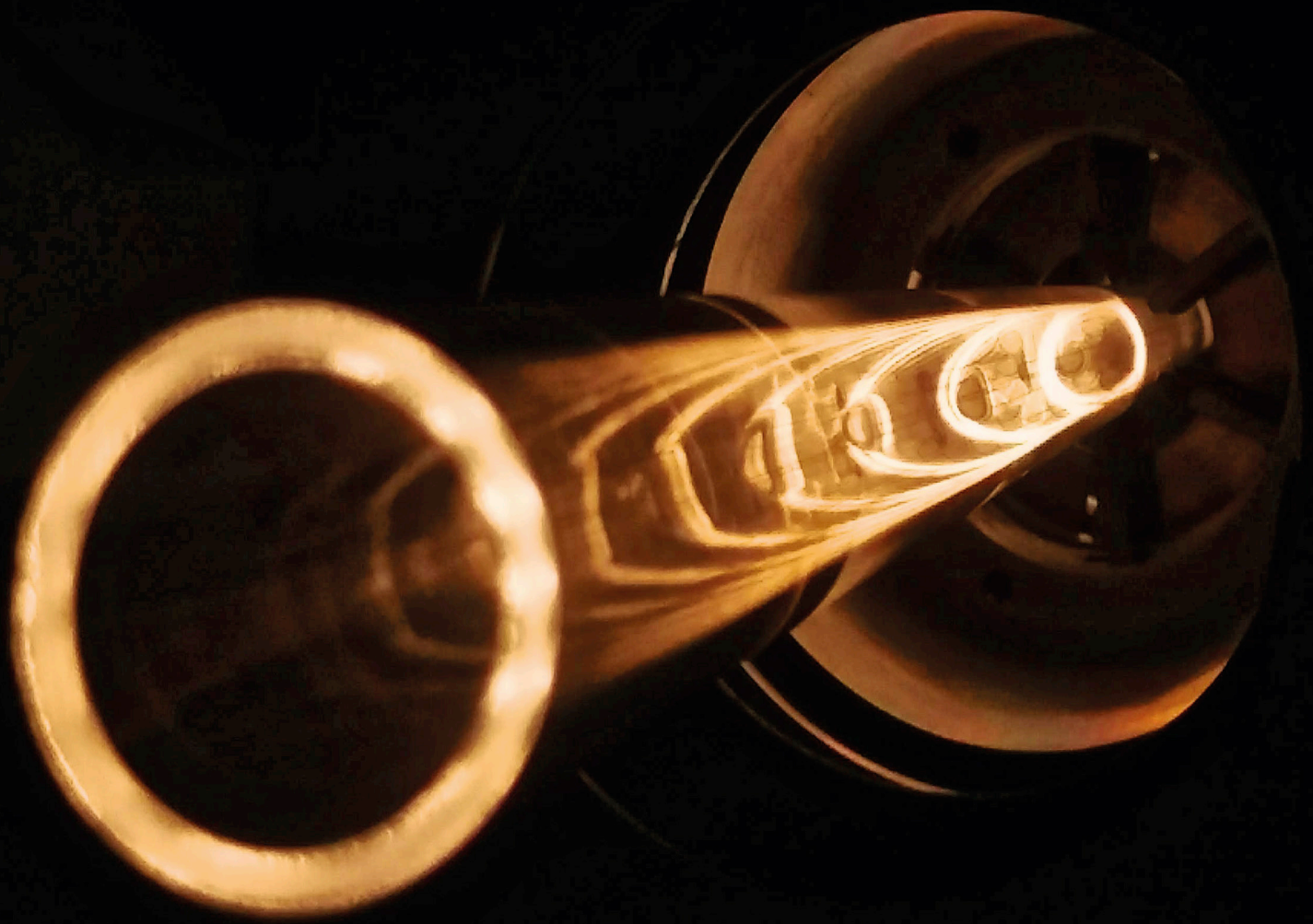


RE:ACTION



From imagination to innovation

How commercialisation is translating research
into real-world solutions

TRAVELLING LIGHT:

The University tech spin-out
acquired by Microsoft

DANDELIION:

How Southampton
mathematicians are driving
EV batteries into the future

ANTIBODY ENGINEERING:

The partnership taking new
cancer drug candidates to
clinical trial

**COLLECTING THE
CONTEMPORARY:**

Helping the GLAM sector
to archive the digital age

WELCOME TO RE:ACTION



The University of Southampton's strategy is based on a triple helix, that exploits the synergies between our core activities of education, research, and knowledge exchange and enterprise. One of the most visible elements of this is how we translate our research into forms that can be used commercially, by established companies, or start-ups and spin-outs. This is an important route to achieving economic growth, which aligns with the first of the new UK Government's Five Missions as well as being beneficial to the University, our staff and students, as a pathway to achieving impact in the world and gaining reputational benefit. The evidence from the annual Knowledge Exchange Framework (KEF) exercise is that we are very strong at this activity. This edition of Re:action provides some compelling evidence in support of this assessment.

The diversity of the activities showcased is particularly significant. They cover a wide range of the academic disciplines of the University, often exploiting interdisciplinary approaches, from our mathematicians contributing to improving the performance of electric vehicle batteries (Giles Richardson, Dandelion), and reducing marine biofouling (Alain Zemkoho with Carisbrooke Shipping) to University spin-out Renovos'

nanoclay technology for regenerative medicine. We also examine the wide range of mechanisms that we use for commercialising our research, from Knowledge Transfer Partnerships, a national scheme that has been running for 50 years, to our various incubator and accelerator activities. Above all, this edition is about people, often working in partnership, to innovate and achieve the extraordinary.

I am sure that you will find the content interesting and possibly inspiring. As always, we would welcome feedback on this issue and suggestions for topical areas that we might showcase in future editions.

Best wishes

A handwritten signature in blue ink, appearing to read 'SM' followed by a stylized flourish.

Professor Mark Spearing
Vice-President for Research and Enterprise
University of Southampton

PLEASE SEND US YOUR FEEDBACK



We are keen to receive your feedback about Re:action. If you have any ideas, comments or suggestions, please send them to riscomms@soton.ac.uk

Re:action is created by
Kate Williams and Sophie Lister,
Research and Innovation Services

CONTENTS

Southampton means business	4
Travelling light: the rise of Lumenisity	5 – 7
The road to innovation	8 – 11
A ‘generation-defining’ company	12 – 13
Powering the future	14 – 15
Critical to delivering impact	16 – 19
Sector focus: healthcare	18 – 19
The collaboration combatting immunotherapy resistance	20 – 23
Nurturing SME collaborations	24 – 25
Cleaner ships, cleaner oceans: tackling marine biofouling	26 – 27
Driving innovation for 50 years	28 – 29
The innovation ecosystem	30 – 35
Student enterprise support	31
Southampton Science Park	32
School of Health Enterprise and Innovation	32
Enterprise units: business activity within the University	33
Future Worlds	33
SETSquared	34
ICURE Explore	35
Growing strong bones: Renovos revisited	36 – 37
Engineering antibodies to offer hope	38 – 39
History’s lessons, today’s challenges	40 – 43
Playing the innovation game	44 – 47
Preserving our digital pasts	48 – 49
Sparking crucial conversations	50 – 52
Research award highlights	53 – 55

SOUTHAMPTON MEANS BUSINESS

Enterprise activity is in the University of Southampton's DNA. Not only is it a key strand of the 'triple helix' approach but it's also part of the University's heritage as a Russell Group member with strengths in engineering and the sciences.

"We've always had an entrepreneurial mindset at Southampton, and we've often been a leader in this area," said Di Galpin, Director of Enterprise and Knowledge Exchange. "In the 2000s we were the first to develop a strategic agreement with an investor; in 2013 we were first to change our approach so that founders got two-thirds of spin-out equity, up from one-third."

Southampton remains ahead of the curve. Following an independent government review and consultation with key stakeholders, in May 2024 the University further reduced the amount of equity it takes in spin-out companies from 33.3%, to 10% in Knowledge Intensive Spin-outs, and 5% in Software Spin-outs. This makes University of Southampton Spin-outs a more attractive prospect for potential investors and founders.

Southampton has come out as a leader, too, in the latest Knowledge Exchange Framework (KEF) results, released this September. The University achieved the top rating of 'very high engagement' for Intellectual Property (IP) and commercialisation activities, with Professor Mark Spearing, Vice-President for Research and Enterprise, commenting, "This is testament to the hard work of our diverse community and reflects the relevance of our triple helix strategy, which draws KEE, education and research together."

Investing in enterprise

Di emphasised that commercialisation is about more than spin-outs and licensing. "There's a real breadth of activity – from consultancy to research collaborations and internships." And profit is only one part of the picture. "Commercialisation is the route to bringing new products and services to people; boosting the local economy; creating jobs; solving problems. Ultimately it's about making



"We've always had an entrepreneurial mindset at Southampton, and we've often been a leader in this area."

Di Galpin

an impact on the world and helping deliver on the government's economic growth mission."

Her own role entails responsibility for most of the Research and Innovation Services (RIS) teams which support Knowledge Exchange and Enterprise (KEE) activities. She is a director of SETsquared (see page 34) and several University companies; she is also business lead on a 2022 5-year strategic plan which lays the foundations for growing and monitoring KEE across the University of Southampton.

The plan entails improving processes, upskilling staff, and focusing on customer needs. It positions KEE as core to the University's overall strategy: "KEE is often under-acknowledged, yet we represent 10% of the University's turnover and half of its research grants and contracts income. So it's important to invest in seeing it thrive and grow, and move it into the digital age."

"The strategy shows that we mean business about making the transformational change that's needed."

Oversight of the plan comes from the Knowledge Exchange and Enterprise Board (formerly the Southampton Enterprise Board), which the University created in 2016. The KEE Board brings together representatives from all the faculties to oversee commercial activity, from allocating internal pump-priming funding to approving the creation of new companies. This forum has brought people together to expand Southampton's tradition of enterprise in new ways.

Enabling innovation

Di's ambition is not just to enable innovation but to ensure it is financially sustainable for the University. "Enterprise should underpin our research and education activities. Ideally we want to be retaining a surplus which we can then re-invest."

Moving beyond purely financial metrics when measuring the value of enterprise activity, however, is also a key challenge. "Enterprise activity is how you demonstrate that we as a University are delivering real impact," said Di. "This activity broadens the skills of our research base and ensures that their work is relevant to today's problems."

TRAVELLING LIGHT

THE RISE OF LUMENISITY

Success doesn't come much bigger than an acquisition by one of the largest and best-known companies in the world. This is exactly what happened to Southampton spin-out Lumenisity, which was bought by Microsoft in 2022.

The deal has seen the software giant relocate staff from Seattle to Southampton, its investment boosting not only the growth of Lumenisity but also the University and the wider local economy.

The story began in 2015, explained Professor Francesco Poletti, one of the company's co-founders. "My academic colleagues and I had come from a successful set of projects developing what we call hollow-core optical fibre technology. We had the impression that it was the right time to try and bring the technology out into the real world. It was getting to the right level of maturity."

Conventional fibre-optic cables guide light through thin strands of solid glass. But after 50 years of development, said Francesco, "this technology has reached fundamental limits." The glass molecules inside the fibres vibrate and scatter, absorbing light

when it passes through them, and they slow it down by approximately 50% resulting in latency – a time delay in the signal's travel. This can, for example, cause glitches in augmented and virtual reality entertainment; remove responsive feel in remote surgery and healthcare; and slow down autonomous systems, presenting a risk that they may not react in time.

"Our technology replaces the glass in the centre of the fibre with a hole," said Francesco. "It's not just a hole – there is a microstructure which is needed to keep light in the centre – but essentially the light is travelling through 99.99% air, or whatever gas is at the centre." This, he explained, has several advantages. "For example, you can transmit much higher laser power without the fibre being destroyed or light distorted. And the fact that light propagates faster is a USP [Unique Selling Point] in industries where very fast transactions matter."

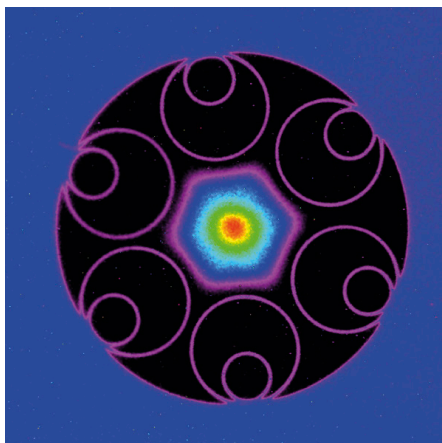


Professor Francesco Poletti

Travelling light: the rise of Lumenisity



First meeting in Romsey board room 2018



“Our technology replaces the glass in the centre of the fibre with a hole. It’s not just a hole – there is a microstructure which is needed to keep light in the centre – but essentially the light is travelling through 99.99% air, or whatever gas is at the centre. You can transmit much higher laser power without the fibre being destroyed or light distorted. And the fact that light propagates faster is a unique selling point in industries where very fast transactions matter.”

Professor Francesco Poletti

Bigger and better

After initial discussions with the Technology Transfer and Intellectual Property (TT-IP) team in RIS (see page 8), the researchers were put in touch with Dr David Parker, an experienced executive and entrepreneur whose sector expertise would prove invaluable. “Initially we thought about addressing two markets: laser delivery, and high frequency trading, run by people who use algorithms to conduct economic transactions in fractions of a second.”

