



UNIVERSITY OF
BIRMINGHAM

University of Birmingham Enterprise

Annual Review 2022–23

We innovate
We activate

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“ We are adapting to the increasing demands and ever changing environment we are in and are on a journey to becoming a technology transfer organisation fit for a top fifty global University. ”

David Coleman, CEO, University of Birmingham Enterprise

Welcome to our annual review

This year, Enterprise has seen considerable growth - not just in the products and services we are working on, or the companies we are supporting, or even the value we are generating for the University and our academics.

We have also seen the addition of several new starters, and well-deserved promotions into new roles. There will undoubtedly be more roles created in the next few years, alongside which will be new systems and approaches, some of which we are already planning for the next year.

Such growth and change are essential if we are to become a celebrated technology transfer company working with a top fifty global university. As this Annual Review demonstrates, the University of Birmingham is increasingly innovative, for example, in combatting important societal issues in health, such as tools which can better inform therapeutic development, or diagnosis of bladder cancer, and in the environment, such as those targeting reduction of carbon emissions in the steel industry. This last year we have also seen more innovations from the social sciences and the arts.

That innovative work will only continue to grow. As well as increasing demand, there has also been significant sector - wide consultation and discussion (including a government review), on how technology transfer offices can accelerate innovation. Both this growth in demand, and the need for acceleration are the key drivers behind our own growth and change. Indeed, this year has seen us radically

evolve our approach to spinout deals, and to further develop our innovative Operating Division (EnterpriseOD™) model. Whilst we are still early in our journey of change, there are really encouraging signs. As well as winning the PraxisAuril Commercial Deal of the Year 2022, we have had significant interest from other Universities in our novel approaches. We are certainly proud to work with and support other universities, particularly where we can in the Midlands. We are especially pleased this year that University of Lincoln were able to benefit so much from our Medici offer.

But our most important ongoing collaborative initiative has been in the creation of Midlands Mindforge, the new investment company launched to raise up to £250m, which will primarily invest in spinouts from our eight collaborating universities. The coming year will be critical, but the essential ingredients, including a new CEO, Dr Lisa Smith, and Chair, Mike Rees, are now in position. Alongside our people, and systems, the region's ability to provide and attract substantial investment (with long term horizons) will also be of utmost importance.

David Coleman
CEO, University of Birmingham Enterprise

University of Birmingham Enterprise has a remit that puts it at the heart of a rapidly transforming sector. The UK government has been reviewing the commercialisation of research as it looks for ways to boost the economy, by creating more viable enterprise from academic research. Academics are increasingly expected to act on the impact agenda, and the University is the keystone in a region that is moving rapidly towards fulfilling its potential.

Last year, we realigned our organisational structure to reflect these developments, and enable us to work effectively with our unique set of customers and their partners. These include our new associated investment company, Midlands Mindforge, companies at the BioHub®, Unit 9 and in the Birmingham Research Park, and the wider universe of companies that license University IP or work with our growing army of academic consultants.

Our commercialisation work continues to benefit significantly from the EnterpriseOD™ Operating Division model, which is unique to Birmingham. This approach greatly lowers the barriers to commercialisation, generates evidence of both impact and real-world demand without having to set up a separate company.

Operating Divisions are managed by the Academic Consultancy Services team under the leadership of Vincent Coole. In the last year his team set up six new Operating Divisions, and was strengthened by the addition of a Project Manager, and a Commercial Intelligence Manager, who moved function to add his expertise to this rapidly growing area.

Our IP and Commercialisation function has also evolved, and now reports into Jerel Whittingham. Three new staff have been recruited to roles that manage IP and spinout formation. In the next year at least one new role, supporting IP formalities and due diligence, will be recruited to. The team will also be upgrading its IP and project management systems, to provide a more seamless, quality-driven approach to the University's increasing IP portfolio.

A new Enterprise Development and Collaboration team has been formed, to build on the enterprise training, business support and collaborations that have been foundational to driving engagement with academics and growing companies in the region. Led by Andrew Cruxton, the team will grow our work with Entrepreneurs-in-Residence, help monitor impact performance, and will recruit a new business analyst in the coming year.

Fully acquired and consolidated by University of Birmingham Enterprise a few years ago, the Birmingham Research Park is now a key asset for the company. It is managed by a new Operations team, under the leadership of Chief Operating Officer Angie Reynolds. The coming year will see further recruitment to this the team, to expand the front-of-house function, and support in the BioHub® laboratories.

Last but not least, we have recruited a new Digital Communications Manager to the Content and Communications team, which is led by Ruth Ashton, and will be invigorating our shop front over the coming year.

Exploration phase

Universities are great places for blue sky thinking, but it can be challenging to create a commercial enterprise from an academic idea. University of Birmingham Enterprise supports the exploration phase to road-test ideas and 'find the market' where innovations can flourish.

A biomaterials platform from health to Formula 1

Cutting-edge biomaterials research at the University of Birmingham has revealed long-lasting antimicrobial wound protective properties of bioactive glass impregnated with silver. Previously used in bone regeneration, the research team has advanced this through a process called 'electrospinning' in which the fibres become like cotton wool; better suited to placement on a wound bed, it also promotes bone and soft tissue growth and delivers compounds which eradicate infection.

The research was submitted to ICURe, a pre-accelerator programme funded by Innovate UK allowing academics to explore commercial applications for exceptional research. Dr Sam Moxon, a Research Fellow with a background in biomedical and chemical engineering was excited to be part of the team as Entrepreneurial Lead. "I was interested in learning about the commercial avenues for research" he says.

Through ICURe, he took part in 12 weeks of bootcamps and travelled internationally to promote their work, benefitting from the support and expertise of the mentors. "Even though you're often travelling by yourself, you're not doing the journey alone," Moxon says.

