a new spectroscopic method for blood serum analysis, allowing same-day detection and grading of a range of diseases, with first applications to brain cancer. University IP was licensed to the company in 2019.

Beinn Bike is a mobile app to help mountain bikers find routes that meet their requirements. University IP was licensed to the company in 2019.

Asura Financial Technologies is a start-up formed in 2018, that is developing software for streamlining and automating workflows in banking and capital markets.

Teqnox has developed a body protector for horse riders. The company was started by Enteprise Fellow Carmen Cummiskey in 2016, and joined the list of Strathclyde start-ups when she became a Strathclyde employee last year under the Enterprise Fellowship programme.

Organlike, another staff start-up, was founded by Strathclyde Professor in Biomedical Engineering Will Shu while he was at Heriot-Watt University. The company is using 3D printing to create body organ models and tools for use in surgical simulation, medical training, and for the medical device industry.

Recent exits

Nightstar Therapeutics

We reported the first 'exit' of Nightstar in our December 2017 issue, after the company had listed on the NASDAQ stockmarket on 2nd October, raising $76.9 million, with a valuation of approximately $900m.

Nightstar has now been acquired by Biogen Inc through its group company Tungsten Bidco Limited (a newly-incorporated UK company and wholly-owned subsidiary of Biogen Switzerland Holdings GmhH).

Nightstar shareholders will be entitled to receive $25.50 in cash for each Nightstar share, giving a premium of approximately 70% to the 30 trading day volume-weighted average price, and valuing the company at approximately $877 million.

The sale of the company is reportedly predicted to generate £255 million of proceeds for Syncona, one of Nightstar's earliest investors – a 4.5x multiple on its investment - and is expected to complete in the second quarter of 2019.

Nightstar is a clinical-stage gene therapy company, developing and commercialising one-time treatments for patients suffering from rare inherited retinal diseases that would otherwise progress to blindness. The company is a spinout from Oxford University and Imperial College London, with scientists from both institutions contributing to the underlying research on which Nightstar's product candidates have been developed.

Nightstar's lead product candidate, NSR-REP1, is currently in Phase 3 development for the treatment of patients with

Choroideremia, a rare, degenerative, genetic retinal disorder that has no current treatments and affects approximately one in every 50,000 people. Positive results from a Phase 1/2 trial of NSR-REP1 were published in in 2014 and 2016. Nightstar's second product candidate, NSR-RPGR, is currently being evaluated in a Phase 1/2 clinical trial for the treatment of patients with X-linked Retinitis Pigmentosa, an inherited X-linked recessive retinal disease that affects approximately one in every 40,000 people.

Granta Design

Granta Design was founded in 1994 as a spinout from the Department of Engineering by Professors Mike Ashby and David Cebon. Its products include GRANTA MI, a system for enterprise materials information management, and CES Selector, which enables users to explore the impact that different materials have on the behaviour of their products.

Last month it was announced that the company had been acquired for an undisclosed sum by ANSYS Inc, an engineering simulation and 3D design software based in Pennsylvania.

Granta Design has collaborated with ANSYS since 2006, and most recently the two companies launched an additive manufacturing partnership, integrating ANSYS simulation with the GRANTA MI: Material Gateway.

Following the acquisition Granta, which is headquartered in Cambridge and has over 180 employees, will continue its open ecosystem, integrating with a wide range of product lifecycle management, CAD, and computer-aided engineering solutions.

"Granta Design pioneered the field of materials information technology," said Shane Emswiler, ANSYS vice president and general manager. "With materials engineering becoming an increasingly important aspect of product development, our customers require high-quality and comprehensive materials information for accurate simulation results. Integrating Granta's solutions into the ANSYS portfolio will provide a seamless user experience—and enable our customers to innovate like never before."

Innovation Communications: Campus, Cluster, and Country

Gregg Bayes-Brown, Oxford University Innovation's Comms Manager, shares his thoughts on the drivers and strategies that surround the communication of university innovation.

My first taste of university innovation came at the Open University (OU).

A former journalist who'd gone to ground in Milton Keynes, I was involved with FutureLearn, the OU's take on a UK-led effort to replicate the Massively Open Online Course (MOOC) movement catching fire stateside at the turn of the decade.

"A platform for teaching anyone anything anywhere for free?" I asked myself. "Sounds great. I wonder what else is out there?"

Once I scratched the surface, I quickly became addicted. I bid the OU a fond farewell, launched Global University Venturing, and spent the next few years finding university innovation stories from around the globe.

Immunotherapies and regenerative medicine, hydrogen powered cars and wireless energy transfer technology, robotics and artificial intelligence. Every day, I'd wake up and find out how tomorrow was going to look.

Discovering this world was and remains endlessly stimulating, but I soon began to wonder, "why isn't anyone else doing this?". Granted, you have regional university innovation trade magazines such as the fine Spinouts UK. But in mainstream tech mags? Business sections of nationals? Barely a mention, if at all. To the outside world, the whole process was essentially magic.

When you dig into why this is, the reasons quickly become apparent. Consider the evolution of university innovation. It is a sector started by scientists and engineers and progressed by businesspeople and financiers. These professions clearly have many strengths, but a natural affinity for storytelling generally isn't one of them.

Also, the average university innovation office tends to be understaffed and overstretched. As a result, communications is considered nice to have, but not a core requirement. Furthermore, there are few storytellers either side of the TTO. On one side, university press offices that regularly aren't engaged with these stories – if they even realise the university has an innovation arm at all. On the other, cash strapped spinouts and startups which often prioritise almost everything else over getting professional assistance to tell their stories.

The result is that communication of university innovation has the same valley of death facing the concepts we work with. There is a vertical cliff edge after the underpinning research has been published, there are scant resources to help stories make it

across the barren wasteland, and the only rides out of there charge exorbitant sums for the pleasure.