At the beginning of 2016, the four co-founders – Francesco and David, alongside former University researchers Professor Marco Petrovich and Professor David Richardson – incorporated the company. After renting premises at the University Science Park (see page 32), they received their first round of investment from a high frequency trading business. “This was the beginning of our adventure!”

For the first few years, the fibres were produced in the University clean room. Lumenisity would then cable the fibres, test them and assist their customers with cable installation. But as the company expanded, there was a clear need for bigger and better facilities.

Producing hollow-core fibres requires a clean room, which is a controlled environment with very low levels of airborne particles. Here, high purity glass tubes are cleaned, reformed, shrunk into smaller capillaries and then assembled and fused inside a larger tube. This preform, about 3 centimetres in diameter and one metre long, must then be stretched in a fibre-draw tower. “At the very top is a furnace that melts glass at 2000 degrees, and you end up with a fibre about the thickness of a hair. In our case the process is even more complicated because we have to maintain the microstructure inside the tubes.”

Building their own clean room with multiple drawing towers in the nearby Romsey industrial estate was a big investment which required more funding. In 2020, Lumenisity managed to attract a substantial investment from BGF, the UK and Ireland’s most active investor, and from Parkwalk, the most active investor in UK university spinouts – alongside significant further funding from its existing industrial investors.

It was improvements in the technology itself, said Francesco, which helped secure this second round of funding. “We had achieved a number of impressive world record results, which were remarkable enough to capture the attention of the optical fibre community worldwide.”

Future digital economy

With production moving to the new facility in Romsey, and the team having expanded to around 90 people, Lumenisity began to talk to



Hollow core fibre technology

Microsoft about a supply contract. “They had been following the progress of the technology for years. Our product has considerable advantages in their sector, enabling faster connections between regional data centres. It could also potentially enable the more efficient training of the next generation of ChatGPT, which will need networks of massive data centres.”

It soon became apparent that the volumes Microsoft required were so big that they would be better off acquiring the company altogether. After a long due diligence phase, the transaction was finalised at the end of 2022.

“There are so many positives to this deal,” said Francesco. “They keep investing in the technology, so our team is now much bigger, going on for 150 people – and the plan is for continuous growth. It’s great for the local economy, and for the University, where

they’re directly funding research and PhD studentships, and where they are looking to strengthen the research capabilities.”

The FASTNET Prosperity Partnership, co-funded by EPSRC and Microsoft, is allowing for further development of hollow-core technology. “We’ve achieved a landmark result this year. Our technology has officially surpassed the performance of conventional fibres, not only in transmission speed, and low latency, but also in the attenuation of light.” Light intensity is lost – attenuated – as the signal travels down the fibre, meaning that for long distance communications electricity is needed to re-amplify the signal periodically and maintain its strength and quality. “As the traffic through our global network keeps increasing, electricity consumption is one of the big problems posed by telecommunication networks. Hollow-core technology might make greener networks possible.”

The FASTNET programme’s target is ultimately to increase data capacity by up to 500%, in faster and greener networks that will support the future digital economy. “My hope is that UK and Southampton companies will seize the opportunity to be early adopters, helping us grow and gaining an advantage for themselves.” said Francesco. “My vision is aligned to Microsoft’s vision, which is to roll out this technology on a huge scale for the benefit of society and humanity.”

Worthwhile journey

While his co-founders Marco Petrovich and David Richardson are now full-time Microsoft employees, Francesco splits his time. “When I work for Microsoft, I develop fibre technology for optical communications. When I work for the University, I look at other applications.” These include potential applications in quantum communications, high-power laser delivery, and more. “We’re working with CERN, we’re working with NASA...over the past couple of years. I’ve been personally contacted by something like 40 companies about this technology. It is an incredibly exciting time, and the University of Southampton is at the heart of this revolution.”

Other companies before Lumenisity had tried to bring hollow-core fibre technology to the market. So how did they succeed where others failed? “We had the solid foundation of a mature technology, and we’d secured a key patent,” reflected Francesco. “We invested in advanced modelling tools. Then there was the outstanding business experience brought by David Parker – as academic founders we would have struggled to navigate those early negotiations without him.”

Doubt and failure are never far away when founding a company, he said. “Luck is a factor. But it’s ultimately the strength of your team which will decide whether you survive those crisis moments.”

The Microsoft acquisition might be the headline story, but for Francesco and all his co-founders, the journey itself has been worthwhile. Even without the final happy ending of a rewarding sale, it would have been an incredible experience, and “we would recommend it to all of our academic colleagues.”

THE ROAD TO INNOVATION

The Technology Transfer and Intellectual Property (TT-IP) team helps take ideas from the realm of imagination into the real world.



David Woolley

“Intellectual property (IP) constitutes a creative work of the mind that’s in some way an innovation in its field,” said David Woolley, Head of the TT-IP team in Research and Innovation Services.

“When it comes to registering IP, whether that’s a patent, copyright or something else, you’re moving from something intangible to a formal legal property. Our team works with researchers to translate their wonderfully creative ideas into something beneficial.”

Where previously almost all commercial activity was focused around specific areas such as Chemistry and Medicine, there is a growing desire for all faculties and schools to be involved. This has led to the expansion of the TT-IP team to serve the whole University.

“When I talk to colleagues at other institutions, they’re incredibly envious of the commercialisation ecosystem we have here,” said David. “Southampton is really a leader in this area.”

Spotting commercial value


Many academics come to the commercialisation process from departments which habitually focus on patent potential. But the TT-IP team are keen for others, including Early Career Researchers, to think

about the commercial value of their ideas. The team runs events in partnership with the Centre for Higher Education Practice (CHEP) and Future Worlds (see page 33) to get researchers thinking about where their IP could go. They also offer the Southampton Enterprise Development Fund (SEDF), which awards grants to help move research outputs towards achieving a commercial step or milestone.

Spotting value is the first challenge: the next is communicating it.

When starting to work with the TT-IP team, academics might underestimate the legwork needed simply to talk about their IP, said Technology Transfer Manager Kambiz Kalantari, who specialises in IP from Engineering and Physical Sciences. “Having a research background can actually be a barrier at first. Academics are so highly specialised, they need to work hard to find a common language with our team and with potential partners.”

His fellow Technology Transfer Manager Charles Opoku, who specialises in IP from Medicine and Life Sciences, concurred: “Most academics are trained to use technical language. We work to help translate that into terms that partners will understand.”



“When it comes to registering IP, whether that’s a patent, copyright or something else, you’re moving from something intangible to a formal legal property. Our team works with researchers to translate their wonderfully creative ideas into something beneficial.”

David Woolley



Kambiz Kalantari

“I’d love more academics to understand how commercialising can boost the societal impact of their work”

Kambiz Kalantari

Exploring patent protection

David, Charles, Kambiz and their colleagues can be involved in a project from the grant application stage through a process that can take anything from nine months to five years.

The first step is working with the researcher to fill in the Invention Information Form (IIF), a document which demonstrates the provenance of an idea. The Technology Transfer Manager will then look at the patent landscape to see who else is operating in this area, trying to find a gap to position a potential patent or commercialisation strategy around.

In faculties with a more formal route for commercial activity, the researcher will then pitch to an IP Panel, comprising the Associate Dean of Enterprise, the Entrepreneur in Residence, and industry experts.

Although this can be daunting, David said, it helps ensure that researchers are equipped to answer the tough questions that will inevitably be raised at some point on their commercialisation journey. “A high

proportion of applicants to these panels do go through to the next stage. Even for those who don’t, it’s usually a positive process with constructive feedback so they stand a better chance next time.”

Spin-out or license?

If the IP panel gives an idea the go-ahead, the TT-IP team will work with the academic to explore which route they want to take, and to negotiate deals. The most common options are granting the use of IP to others through a License Agreement, or setting up a new, independently operated company called a spin-out.

The best route will depend on the particular IP, and there are advantages and challenges to each approach. While a License Agreement takes advantage of an existing company’s resources and requires less input from the inventor, allowing them to move on to the next project, it also takes the future of their invention out of their hands. Creating a spin-out gives the founder a much more significant say, but also requires far higher involvement on their part, and carries more risk.

AN INNOVATOR’S JOURNEY – DR MEISAM JALALVAND

“I thought they would be more negative and probing, but they were supportive and even suggested a few new ideas.”

Dr Meisam Jalalvand

Dr Meisam Jalalvand from the School of Engineering is one researcher to have recently explored patent protection for his product, a sensor which can detect damage in fibre-reinforced materials used in the aerospace and energy industries (for example, in wind-turbine blades). He began to consider IP protection after another, similar product of his attracted interest from an industry partner, and then received EPSRC IAA funding to explore the commercial route.

Now nearing the end of the process, he found it “quite straightforward” with the help of the TT-IP team. His experience of pitching to the IP panel was “actually very positive – I thought they would be more negative and probing, but they were supportive and even suggested a few new ideas.”

Meisam is aware that there can be downsides to the commercial route, and that it isn’t right for everyone. “For example, we had to



Dr Meisam Jalalvand

hold back publishing results for a number of years.” But now, he is pleased to be close to applying for a patent – and is looking forward to the more open conversations with potential customers which can happen once the patent is filed.



Charles Opoku

“Most academics are trained to use technical language. We work to help translate that into terms that partners will understand.”

Charles Opoku

The common thread from his team’s perspective, said David, is that “it’s always about helping an academic find the right company to take their invention forward. It’s just that sometimes that company already exists, and sometimes you have to create it!”

Reaping the rewards

Every inventor or founder hopes that they’ll go on to make a profit from their innovation. But the rewards are more than financial, said Kambiz. “I’d love more academics to understand how commercialising can boost the societal impact of their work.”

Going through the journey of commercialising can be hugely beneficial for an academic’s skill set and understanding of their work, said David. “Researchers are generally confident in their expertise when they enter the process. But the more they talk to people in the outside world who aren’t academics, the more they recognise that others can add valuable feedback on their work. It’s a massive opportunity to capture additional insights and become ‘supercharged’ in your understanding.”

This holds true, he said, even if the initial innovation isn’t quite right for the market.

“Then they’re exceptionally clear on what the gap is and what they need to do next. They have market-informed knowledge to make their research proposals better; they’re raising relevant real-world problems and saying how they’ll bridge the gap.”

To transition from the world of academia to success in entrepreneurship requires a shift in mindset “from working with your head down to pro-actively pushing for feedback. I think this helps academics to recognise there are many perspectives on the work they’ve been undertaking, and to further appreciate the contributions of others, including from those outside their current team.

“The process also builds resilience. In entrepreneurship, there’s an acceptance that the failure of one idea isn’t a weakness – it’s just means that you haven’t yet finished, so you need to pivot to the next thing and move on.”

 **The Technology Transfer and Intellectual Property team can be contacted on:**

intellectualproperty@soton.ac.uk

AN INNOVATOR’S JOURNEY – DR MIKE GODFREY

“The main benefit of the ICUR programme was the funding, which allowed me to travel and liaise with potential partners.”

Dr Mike Godfrey

In the process of formation and when they’re newly formed, companies need support. At Southampton, this comes from an ecosystem of incubators and accelerators which can help with everything from idea development to business planning and finding investors.

Dr Mike Godfrey, Doctoral Prize Research Fellow in Mechanical Engineering, has been engaged with the TT-IP team for two years, working on patenting his idea for a surgical implant designed to replace damaged spinal discs. Having taken part in the MedTech SuperConnector (MTSC) programme at Imperial College London, a fellow participant recommended SETsquared’s ICUR programme (see page 34) as the next step towards commercialisation.

“The main benefit of the ICUR programme was the funding, which allowed me to travel and liaise with potential partners,” said Mike. “Through this, we discovered the veterinary



Dr Mike Godfrey

market was a more appropriate intermediary market entry strategy.”

With support from the TT-IP team, Mike has now filed a patent application, “and we have some exciting collaborations lined up for the near future with a veterinary surgeon, clinicians and others.” He hopes that his technology will one day become the go-to intervention for spinal degeneration.

A 'GENERATION-DEFINING' COMPANY

HOW VIRIDICO2 IS SCALING UP

The idea that waste CO₂ could be converted into valuable raw materials sounds almost too good to be true. But this dream prospect is being turned into reality by Southampton spin-out company ViridiCO₂.

16% of global annual emissions are caused by CO₂ from the foundation, formulation and chemical industries, where the company's technology is set to usher in a revolution. A patented solid catalyst technology is added to chemical processes where it activates CO₂ – converting it into products that can be used to make cosmetics, furniture and clothing. Not only does this cut down on the use of fossil fuel-based chemicals, it also reduces the energy needed for the whole manufacturing process.

ViridiCO₂'s founding story was featured in Re:action in 2021. Since then, their team has grown from 6 to sixteen, and their scale of production from milligrams to kilogrammes on a weekly basis.

Massive jump

"We're working with just about every big chemical manufacturer in the world to trial our technology," said CEO and co-founder, Dr Daniel Stewart.

This entails in-depth discussions with each customer about their objectives and pain points – some might be interested in saving money by running their production processes at lower temperatures, for example, while others will be primarily focused on sustainability. "The chemistry is very similar

in each case, but the output is different," said Daniel. "We must understand the needs of each customer and enable them to produce novel products which uniquely meet these requirements"

One major challenge is around the inherent complexity of scaling up chemical production. "Scaling from one litre to ten litres is not straightforward. Trying to go from 10 litres to 10,000 litres is even less so." Then there are the variables that can't be controlled outside of the lab. "We've just done this with a company in India, for example – it's 43° outside, whereas in our lab, it gets a bit chilly! The ambient temperature affects how much energy and pressure we need to put into the reaction, so we must work on site with customers to understand these external influences."