He was also supported by Dr Gowsihan Poologasundarampillai, Associate Professor of Biomaterials and Biomanufacturing at the School of Dentistry.

The ICURe process has helped them realise "our work was actually more of a platform technology than just one simple idea" Moxon explains, as the team was encouraged to explore 'wild card' applications. Because their material is stable at very high temperatures, they began exploring alternate engineering component options and have since received interest from Formula 1 teams and aerospace and automotive companies. With support from ICURe, they are moving to a second phase with their wild card idea which has the potential to spin out in the next 12 months.

University of Birmingham Enterprise has been "essential to the process". With a technology transfer officer assigned to each team, they have assisted with networking, market insights, strategising and investment support. "Working with Enterprise gives you the best opportunity of actually being successful" Moxon notes. "They're an integral part of transitioning the idea out of the university and into a company".



Beam steering for next generation data exchange

A team of researchers, led by Professor Alexandros Feresidis at the Department of Electronic, Electrical and Systems Engineering, has developed a beam-steering antenna capable of boosting the efficiency of data transmission across the millimetre wave spectrum.

The continuous 'wide-angle' beam steering can be used to track mobile phone users whilst in motion with increased efficiency at higher frequencies, unlocking a greater spectrum and lowering operating costs for telecom providers to enable higher-speed communications.

Currently incubating as an Operating Division within University of Birmingham Enterprise, the team is working to commercialise their technology through Wavector, as a new spinout company. Focusing on the development of products and applications "is one of the best ways to demonstrate the impact of our research" explains Feresidis.

Participating in the ICURe programme has proved an invaluable experience, allowing them to conduct essential market research and source potential beachhead markets to "focus our efforts, and take our state-of-the-art technology and address real world pain points" explains Research Fellow Dr James Churm of Wavector.

They developed a preliminary business model and learnt about the pathways for promoting their work, how to present their work for commercialisation and how to develop a strong industry network. "ICURe has given us confidence that we're going down the right track," says Churm.

The University of Birmingham is a key research hub site for millimetre wave, and terahertz technologies more broadly; they have one of three specialist Vector Network Analysers in the UK, testing facilities, a complementary fabrication suite and design fabrication capacity. Capitalising on this, Feresidis and his team are looking to grow the team, bringing on a commercial lead to support continued expansion of Wavector and in-roads into commercial markets.



Operating Divisions

Operating Divisions (ODs) are a flexible route to commercialisation, and they provide customers with quick, easy access to cutting edge services and expertise from the University and its researchers.

Academics following this route can test their ideas and finesse the service offering according to 'real world' feedback. They also generate impact without the need to set up a spinout – and provide evidence of demand and a trading history that can help with future investment if a spinout is formed subsequently.

A desktop epidemiologist

Health services like the NHS hold a wealth of anonymised data from electronic patient records, and an estimated 30% of the world's data volume is generated by the healthcare industry. But sorting through that data, to inform clinical trials and the development of new drugs and therapies, can be difficult, taking months of work by analysts.

Dexter, a software developed at the University of Birmingham's Institute of Applied Health Research, automates that work – unlocking real world evidence to bring new treatments to patients as quickly as possible.

University of Birmingham Enterprise set up the Operating Division (also called Dexter) in 2022 to commercialise the software, which provides precise insights to fine-tune the design of clinical trials, cutting costs and risks associated with clinical studies. "Dexter is a desktop epidemiologist which can support your health data research by getting things done within minutes to hours, as opposed to months to weeks," explains Professor Krish Nirantharakumar, its Chief Scientific Officer. "It can search among 20-30 million patients for candidates who will be eligible for your trials, and enables you, based on inclusion and exclusion criteria, to capture these people within minutes."

Dexter has made big strides in 2023, partnering with Globant, a digital transformation group, to provide its software as a service.

Under a new partnership with Cegedim Health Data, Dexter provides a data platform, through which Cegedim can host its own data securely, helping to inform clinical trial recruitment. Dexter hopes to provide the software as a service to NHS organisations, to help frontline clinicians access anonymised data, and democratise health data research for better care. "Engaging with the NHS and providing software as a service is likely to be the big win in the year ahead," says Professor Nirantharakumar.

University of Birmingham Enterprise helped Dexter access grant funding under the ICUR scheme for bioscience research teams. "The early-phase support from University of Birmingham Enterprise has benefited us hugely," Professor Nirantharakumar notes. "They look at the IP, manage contracts and help with networking. They have really good networks across the NHS, so it's easy for them to generate those contracts in a way that benefits both parties. It's a huge support for a company that is going to spin-out soon."

University of Birmingham Enterprise also supported Dexter through the Enterprising Birmingham Fund, which allowed a specialist advisor to scope out the market, facilitate the customer and partner discussions and refine the marketing and online strategy. The advisor is now working with the Operating Division to gather real-time market intelligence and build the customer base to develop a business plan with the intention of spinning out within the next year.



Find out more about our Operating Divisions
birmingham.ac.uk/partners/enterprise/acs/op-divs

“ The early phase support from University of Birmingham Enterprise has benefitted us hugely. ”

*Professor Krish Nirantharakumar,
Professor, Health Data Science and Public Health, Institute of Applied
Health Research*

Agile industry engagement

In the world of dentistry, dental and biomaterials, the market share on products is tight. Credible testing and approval are essential to gain a commercial advantage and Professors Josette Camilleri and Will Palin, supported by University of Birmingham Enterprise, have developed an Operating Division to provide swift support to industry.

The duo have worked together for six years and share an interest in developing and testing new dental materials. As academics, they are often called upon to independently investigate and test newly commercialised materials and technologies.

However, because the industry relies on quick turnarounds for a competitive edge, "companies are put off by university bureaucracy, and the time it can take to generate contracts," Palin explains. "This is one of the big positives of the Operating Division."