It's easy for us collectively to look at this and brush it off as not much of a problem. University innovation offices still license tech, we still pop out the odd spinout, the various numbers and metrics we collect at the end of the year look okay compared to the last one, so what's the big deal? The issue is that we can beat people until we're blue in the face with our facts and metrics, but it is compelling storytelling that makes the difference.

Our messaging as a sector continues to miss its mark. In his recent editorial on the AUTM 2019 Conference, my successor at GUV, Thierry Heles, wrote on the invisibility of the tech transfer – and this is from a trade mag for the sector. Research conducted by Oxford University's news office in 2016 demonstrated that, even with Oxford's brand recognition, sizeable research funding, and strong success in innovation, numerous groups from general public to MPs still see Oxford as students and humanities – OUI and our many spinouts were barely on anyone's radar at all.

The human brain has evolved to understand story over fact. The very concept of a fact, an undeniable proven truth, has only emerged with scientific method. This is why climate change is still treated as debatable by many. The facts are stark and brutal, while the narrative of "the planet is doomed and it's our fault" is unpalatable for many. As a consequence, anyone saying "you aren't at fault, your family are safe, the scientists are wrong, burn all the oil you want" will probably find a market.

In contrast, using narrative as a force for good is what has inspired my three C's for innovation communication: campus, cluster, and country.

One takeaway from a recent Oxford-MIT event is that at MIT, the saying goes that you're not at MIT until you've done a couple of spinouts. This attitude comes from a culture geared up to embrace innovation, with over 90% of the Institute working with MIT's innovation arm. This sort of culture only comes when you have a strong enough narrative to inspire it. In a similar vein, we can use narrative to shift internal perception of the TTO away from IP stormtroopers who pester academics who just want to do research and to facilitators who catalyse research into reality and allow academics to have a substantial, positive impact on society.

This can be done through targeted internal communications across a university, but it works more effectively when it is done hand in glove with the cluster, using spinouts and prominent examples of entrepreneurship as news hooks to drive wider, culture changing narratives.

During my time at GUV, one thing I found is that the more a cluster communicates and collaborates with itself, the stronger that cluster is. Silicon Valley is recognised the world over, and much of that success comes from the draw the Bay Area has from its messaging, and there's a similar story in Cambridge, MA too.

You can see this difference between Oxford and Cambridge, UK. Both have similar research bases, attracting world-class talent to work in equally fantastic settings. Yet even though Oxford receives more funding for research, it is Cambridge that's known for doing something with it. The same MPs who align Oxford with humanities and Harry Potter recognise Cambridge's scientific and technological achievements, and the innovation which stems from them. This is no fluke, but the consequence of a concerted cluster wide effort to articulate the entrepreneurial strengths of Cambridge.

Working in tandem with the Oxford Local Enterprise Partnership, OUI has begun to pull together Oxford's first cluster comms group. The idea is that whether you speak to me, the Vice Chancellor of Oxford Brookes, Williams F1, or a startup on the Harwell campus, we'll all be saying the same things about Oxford in a bid to create a rising tide that raises all boats.

Comprised of a group of the universities, corporates, research institutes and investors, we're working on shared messaging that showcases innovation excellence in Oxford, we're sharing data, research and opportunities across the network, and implementing a far more integrated, collaborative approach to communication in general across the region.

Our first project is a cluster map. Taking a page from Oxford's JRR Tolkien, who drew the map of Middle Earth before he began to tell its stories, the cluster map is all about taking the currently ethereal concept of the Oxford tech cluster and making it tangible. Drawing inspiration from similar projects in both Cambridges, this map will both be an interactive map of everyone who's here, plus a who's who of Oxford's innovative residents.

While organisations across Oxford may have different and even competing agendas, there is significant overlap. We all need talent, we all want to attract investment of some kind, and we're all looking for partners to collaborate with. The cluster comms project and the forthcoming map provide all comers to Oxford – be it potential hires for a spinout looking for a community, investors looking for the next unicorn, or journalists and politicians looking to better understand what we do here – with a single, clear window into Oxford.

From my point of over here at OUI, cluster comms allows us to tell deeper, more engaging stories beyond the four walls of our Botley Road office while handily positioning us as a lynchpin in fostering innovation around Oxford. It sells the concept of Oxford to the talent we're looking to attract to work in and lead our spinouts. It showcases the potential of what we've got on our hands here both regionally and nationally. And crucially to OUI, it brings interest to our "invisible" activities, enhancing our ability to encourage ideas from the University and develop methods, such as Oxford Sciences Innovation, to support them.

There's much talk of the OxCam Innovation Arc, an attempt to marry the innovative outputs of both clusters with Milton Keynes in the middle. But for this to be a success, the outside world needs to be excited by the prospect, and that will only

come when the narrative is as compelling as the metrics charting the impact of innovation from Oxford. From my perspective, ensuring this project and others like it work are key to the UK retaining a competitive edge in the months and years ahead.

More than anything though, communications exists to inspire. An aspect of innovation that is often overlooked is that it is diversity and the ability to access the greatest minds, regardless of nationality, gender, race, sexuality, religion or any other definition of a human being – the only thing that matters is ability to get involved.

This is a sector filled with wonder and excitement, and it should be viewed as such. We should be having academics burst through into our offices who can't wait to turn research into reality, we should be stealing talent away from tech giants and hedge funds, and have investors and corporates banging on our door to get involved – all of them here to help us build the future.

My mission is to inspire as many people to do as I did all those years ago back at the OU, to scratch the surface, and fall down the rabbit hole with us. But that only happens when we speak about it. If scientists and engineers were the first wave, financiers and businesspeople the second, I see creativity and communications as the third step in the evolution of university innovation. Let's put this sector – both figuratively and quite literally in my case – on the map.