ViridiCO₂'s "robust" solid catalyst product has stood up to testing. They have already reached Technology Readiness Level (TRL) 6-7, a measure on an industry-recognised scale which means that their technology is being validated in their customers' environments. "This is a completely independent evaluation of our catalyst, and to get to that stage in just a few years is a massive jump," said co-founder and Chief Scientific Advisor, Professor Robert Raja.



Employees celebrate ViridiCO₂'s third birthday

Team building

After early support from an EPSRC Impact Acceleration Award, Innovate UK ICUR Follow On Funding and angel investors, the company has recently secured £3million in seed funding from venture capital firm EQT Ventures. "We look to back generation-defining companies and ViridiCO₂ has the potential to accelerate the energy transition of a whole industry," said Ali Mitchell, Partner at EQT, who is also a Southampton alumnus. "The team has created a solution that is a true win-win for business and the world."

This money has enabled ViridiCO₂ to build the right team – a more crucial investment



“We’re working with just about every big chemical manufacturer in the world to trial our technology.”

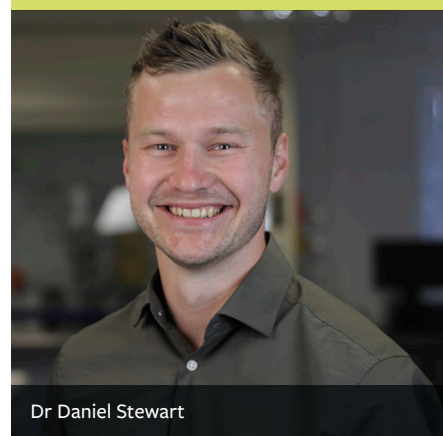
Dr Daniel Stewart



ViridiCO2's catalyst product



Professor Robert Raja



Dr Daniel Stewart

at this stage than lab infrastructure, Daniel said. “We’ve brought in Nick Smith as Commercial Director, and his 20 years’ experience in the chemical industry has opened doors. Everybody wants to work with us!”

Robert brings 30 years in academia and the chemical industry to his role as Scientific Advisor. Unusually for a spin-out co-founder, he still sits entirely within the University, a position which Daniel said works well for the company. “It means we can take advantage of the University ecosystem and grant opportunities, and that our business supports the University too.”

Daniel himself had envisaged a career in academia when he embarked on his PhD, but took the daunting decision to step onto a different path. “When you’re presented with an opportunity like this – to the best of our knowledge, no one else in the world can do what ViridiCO2 is doing – you have to grab it. I took the reins without any business training and I’m learning on the job!”

Paradigm shift

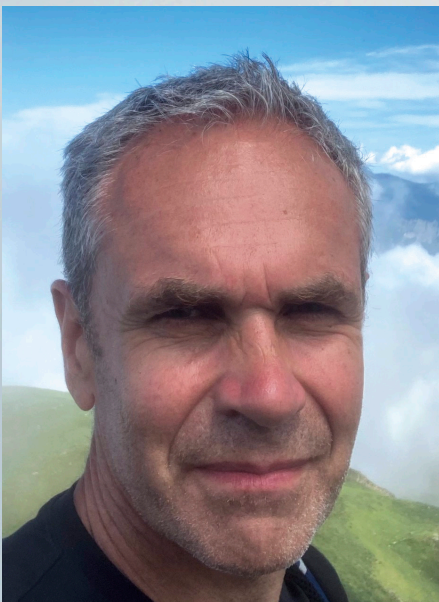
The team is excited to roll out their first commercial licenses within the next few years, enabling customers to use their technology at scale on an ongoing basis. Robert mentioned that they “are also building academic and

industrial collaborations to develop non-fossil fuel-based starting materials that could be utilised by ViridiCO2, with a view to developing a circular economy across the entire process”.

“It’s easy for people to think of commercialisation as having a start and an end point, but really it’s ongoing, even once we have our first license,” said Daniel. “It may still be some time before consumers can actually buy shampoo or clothes made with our product.” The ambitious long-term road map, though, is clear: “Create a paradigm shift in chemical manufacturing to transition towards a more sustainable future.”

POWERING THE FUTURE

By 2040, it is predicted that almost all cars sold across the world will be electric. In the UK, Rishi Sunak's government laid out a path for a ban on petrol car sales by 2035, setting aside over £2 billion to back the transition. With electric cars set to drive us into the future, the race is on to improve the key component that could make these vehicles more affordable and practical: the battery.



Professor Giles Richardson

Dandeliion, an innovative battery modelling technology, has been developed by Southampton researchers Dr Ivan Korotkin and Professor Giles Richardson from the School of Mathematical Sciences, alongside Professor Jamie Foster and Dr Smita Sahu from the University of Portsmouth. Backed by funding from The Faraday Institution and now licensed to About:Energy, Dandeliion provides critical insights into the physical processes happening inside a battery cell – enabling more advanced electrochemical models to be used in battery design.

Five-dimensional problem

“A basic battery is an anode and a cathode, just two sheets of material sandwiched together,” said Giles. “You’d think that modelling the electrochemistry inside that battery would be a one-dimensional problem. But in fact, it’s at least two-dimensional because of what’s happening on a microscopic scale. The anode and cathode (the positive and negative electrodes) are composed of microscopic or nanoscale particles which are sandwiched together like raisins in a cake: you don’t only have to worry about transport of material between the anode and cathode, but also inside these particles.”

A typical household battery is composed of a single cell wrapped around in a ‘Swiss roll’ construction, but inside an electric vehicle “the cells are much bigger and collected in a pack consisting of several thousand cylindrical (or pouch) cells. Chemical reactions are very temperature-dependent – and given the size of these batteries, the temperature in the middle can be quite different to that on the outside.” This means that any model of what’s happening in the battery must solve for different temperature scenarios in multiple different locations, “which turns a two-dimensional problem into a five-dimensional problem!”

There’s also the role of the car’s cooling system to take into account, and scenarios in which the failure of some batteries transfers more load to the others, causing them to overheat. “So the computational scale of the problem is massive.”

When creating code to tackle problems like this, said Giles, “typically if you double the size of a system of equations you quadruple the time it takes to solve. You’re talking about weeks and months of computer time. But if you’re smart, you can get the code to scale linearly. When you double the size of the

system, you only double the time it takes.” He credits Ivan with implementing the team’s ideas to write a novel code fast and powerful enough for the needs of battery modelling. “Our code can deal with incredibly large systems that other linear scaling codes fall over trying to do.”

Commercial potential

It was clear to the team that a code which enabled fast large-scale battery modelling had commercial potential. Although they initially considered the open-source route, this would not have fit the needs of their customer base, said Giles. “When you’re dealing with battery or automotive manufacturers, they want reliable code that’s going to last a long time. With open-source, you’re subject to the whims of whoever’s writing new bits of code – and there’s a particular difficulty in staying on top of maintaining the code, which nobody wants to do for free.” Paying someone to reliably develop and maintain code requires income, and so “in the end it became clear to us that for this to have a longer lifetime, it needed to be commercialised.”

In the long term, the team hopes to operate as a full spin-out, but as a first step they have formed a licensing agreement with world-leading battery technology company About:Energy, itself a spin-out from Imperial College London and the University of Birmingham. The partnership was announced at the end of 2023. Giles and his team will continue to be involved in the development of the software, as well as providing technical support to end-users.

By harnessing DandeLiion technology with its own software platform The Voltt, About:Energy will significantly reduce the cost and timeline associated with battery development, as well as improving the way batteries are managed in the field to extend their lifetime. “Manufacturing batteries has an environmental impact, and they are hard to recycle because the valuable electrode materials are gummed together in a plastic matrix. So you want to use them in a way that doesn’t degrade them quickly.” This will have an impact not only in the electric car industry, but across all battery applications.

The partnership has particular benefits for the University too, beyond licensing income. Demonstrating impact is an important part of the Research Excellence Framework, but it can be hard to do when mathematics researchers work with large companies, said Giles. “If you commercialise the research yourself, or work with a small company like About:Energy, it’s much easier to prove impact.”

Perfect complement

The licensing agreement took several years to come together, due to the involvement of both Southampton and Portsmouth Universities, and the unusual nature of their product. “The challenge is that we don’t fit the normal model, either in terms of our product or our way of doing things,” said Giles. “Normally when a researcher creates something – for example, a medical device – it’s a clear product that’s being brought to market. Whereas our product is constantly

“Our code can deal with incredibly large systems that other linear scaling codes fall over trying to do.”

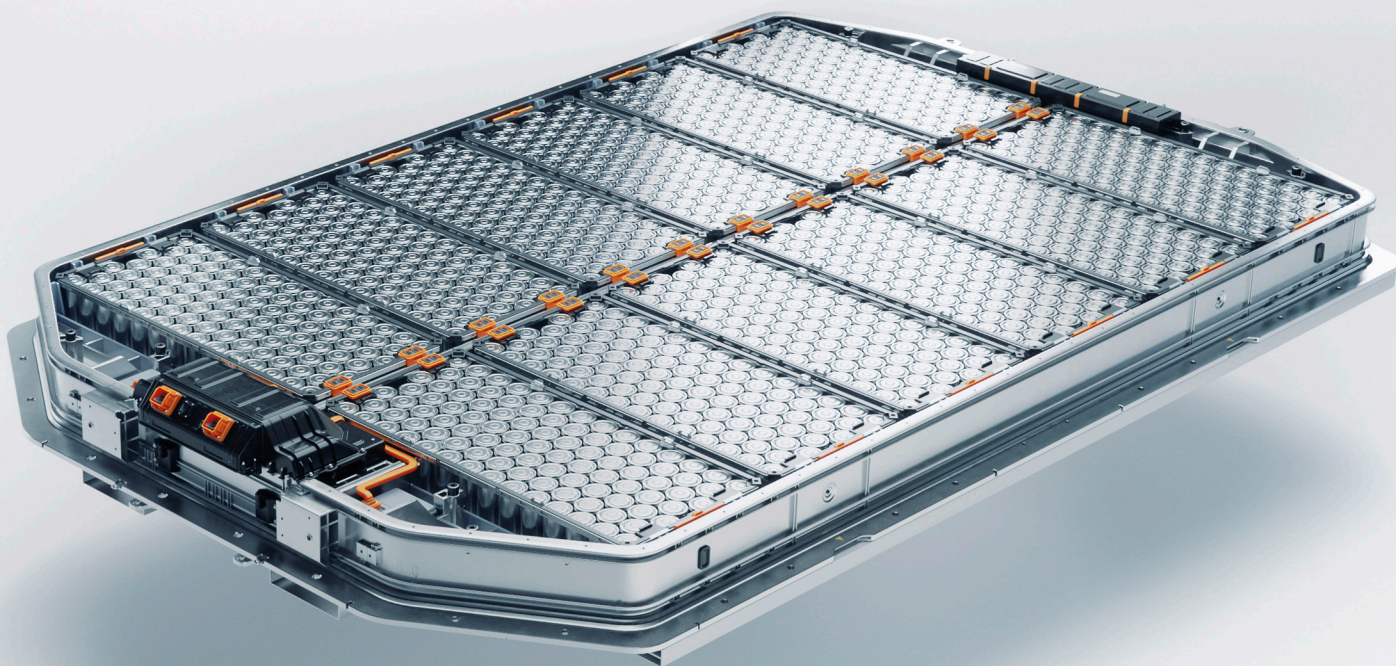
Professor Giles Richardson

evolving, which it has to be because batteries are evolving. Manufacturers might ask us for something one day, then want something totally different the next!”

He thinks that boldness is needed in order to take advantage of commercial opportunities in fast-moving fields. “I’d love to see a streamlined process in the University to make sure we grab the first-mover advantage, and more willingness to take on the inherent risks.”

He is currently using DandeLiion’s modelling power to investigate the potential of cheaper battery electrode materials, such as lithium iron phosphate and lithium manganese iron phosphate. Lithium ions transition in and out of these new electrode materials in a fundamentally different way to standard electrode materials, and so must be modelled with a different approach.

It takes years to determine whether any new business venture is successful, said Giles. But he is confident that About:Energy’s industry contacts and sales expertise give DandeLiion the best chance of becoming profitable. “Their work is a perfect complement to ours.”



CRITICAL TO DELIVERING IMPACT

“It is important to recognise that external partnerships are critical to deliver impact,” said Rosemary Nunn, Head of Business and Industry Partnerships in Research and Innovation Services. “They offer us a unique pathway to impact.”

In 2021/22 the National Centre for Universities and Business reported that over £1billion of UK academic funding comes from interaction with business annually, 25% of which is with SMEs (small to medium sized enterprises).

Collaboration with business at an early stage of research is now expected by research funding councils. Business engagement plays an increasingly important part in the Research Excellence Framework (REF), in particular the Engagement and Impact element (25%), and the Knowledge Exchange Framework (KEF) assessment exercises. Both of these directly (REF) and indirectly (KEF) inform the allocation of government funding to universities.

The value of the intellectual property and the intellectual capital in UK universities is well-known, believes Rosemary, but the full potential return on investment is yet to be realised as a comprehensive knowledge base remains elusive.

In the past, she explained, large research-intensive universities tended to focus on “profit-maximising pathways” from their research such as intellectual property, leading to technology transfer and commercialisation.



“But all of the knowledge and information that exists outside of the things on that pathway didn’t necessarily get curated, or built into an accessible, searchable environment.”

Driving maximum value

An economist by training, Rosemary began her career designing and implementing processes to gather, analyse and share sector knowledge within the defence industry – which led to a fascination with the

role of knowledge in driving innovation and growth.