Called Birmingham Dental & Biomaterial Testing Service, or BiMaTs, the service mitigates the long waiting times, and can generate and

agree contracts within a matter of days. Working with Enterprise directly, template contracts are generated which can then be amended by either party to speed up the process significantly.

Formed six months ago and operational for four months, BiMaTs provides testing services and expertise for dental and biomaterials companies, covering a range of areas across dentistry, materials, including quality control and innovation. Support from Enterprise has been essential in allowing them to expand their services commercially whilst maintaining their primary roles. "We are both academics" says Camilleri. "Although we dedicate time to the industry, we still want to continue to innovate".

The Operating Division manages their finances to support them in straddling academic work and industry engagement. "It was one of the prime motivations for starting the company" highlights, Camilleri, with Palin noting "the service from Enterprise has been excellent, they're always on hand and fully supportive".

Birmingham Research Park

University of Birmingham Enterprise manages Birmingham Research Park, which provides office, laboratory space and incubation services, and is home to a thriving community of research-led companies in sectors including biotechnology, computer systems and medical diagnostics.

The Park has maintained almost full occupancy over the past year, and tenants have reported strong growth, with Nonacus, a cancer testing company, graduating from the Park into its own headquarters facility nearby.

Fallouh Healthcare, a surgical device company, has employed new staff and taken on additional premises, while 4T2 Sensors received a grant to scale-up its food and drink sensor technology with Diageo. Two new start-ups have joined the Unit 9 med-tech incubator – which opened in 2022 to help pre-revenue med-tech companies test their product and business proposition.

Enterprise continues to deepen ties between the University and its Research Park tenants, and to connect the campus with the West Midlands region. It has connected tenant companies with the University internship scheme, and recruited lab and business Enterprise has hosted regular visits for school students, including through In2scienceUK, a STEM work experience programme for disadvantaged students, and Enterprise staff have been recognised by the University for their work on student outreach.

Enterprise has also continued its external engagement, hosting delegates from the University of Campinas Brazil, a key University partner; Indian companies taking part in Birmingham's 2022 Scale Up Games; and European startups participating in the Global Entrepreneurs Programme. Articles promoting the Unit 9 med-tech incubator have been published in the Clinical Services Journal and Med-Tech Innovation.

Enterprise has made recent site improvements, including installing solar panels and further external improvement works. It now offers a new wellbeing facility, and free occupational health services as well as on-site yoga classes.

"Our tenants say again and again that the space is useful, but it is the network, the ecosystem and the support that makes all the difference," says Angie Reynolds, COO, University of Birmingham Enterprise.

MicrobesNG: growth and diversification

Since its invention in the 1970s, genomic sequencing has become one of the most important weapons in the scientific arsenal, helping researchers identify diseases, follow their evolution, and plan the most effective treatment. To the world, the importance of this critical technology is only growing.

MicrobesNG is a specialist microbial genome sequencing company based at the BioHub®. It was founded at the University of Birmingham in 2015, with the goal of democratising genome sequencing, and moved to the BioHub® four years later following its successful spin out. It maintains strong ties with the University.

The focus this year has been on growth and diversification of services across the business. Increasing its workforce by more than 50% the company has achieved significant revenue growth, generated from a global customer base composed mostly of Universities. Key milestones were met with the launch of new metagenomics and plasmid sequencing services enabling the diversification of its suite of complimentary sequencing services.

"Our ambition is to be the go-to microbial sequencing company in the UK," says Jennie Law, MicrobesNG's Head of Operations.

Nonacus: a less intrusive test for bladder cancer

Testing for bladder cancer normally requires a painful cystoscopy exam – which inserts a scope into a patient's bladder. A collaboration between Nonacus, a med-tech company established at BioHub®, and University of Birmingham researchers, offers a new alternative: a urine test that can quickly and accurately detect bladder cancer, sparing patients invasive procedures.

The test uses Nonacus' sensitive liquid biopsy technology with a panel of biomarkers developed by researchers from the University's Bladder Cancer Research Centre, to detect whether DNA from tumour cells is present in the urine. Since only 10% of patients who have a cystoscopy are found to have cancer, the new test could potentially save 90% from undergoing a painful procedure, says Nonacus' CEO Chris Sale. Commercial rollout is underway through clinically-accredited laboratories.

Nonacus, which launched in the BioHub® in 2015, has undergone rapid growth and recently graduated into its own laboratories. "We could have set up the company in Cambridge or Oxford or London, but the BioHub® was really quite unique," says Sale. "It was set up for completely fledgling companies without huge amounts of funding. The fact that you can take just one or two lab benches, and all that lab equipment is looked after, is a big draw."

The BioHub®'s location has helped Nonacus grow, he adds: "Being so close to two big hospitals, and to the University of Birmingham, and all the research that goes on there, was another big benefit." Nonacus is continuing its collaboration with researchers at the University, with the goal of developing further cancer tests and surveillance tools.

Graide: AI lightens heavy marking loads

Research Park tenant Graide aims to lighten the huge workloads faced by school and university educators, through an AI-powered assessment platform. The technology learns how each teacher marks and gives feedback, so they never have to grade the same method twice – saving time and ensuring consistency.

The University served as a pilot customer for Graide, which was launched by former PhD students. After starting life as a tool for

mathematical assessment, it has recently applied its technology to text assessments, allowing it to be used across other STEM and arts subjects. The group has drawn on University of Birmingham Enterprise's network of startups and events, says CEO Dr Manjinder Kainth. "You get the benefit of learning at those events, and the benefit of networking".

Space for innovators

In 2022, University of Birmingham Enterprise launched Unit 9, a new incubator to overcome a key challenge in the region – the lack of affordable, short-term space for med tech use.