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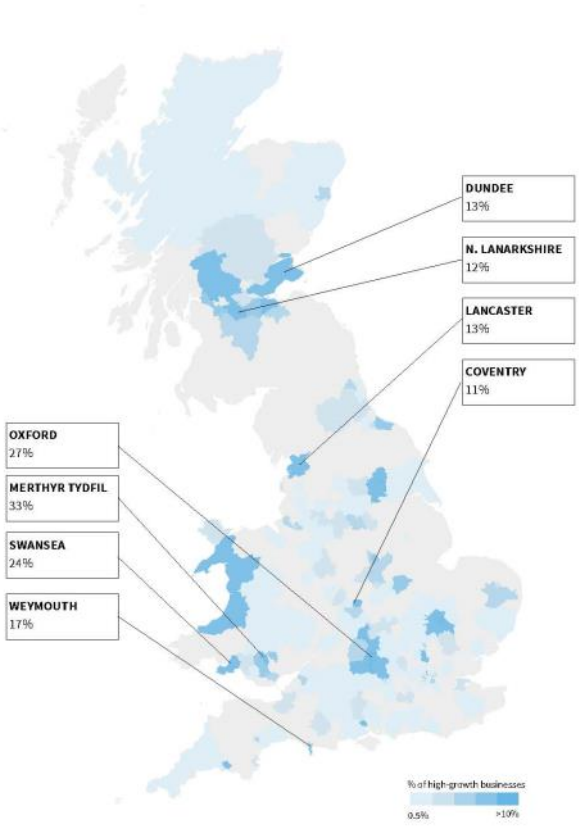
Where do they all come from?

Beauhurst's Henry Whorwood looks at how spinouts are distributed across the country

Given the IP-intensive, high-tech nature of spinouts from academic institutions, one would expect London to be the top location for spinouts – just as it is for high-growth businesses generally. And so it is, but not by as clear a margin as one might expect. London has nearly twice as many high-growth businesses as the next most populous region, the South East – but London only has 15% more spinouts.

Now, there is obviously going to be a correlation between where spinouts are and where universities are. But, when we look at the spinout population as a proportion of the high-growth business population, we see that almost every other region has a much greater density than London – but London is obviously not short of top universities. Moreover, the devolved administrations of Scotland, Northern Ireland, and Wales outperform every English region in terms of spinout density (but we must also note their much smaller populations of high-growth firms).

Is it the regions and the support they offer that is particularly attractive to spinouts? Are the founders of spinouts more attached to their locations? Or are English regions just that much better at fostering growing businesses that aren't spinouts? Would spinouts grow faster and be more successful if their founders were more willing to relocate? Are spinouts fairly unique in that their founders have established lives at the universities where they developed the IP that the spinout is going to commercialise? Moving from correlation to causation here will be tricky.



What can be said with confidence, however, is that these figures demonstrate the crucial importance of spinouts to the growth business economies of every region outside London.

When we look more locally than the regional level, we can identify some small areas where spinouts are an even more important part of the local economy. It is no surprise to see Oxford City Council (and Cherwell District Council) and Cambridge City Council on the list, and indeed the importance of the technologies developed at universities in Belfast has long been recognised.

It is perhaps more surprising to see the scale of contribution made by Lancaster and Dundee universities to their local areas' economies.

Proportion of spinouts by region

REGION	SPIN-OUTS	HIGH-GROWTH COMPANIES	%	ALL COs
East of Scotland	71	907	7.83	59,237
Tayside	22	288	7.64	30,170
Northern Ireland	37	532	6.95	104,841
West of Scotland	57	1,094	5.21	85,113
Aberdeen	15	301	4.98	23,701
Wales	61	1,337	4.56	101,281
East of England	134	3,107	4.31	347,293
South East	177	5,364	3.30	530,995
North East	36	1,249	2.88	81,444
Yorkshire and Humberside	61	2,327	2.62	220,338
West Midlands	57	2,447	2.33	279,461
South West	63	2,776	2.27	266,250
North West	69	3,318	2.08	370,234
East Midlands	39	1,905	2.05	204,425
London	209	11,129	1.88	970,177
Highlands and Islands	2	171	1.17	16,804
South of Scotland	0	51	0.00	6,681
TOTAL	**1,110**	**38,303**	**62.06**	**3,698,445**

List of local authorities where spinouts >10% high-growth population

LOCAL AUTHORITY	SPIN-OUTS	HIGH-GROWTH COMPANIES	%
Merthyr Tydfil County Borough Council	1	3	33.3
Oxford City Council	67	246	27.2
Swansea City and Borough Council	26	110	23.6
Cambridge City Council	81	454	17.8
Antrim and Newtownabbey Borough Council	3	18	16.7
Weymouth and Portland Borough Council	1	6	16.7
Cherwell District Council	19	125	15.2
Dundee City Council	8	61	13.1
Lancaster City Council	11	85	12.9
Vale of White Horse District Council	19	149	12.8
North Lanarkshire Council	13	107	12.1
Coventry City Council	19	170	11.2
Belfast City Council	29	264	11.0
Ceredigion County Council	2	19	10.5
South Oxfordshire District Council	17	166	10.2

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Recent spinouts

The following companies are new to the Spinouts UK database. In several cases, the date of announcement of the company's formation was much later than the date of incorporation.