A 20-year career in Strategy, Innovation, and Knowledge Management followed, with director-level roles with major corporates, as well as running her own business, I&K – the Innovation and Knowledge Agency. She was Head of Commercialisation and Innovation at the University of Greenwich for two years before joining Southampton in 2023 following a move to the Isle of Wight.

Her role at the University of Southampton was a welcome opportunity to step into a more research-intensive environment and develop her interest in what she calls “the whole picture.” Rosemary’s focus is on helping businesses to understand the full scope of what the University has to offer and driving maximum value from relationships.

“We have a broad and impressive range of propositions to offer industry, and vice versa,” she explained. External partnerships might provide any combination of potential benefits: from research collaboration and generating income, to supporting the University’s sustainability work or civic agenda, utilising specialist facilities, or providing opportunities for students and graduates.



“The University has many valuable long-standing relationships and deep research collaborations with business,” said Rosemary, “but there is an opportunity to increase the number and depth of those partnerships.”

She is conducting a review of strategic partnerships and mapping the current landscape of business relationships across the University. Large corporations are likely to offer “multiple touchpoints” with the University’s work, she explained. Where those partnerships focus on one academic or research group only, there is a risk that wider opportunities might be missed.

Led by Rosemary, the Business and Industry Partnerships team exists to support and enhance those relationships. Their industry knowledge and understanding of the breadth of the University’s capabilities can help to recognise who else might derive value from the relationship, and “maximise the potential for collaboration and income generation.”

The team can also help with sector expertise, contacts, approaches, and establishing partnerships.

“If you’re thinking about engaging with business, come and talk to us,” said Rosemary.

Growth strategies

Rosemary is also focused on growing partnerships in key sectors. She is developing value propositions setting out the expertise, capability and facilities that the University has to offer particular sectors, beginning with AI for Healthcare, and Marine and Maritime.

Explaining how she works with the University’s pipeline of potential partners, Rosemary said:

“We are testing a new approach, asking companies to share their innovation roadmap with us, under a non-disclosure agreement, and then we are aligning that roadmap to our academic capabilities and value propositions. We are looking at multi-disciplinary routes into companies’ major innovation projects.”

The team has recently developed a new strategic partnership in professional services, one of the few specific sectors listed in the Government’s new Industrial Strategy Green Paper. Other sectors in focus are engineering, including manufacturing, defence, aerospace and space; transport and logistics; the wider healthcare sector; and advanced technology; as well as supporting strategic developments such as the Centre for Green Maritime Innovation (CGMI) and the Institute for Medical Innovation (IMI).

Working with SMEs in the region and beyond, is also central to Rosemary’s vision. “Innovate UK (the UK’s national innovation agency) sees SMEs as the growth engine for the UK economy,” she commented. Partnerships with SMEs support the University’s public and community engagement and are key to the University’s Civic Agenda for local growth and regeneration.

Whether through Knowledge Transfer Partnerships, place-based impact acceleration, or engagement with the Help to Grow Management programme offered through Southampton Business School, Rosemary sees working with SMEs as “offering significant untapped potential as a route to impact and income generation.”

The University has an “open door to business,” she concluded.

Read more about the BIP team’s work with SMEs on page 24.

The Business and Industry Partnerships (BIP) team can be contacted on:
business@soton.ac.uk

SECTOR FOCUS: HEALTHCARE

Some of the University’s most successful relationships with business are in healthcare. Partnerships provide vital income, advance the University’s research, and drive progress in addressing global health challenges. They can involve commissioning or collaborating on research, joint grant applications, clinical trials, consultancy, or accessing specialist facilities.

Established partnerships include with GSK, AstraZeneca, Bioinvent, Bristol Myers Squibb, Pfizer, and Roche.

It is Corporate Partnerships Manager Charlotte Shearing’s job to nurture and steward these relationships, along with Corporate Partnerships Officer Hannah Illsley. As healthcare sector specialists, they play a key role in matching industry’s requirements with research expertise.

“I will help our academics to understand how they could work with a company,” said Charlotte.

“And if a company comes to us and says, “I am interested in a particular patient cohort, facility, or capability,” I would know who in the University could support this, what form a partnership might take, and the most cost-effective way to do it.”

The Business and Industry Partnerships (BIP) team’s position within RIS, alongside the University’s intellectual property and contracts specialists, also helps partnerships run smoothly.

Sector specialists

Keeping up with University developments, partners’ innovation goals, industry changes, and government priorities, helps to ensure that they spot opportunities to extend existing partnerships. “It is part of our job to find the hidden gems within the University,” said Charlotte.

In partnerships with huge corporations, major research collaborations will often grow out of existing relationships with an academic, but there may be opportunities to develop relationships with other parts of the company.

A call for UKRI Prosperity Partnership funding (which supports business and academic research partnerships), for example, prompted Charlotte to link a contact within AstraZeneca’s imaging arm with Professor of Molecular BioPhotonics and Imaging, Sumeet Mahajan, leading to a successful joint application.

Hannah recently succeeded in including Bristol Myers Squibb, whose collaboration with the University had mainly focused on cancer



“It is part of our job to find the hidden gems within the University.”
Charlotte Shearing

research, in the Student Innovation Challenge. Run by the Careers, Employability and Student Enterprise team (see page 31), the challenge offers students the chance to work as a group to solve a problem set by industry.

Going forward, a key focus for development with new and existing partners is Med Tech (which covers all technologies used for medical purposes), including Digital Health.



Bristol Myers Squibb Student Innovation Challenge 2024
Blue team (joint winners)



Bristol Myers Squibb Student Innovation Challenge 2024
Red team (joint winners)



Hannah Illsley



PARTNERSHIPS DRIVING NEW TREATMENTS

Healthcare sector partnerships, including with GSK and AstraZeneca, generate multi-million pounds in income for the University of Southampton, and lead to real-world progress in understanding and treating a range of conditions.

Work on Covid-19 with AstraZeneca and the Faculty of Medicine's respiratory medicine specialists, led by Professor Tom Wilkinson from Clinical and Experimental Sciences,

resulted in new patient treatments during the pandemic.

Professor Wilkinson has also collaborated with GSK on major research into asthma and chronic obstructive pulmonary disease (COPD).

His research group's long-standing partnership with AstraZeneca is investigating differences in gene expression which drive

the immune response to viral infection in COPD, which causes more than three million deaths a year worldwide. Tom said:

"This important programme of research aims to provide ground-breaking insights into disease mechanisms of COPD and will help us work towards the development of a new generation of much-needed therapies."

A high-magnification histological image of tissue, likely stained with hematoxylin and eosin (H&E). The image shows a dense population of cells with prominent, dark purple nuclei and pinkish-red cytoplasm and extracellular matrix. The tissue architecture appears disorganized, with cells packed closely together, suggesting a pathological process such as cancer. The background is a solid, light pink color.

“Working with a small company gave me access to their drug for my research, and they were very supportive, including part-funding a PhD student.”

Professor Gareth Thomas

THE COLLABORATION COMBATTING IMMUNOTHERAPY RESISTANCE

Immunotherapy, which recruits the body's own immune system to recognise and attack 'foreign' cancer cells, is one of the most exciting developments in cancer treatment in recent years. However, it is only effective in about 20 per cent of patients. In Professor Gareth Thomas's specialism, head and neck cancer, success rates are even lower.

Gareth is Professor of Experimental Pathology at the University's Centre for Cancer Immunology. His research, aided by a decade-long collaboration with a pharmaceutical company, has revealed a key cause of resistance to immunotherapy, and found a drug that could help overcome it.

"Our research has been focused on a type of cell called cancer-associated fibroblasts (CAFs)," Gareth explained. "Fibroblasts are found throughout the body. They maintain the natural structure of tissues and play an important role in wound healing. Cancers 'corrupt' normal fibroblasts to provide a protective environment that benefits the tumour."

In 2011, Gareth's research group conducted a study looking for molecular markers in head and neck cancers that could be used to identify aggressive tumours where patients' survival was poor.

"Surprisingly, what we actually found was that the best predictor of early patient death was the presence of these cancer-associated fibroblasts," explained Gareth. They subsequently established that tumours containing CAFs tend to spread aggressively and are resistant to treatment, including immunotherapy.

Since then, Gareth's research has sought to understand how fibroblasts become corrupted and how CAFs regulate immunotherapy resistance.

"We found that CAFs shield the tumour from the patient's immune system, preventing immune cells called T-cells from penetrating the tumour to attack malignant cells. This is significant in terms of immunotherapy, which works by boosting this immune response."

The team also discovered that an enzyme called NADPH Oxidase-4, or NOX4, played a major role in activating the normal fibroblasts. "We found that if we blocked NOX4, we could stop the fibroblast becoming a cancer-associated fibroblast. We also found that inhibiting NOX4 could turn a CAF back into a normal fibroblast."

"We needed to find a company with a drug that targeted NOX4," said Gareth. In 2014 he approached Swiss-based pharmaceutical Genkyotex, whose product Setanaxib had been developed to inhibit NOX4 in patients with fibrotic diseases such as liver and kidney fibrosis.

"The activated fibroblast that you find in cancers can also be found in scarring conditions like fibrosis," Gareth explained. "Genkyotex hadn't considered that their drug could be useful for cancer."

Continued on page 22 →

100 µm

The collaboration combatting immunotherapy resistance

The team tested Setanaxib on specially developed mouse models with CAF-rich cancers. They confirmed that the drug prevented the formation of CAFs and reversed formation when it had already occurred. The tumour-protective power of CAFs was effectively eliminated, allowing cancer-killing T-cells to enter tumours.

The next step was to try Setanaxib with different types of immunotherapy, including anti-tumour vaccination, and the most-widely used ‘checkpoint inhibitor’ anti-PD1 checkpoint therapy. (Checkpoint inhibitors work by blocking proteins that stop the immune system from attacking cancer cells). When the NOX4 inhibitor was combined with immunotherapy and used on the mouse models, CAF-laden tumours that were previously resistant to immunotherapy responded successfully.

By 2020, these pre-clinical results had provided enough evidence for a Phase 2 clinical trial. At the same time, Genkyotex was bought by Swedish pharmaceutical Calliditas. “Thankfully, Calliditas were really interested in what we’d done and wanted to push forward,” said Gareth.

Biological evidence

With the support of the Technology Transfer and Intellectual Property (TT-IP) team in Research and Innovation Services, the University signed an Intellectual Property (IP) Agreement with Calliditas. A Phase 2 clinical trial testing the effectiveness of Setanaxib in combination with immunotherapy drug Pembrolizumab, began in 2022. It ran at 30 centres in Europe and the US, with 55 patients.

Results were announced in May this year. Patients who received the combination showed statistically significant improvements in progression-free survival (the time from start of treatment to disease progression) and overall survival (the duration of patient survival from the time that treatment started), compared to those who received only immunotherapy.

“I was on cloud nine for weeks,” commented Gareth. “Treatment with the NOX4 inhibitor and immunotherapy almost halved the risk of progression within the trial.

“Our molecular analysis also showed an increase in T-cells within the tumours of the patients who received the Setanaxib, so we had



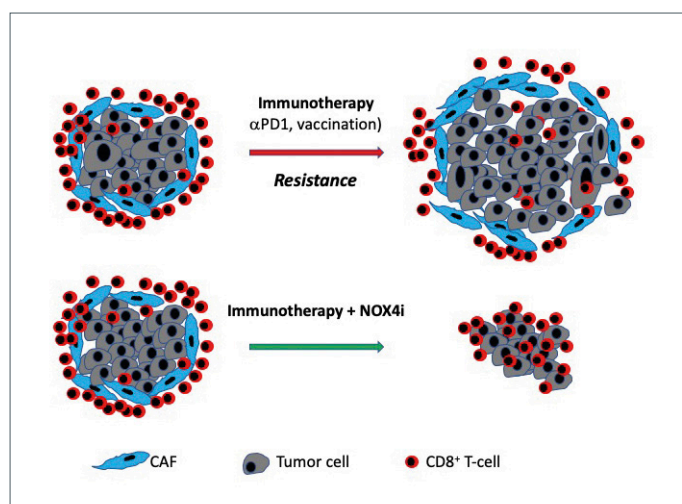
Professor Gareth Thomas

biological evidence that the drug was allowing T-cells to get at the tumour cells and kill them.”

These results are the proof needed to move to Phase 3 trials – essential for Setanaxib to become part of standard cancer patient treatment, as Gareth hopes. The next step is uncertain, however, as Calliditas has recently been acquired by Japanese multi-national Asahi Kasei.