Located in the Birmingham Research Park, the Unit 9 incubator provides flexible, low-cost support for companies to do initial research, proof-of-concept work, or prototyping, without an equipment cost burden.

Funded by University of Birmingham Enterprise, the Greater Birmingham & Solihull Local Enterprise Partnership Growth Hub and the West Midlands Combined Authority, Unit 9 has rapidly attracted new enterprises that were keen to be based in the facility.

Fallouh Healthcare, a company formed by Birmingham cardiothoracic surgeon Mr Hazem Fallouh is developing a new device for early diagnosis of a life-threatening condition caused by accumulation of blood clots in the space around the heart. Since joining Unit 9, Fallouh has received a £500k grant from Innovate UK to build a prototype and conduct a usability study at the Queen Elizabeth Hospital site.

NovNat Tech Ltd, a company developing a technology that can generate water out of air, has also secured funding from Innovate UK. Founders Abdulbari Belouafi and Ibrahim Albaik are graduates of UoB Elevate, the incubator and business growth programme for University of Birmingham students and graduates.

Abdulbari extols the support available at Unit 9: "As first-time innovators we were unaware of the range of support that is available. The monthly meetings allow us to discuss our current challenges with fellow innovators and business support advisors from University of Birmingham Enterprise, and the information share and signposting is truly valuable."

Spinout Healome Therapeutics is commercialising a novel fluid gel platform that delivers a 'pro-healing' microenvironment for the leading causes of preventable blindness. Developed by Birmingham researchers, the gel flows like a liquid when dispensed from an eyedropper, but self-structures into a soft, clear, protective layer over the surface of the eye, that is not blinked away like conventional eyedrops.

Unit 9 was an ideal fit for Healome. Dr Richard Williams, CEO of Healome Therapeutics, explains: 'Unit 9 has been a much needed and timely development for us. It has allowed us to keep the business moving while we gather the data and information to choose the best way forward. We have a very collegiate community in Unit 9 that is always supportive of one another through the start-up journey.'

Also at Unit 9, Biotica Chemicals has developed prototypes and started trials on a novel plant-based biodegradable polymer formulation that coats fertilizer granules to creates 'smart' fertilizers that only release nutrients in response to plants' needs. As a result, the company received an Innovate UK grant to improve these prototypes, run more test trials, and scale up production.

Chief Technology Officer Dr Sameh El Sayed said: "Affordable laboratory space is vital for small startups, who need to make the first prototypes and to prove the value of new products. We also received support from University of Birmingham Enterprise and the networking with other businesses, funding opportunities, legal and IP advice, events, and introduction to interested investors and potential collaborators has been truly valuable."



Abdulbari Belouafi, Founder, NovNat Tech Ltd.

“ We also received support from University of Birmingham Enterprise and the networking with other businesses, funding opportunities, legal and IP advice, events, and introduction to interested investors and potential collaborators has been truly valuable. ”

*Sameh El Sayed,
CEO, Biotica Chemicals Ltd.*



Sameh El Sayed, CEO/Co-Founder, Biotica Chemicals Ltd.

Creating entrepreneurs

Medici, the University's flagship training programme, supports academics to explore commercial avenues for their research and develop spin out opportunities. This year, the University of Lincoln hosted a dedicated Medici training programme delivered by University of Birmingham Enterprise.

Jessica Boot-Marshall, Industrial Partnerships Manager at the University of Lincoln, identified the need for more commercial and spin out training, but without the internal provision to deliver, sought support from Medici programme managers to deliver training on campus, since travel to Birmingham would have been prohibitive for many potential participants.

The training was a seven-day program delivered over two weeks to 22 academics poised to explore the commercial possibilities of their research. Sessions included commercialisation, IP, contracting, networking and pitching for investment. "They really made sure to tailor it to a Lincoln perspective, which spoke to the research we deliver and made it quite personal" Jessica explains.

Feedback from the training has been positive, with participants highlighting the high calibre trainers and enjoying the in-person delivery, an essential factor in ensuring a variety of academics could participate. "We're very grateful to them for making the time and putting it on the road" Jessica says. "Academics have said it was the best training course they've been on, really practical, clear and straightforward".

Expanding Medici to deliver a dedicated programme to external institutions sessions is an exciting progression. University of Birmingham Enterprise's ability to deliver Medici to smaller, growing universities with less specialised academic training capacities, and being able to travel to deliver courses in-person, engenders more personal experience. "The team was so flexible and helpful" Jessica highlights, "we've been really impressed with the whole experience".

The Medici training is benefitting academics in multiple different disciplines, supporting the creation and expansion of diverse

commercial enterprises beyond the expected tech and engineering products, within the arts and creative industries.

Dr Joanna Bucknall, a lecturer in the Department of Drama and Theatre Arts, founded the Immersive Experience Network (IEN) with training and assistance from the Medici team. The hub and online platform support creators to develop work, expand their audiences and grow into financially viable creative companies as well as generating commercial and academic market research, and holding in-person networking events.

Recognising the importance of securing funding, private investment and building public engagement, as well as generating revenue, Dr Bucknall found that Medici offered "a really powerful way to explore these opportunities. It empowered me to begin to understand business and entrepreneurial angles and gave me a solid toolkit to consider my work commercially".

The Medici training has helped Dr Bucknall and the IEN create multiple revenue streams from a single 'product', with plans to develop a membership app and a subscription model to facilitate access to talent and creative communities in the sector. "I wanted to capitalise on, and leverage some of my research commercially, and Medici gave me the opportunity to do that," she reflects.

Dr Bucknall still benefits from ongoing Medici support, including mentorship and guidance, as she applies for further funding and external investment to continue expansion. "Now I'm able to recognise opportunities, potential markets and revenue streams and to advocate for those with the other founding members, as well as with our broader community membership".