company	university	sector	incorporated	web
Clinspec Diagnostics	Strathclyde	life sciences	16-May-16	www.clinspecdx.com
Teqnox	Strathclyde		18-Aug-16	teqnox.co.uk
Asura Financial Technologies	Strathclyde	fintech	30-Aug-16	www.asurafin.com
Accunea	Imperial	medical devices	09-Mar-17	www.accunea.com
OrganLike	Strathclyde		13-Jul-17	www.organlike.com
Maritime Safety Innovations	Strathclyde		05-Sep-17	
Solar Flow	Imperial	renewable energy	10-Nov-17	solar-flow.co.uk
Textile Two Dimensional (T2D)	Cambridge	materials	02-Jan-18	www.textile2dimensional.com
OxStem Beta	Oxford	regenerative medicine	12-Feb-18	
OxStem Immuno	Oxford	regenerative medicine	12-Feb-18	
MacrophOx	Oxford	drug discovery	12-Mar-18	
Beinn Bike	Strathclyde	mobile app	15-Mar-18	beinn.bike
Poro Technologies	Cambridge	materials	30-Apr-18	
Actuation Lab	Bristol	medical devices	14-Jun-18	actuationlab.com
Carbometrics	Bristol	diagnostics	03-Jul-18	www.carbometrics.com
Simulitix Research	Bristol	research tools	26-Jul-18	www.simulitix.com
Ikarovec	Cambridge	drug discovery	07-Aug-18	
Olivia Moore	RCA	fashion	17-Aug-18	oliviamoorelondon.com
Vocifer	RCA	voice amplification technology	18-Sep-18	
Ni2o	Oxford	medical devices	01-Oct-18	ni2o.com
Cortex Organics	Oxford	healthcare	10-Oct-18	
Concrene	Exeter	materials	22-Oct-18	
Xampla	Cambridge		23-Oct-18	
Metasonics	Bristol	materials	29-Oct-18	www.metasonics.co.uk
sOPHIa Oxford	Oxford	B2B software	06-Nov-18	ophi.org.uk
Amphibio	RCA	manufacturing & materials	14-Nov-18	www.junkamei.com/amphibio
Clifton Photonics	Bristol	micro & optoelectronics	10-Dec-18	
Bestevidence	City	mobile app	11-Dec-18	www.bestevidence.info
iCOMAT	Bristol	manufacturing & materials	16-Jan-19	
CityDefend	City	data storage & security	05-Feb-19	citydefend.com

Recent investments

This list, and our investment deal reports on p11ff, cover only some of the many investments made in university spinout companies over the past few months. A comprehensive list of investments is maintained by Spinout UK's new owner, Beauhurst - for contact details see the article on p6.

date	company	university	amount (million)	investors
28-Sep-18	SLAMcore	Imperial	£3.80	Amadeus Capital Partners, SPARX, Toyota AI Ventures, MMC Ventures, Octopus Ventures
20-Oct-18	DefiniGEN	Cambridge	£1.50	Parkwalk, 24Haymarket
01-Nov-18	Echion Technologies	Cambridge	£1.50	U of Cambridge Enterprise Fund (Parkwalk)
05-Nov-18	Duel (Daredevil Project)	Bristol	£0.15	U of Bristol Enterprise Fund (Parkwalk)
12-Nov-18	Aqdot	Cambridge	£2.75	Parkwalk
26-Nov-18	Congenica	Sanger Institute	£6.40	Parkwalk
05-Dec-18	Ultrahaptics	Bristol	£35.00	Mayfair Equity Partners
11-Dec-18	MedaPhor Group plc	Cardiff		Parkwalk Opportunities Fund
18-Dec-18	Morphogen-IX	Cambridge	£18.40	Medicxi, Cambridge Innovation Capital, Cambridge Enterprise
03-Jan-19	Cutitronics	Strathclyde	£1.25	Croda International
07-Jan-19	Exscientia	Dundee	£20.40	Celgene Corporation, GT Healthcare Capital Partners, Evotec AG
08-Jan-19	GeoSpock	Cambridge	£10.00	CIC, Parkwalk Advisors, Global Brain, 31Ventures, KDDI Supership, Jonathan Milner
10-Jan-19	Flusso	Cambridge	£0.83	U of Cambridge Enterprise Funds, Parkwalk Opportunities Fund
28-Jan-19	Featurespace	Cambridge	£25.00	Insight Venture Partners, MissionOG, IP Group, Highland Europe, TTV Capital, Robert Sansom, Invoke Capital
01-Feb-19	Istesso	Aberdeen	£10.00	IP Group, Puhua Capital, Parkwalk Opportunities EIS Fund
20-Feb-19	Mogrify	Bristol	£2.83	Ahren Innovation Capital, 24Haymarket
25-Feb-19	PetMedix	Cambridge/ Sanger	£8.00	Digitalis Ventures, Parkwalk
25-Feb-19	Refeyn (Arago Biosciences)	Oxford	£2.60	UOIF (Parkwalk)

Recent exits

exit date	company	type	incorp	university	value	acquirer
22-Jan-19	Granta Design	trade sale	06-Apr-93	Cambridge	n/d	ANSYS Inc
04-Mar-19	Nightstar Therapeutics	trade sale	31-May-13	Oxford, Imperial	US$877m	Biogen Switzerland Holdings

Spotlight on . .

University of Nottingham

NTV celebrates record year for University of Nottingham spinout portfolio

Nottingham Technology Ventures creates, manages and invests in University of Nottingham spinout companies, working alongside the University's IP Commercialisation office to identify and support research that has long-term potential. In the 2017-18 financial year, it helped realise a record-breaking £11.5m return from the University's spinouts.

Nottingham Technology Ventures operates at the heart of one of the most powerful stories of industrial transformation in the Midlands.

Based on the University of Nottingham Innovation Park, it sits inside one of a number of iconic new buildings on a site which was once synonymous with traditional 20th century manufacturing as the home of Raleigh Bicycles.

The University's core mission to link teaching, research and ideas to societal change and economic benefit are the main reason why the site has now become a prominent symbol of the future - and why NTV is managing a valuable spinout portfolio.