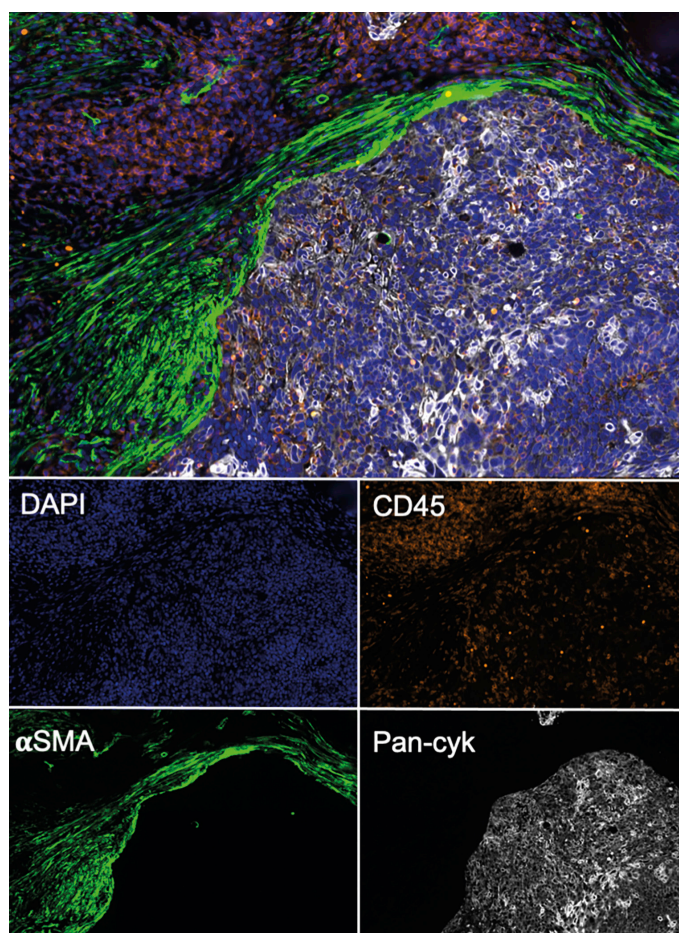
Power of long-term collaboration

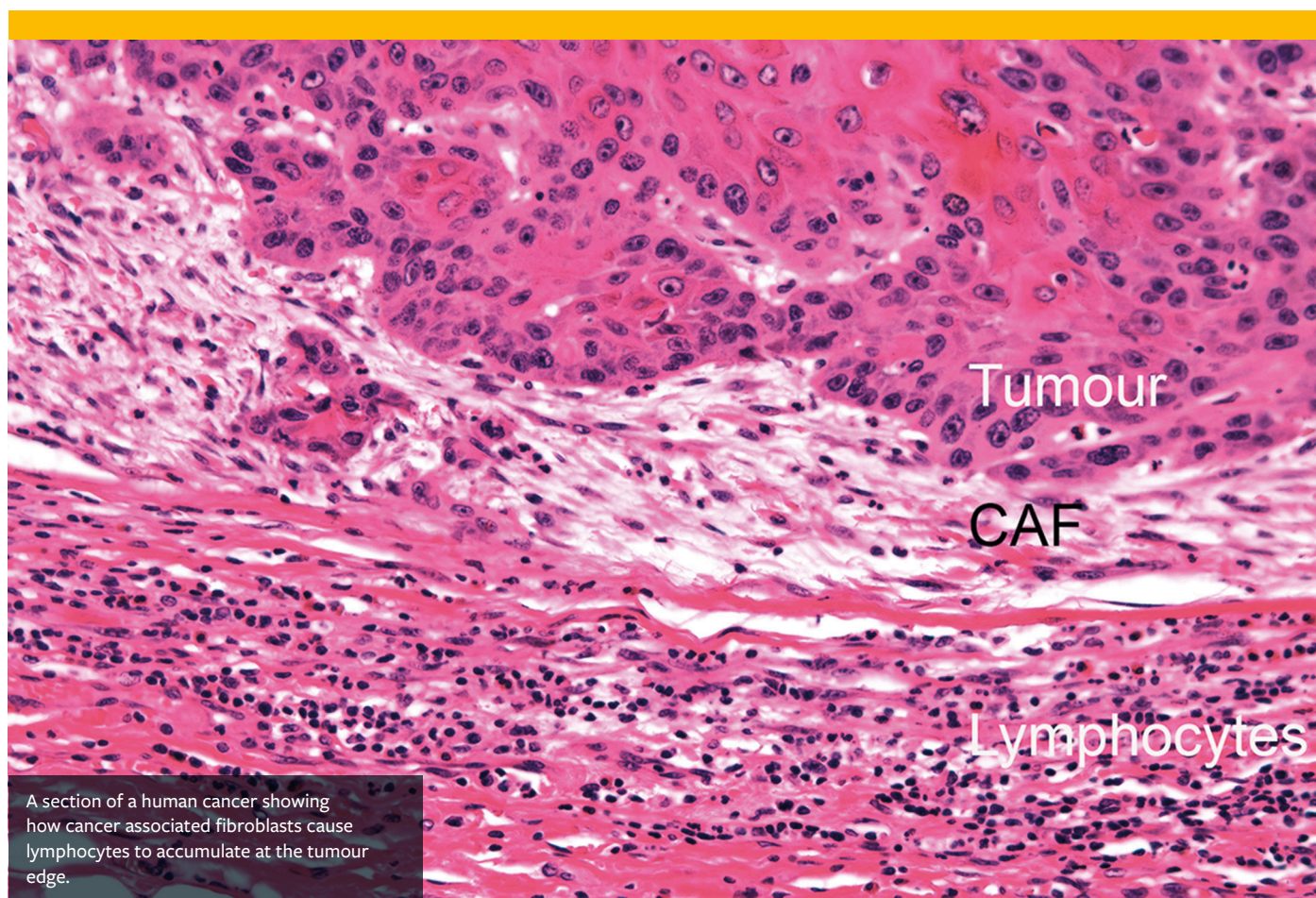
Reflecting on this decade-long collaboration, Gareth commented: “Working with a small



Above: How the NOX4 inhibitor overcomes immunotherapy resistance.

Right: Multiplexed immunochemistry showing the association of cancer associated fibroblasts with tumour cells. Showing DAPI (cell nuclei), CD45 (immune cells), SMA (CAF) and Pan-cytokeratin





company like Genkyotex gave me access to their drug for my research, and they were very supportive, including part-funding a PhD student.”

The agreement between the University and Calliditas includes being named as joint inventors on the patent for Setanaxib’s use in cancer. The University benefits from a series of royalty payments when the drug development programme reaches key milestones.

“It’s been a long journey, but I’m pleased with it. The translational element was what we always wanted to achieve. I hope it can continue, but the proof of principle is there.”

Richard Philipson, Chief Medical Officer at Calliditas Therapeutics commented:

“Working with Gareth has shown me the power of long-term collaboration between industry and academia. With Gareth’s research, support and insights, we have taken Setanaxib from the fundamental research at the University of Southampton on cancer-associated fibroblasts, through to completion of a Phase 2 clinical trial in patients with head and neck cancer, with a positive outcome.

“I firmly believe that the work that we have done together will translate to development

of drugs that will have transformational benefits for patients with cancer.”

In 2023, Gareth’s group embarked on a £1.38million research programme with Cancer Research UK (CRUK) exploring how CAFs manipulate the immune microenvironment in head and neck cancers.

“We are working with CRUK to set up another clinical trial with a different inhibitor, which we think works very similarly to the NOX4 inhibitor,” said Gareth.

“I think ultimately someone will find a drug which targets CAFs. And that will have substantial benefits for those cancer patients with CAF-rich tumours.”

“Exciting stuff”

Since Gareth began researching CAFs more than a decade ago, ‘big pharma’ has caught on to the importance of fibroblasts. Gareth’s research group’s 2020 paper showing that targeting NOX4 could help overcome immunotherapy resistance, was published in Cancer Research and attracted considerable attention and an award for the most cited Cancer Research paper 2020/2021. It led to several other collaborations, including with AstraZeneca, Boehringer Ingelheim, and Gilead.

“If you can overcome the problematic biology of CAFs then, as well as immunotherapy, other treatments such as chemotherapy and radiotherapy will start to work better,” said Gareth.

These findings may have applications beyond cancer. The team has been investigating the presence of other types of ‘cancer-associated fibroblasts’ in other conditions, including inflammatory diseases like rheumatoid arthritis and Crohn’s disease.

“Fibroblasts are important regulatory cells that can switch inflammation on and off. In cancer, we want to promote an immune response, but in something like rheumatoid arthritis, you’d want to suppress it. Understanding how fibroblasts shape the immune response will help us develop new therapies to do this.”

On partnerships with industry, Gareth concluded:

“Never be afraid to approach a company if you have a good idea and data to back it up. Pharma has access not only to money but often to techniques we can’t afford to do ourselves. If you’ve got someone who’s truly interested in your research, you can get some exciting stuff done.”

Feature

NURTURING SME COLLABORATIONS



99% of UK businesses are small to medium sized enterprises (SMEs) – companies with up to 250 staff. Across the country there are five and half million SMEs, with an estimated 60,000 operating in Hampshire.



“Working with smaller regional businesses is particularly important for enabling innovation and local growth.”

Kerrie Graham

SMEs drive the economy, providing products, services, innovation, and employment. The University has a strong record of engaging with SMEs, including through the now-concluded Scale-Up programme from the SETsquared Partnership (see page 34). Business Engagement Manager Kerrie Graham, who leads on SME engagement in the Business and Industry Partnerships (BIP) team, explained their importance:

“Working with smaller regional businesses is particularly important for enabling innovation and local growth, and supports the University’s Knowledge Exchange, Enterprise, and Civic strategies. Externally, there is increasing focus on collaborations with SMEs by government and funding bodies. SME partnerships also open up business and commercially driven funding, such as through Innovate UK. As part of UK Research and Innovation, their focus on supporting SMEs to scale up means their funding programmes increasingly require an SME partner.”

For research and teaching staff, relationships with SMEs offer opportunities for knowledge exchange and impact acceleration, through programmes such as Knowledge Transfer Partnerships (KTPs), collaborative and contract research, and consultancy. SME partnerships can lead to impact case studies, follow-up projects, academic papers, and career development – and student projects can boost employability.

Under a developing SME engagement strategy, Kerrie is leading a project to review how the University can build and engage a ‘community’ of SMEs which can link companies with the increasing social, environmental, regional, civic, and place-

based development opportunities becoming available through the University.

“We want to engage with partners in a meaningful way, joining the dots across the offer from Southampton, highlighting our amazing research, and demonstrating the benefits of working with us,” she said.

Part of Kerrie’s approach is to foster relationships with business organisations who can provide access to ready-made networks, both sector-specific and general. To access untapped potential with regional marine and maritime SMEs, for example, she has been working with Maritime UK Solent. Helping them to understand the University’s offer is enabling them to signpost their members to University expertise and resources, as well as providing opportunities for targeted promotion to their members. Relationships with non-sector specific organisations, such as Barclays Eagle Labs and the Enterprise Club of Business South, is also helping to increase reach.

The University’s business-facing initiatives and events, such as those from the Future Towns Innovation Hub, provide the BIP team with opportunities to extend their support and connect businesses with the right University leads. The team also signposts to the University’s wider enterprise ecosystem, from the Business School’s executive education, management programmes, and sustainability reporting services for business, to the Catalyst business accelerator at Southampton Science Park, and the SETsquared Partnership’s Entrepreneurs Workouts.

Trusted relationships within the University are key and Kerrie works closely with teams who engage with business, including the Careers,

Employability and Student Enterprise (CESE) team.

As well as building partnerships directly, the BIP team is there to support and enhance relationships that academic colleagues have developed.

“If an academic already has a great relationship with a business, where appropriate we can suggest other opportunities or capabilities within the University that could be beneficial, or help with something further down the line, maximising the value to the business partner and the University.”

Central to the team’s approach is recognising and nurturing what Kerrie calls “that spark of mutual interest” between an SME and the University, spotting potential, making introductions, providing support, and extending opportunities to other parts of the University.

 **The Business and Industry Partnerships team can be contacted on:**
business@soton.ac.uk

CLEANER SHIPS, CLEANER OCEANS: TACKLING MARINE BIOFOULING

Biofouling – when microorganisms such as plants, algae and small animals form a film on a ship’s hull – is a major problem in shipping. But now, a partnership between Isle of Wight company, Carisbrooke Shipping, and the University’s School of Mathematical Sciences and School of Mechanical Engineering is offering a new way to manage the issue.

Optimal timing

The project, led by Professor Alain Zemkoho, alongside colleague Professor Julian Wharton from the School of Mechanical Engineering, is focused on enabling Carisbrooke to further optimise the management of hull biofouling across its fleet. Its anticipated aims are to enable Carisbrooke to reduce the costs of biofouling, as well as to reduce marine environmental impact and emissions via reduced fuel consumption.

Carisbrooke Shipping Ltd is a well-established UK shipowner and ship management company

based in Cowes, Isle of Wight, since 1969.

Their fleet of 20+ general cargo vessels trade internationally, from domestic and short-sea voyages around the UK, Mediterranean and Baltic, to deep-sea passages.

As biofouling builds up naturally, it has a negative effect on the ship by increasing the drag: hull performance deteriorates, and fuel consumption grows substantially, increasing costs and contributing to emissions.

“You can’t stop the process of biofouling” said Alain. “Shipping companies are required

by environmental regulations to manage it, and they do that by periodically having their fleets cleaned. But this process costs money, and you lose income every time a vessel is out of action. So, the question is: when is the optimal time for that cleaning to happen?”

Alain’s area of research is optimisation, where mathematical tools can be applied to aid decision making. “Optimisation is about getting better outcomes,” he said. “For example, if you run a company and you want to minimise costs, you can gather data about what you’re spending and where you’re making profit. We





Professor Alain Zemkoho



A vessel in Carisbrooke's fleet

could then build a mathematical model that, when you put the required data in, could tell you the best way to use your resources.

“What we are trying to do with Carisbrooke is build a machine learning model that uses data which informs biofouling build-up from their ships’ sensors – such as the fuel consumption – to identify the critical point for cleaning.”

Sustainable future

Alain has explored commercial collaborations over the course of his career, including developing an algorithm which predicted the buildup of foam in the biogas production process. It was this experience which led Southampton Marine and Maritime Institute (SMMI) to approach him for the partnership with Carisbrooke, which was initially funded by the SMMI and the National Biofilms Innovation Centre (NBIC). This phase focused on analysis of the vast amounts of ships’ historical voyage data provided by Carisbrooke, using mathematics, advanced artificial intelligence and machine learning techniques, in order to understand, predict and optimise biofouling management.