“ I wanted to capitalise on, and leverage some of my research commercially, and Medici gave me the opportunity to do that. ”

*Dr Joanna Bucknall,
Lecturer, Department of Drama and Theatre Arts*

Innovative and immersive 360-degree training

Dr Cooner, a qualified social worker and Associate Professor, first learnt about 360-degree filming via desensitisation programmes to help people with a fear of heights. Recognising the potential for translating rich social work interactions into immersive videos, he developed, filmed and added the footage to headsets mimicking the practice of 'vicarious learning' common in social work training. The videos became a novel way of disseminating the findings of his recent study which assesses factors that enable or prevent effective child protection relationships between social workers and families.

A local authority trust approached Dr Cooner, offering to develop and commercialise the videos, resulting in a seven-module training package delivered across two days which includes videos of 'barrier and enabler' versions of events, trigger questions and participant discussions. This has been a "different way of delivering research to create impact, and a realistic, authentic way of delivering research messages," Dr Cooner explains, highlighting positive feedback

from local authorities using the training. "It has made them more confident in their work and allowed them to identify areas that require improvement and then to seek additional training".

It is unusual to produce commercial products in social sciences, and Dr Cooner cites 'instrumental' support from Enterprise including workshopping multiple opportunities and developing a contract to allow the team to share the IP and product. Future aims include developing licences to provide the training package to other local authorities on an annual basis. "It's really allowed us to create business relationships with other authorities, because we've got a physical product," Dr Cooner says. He is excited about continuing to commercialise the concept. "Because it situates participants in the virtual environment, this model of training has applications in other fields from psychology, business, medicine, teaching and physiotherapy".





Medical innovation

Switching off chronic inflammation

Currently, 1 billion adults and 206 million children are predicted to be obese by 2025. Obesity and autoimmune disorders like type 1 diabetes mellitus and rheumatoid arthritis are all inflammatory conditions and if untreated, chronic inflammation can damage cells.

Research by Professor Ed Rainger and Drs Helen McGettrick and Asif Iqbal is set to improve the management of chronic inflammatory conditions, building on work published in Nature Medicine on the peptide pathway, PEPITEM. In healthy people, this pathway keeps inflammation low by regulating the flow of immune cells from the blood into tissues, but in people with inflammatory disorders, the regulation of this flow is impeded, and immune cells accumulate in tissue causing long-term damage.

The effects of PEPITEM were demonstrated in mouse models, where research showed it could significantly mitigate effects of inflammatory conditions. Currently available treatments usually treat the symptoms of chronic inflammation, while PEPITEM replaces a defect in the control of inflammation and dials down the inflammatory response.

Supported by University of Birmingham Enterprise, the researchers have filed patents to support commercialisation. The Enterprise team provided guidance on commercialisation and provided funding facilitation, helping translate the science into commercial models, and has supported the team to gather data for patenting and licensing, as well as providing media and press support. "Enterprise has been really supportive in helping us develop the whole programme on the way to generating a therapeutic agent," says Professor Rainger.

The researchers hope that PEPITEM will increase the health span of ageing adults so that they can enjoy their later years free from chronic disease. The team are planning to secure funding for translation to human trials, likely starting with applications in skin or eye diseases.

“ When I contacted University of Birmingham Enterprise, they helped me through the whole process. ”

*Dr Julie Rayes,
British Heart Foundation Fellow, Institute of Cardiovascular Sciences*

Accelerating myeloma diagnostics

In the UK, an estimated 50% of patients with myeloma, a form of blood cancer, receive a delayed diagnosis. For the majority, the delay significantly impedes their quality of life, including increased likelihood of spinal fractures and reduced mobility.

Myeloma presents with non-specific symptoms like pain and fatigue, and up to a third of patients are diagnosed in an emergency scenario. In low-middle income countries, diagnosis is more problematic due to limited access to the specialised laboratory testing currently required to detect myeloma.

Thanks to work by Professor Mark Drayson and Dr Jennifer Heaney, Research Fellow at the University of Birmingham's Institute of Immunology and Immunotherapy, diagnostic delays may soon be over. They have developed a new point-of-care test for multiple myeloma that is cheaper, quicker, and more accessible than existing

laboratory-based tests. It is a high sensitivity, high-specificity test, designed to pick up patients with myeloma requiring treatment.

Early research and proof-of-concept development was completed at the University of Birmingham, but taking the test to prototyping required external involvement. To facilitate this, a CRUK (Cancer Research UK) Primer Award for Dr Heaney is funding one year of work to develop a prototype.

University of Birmingham Enterprise is assisting with IP, facilitating discussions with patent lawyers, and will help file patents once prototype data is available.

The work of Dr Heaney and her team builds on previous successful collaborations between the university and industry on diagnostic tests for myeloma. They will work together with Enterprise to develop a commercialisation plan.

Developments in bleeding and clotting

The Birmingham Platelet Group (BLG) is an internationally recognised group of 12 Principal Investigators (PIs) taking on interdisciplinary and multidisciplinary research projects across platelets, small cells that underlie cardiovascular diseases.

The group brings together scientists and clinicians working in collaborations to take the projects to early phase clinical trials. Many of these are supported by University of Birmingham Enterprise.

Research conducted by a British Heart Foundation (BHF) Fellow Dr Julie Rayes, is tackling blood clotting in sepsis and chronic inflammatory diseases. She has discovered a new molecule, mainly released by an activated immune system and used by hospitals as a biomarker of inflammation, that could be essential for clotting in patients. The molecule addresses an unmet need as currently "We can't target a harmful molecule that induces clotting without increasing the risk of bleeding" Rayes explains.