It is also building on significant heritage. Beyond popular icons like Robin Hood and Brian Clough, Nottingham has a history of discovery, innovation and creativity to tell. Under the guidance of the late Dr Stewart Adams OBE, it was the birthplace of ibuprofen, while pioneering work at the University by Sir Peter Mansfield led to the development of Magnetic Resonance Imaging scanners used in hospitals worldwide.

The University has also spread Nottingham's reputation around the globe, being the first to set up a fully-fledged Sino-foreign campus in China in 2004, with a sister campus in Malaysia. In that sense, it sits alongside Paul Smith and Boots as one of the city's most prominent exports.

The University's core mission and broad momentum today underpins a portfolio of 18 spinout companies which NTV manages, covering sectors which range from agriculture and the environment to healthcare, engineering and software.

All reflect a strategy of nurturing research projects which are capable of commercialisation, can deliver benefit at societal level, and will therefore contribute to the local and regional economy.

Professor Dame Jessica Corner, Pro Vice Chancellor for Research and Knowledge Exchange at the University of Nottingham, said "Research into the ideas and industries of the future is central to the contribution the University makes to the world around us. The professional expertise we have within NTV is vital in helping us to fulfil that mission.

"Our central purpose is to improve life for individuals and societies worldwide. Through bold innovation and excellence in all we do, we make both knowledge and discoveries matter."

NTV's team, led by CEO Andrew Naylor, helps develop new spinouts and also advises on investments that the University makes from two funds, including the realisation of value from University shareholdings.

NTV has a different approach from more conventional investment funds, combining academic and technical expertise with specialist commercial knowledge to support projects with especially long development timelines.

Andrew Naylor said "The 2017/18 financial year was superb for the University's spinout portfolio. We're immensely proud to have played a part in working with some truly ground-breaking businesses and in helping the University achieve a record return from its financial commitment.

"This return is also a tribute to an expert IP commercialisation office at the University which has a long track-record of identifying the value in research projects, nurturing and developing potential, and bringing transformative products to market.

"The financial return that has been achieved demonstrates both the sheer scale of innovation being driven by our research teams and our ability to translate that into valuable real-world outcomes."

University of Nottingham spinout successes

Historic successes in the spinout portfolio include Monica Healthcare, which developed a foetal heart monitor later acquired by industry giant GE Healthcare, and PRECOS, which was acquired by an international bioscience company after it developed a new method of carrying out pharmaceutical testing.

Monica Healthcare (*www.monicahealthcare.com*) developed wireless, wearable, waterproof technologies for foetal and maternal heart monitoring which measure the electrical signals from the surface of the skin.

Its products provide excellent monitoring for expectant mothers, including those with a high BMI, which is a strong advantage over other well-established systems that tend to be less effective in these patients. Monica's first product for foetal monitoring was the AN24. Whilst this is still sold in markets where consumable pricing is sensitive, it is largely superseded by the latest product range, branded Novii, which offers a number of improvements for the patient and has a more consumable focused approach.

GE Healthcare started selling the Novii products in 2015 and very quickly exceeded forecasts. The clear fit of the Novii range in GE's product portfolio resulted in GE Healthcare acquiring Monica in 2017.

Professor Barrie Hayes-Gill, of the University's Faculty of Engineering, founded both Monica Healthcare and a second spinout, **SurePulse Medical** (*www.surepulsemedical.com*). He said "The formation of two spinout companies has enabled our technology to reach and benefit the lives of so many mothers and babies around the world.

"It has been a challenging but worthwhile journey that I would be eager to repeat, and I encourage all of my colleagues to follow this highly rewarding path."

Promethean Particles (*www.prometheanparticles.co.uk*) works with customers to design, develop and manufacture a wide range of bespoke inorganic nanoparticle dispersions for multiple industry applications. The company has developed a unique, patented manufacturing process using continuous hydrothermal synthesis.

The process exhibits the quality and safety advantages demonstrated in wet processing, but surpasses the limitations of existing wet batch processing by being a continuous process and highly scalable, and is therefore better able to meet commercial demand at consistent quality and reduced cost.

Bespoke nanoparticle dispersions are developed at laboratory scale before being scaled up and produced on the world's largest multi-material nanoparticle plant, owned and operated by Promethean Particles.

Exonate (*www.exonate.com*) develops Vascular Endothelial Growth Factors (VEGF) control agents that may be used as therapeutics in areas such as pain control, macular degeneration and cancer. Exonate's research in this area has identified and focused on therapeutic candidates for wet Age Related Macular Degeneration that can be administered as a simple eye drop, thereby overcoming the unpleasant need for existing treatments that involve monthly injections in the eye

Locate Bio (*www.locatebio.com*) is based in MediCity Nottingham and has developed a family of unique, thermally-activated, injectable scaffolds that solidify within the body and can be used to support tissue growth before degrading away.

The TAOSTM (Targeted, Orchestrated Signalling) technology is a world first in tissue repair and enables the precision focus of therapeutic signals from small molecule or biological actives at the site of repair. TAOSTM has many potential application sites across the body.

Pipeline technologies include **IntraStem**, which has also been licensed by the University and is a new delivery system for cells that can meet industry recognised needs to advance cell therapy markets such as transfection, genome editing and induced pluripotent stem cells.

Recent investments

This selection of reports from the deals listed on p9 is intended to illustrate the range of universities, market sectors, and deal sizes over the past few months

Featurespace

Featurespace, a start-up from the University of Cambridge which provides adaptive behavioural analytics for fraud detection and risk management, has completed a £25.0 million fundraising.

The round was led by Insight Venture Partners, a New York-based global private equity firm focused on high-growth investments in the technology sector, while MissionOG, a US-based venture capital fund with operational experience across the payments industry, also participated in the round as a new investor. The funding was also supported by existing investors including IP Group plc, Highland Europe, TTV Capital, Robert Sansom, and Invoke Capital.