Alain worked with the University’s Technology Transfer and Intellectual Property team

(TT-IP, see page 8) within Research and Innovation Services to set up the evaluation license for this work, and to explore the shape that potential future commercialisation could take.

“Small to medium enterprises (SMEs) like Carisbrooke don’t have capacity for the sort of work we’re doing,” said Alain. With Carisbrooke providing real-life operational data and Alain’s team bringing data science expertise, the partnership has resulted in publishable research, as well as some promising indicators for Carisbrooke from the visualisation tool. “Our work so far has identified that more frequent cleaning would potentially have positive impacts such as reducing water pollution and the company’s fuel consumption.”

“It was impressive to see the amount of work and modelling expertise invested in this project,” said Carisbrooke’s Fleet Optimisation Centre project lead, Natalia Walker. “Carisbrooke are constantly on the lookout for innovative technology to ensure the sustainable future of our fleet on the path to maritime decarbonisation. We hope to see our partnership with the University of Southampton go from strength to strength.”

High potential

A further stage of the project, funded through the Engineering and Physical Sciences Research Council Impact Acceleration Account and running until February 2025, aims to develop the algorithm further to include the effects of biofouling interventions, and to enhance the tool’s usability and functionality. Alain said, “Currently you need to have data science or Python expertise in order to use it, but we want it to be accessible to shipping company staff, so we’re developing a user-friendly interface for the software. We also want to incorporate add-ons so that the tool can address issues beyond biofouling, such as monitoring fuel consumption.”

The enhanced user-friendly version of the software should be ready towards the end of spring 2025, when Alain hopes it can be adopted by Carisbrooke – and taken to a wider market.

“Our expectation is that there’s a high potential there for this sort of tool. We have a wrap-up workshop planned for the end of February where we’ll invite companies to a formal demonstration and hopefully generate some interest.”

“What we are trying to do with Carisbrooke is build a machine learning model that uses data which informs biofouling build-up from their ships’ sensors to identify the critical point for cleaning.”

Professor Alain Zemkoho



DRIVING INNOVATION FOR 50 YEARS

Run by Innovate UK (the government's innovation agency) since 1975, Knowledge Transfer Partnerships (KTPs) link forward-thinking businesses, with the world-class knowledge base of UK universities to deliver strategic innovation projects led by talented graduates.

Since the programme began, KTPs have helped around 12,000 businesses, not-for-profits, and public sector organisations to embed knowledge critical to the growth and performance of their business.

A KTP is a collaboration between a business, a university-based academic team, and a KTP Associate – a qualified recent graduate – who together work on a specific and strategic innovation project lasting one to three years.

Justin Lewis in the Business and Industry Partnerships Team (Research and Innovation Services) manages KTPs at the University of Southampton, with support from Faculty teams, Finance, and Human Resources. Kerrie Graham oversees the programme. She explained:

“Whether businesses are looking to accelerate product development, access new markets, increase productivity or embed the latest in management, marketing, or strategic expertise, a KTP really could help them realise their ambitions.

“We work with the business from initial idea and identification of our relevant capabilities and facilities, through the KTP application process to recruitment, and on to project delivery and completion.”

Spearfish Security Ltd hosted a Management KTP with the University, accessing expertise from Southampton Business School and the School of Electronics and Computer Science. Managing Director Dan Hooton said, “If you're trying something new and you want to

access cutting-edge academic research, then a KTP is for you.”

Innovation de-risked

Projects are up to 67% funded through an Innovate UK grant, helping to de-risk the innovation. An Innovate UK Knowledge Transfer Advisor supports each KTP. For the business, a KTP can be a gateway to further engagement with the University.

With around 300 KTP Associates recruited annually to lead change on strategic projects, KTPs offer graduates a unique career springboard. 70% of KTP Associates are offered employment by the host business post-project.

KTPs allow teaching and research staff to work with industry, applying the outcomes of their research to real-world business challenges. Partnerships bring income into the University and, on average, two research papers arise from each KTP.

“We currently have nine live KTPs, with a total value of around £1.8million, but we have a good pipeline of projects, and we're aiming to increase to 12 in the next year. We have ambitions to grow the programme much further in future,” said Kerrie.

“Whether businesses are looking to accelerate product development, access new markets, increase productivity or embed the latest in management, marketing, or strategic expertise, a KTP really could help them realise their ambitions.”

Kerrie Graham

Find out more about Knowledge Transfer Partnerships at:

www.southampton.ac.uk/business/develop-organisation/knowledge-transfer-partnerships

KTP CASE STUDY: SILVERSTREAM TECHNOLOGIES



Stephen Potts

Silverstream Technologies is a market-leading maritime clean technology company, specialising in hull air lubrication. Their Silverstream® System creates a carpet of microbubbles on a vessel's hull, significantly reducing fuel consumption and associated emissions.

In 2019, Silverstream and the University of Southampton collaborated, via a KTP, to advance the application of data analytics and artificial intelligence within Silverstream's technology.

"We had a clear vision and wanted to build a roadmap to bring it to life," said Stephen Potts, Silverstream's Chief Strategy Officer. The University suggested a KTP.

Guided by academic supervisors Professor Adam Sobey and Professor Dominic Hudson (Civil, Maritime and Environmental Engineering) and supported by Justin Lewis, a successful KTP application followed, resulting in the recruitment of KTP Associate Josef Camilleri.

The academic team, who have previously developed AI and machine learning for the maritime industry, worked alongside

Silverstream to provide technical expertise. "The good thing about a KTP is that you don't just get the KTP Associate, you also get the knowledge, research, and expertise that sit within a university," commented Josef.

"Was the KTP successful? Yes. Would I recommend it? Yes," said Stephen. "It helped us build a complete data analytics team from scratch. Working with the University of Southampton was a pleasure."

When the KTP ended the company employed Josef. Today, Silverstream has over 80 vessels in service, with more than 200 contracted to date. Silverstream's team of 26 data and vessel performance experts analyses 20 million data points each week, using AI and machine learning to continually enhance performance and efficiency.

Stephen commented that KTPs are well-suited to companies who "want to invest real understanding and time into a subject, to really pull out the expertise and perhaps do something in a very different way than you've done before."

"The key is, talk to the University, see what's possible."

Wake from a vessel fitted with the Silverstream® System 2022



THE INNOVATION ECOSYSTEM

An aspiring founder at Southampton isn't alone when it comes to developing their business idea. For those considering spinning out, there is a whole ecosystem of support options at hand.

These include some of the teams within Research and Innovation Services, such as Technology Transfer and Intellectual Property (see page 8) and Business and Industry Partnerships (see page 16). Then there are the incubators and accelerators which can help a would-be entrepreneur get their idea off the ground. “‘Incubator’ describes a wrap-around service which potential founders might engage with at an early stage,” said Head of the TT-IP team David Woolley. As part of the journey to innovation, his team can help direct researchers to the right service after intellectual property (IP) protection has been established. “They’ll work with a founder over a long period to build the best set of assets and determine the right timing for an idea to come to fruition.”

Accelerators often work with founders who may have already spent years fine-tuning their business proposition. “Accelerators are more aligned to fast delivery – we’re talking 3-6 months – and getting founders to the point of deal-readiness.”

“This ecosystem is the place where the world of outside experts meets our academic base and our students,” said Director of Enterprise and Knowledge Exchange Di Galpin. “What we do is create and harness those links so that any new company can access the right support and develop the right partnerships to help them succeed.”

“This ecosystem is the place where the world of outside experts meets our academic base and our students.”

Di Galpin



A student enterprise event at The Junction

STUDENT ENTERPRISE SUPPORT

“Student enterprise is a flagship activity at Southampton, and is part of what attracts students here,” said Di. The Student Enterprise team provides current students and recent graduates with the skills, funding, and support to set up their own businesses – whether they’re aiming to lead a social enterprise, work freelance, or launch a scalable startup. A survey of graduate outcomes 15 months after graduation found that taking part in Student Enterprise activities improved graduate prospects by at least 10%.




Monique Cleary

The Student Enterprise Junction, located in the heart of Southampton City Centre and managed by the Student Enterprise team, provides students and recent graduates with a dynamic space to explore business ideas and hone their entrepreneurial skills

There’s also the Successful Futures project, which has developed a skills model of the employability and enterprise skills needed by graduate recruiters. All degree programmes at the University have been mapped against the model, so that students know in advance which skills they will be developing during their degree, alongside their academic learning. This helps them to explore career ideas and plan their next steps.

Recent University success stories include Southampton student company Meta Futura Aerospace receiving prestigious awards in the Engineering in Business Champion of Champions grand final; and postgraduate student Monique Cleary winning the Black Women Talk Tech and Accenture pitch competition for her company addressing the lack of non-Caucasian images in podiatry materials.

 **Find out more at:**
thejunction.info

Continued on page 32 →



SOUTHAMPTON SCIENCE PARK

Southampton Science Park is the South of England's innovation hub. Set across 72 acres and currently home to 100 companies, the Science Park offers a wide range of commercial offices, laboratories, and meeting and conferencing facilities. It's the perfect environment for companies engaged in research, development, high-tech manufacturing, or services which directly support these sectors – making it the natural next move for many start-ups ready to take their first steps out of the University.

About 15% of the companies at the Park originate from the University, either as spin-outs or as the brainchild of academic staff.

The Science Park and the University enjoy close links, making it an attractive prospect for outside companies, who can benefit from access to leading scientific expertise and opportunities for graduate and postgraduate placements. "We're creating a flow of knowledge and understanding between the business world and our research base," said Di Galpin. "Science Park companies often employ University graduates – and they create jobs in the region, which is important for our Civic agenda."

 **Find out more at:**
www.science-park.co.uk

SCHOOL OF HEALTH ENTERPRISE AND INNOVATION

Based in Southampton Science Park, the School of Healthcare Enterprise and Innovation (formerly known as the Wessex Institute) in the Faculty of Medicine hosts several distinct but linked units and activities. Supporting knowledge exchange from academia to the real world and fostering business connections are at the heart of its work.

A variety of staff – including academics, clinicians, managers (many with a scientific background) and specialist research managers – use Knowledge Exchange and Enterprise to translate research into practical solutions for healthcare systems and services worldwide.

The School works closely with innovators, researchers and young people from across the region and internationally to change the landscape of knowledge exchange in healthcare. The School also collaborates with groups across MedTech innovation – from researchers and policymakers to industry and the public.

 **Find out more at:**
www.southampton.ac.uk/about/faculties-schools-departments/school-of-healthcare-enterprise-and-innovation

ENTERPRISE UNITS: BUSINESS ACTIVITY WITHIN THE UNIVERSITY

Enterprise Units occupy a unique position, operating as profit-making entities with their own staff and budgets while still sitting within the University. “We’re external-facing, undertaking consultancy and services to a broad range of industry customers,” said Professor Philip Warwick, Associate Dean of Enterprise for the School of Ocean and Earth Sciences (SOES). The Enterprise Unit which he heads up within SOES, GAU- Radioanalytical Laboratories, focuses on waste disposal in the nuclear industry.

There is no formal requirement for Faculties or Schools to have their own Enterprise Units. Instead, there is an organic development of the work which forms the basis of a Unit, as researchers’ interests intersect with industry needs. “[Units] stem out of particular academics or academic groups who have developed expertise and can see that there’s a route for commercialisation.”

So why form an Enterprise Unit, instead of spinning out? “There are clear benefits in terms of having the University support infrastructure,” said Philip. “We have the University brand, which obviously carries quite a lot of weight. And we don’t have shareholders, so we can use any surplus to support University activities.”

The benefits go both ways. “Enterprise Units are important to the University because they enable the elements of our triple helix activity to coexist. Beyond income generation, Enterprise Units are a key contributor of impact case studies for the Research Excellence Framework (REF), and they’re a route to external engagement. We have very strong links with our partners and that can have massive benefits in terms of reputation and developing strategic links with industry.”

“Enterprise Units are a key contributor of impact case studies for the Research Excellence Framework (REF), and they’re a route to external engagement. We have very strong links with our partners and that can have massive benefits in terms of reputation and developing strategic links with industry.”

Professor Philip Warwick

FUTURE WORLDS

The University’s on-campus start-up accelerator, Future Worlds, aims to help the next generation of aspiring founders change the world with their ideas. As well as inspiring staff and students through events and workshops, Future Worlds helps accelerate the development of ideas into successful start-ups, through space, access to funding, and a network of mentors.

“It’s a really good environment to have a rigorous grounding from lots of external experts,” said David. This helpful outside perspective comes from solicitors, IP attorneys, accountants, sector experts, former founders and others. “That’s an invaluable package of advice and experience.”

Each Future Worlds cohort begins with a two-day bootcamp, from which successful participants can continue to the full six-month programme. Highlights include a trip to San Francisco, where founders are plugged directly into the world’s most important startup ecosystem; and the Demo Day in London, where founders pitch to a network of multi-millionaire investors, mentors and corporate partners.

Since its inception in 2015, Future Worlds has helped hundreds of people at the University to explore start-ups – in the last four years alone, Future Worlds start-ups have raised more than £55m. Success stories include ViridiCO₂, who also came through the ICURe programme (see pages 12 and 35); quantum hardware company Aquark Technologies; and Fourier Audio, whose sound design tools are set to revolutionise the live music experience.

“Future Worlds is developing a real profile not only in the UK, but globally,” said Di Galpin.