As a young PI "I was not familiar with anything relating to commercialisation," says Rayes, "when I contacted University of

Birmingham Enterprise, they helped me through the whole process". Through the Enterprise team, the project was given internal funding to generate further data, and they encouraged an application to UK SPINE to develop antibodies that selectively target their identified pathway. Having the patent was essential in being awarded UK SPINE funding. Rayes notes, "all this work has been possible because of the support from University of Birmingham Enterprise."

The BLG has raised nanobodies (similar to antibodies but smaller) against several platelet activating pathways. The nanobodies have been crosslinked to make agents that activate platelets for application in the development of diagnostic clinical assays for a range of platelet disorders, and can also be used as novel imaging tools in microscopy, and one has promise for a new class of antiplatelet drug that will cause less bleeding than current drugs such as aspirin.

With assistance from the Enterprise team, the nanobody has been patented. This support is instrumental for next stage developments, says the BHF Professor Steve Watson "we couldn't do what we do without them".

Intellectual property

Reducing the world's carbon emissions

As we race towards a zero-carbon future, the energy-intensive iron and steel industries are some of the trickiest sources of emissions to control. The sector generates around 9% of total global emissions, but the products are hard to substitute and it is energy-intensive to generate the 1,600°C temperatures required to smelt iron and steel without burning fossil fuels.

One option is electric arc furnaces, but that would require significant investment in clean energy and building new electric arc furnaces across the globe at huge cost. An alternative is to develop Carbon Capture and Use (CCU) methods to reuse emissions rather than avoiding them altogether. Birmingham's Chamberlain Chair of Chemical Engineering, Professor Yulong Ding has led the way on CCU.

Professor Ding, who is also director of the University's Centre for Energy Storage, encouraged his then PhD student, Dr Harriet Kildahl, to investigate further when she found a perovskite material she was working with could offer a very high conversion rate for carbon dioxide at relatively low temperatures, while retaining its stability. The result of the research was a model for a system to convert

carbon dioxide into carbon monoxide, which can be fed back into the steelmaking process, reducing emissions by up to 90% without the need to build new furnaces.

A patent was filed before a peer-reviewed paper was published in January by Dr Kildahl, Professor Ding and others, which suggested the technology could save British steelmakers £1.28 billion over five years and reduce total UK emissions by 2.9%, gaining significant media attention and interest from the industry.

That was when the University's commercialisation team stepped in, beginning commercial discussions with potential partners for commercial trials in the iron, steel and coke industries, and their supply chains.

In laboratory tests so far, the perovskite material has shown no degradation after over a month of use. Early commercialisation discussions suggest the technology might first be trialled in the direct reduced iron (DRI) process, which presents fewer technical hurdles than blast furnace steelmaking, although steel furnaces remain the ultimate target for the technology.

A sustainable coating to mitigate pathogen transmission

During the Covid-19 pandemic, sales of cleaning products soared as people relentlessly disinfected surfaces in a bid to prevent spread of the disease. An unfortunate result was the mass release of cleaning chemicals into the atmosphere and water systems. Learning from this experience, researchers at the University of Birmingham have developed a novel, sustainable coating to prevent the spread of pathogens, which is now on the road to commercialisation.

The new technology - a thin film that is invisible to the naked eye - has its origins in the pandemic era observation that the Covid virus was rarely spread by newspapers. Researchers from the School of Chemical Engineering led an EPSRC funded project that involved FiberLean Technologies, a company that produces micro-fibrillated cellulose (MFC), and the University of Cambridge. They found that the porous nature of the MFC film disrupts respiratory droplets and makes them inhospitable to pathogens.

"Most cleaning products use chemicals to attack the cell membranes of pathogens," explains Professor Zhenyu Zhang from the School of Chemical Engineering, "But porous cellulose acts as a desiccant. As water escapes, osmotic pressure disrupts the integrity of the cell's membrane."

In tests, they found a thin covering of film could lead to a three-fold reduction of infectivity of SARS-CoV-2, compared to a glass surface with no film covering.

University of Birmingham Enterprise filed a joint patent application with FiberLean Technologies and the University of Cambridge, and is now seeking partners to commercialise the microfilm for household products such as door handles.

Better batteries

About:Energy, a startup which helps predict battery performance, emerged from a collaboration between PhD students Gavin White from Imperial College and Kieran O'Regan from the University of Birmingham. Its first funding prior to the start of trading in January 2022 came from the Faraday Institution, a UK government backed research market analysis, and early-stage commercialisation organisation. Its board of directors include the academics who mentored the co-founders through their PhDs. A pre-seed round of around £200k in 2022 was accompanied by the recruitment of additional senior commercial advisors.

The last 12 months has seen About:Energy continue to move in a commercial direction. Recently the company raised £1.5m. This has allowed it to rent office space for the first time and expand its number of full-time employees. It has developed an outward facing customer platform, The Voltt, which gives industry clients fast and easy access to battery cell data and battery modelling tools that can help optimise battery design and extend battery life.

This led a major German sports car company to become one its newest customers. Further venture capital investment is anticipated as it seeks to scale the business.

However commercial focus does not mean abandoning the company's academic roots, About:Energy's non-executive chairman Neil Morris emphasises. Instead, the company will continue to use laboratory space at both Birmingham and Imperial, and, crucially, collaborate with PhD students on research. "That's a vital two-way street," Morris says, "We get to access some top academic people and they get to work directly with a commercial company."



Our spinouts

Helping bones grow back

For 4D Biomaterials, a joint spinout from the University of Birmingham and University of Warwick, the last 12 months have provided breakthrough in-vivo validation and with that a clear pathway to commercialisation.