Featurespace will use the funds to support international expansion and continued development of its software capabilities as well as supporting the continued distribution of its real-

time, ARIC™ platform, which uses Adaptive Behavioural Analytics to detect anomalies in individual behaviour for fraud and risk management.

GeoSpock

Data integration company GeoSpock, a University of Cambridge startup, provides analytics, builds insight, and enables predictions across space and time. The company powers future mobility applications, including the management of autonomous vehicle fleets, working with businesses across the automotive, telecoms, mobility, marine, media, and retail sectors.

Cambridge Innovation Capital has led a £10 million funding in the company. All other institutional investors participated and were joined by Japanese data tech company KDDI Supership, bringing the total raised to date by GeoSpock to £19.25 million.

The additional funding will support GeoSpock's rapid international expansion strategy to help develop key client accounts, particularly in the strategic markets of Singapore and Japan. The investment will also allow the company to continue to invest in research and development, particularly in the areas of machine learning and data science.

Morphogen-IX

Morphogen-IX, a biotechnology company focused on the development of bone morphogenetic proteins (BMPs) for the treatment of pulmonary arterial hypertension (PAH), completed a £18.4 million round of financing in December. The Series B was led by Medicxi, alongside investments from Cambridge Innovation Capital and Cambridge Enterprise.

This investment will support formal preclinical development of the company's lead candidate, MGX292, and initiation of clinical trials by 2021.

Morphogen-IX's technology is based on targeting the central pathway underlying PAH identified in human genetic studies, pioneered in the British Heart Foundation-funded laboratory of Professor Nick Morrell at the University of Cambridge, who is now CEO at Morphogen-IX, together with co-founders Dr Wei Li and Dr Paul Upton.

SLAMcore

Imperial Innovations, the technology commercialisation partner for Imperial College London, announced in September that SLAMcore, which is developing spatial AI algorithms for robots and drones, has raised $5m in funding led by Amadeus Capital Partners. Existing investors SPARX and Toyota AI Ventures joined the round alongside newcomers, MMC Ventures and Octopus Ventures. SLAMcore was founded at Imperial College London and Imperial Innovations holds a small stake in the business.

To be truly useful, robots and drones require spatial intelligence, including the ability to accurately calculate their position, understand unfamiliar surroundings, and navigate with consistent reliability. The fundamental algorithms that achieve this spatial awareness are often referred to as Simultaneous Localisation and Mapping (SLAM). SLAMcore offers spatial AI solutions designed to easily integrate into existing platforms, allowing robotics companies to concentrate on delivering value to the end customer.

Exscientia

Exscientia, a spinout from the University of Dundee, is a pioneer in the use of Artificial Intelligence (AI) in drug discovery and design.

Exscientia's *Centaur Chemist*™ platform offers new approaches to improve drug efficacy. Novel compounds are automatically designed and prioritised for synthesis by the company's AI systems, which rapidly evolve compounds towards the desired candidate criteria for clinical development.

Exscientia systems learn from both existing data resources and experimental data from each design cycle. The principle is similar to how a human would learn, but the AI process is far more effective at identifying and assimilating multiple subtle and complex trends to balance potency, selectivity and pharmacokinetic criteria.

In January Exscientia announced that it had raised US$26 million in a Series B financing round from new investors Celgene Corporation and healthcare investor GT Healthcare Capital Partners, as well as existing investor Evotec AG.

Exscientia will use the proceeds of this financing round to expand its pipeline dramatically, with a target of establishing a portfolio of projects, both in-house and with partners, by the end of 2019.

The company has made considerable progress during 2018 and anticipates its first programmes driven by AI to be IND-ready within the next 12 months (IND is the US Food and Drug Administration's Investigational New Drug programme).

In November last year, Exscientia acquired fellow Dundee spinout Kinetic Discovery for an undisclosed amount. Kinetic Discovery brings specialist protein engineering, biophysical screening and structural biology expertise that is highly synergistic to Exscientia's current drug design, pharmacology and computational science platform. Both companies have had investment from commercialisation specialist Frontier IP, which received Exscientia shares for its 5% Kinetic holding.

Cutitronics

Cutitronics, a spinout from the University of Strathclyde, has developed an intelligent applicator for skincare products.

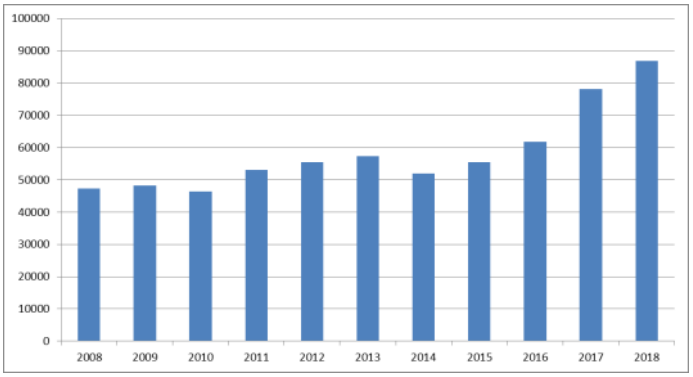
In a three-step process, the company's patented CutiTron technology first measures the user's skin health, then stimulates

. . . continued on page 14

Artificial Intelligence: is your business ready?

Science fiction writers have long speculated about the development of intelligent machines and, as the pace of technological progress quickens, reality is catching up with fiction.

For example, recent years have seen computers score their first victories over human professional players at the fiendishly complex board game, Go. As another example, so-called "chatbots" are replacing humans in customer service roles, imitating human responses to customers' inquiries with such realism that customers may never guess they are talking to a machine. In this regard, chatbots may be said to have passed the famous Turing Test, a milestone in the development of AI.