 **Find out more and apply for the next cohort at:**
futureworlds.com

The innovation ecosystem

SETsquared

SETsquared is a collaboration between the six research-led universities of Bath, Bristol, Cardiff, Exeter, Southampton and Surrey. As a world-leading business incubator, SETsquared provides a wide range of support programmes and investor relationships to help turn ideas into thriving businesses.

“SETsquared was put together in 2002 to support commercialisation of university research,” said Rosy Jones, delivery lead for the ICURe programme, run by SETsquared. Underpinned by Higher Education Innovation Funding (HEIF), the partnership has so far supported over 5,000 entrepreneurs helping them raise £5bn in investment, with an estimated economic impact of £15.7bn.

“What has developed is a peer relationship group where each institution gets the benefit of working with people from across the other partner universities,” said Rosy. “There’s a lot of power in the togetherness of the six institutions.”

The Partnership has recently received a major boost thanks to a new £300m investment vehicle with regional firm QantX. This will drive the creation and growth of science and technology companies, helping address imbalances in spin-out equity funding in the SETsquared region compared to the ‘Golden Triangle’ (between Cambridge, London and Oxford).

Programmes run by the central SETsquared team include ICURe (see right) and IMPACT-IP, which aims to increase the impact of research through improving the commercialisation process; the programme

offers resources for research staff including training, templates and deal-readiness playbooks. IMPACT-IP also offers Commercialisation Fellowships and Entrepreneur in Residence opportunities.

Each SETsquared university has its own incubation unit, with Southampton’s based at the Science Park (see page 32). This unit runs the Catalyst programme, designed to help fast-track innovation-led businesses in the Solent region. This intensive programme runs over six months and offers the chance to learn from world-class business mentors, along with the opportunity to network with the Science Park’s innovation community.

The Science Park has recently announced a partnership with three of the South’s most exciting research organisations – Health Innovation Wessex, the National Oceanographic Centre and the University of Southampton’s School of Healthcare Enterprise and Innovation – to expand the Catalyst programme.

 **Find out more about the SETsquared partnership at:**
www.setsquared.co.uk

Express your interest in contributing to IMPACT-IP resources, or apply for Commercialisation Fellowships and Entrepreneur in Residence opportunities, at:
www.setsquared.co.uk/impact-ip

Apply for the Catalyst programme at:
www.science-park.co.uk/business-support/the-catalyst-programme



Above: Rosy Jones

Right: The SETsquared management board celebrates their new partnership with QantX



ICURe Explore

SETsquared delivers Innovate UK's flagship programme ICURe Explore. Originating in Southampton, this year it is celebrating its 10-year anniversary. This programme gives researchers up to £35K to spend twelve weeks investigating whether the market might be interested in their technology. The process is outward-looking: they must make contact with potential customers to gauge interest within their target industry.

"Most scientists will have an initial idea as to what their science will be used for, and quite often when they interact with the market, they realise they're wrong!" said Rosy Jones, delivery lead for the ICURe programme. "That's why *pivot* is such a significant word for entrepreneurs. The programme supports people in that pivot."

It might take between six and eighteen months for a potential business to spin out following ICURe Explore. Researchers can then opt to join a follow-up programme, ICURe Exploit, during which they write a detailed business plan and apply for up to £250K of Innovate UK funding.

There are also two pre-Explore programmes – Engage and Discover – which support researchers to take the first steps towards presenting their research in business terms.

"ICURe enabled me to devote my time to investigate how our research could address the real problems of the industry," said Professor Rob Maunder, founder and CTO of wireless technology spin-out Accelercomm. Rob began ICURe Explore in 2015, and credits

the programme with helping him secure funding from both Innovate UK and private investors – as well as laying a solid foundation for his business.

"The input that we received through ICURe from the many conversations with stakeholders helped us write a business plan, and when we look back at that plan eight years later, it's still relevant," he said. "The approach we're taking to the IP business model, the evolution of the roadmap, progressively adding more and more components until we got to the complete system – all of that is described in that business plan."

The investors and industry experts who advise ICURe cohorts gain benefits too, said Rosy. "They get to be the first to see new technology up-close. If they serve as a non-executive director, they may get the chance to become an executive director if the company spins out. Plus, they get to work with researchers, who are lovely people!"

"We have a number of different roles and panels that industry experts can ask us about if they're interested in getting involved."



Find out more about the ICURe programmes at:
www.icureprogramme.com

Investors and industry experts can express interest via:
icure@setsquared.co.uk



Above: Professor Rob Maunder

Right: The Accelercomm team



GROWING STRONG BONES

RENOVOS REVISITED

What might success look like, six years on from spinning out? For medical technology company Renovos, founded in 2017, it means meeting milestones on the long road to regulatory approval; gaining clinicians' official recognition of their technology's groundbreaking potential; and growing a team capable of taking the company into the future.

Renovos, which previously featured in Re:action in Spring 2021, has since gone from strength to strength. "In 2022 we filed our first patent as a company, which has now been granted in the US," said CEO Dr Agnieszka Janeczek, who co-founded Renovos alongside Southampton colleagues Professor Richard Oreffo and Professor Jonathan Dawson. This patent protects the composition of the company's synthetic nanoclay material, RENOVITE®, an injectable gel which supports bone healing. The nanoclay provides a slow, localised release of the biologic BMP-2 – a regenerative therapeutic agent – meaning that this potent drug can be given more effectively at lower doses, which is both cheaper and safer for the patient. RENOVITE® is set to be used in orthopaedic applications, including spinal fusion.

Road to regulation

Though RENOVITE® is still at the preclinical stage, its future couldn't look more promising. In 2023, international medical devices company Biocomposites announced equity investment; the company has also received funding from Innovate UK, and Agnieszka herself has been awarded a prestigious UKRI Future Leaders Fellowship to explore using the gel to deliver cell therapies. All of this is helping accelerate development.

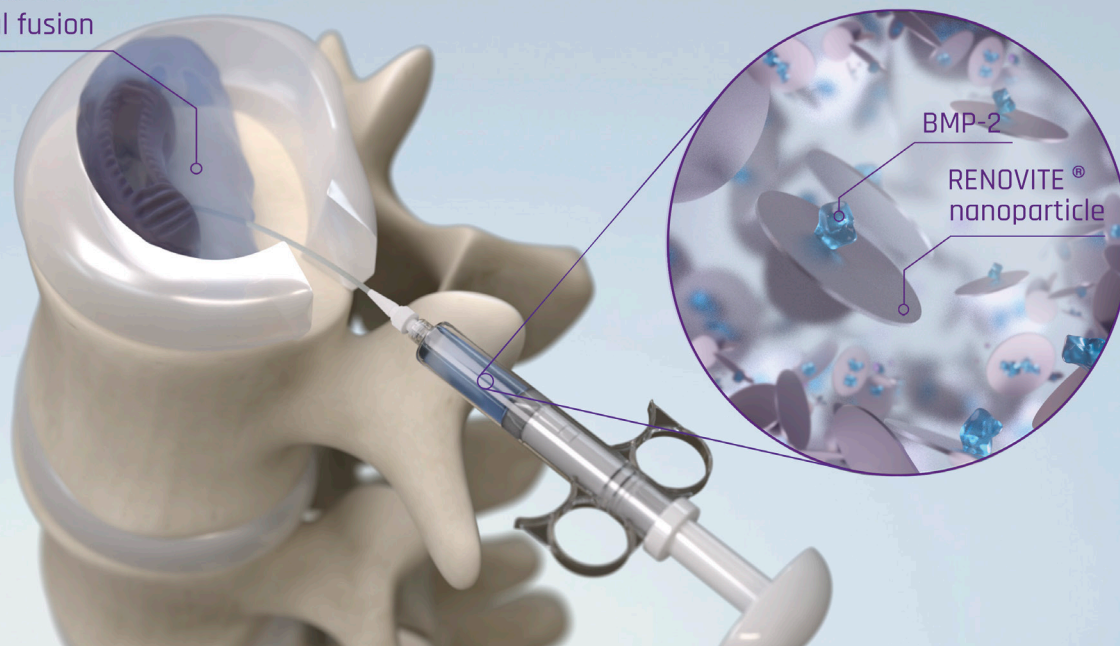
In 2024, the nanoclay material was awarded Best Technology in Spine by Orthopaedics This Week at the North American Spine Society Meeting, as well as receiving a Breakthrough Designation from the US Food and Drug Administration (FDA), a programme which



"The awards help hugely with our visibility, and with our outreach to clinicians. Even though we don't yet have a product that's ready for them to use in the clinic, we want their feedback, and to develop something they'll be happy using, from the product itself to the kit design and packaging."

Dr Agnieszka Janeczek

Controlled biologic
for safer, precise and
reliable spinal fusion



speeds up the development, assessment and review process for a select few new technologies with the potential to change patients' lives.

"The awards help hugely with our visibility, and with our outreach to clinicians," said Agnieszka. "Even though we don't yet have a product that's ready for them to use in the clinic, we want their feedback, and to develop something they'll be happy using, from the product itself to the kit design and packaging."

Despite the Breakthrough Designation there's still some way to go on the road to regulation. "Even though we've been looking at this technology for the last fifteen years, since the research began at the University of Southampton, there's still testing to be done on the biocompatibility and safety of the product before we can use it in humans. We've run multiple small animal models; the next year is key as we'll be doing a safety and efficacy study in a sheep model. Then in late 2025-2026, we'll be recruiting our first human patients."

The first clinical trial will take place in the US, where Renovos' first market will be. They then hope to expand into European and Asian markets with subsequent trials, ensuring the product will be available worldwide.

"Everything's coming together"

"The biggest difference since we last spoke to Re:action in 2021 is that we now have a growing team," reflected Agnieszka. Funding has enabled Renovos to take on new

technical staff, allowing Agnieszka herself to focus more on strategy and developing relationships – including searching out potential collaborators and partners in the areas where Renovos is hoping to expand, such as wound healing, antimicrobials, oncology and the dental market. When it comes to hiring, "technical skills matter, but fitting in with our business is maybe even more important. We want people we can trust to work towards our common goal."

Agnieszka, who came through the SETsquared ICURe and Southampton Science Park Catalyst programmes after her PhD (see page 34–35), still enjoys a close involvement with the technology where she can. "And on the flipside, I'm fortunate that many of the people I've hired from academic backgrounds are really keen on learning the commercial side."

Her own biggest learning curve has been "the regulatory aspects and just how much work – and paperwork! – it takes before a product can be put into humans, even for a clinical trial. Even with our product, which is delivering a biologic that's been used clinically for 21 years, much of the testing has to be repeated."

She credits her researchers and staff with bringing the technology through this long process to the point of commercialisation. "It takes a village – and now we're finally at the stage where everything's coming together. So I'm just really grateful to everyone who's contributed to Renovos over the years to enable us to be where we are right now."

Above: An illustration of Renovos' product at work

ENGINEERING ANTIBODIES TO OFFER HOPE

Shared scientific goals and trust are at the heart of an enduring and fruitful partnership between cancer immunologists, Professor Mark Cragg and Associate Professor Dr Ali Roghanian, and pharmaceutical company BioInvent International.

Mark and Ali, with their colleagues in the Antibody and Vaccine Group, are interested in generating antibody drugs that can be used to reprogramme the immune system to act against cancer cells. Their research is helping to explain the mechanisms via which cancers suppress the patient's natural immune system, and why they resist some cancer treatments.

The collaboration with BioInvent, which has spanned more than a decade, is helping Mark and Ali, along with Professors Stephen Beers and Sean Lim, to play a vital role in developing innovative new immunotherapy treatments. These could bring hope to end-stage cancer patients whose tumours have resisted other treatments.

Based at the University of Southampton's Centre for Cancer Immunology, the team specialises in developing monoclonal antibodies (mAbs), or antibody therapeutics, a type of immunotherapy.

Immunotherapy uses the body's own immune system to fight cancer by helping it to recognise and attack cancer cells. Monoclonal antibodies are proteins made in the lab that mimic the antibodies which occur naturally in the body to help it fight infection. These work in several ways. One way is by recognising specific proteins on cancer cells called 'receptors.'

Much of Mark and Ali's work with BioInvent is focused on a family of receptors called Fc receptors, which serve as a link between the antibodies and the immune cells.

Aiming at a common target

In 2010, the Southampton research group identified an 'inhibitory' Fc gamma receptor called FcγRIIB, on the surface of some tumour



cells, as the mechanism causing them to resist treatment with rituximab (the first mAb to be approved for cancer treatment). They showed that rituximab could be absorbed and removed from the tumour cell by the interaction with FcγRIIB, and blocking FcγRIIB with an antibody could prevent this.

Coincidentally, BioInvent, a clinical-stage company developing antibodies as potential new cancer drugs, was working on mAbs targeting the same receptor. They agreed to collaborate.

The Southampton group had patented an approach to overcome this resistance by blocking FcγRIIB. They licensed the patent to BioInvent and the two groups of scientists worked together to investigate whether "the same concept that we showed in mice also worked in humans," said Mark.

The antibody they developed, called BI-1206, blocks the detrimental effects of the inhibitory FcγRIIB and recruits immune cells toward the tumour. They found that this enhanced the anti-cancer effect of

therapeutic antibodies, such as rituximab, by stopping them being absorbed (and rendered ineffective) by the tumour cells.

Further work to develop the antibody into a therapeutic led to the first-in-human trials of BI-1206, to assess the maximum dose that could be given safely to humans alone and in combination with rituximab. The trials were led by Professor Andrew Davis (Cancer Sciences), funded by Blood Cancer UK and endorsed by Cancer Research UK.