The company, which moved into a larger operational facility at MediCity in Nottingham this year, was set up to develop a new class of materials that emerged from research by Professor Andrew Dove at Birmingham's School of Chemistry. These materials are liquid resins that when cured are biocompatible and bioresorbable. They can be 3D printed making them potentially usable in medical devices destined for the human body, but when the company was spun out it had yet to develop a specific end product from its resins. This year, however, the company conducted a successful in-vivo trial of an interference screw, which is intended to help repair injuries of the anterior cruciate ligament. The screw successfully

facilitated bone regrowth around it within four weeks when implanted into the tibias and femurs of sheep. This paves the way for 4D Biomaterials to carry out longer-term trials and seek FDA clearance for a market launch in the US by 2025. In May the company also secured a US patent for its underlying technology.

Such rapid progress has led to growing investor interest too. The company has turned away an acquisition offer and instead raised £740k in May through a convertible note – debt funding that can convert into equity at a later date. That included a further £175k from the University of Birmingham and £400k from an Australian consortium including leading orthopaedic surgeons and puts 4D Biomaterials in a strong position to negotiate longer-term financing with strategic partners, for example existing medical device manufacturers.

Faster diagnosis through DNA

Spun out of the School of Chemistry in spring 2021 by Birmingham born and bred PhD student Jack Kennefick, and Birmingham academic Dr Robert Neely, Tagomics is developing novel approaches for analysing the DNA circulating in a patient's blood, which have the potential to improve disease diagnosis and the understanding of how drugs function.

Over the past year Tagomics has focused on applying its innovative platform for tumour tissue analysis and liquid biopsy, which is the analysis of very small quantities of DNA in blood. The technique improves on existing methods of DNA analysis, broadly known as multiomics, by cutting the cost, complexity, and time required to apply multiomics analysis to clinical samples.

Tagomics has also raised £1.5 million in pre-seed finance and research funds from investors and the grant making body Innovate UK. Those funds have allowed the company to grow to seven employees including Chief Scientific Officer, Rob Neely, who led the laboratory where Tagomics' foundational research took place and has been seconded to the company by the university.

University of Birmingham Enterprise was instrumental in negotiating licences for Tagomics to use three patents that the University owns in return for a licensing fee and equity in the company, and continues to support the company's interaction with the University.

Most UK biotech companies have emerged in the so-called "golden triangle" between London, Cambridge and Oxford, but Tagomics is part of a growing cluster of research companies in the West Midlands. It benefits from access to the University's chemistry, biology and engineering departments, as well as access to patients and medical doctors at the Queen Elizabeth hospital on the University campus.

"The biotech ecosystem in the West Midlands is growing, which is exciting" says Dr Kennefick. "To continue to build this ecosystem and retain and draw in companies and talent, it is essential to enhance the level of support for all biotech businesses, particularly spin-out/start-up companies".

A Google Maps for under ground


A new University of Birmingham spinout, Delta g, has raised £1.5 million in its pre-seed investment round to fast-track the commercial availability of its ground-breaking quantum technology gravity gradiometry sensors for mapping the underground space.

Founded by Professor Michael Holynski, Dr Andrew Lamb and Jonathan Winch, the company is based on technology developed at the University of Birmingham, as part of the UK Quantum Technology Hub for Sensors and Timing.

The technology aims to deliver a revolutionary approach to mapping complex subsurface and unseen locations, and create a 'Google Maps for the underground' in a way that's fast, accurate, cost-effective, and scalable, bringing widespread benefits across industries such as construction and utilities.

To fulfil vast infrastructure, development and repair projects, such as roadworks, these sectors rely on accurate surface-level information to enable the visualisation of underground locations. However existing cartographic tools are limited, whether this is poor ability to see past only the topmost layers, inconsistent measurements in varying ground conditions, a complete inability to measure in high-vibration environments, or slow measurements resulting in prohibitive time and financial costs of surveys.

The company will use its new funding to embark on real-world trials with major industrial clients to demonstrate the efficacy of its approach and to further commercialise its technology, reducing the size, weight, power and cost of its hardware so that it can be deployed at scale in the field.



Find out more about our spinouts
birmingham.ac.uk/partners/enterprise/spinouts



Tyseley Energy Park

Birmingham-born technologies that started out as IP are now being developed and commercialised at Tyseley Energy Park, which is on a mission to transform clean energy innovation in Birmingham and the West Midlands.

UK's first centre for rare earth magnet recycling

Rare earths are crucial in everything from electric vehicles and wind turbines to loudspeakers. A clean energy future is impossible without them, yet supply chains are constrained. China has a near monopoly on many of the minerals – and recycling them from the magnets they are used in is difficult. The world's first centre for rare earth magnet recycling, at Birmingham's Tyseley Energy Park, aims to change that.

It uses a process called Hydrogen Processing of Magnet Scrap (HPMS) – developed by HyProMag, a company set up by University of Birmingham researchers – to reduce magnets containing rare earths to a demagnetised powder, which can then be reused.

A pilot plant opened at the University last year, and work is now underway to build a large-scale facility at Tyseley, after HyProMag was acquired in March 2023 by Mkango, a company developing sustainable rare earth supply chains.

"We saw a very significant opportunity in the rare earth magnet recycling space. Less than 5% of rare earth magnets are recycled and HyProMag's technology has the potential to unlock that supply chain," says William Dawes, Mkango's CEO.

Mkango has been a strategic partner of the University since 2018, and its acquisition of HyProMag paves the way to scale HPMS technology globally. First production is expected in the UK in 2023 and in Germany in 2024, while the technology will also be rolled out in the US.

"With the support and the relationship with the University of Birmingham, we have a fantastic platform to scale up and roll out the business," says Mr Dawes. "The University is a centre of excellence for magnetic materials and recycling. It's a huge benefit for us to have that relationship. It's going to be absolutely key to develop supply chains in the UK and globally remain the ultimate target for the technology.

“Technologies born in the Birmingham ecosystem are staying in the region, thanks to the University's relationship with Tyseley.”