The trajectory in AI is undeniable. Our own research at Marks & Clerk reveals that more than 78,000 patent applications relating to AI were filed around the world in 2017. Around 86,000 such patent applications were filed in 2018, which represents almost a twofold increase in the past decade. This is yet another indicator of the speed of innovation in AI.

Getting ahead of the AI curve

Despite these impressive statistics, and the sometimes dramatic headlines about AI, other evidence suggests that many businesses are unprepared for the challenges and opportunities AI will bring. While 72 per cent of business leaders recently surveyed by PwC believe AI will be fundamental to the future, just 15 per cent of enterprises are using the technology currently.

Whatever sector of the economy you are in, preparing for AI now will put you ahead of the curve. Whether you are an automotive company readying itself for the ascent of intelligent self-driving cars and smart-cities where algorithms optimise traffic flow, or whether you are a bank using AI to analyse customer data and develop ever more personalised services – AI is a technology that will be applicable in any field.

Those businesses that embrace it now will give themselves a huge market advantage. Perhaps just as importantly, patent-savvy businesses can create legal hurdles for their competitors to jump if they come late to the AI revolution.

Innovation and intellectual property

As with any emerging technology, developing AI-based products and services to set your business apart can be a significant investment. Protecting that investment with robust intellectual property (IP) should be an essential part of your business strategy.

There is a widely-held misconception, particularly among UK businesses, that it is impossible to patent software. Businesses have instead often relied on copyright to protect the computer code that underlies their software innovations. Although this approach is sometimes sufficient for traditional software, which is programmed entirely by humans, it will likely prove to give inadequate protection for the machine learning techniques that are the foundation of the AI revolution.

Fortunately, the law is catching up with developments in this space, and earlier this month the European Patent Office (EPO) issued updated guidance on patenting AI. This guidance makes clear that many types of AI-related technologies are indeed patentable, and provides much-needed certainty for businesses looking to protect their AI innovations.

In the Industrial Revolution of the late eighteenth century, great wealth was amassed by the owners of factories and machines that enabled mass-production. In the AI revolution, ownership of the physical means of production will not be a sure-fire way to create wealth. Rather, the winners will be those whose intellectual property gives them ownership of AI.

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the skin to absorb the product much more readily. Finally, depending on the information provided by the analysis, it dispenses the correct amount of the cream. Through a mobile app, users can track the results and improvement in their skin health through use of the intelligent applicator.

Croda International, a FTSE listed speciality chemicals business headquartered in Yorkshire, first invested in Cutitronics in July 2017, resulting in an exclusive commercial arrangement. In December Croda announced that it had invested further in Cutitronics, but remains a minority shareholder.

This additional investment will provide Cutitronics with an opportunity to develop design updates for its CutiTron™ device, user and compliance testing, and pilot manufacture, which is anticipated to result in the first customisable commercial device.

Mogrify

In February Mogrify announced a second close on its seed funding, bringing the total raised to US$3.7 million, together with the appointment of Dr Darrin Disley as CEO. The funding round was led by existing investor Ahren Innovation Capital, with 24Haymarket and Dr Disley also investing.

The company will use the funding to market novel IP and cell types generated using its direct cellular conversion platform, which will power the development and manufacture of lifesaving cell therapies across all therapeutic areas.

Mogrify, listed by the University of Bristol as a spinout based on University owned IP, builds on a 10 year development by its co-founders in sequencing and gene-regulatory data to identify the optimal combination of transcription factors (*in vitro*) or small molecules (*in vivo*), needed to convert any mature cell type into any other mature cell type without going through a pluripotent stem cell- or even a progenitor cell-state.

The making of bioscience spinout companies in the UK

BBSRC has published a paper investigating the ways in which UK universities and research institutes spin out life sciences companies, and the links between spinout companies, the industrial sectors they service, the different scientific research areas funded by BBSRC from which they emerge, and the patents and other IP they hold.

The analysis is used to consider the implication for a research funder, how best to measure successes, and what interventions might be required to facilitate and sustain the creation of new bioscience ventures arising from investments in research and capabilities.

The Biotechnology and Biological Sciences Research Council (BBSRC) is part of UK Research and Innovation (UKRI), a new body which works in partnership with universities, research organisations, businesses, charities, and government to create the best possible environment for research and innovation to flourish.

Central to BBSRC's mission is enabling the optimal and successful application of the outcomes from the excellent research and capabilities it funds, which in some specific circumstances includes the creation of spinout companies. Recent interest in spinout company formation, from policy makers, government, and economists, has focused on high growth spinout companies and the private investments they secure as the sole measure of success.

The BBSRC paper takes a different approach by considering the links between the spinout companies, the industrial sectors they service, the different scientific research areas funded by BBSRC leading to the creation or development of these spinout companies and the intellectual property rights in the form of published patents held by some of these companies.

The paper is based on a combination of different datasets including BBSRC research grants data, BBSRC spinout companies identified using Researchfish®, and published patent data from BBSRC/UKRI and the Intellectual Property Office (IPO), with some company and investment data provided by Spinouts UK prior to its acquisition by Beauhurst. The IPO and Spinouts UK contributed to the analysis and interpretation of the data.

The research identified 387 spinout companies linked to BBSRC investments in research and capabilities (skills and infrastructures) in the 2017 dataset. Spinout companies were created over many years with 32 spinouts registered pre-1997, and 356 companies registered in subsequent years until 2016.

These companies operate in many varied industrial sectors across the UK economy.

Many of the 387 spinout companies remain active for many years after incorporation. As of 2017, 260 companies were still active (67%), 104 had been dissolved (27%), seven were in liquidation (2%), five were dormant (1%) and 11 no longer had a record (3%) in Companies House. Of the 260 still active spinout companies, 216 were at least five years old (64%).

Of the 387 spinout companies building on BBSRC investments, 130 companies had at least one patent published. However, many companies had filed more than one patent, giving an average of 16 published patents. Collectively the 130 spinout companies had 2,151 patents published around the world.

The paper analyses the combined data from a number of different angles. These include the distribution of the spinouts in the context of the 21 scientific topics under which BBSRC classifies research grants, the time between the completion of a BBSRC grant and the incorporation of a company, the time between the incorporation date of a company and its first patent filing, and the technology fields and patent authorities covered by the patents taken out by these companies.

Of the 130 spinout companies identified by the IPO as having at least one patent published, 99 companies were identified in the Spinouts UK database as having a successful 'event', either via an investment round or a successful exit (M&A or listing). There is however a weak positive correlation between the number of patents held and having a successful event in 26% of the cases.

The paper can be downloaded from the Spinouts UK website. For further information, contact:

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Dr Anne Lane appointed new Managing Director for UCLB

UCLB, the wholly owned subsidiary technology commercialisation company of UCL, has appointed Dr Anne Lane as its new Managing Director.

As part of UCL Innovation & Enterprise, and a leading university technology transfer business in the UK and globally, UCLB has a track record of supporting the commercialisation of technologies developed in UCL.

Since joining UCL in 2000, Anne has been instrumental in building UCLB's foundations, and through various roles in the company has guided some of the university's most outstanding successes, in particular Stanmore Implants, Apollo Therapeutics, the UCL Technology Fund and Orchard Therapeutics.

Welcoming Anne to her new role, UCL's Vice-Provost (Enterprise) Dr Celia Caulcott, said:

"Through her extensive knowledge and experience of UCL and its partner hospitals, Anne will make a tremendous contribution to the future success of UCLB, building on its current successes and spearheading new ventures. In addition, as a member of the UCL Innovation & Enterprise Directors team, her experience, skills and knowledge will contribute to the wider innovation and enterprise agenda at UCL, and thus to the future success of the university."

Anne has a PhD in medicine from UCL and an Executive MBA from Molson Business School, Montreal. After research at UCL and teaching and research at Harvard University and Harvard Medical School, Anne worked for RTP Pharma Inc in Montreal, out-licensing and preparing valuations of the company's portfolio for public listing. Anne joined UCL Ventures in 2000 and acted as consultant for the National Transfer Centre in the US.

On learning of her appointment Anne said: "I'm thrilled at this opportunity to lead UCLB, and continue our mission to translate knowledge and discoveries for the benefit of wider society and the economy. UCL is an incredible community of thinkers and innovators and UCLB is in an excellent position to support the commercialisation of technologies developed in UCL, alongside the many routes for research transfer and knowledge exchange that UCL Innovation & Enterprise supports."

Find out more about UCLB at www.uclb.com

Project partners

We are very grateful to the following organisations for their support

IP Group works with leading universities to develop and commercialise some of the world's most exciting technology innovations. Offering more than traditional venture capital, IP Group provides its companies with business building expertise, networks, recruitment and business support.
The Group's portfolio includes early stage to mature businesses across the biotech, healthcare, technology and cleantech sectors. *www.ipgroupplc.com*

UMIP, a division of The University of Manchester I³ Ltd, is the University's agent for IP commercialisation. UMIP brings the University's groundbreaking inventions and software into the commercial world by attracting entrepreneurs, investors and corporate venture partners to our campus and engaging with academic colleagues to license or spin out companies. *umi3.com*

Marks & Clerk is the UK's largest firm of patent and trade mark attorneys and advises companies on their intellectual property across a full range of sectors worldwide.
www.marks-clerk.com

Mercia Technologies is a leading UK technology investor with a particular emphasis on the Midlands, North of England and Scotland. We focus on high growth sectors leveraging the team's deep expertise across four fields including digital & digital entertainment; software & the internet; electronics, materials, manufacturing & engineering; and life sciences & biosciences. *www.merciatech.co.uk*

MFL Science & Technology is a specialist insurance broker risk management adviser to many of the UK's leading 'spin out' businesses. *www.m-f-l.co.uk*

Oxford University Innovation (OUI) is the research commercialisation company of the University of Oxford, managing technology transfer and consulting activities. Having created more than 150 spinouts, Oxford is first in the UK for number of spinouts, the number that survive, and jobs created. In the 2016~17 financial year OUI completed more than 50 licenses and consulting agreements every month. *innovation.ox.ac.uk*

PraxisAuril provides a single voice for 5,000+ university business collaboration specialists working in 200+ universities and stakeholder organisations around the world. Our members benefit from a unique and comprehensive range of training programmes, practical tools, advocacy and connectivity. PraxisAuril operates in the best interests of the sector, driving consistent professional standards, development, and recognition of the KE profession.
www.praxisunico.org.uk

Scottish Enterprise helps translate ideas and research into more spinout and start-up companies, and encourages Scottish companies to make use of technology and research being developed. *www.scottish-enterprise.com*

UCLB is a technology transfer company commercialising on the research and innovations developed by UCL.
Offering world-class expertise in areas from life sciences to engineering and from the arts to the built environment, we work to make commercial connections between the expertise and innovations of UCL's academics and the needs of industry and the wider marketplace. *www.uclb.com*

University of Birmingham Enterprise supports academics who want to innovate, take their ideas to market, work with businesses and social enterprises, or enrich their professional lives by doing academic consultancy projects. We do this by providing enterprise training, funding, office and laboratory space, and a full technology transfer service. University of Birmingham Enterprise also manages investment funds and the incubation services and facilities at the Birmingham Research Park. *www.birmingham.ac.uk/enterprise*