David Coleman, CEO, University of Birmingham Enterprise

A new technology for plastics recycling

Scientists at Tyseley are tackling the plastics crisis. Professor Bushra Al-Duri, from the School of Chemical Engineering, has invented a plastic recycling process based on supercritical water.

Using only water, heat, and pressure, the process breaks down otherwise unrecyclable plastics into simple commodity chemicals that can be re-used indefinitely.

If successful, the technology will simultaneously increase plastic recycling rates and decarbonise plastic production – ameliorating two major environmental issues in one step. The technology has been licensed to engineering and innovation firm Stopford Ltd, who have partnered with the Al-Duri group to co-develop the process under the name Solvergy™.

A prototype Solvergy™ reactor system, funded by UK Research and Innovation's Smart Sustainable Plastic Packaging (SSPP) Challenge and designed for polyolefin based plastic packaging, is already in operation at Tyseley Energy Park. Now the partnership is turning its attention to other plastics: in April they launched a new UKRI backed

project to adapt the platform technology to PET plastic waste (eg bottles, pots, salad trays, and tubs) via a further £300k funding award from SSPP.

The core of the technology is supercritical water (water above its critical point of 374.5°C and 220 bars), whose unique properties enable selective depolymerisation of contaminated plastics into clean feedstocks. Importantly, Solvergy™ avoids the need for harmful chemicals or emissions.

"Environmental performance is critical" says Professor Al-Duri. "Our process cracks plastic using only a green solvent (water), along with heat and pressure. At the end of the process we recycle as much energy and water as possible."

The technology is being advanced at the Birmingham Energy Innovation Centre at Tyseley. "The technology is quite advanced and because of the materials we are dealing with, we need a safe lab. The Birmingham Energy Innovation Centre, at Tyseley, gives us the space and facilities that we need," says Professor Al-Duri.

Academic consultancy

Birmingham academics are in demand for their expertise, and undertake a wide range of consultancy projects including fact-checking television scripts, membership of scientific advisory boards, expert witness testimony, and more.

Forensic linguistics: safety, security and fairness

Linguistic sleuths, working in what's known as forensic linguistics, use their skills to identify anonymous authors by the quirks of their vocabulary and grammar – and are under growing demand as digital threats proliferate, and AI is leveraged by malicious actors.

Jack Grieve, a University of Birmingham Professor of Corpus Linguistics, is using those skills as a consultant for a project which is developing AI large language models to reveal – or conceal – an author's identity.

The programme, funded by the US Intelligence Advanced Research Projects Activity (IARPA), is “interested in online intelligence-gathering, and the reverse problem: how you can remove style features from a text, when someone needs to conceal their identity,” Professor Grieve explains. “There’s been a lot of interest in forensic linguistics recently, with the growth of large language models, because they have capabilities that can really be leveraged for criminal purposes.”

Professor Grieve also consults on a project to strengthen its speech recognition software. It aims to solve a problem: the software which many of us now rely on for converting speech to text often struggles with regional accents and dialects.

Professor Grieve uses his expertise as a dialectologist to advise the company on linguistic variations in its target countries, providing information that can be used to train the company's systems. “It will improve the performance of the systems and make them more competitive,” Professor Grieve says. “It’s a way of making sure that these systems work well for people from lower socio-economic backgrounds.”

Working with University of Birmingham Enterprise on the contracts has been critical, he adds. “There were a lot of contractual negotiations, and I’d never been involved in any kind of contract work that was so complicated. I had almost given up on it,” he says of the contract. “Enterprise really supported the process. I could never have pulled it off on my own.”

Oral health: the hidden global health crisis

In terms of years lost to disability, the oral disease burden on the global economy is greater than any other human disease. The most relevant is periodontitis, triggered by bacteria and resulting in severe chronic inflammation linked to heart disease, diabetes, kidney disease, rheumatoid arthritis, Alzheimer’s disease and premature mortality.

The psychosocial impact has also been overlooked, but those people that lose teeth to gum disease report a severe impact on their self-confidence and lives in general.

Professor Iain Chapple and his research group at Birmingham's School of Dentistry were approached by Sigrid Therapeutics to evaluate a potential oral health application of their technology which involves silicon dioxide microparticles that pass through the body without causing harm. Sigrid had data showing the

technology lowers blood sugar, and Professor Chapple saw potential for it reducing inflammation in gum disease. They trap the enzyme amylase – responsible for breaking down starch to sugar, and prevent an increase in blood sugar after eating. Amylase is also produced in saliva, and less sugar in the mouth means the food supply of mouth bacteria is cut off.

As an expert in inflammation and the links between systemic diseases of the body and oral diseases, Professor Chapple was sought by Sigrid to be on their advisory board and has worked to produce a study protocol to evaluate the effects of their product on oral inflammation, the oral microbiome and salivary transcriptome in humans. He is keen to ensure that any studies they design have clinical impact and result in positive user attitudes toward the new technology.

“Collectively, Birmingham academics have a breadth and depth of expertise – and they are in demand as consultants to industry, non-profit and public sector organisations, and governments”

David Coleman, CEO, University of Birmingham Enterprise

Our mission

Our mission is to catalyse the adoption of important innovations, developed by, with or at the University of Birmingham that can change lives for the better.

Our vision is to be celebrated for our approach to creating social, financial and reputational impact from University intellectual property and expertise, and to make it easy for academics and businesses to commercially engage in order to utilise the intellectual property and expertise developed at the University, and for our associated businesses to grow.

“ Our values are shared with the University.
We are ambitious, innovative, open,
collaborative, and responsible. ”

University of Birmingham Enterprise

Our portfolio

35	spinouts	13	Operating Divisions
755	patents	50	companies in the Birmingham Research Park and its incubators

In 2022-23

172	Academic Consultancy Service contracts	08	new spinouts and Operating Divisions
167	researchers received training	85	businesses received training
£13 _m	value generated (for University and academics)		

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