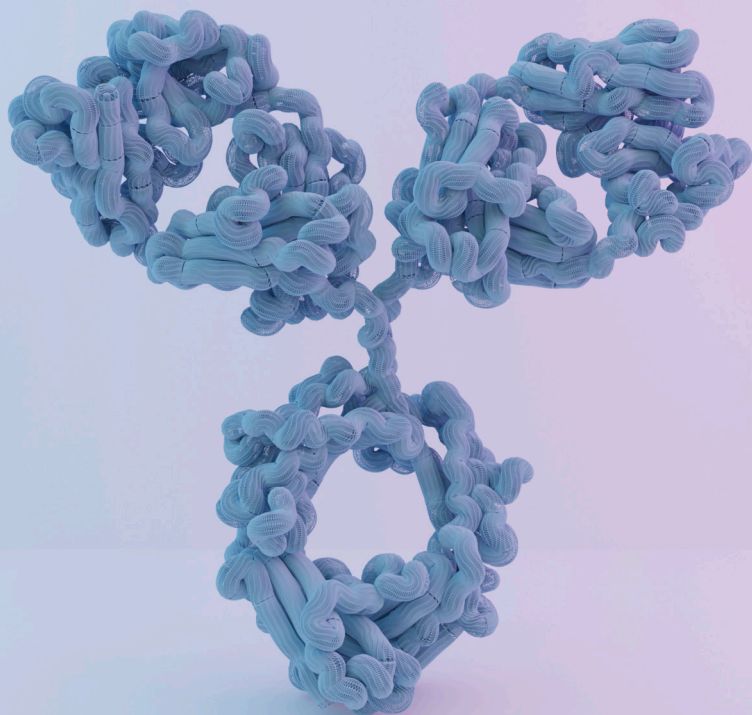
Clinical studies conducted by BioInvent have since evaluated BI-1206 in combination with rituximab for the treatment of Non-Hodgkin's Lymphoma, with encouraging results. "So far, several patients have been treated effectively using this combination of antibodies when previously they didn't respond to rituximab alone," said Ali. "For me, that's the ultimate achievement."

BI-1206 is now being developed for use in treatment for mantle cell and follicular lymphoma.

Antibody engineering

Since then, the partnership has developed a second antibody targeting the inhibitory FcγRIIB to improve the effectiveness of immunotherapy in the treatment of solid cancers.

Fc gamma receptors can be 'inhibitory' or 'activating.' Activating Fc gamma receptors play a key role in deleting tumour cells. Using genetic engineering, the team modified BI-1206 to create a new antibody, BI-1607, that "blocks the inhibitory FcγRIIB, but it doesn't engage the activating Fc gamma receptors," explained Mark.



Artistic representation of a therapeutic antibody generated by Dr Hayden Fisher using Blender.

Following lab testing, several clinical trials are underway to evaluate BI-1607 in combination with other types of antibody therapeutics.

In December 2023, encouraging early results from a first-in-human trial of BI-1607 combined with antibody therapy trastuzumab to target highly aggressive HER2+ advanced or metastatic solid tumours including breast cancer, were announced. Following the treatment, stable disease (tumours showing no progression) was observed in several patients whose tumours had previously grown after trastuzumab treatment. These results provided the basis for a Phase 2a trial that began in 2024.

Checkpoint blockers

As well as potentially enhancing the effects of tumour-targeting monoclonal antibodies like trastuzumab, since 2015 the partnership has investigated the potential of their antibodies in combination with a type of antibody immunotherapy called immune checkpoint blockers.

‘Checkpoint proteins’ found on T cells (a type of immune cell) regulate the immune system, acting as a brake to ensure that it does not attack healthy cells. Some cancers can activate this brake, sending an ‘inhibitory signal’ to turn off the T cells’ immune response, stopping them from attacking cancer cells as they should. Checkpoint blockers work by blocking this inhibitory signal, explained Mark.

A Phase 1/2a clinical trial is now underway to assess how the BI-1206 antibody might help reverse an important mechanism of

resistance to a checkpoint blocker called pembrolizumab. This could enhance anti-tumour immune responses in patients with solid tumours.

In July 2024, BioInvent announced a Phase 2 clinical trial, to evaluate BI-1607 in combination with two checkpoint blockers, ipilimumab and pembrolizumab, in patients with metastatic melanoma (cancers which spread from the original tumour to a new site in the body).

Scientific alignment

“I think this collaboration is unique in terms of how tightly the two teams interact,” commented Mark. BioInvent’s Chief Scientific Officer, Björn Frenhéus, visits frequently and the Southampton team meets regularly with BioInvent’s research team based in Sweden. Björn is now an honorary professor at Southampton.



Professor Ali Roghanian

“At BioInvent, we pioneer the development of novel antibody-based drugs for cancer treatment,” said Björn. “Our collaboration with the Antibody & Vaccine Group, with their cutting-edge understanding of therapeutic antibody mechanisms of action, has been central to our success. It provides a prime example of biotech and academia working together to bring novel medicines to cancer patients.”

Mark believes that “scientific alignment” is the key to the partnership’s success. “It helps to have people who are focused on translating research into treatments. It keeps you focused on the end goal.”

Over more than ten years the relationship has touched on multiple areas of research within the Centre for Cancer Immunology and generated 14 research papers, with four more on the way. The University and BioInvent have filed several patents for antibodies which may become new cancer therapies.

Collaboration with BioInvent has supported industrial CASE PhD studentships, postdoctoral positions, and technicians, as well as generating a multi-million-pound income for the University. It also gives the Southampton group access to BioInvent’s patented antibody-generating technology.

For Mark and Ali, the greatest value is in what it has enabled them to do.

“It gives us the capability of taking antibodies to clinical trial,” which, at an estimated £8-10million per new drug, is beyond most academic institutions, said Mark. For them, “the ideal scenario” is that one of their antibodies “turns into an approved drug – that’s the dream.”

HISTORY'S LESSONS, TODAY'S CHALLENGES

For many years historians have rejected the idea of learning lessons from the past, seeing what they term 'presentism' as applying present-day perspectives and values to historical events, which can result in distorted interpretations of the past. Recently, however, this view has begun to change, with many historians uncomfortable with History's self-imposed neutrality in the face of today's global challenges.

Dr Chris Fuller, Associate Professor in the University's History department, is one of them. A specialist in US foreign policy and counterterrorism, Chris has contributed historical evidence to the congressional hearings into the January 2020 assaults on the Capitol following the US election, and to work with the United Nations (UN).

The UN "wanted an 'applied history' approach to counterterrorism," Chris explained, "they were looking at how technologies such as

drones had evolved, what that meant they might do in future, and how they might be used by terrorists."

Chris saw the potential to offer a similar service to commercial partners.

Through a contact in the Sustainable and Social Finance Team of Barclays Bank, Chris knew that Barclays struggled to get public take-up of financial products aimed at encouraging adoption of domestic green

energy technologies, no matter the financial incentives.

In late 2023 he approached Barclays with the suggestion that historical examples of new technologies being introduced to the public could offer insights into how to manage the contemporary transition to clean energy.

The team at Barclays agreed to his proposal, so Chris turned to his colleagues,



Dr Chris Prior and Dr Charlotte Riley, both Associate Professors and British History specialists.

“The first example that came to mind was the UK’s transition from ‘town gas’ to ‘natural gas’ in the 1960s and ‘70s,” said Chris Prior. “It was nothing less than a revolution in how the UK got its power.

“The more we talked about it, the more we realised the usefulness of the parallels.”

The end of ‘town gas’

Between 1967 and 1978, newly discovered North Sea gas replaced ‘town gas’ (produced by heating coal in large gas plants) as the source of gas energy to British homes and industry. 35million domestic appliances were converted to take the new gas supply, across 13.5million households.

The largest gas conversion ever undertaken, this transition required significant investment, supportive legislation, mobilisation and training of a massive workforce, and the buy-in of the British public. Despite the scale and complexity of the operation, the project was delivered on time and under budget.

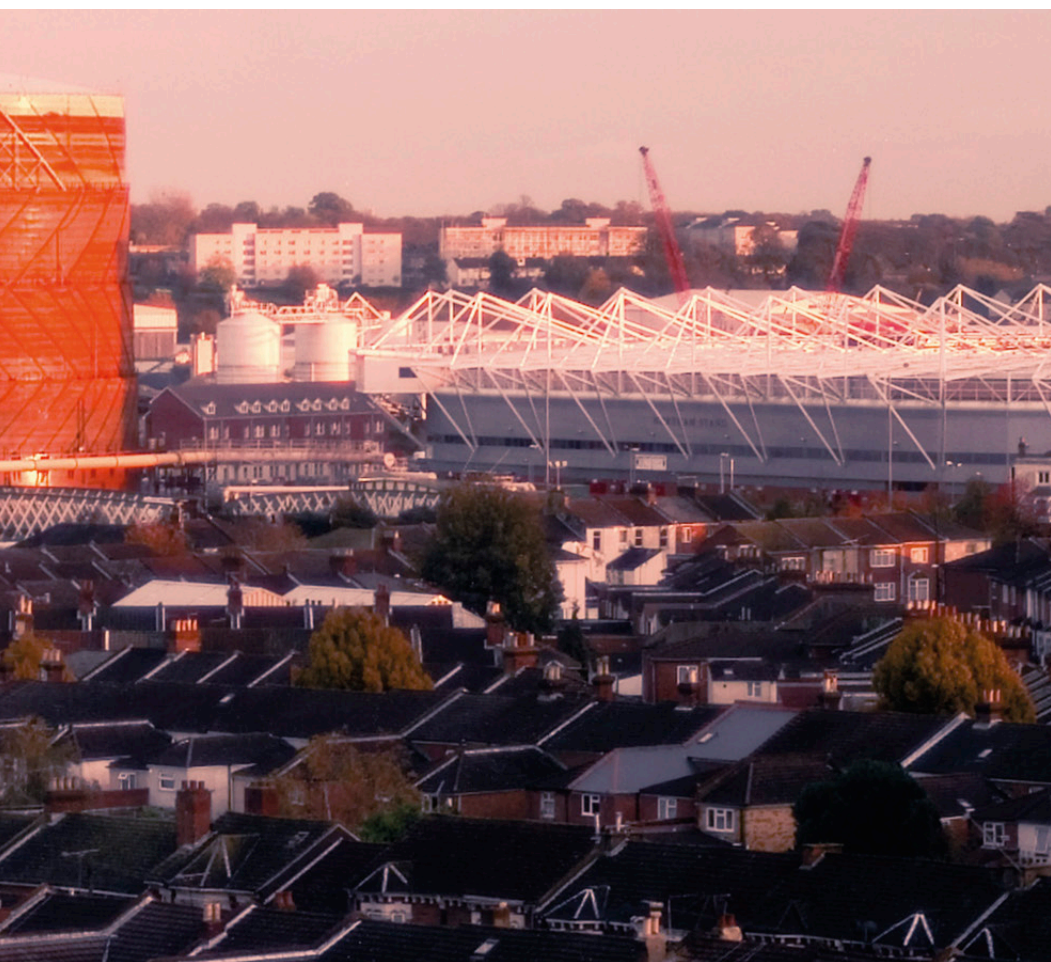
The team set out to understand how and why this happened, and what might be learnt from it that could be useful in bringing about a transition to clean energy in the present day.

Using the National Archives, the National Gas Museum in Warrington, and the Women’s Library at LSE, they investigated how the government, the Gas Council and the Area Gas Boards, which ran the nationalised gas system, sought to roll out the transition.

Continued on page 42 →



‘Mr Therm’, the mascot of the Gas Board at the time of the transition from town gas to natural gas



Between 1967 and 1978, newly discovered North Sea gas replaced ‘town gas’ (produced by heating coal in large gas plants) as the source of gas energy to British homes and industry. 35million domestic appliances were converted to take the new gas supply, across 13.5million households.

History's lessons, today's challenges



Left to right: Dr Chris Fuller, Dr Charlotte Riley and Dr Chris Prior

The resulting report for Barclays explained the context against which the transition occurred, the opportunities and challenges, and the process of conversion. It drew out the parallels: a transition to 'greener' technology; an unfavourable economic climate; a new government with a growth agenda. The report also pointed to the "profound differences between then and now," said Chris Prior.

The backdrop to the conversion was the political and economic turbulence of 1960s Britain. Harold Wilson's Labour government was struggling to fulfil its promise to harness 'the white heat of technology' to take the UK into a new future. The discovery of natural gas beneath the North Sea in 1965 offered a lifeline, and the government quickly agreed with the Gas Council to switch the national supply.

The economic potential and the possibility of 'permanently shifting [the UK's] dependence on foreign fuel supplies,' (as The Times put it in May 1965) was worth the estimated £400million cost. The change would also address public health concerns around polluting town gas.

Despite the lack of consumer choice (town gas would be switched off after conversion) "there was a significant effort put into convincing the British people — especially housewives — that the switch would be effective, and stress-free," said Charlotte. Engineers recruited to manage the switch were trained not only in how to convert appliances, but also in the interpersonal skills needed to go into people's homes.

A sustained, agile and well-funded PR effort avoided negative campaigning (such as the recent memory of deadly smog), focusing instead on safety, environmental benefits,

long-term economic gains, energy security and independence.

As the report points out, the transition from town gas to natural gas was sold on a forward-looking vision of Britain as a world-leader in new technology, embracing change and innovation.

"We laid out which mechanisms existed then that don't exist now," explained Chris Fuller. "That showed them where they need to create their own mechanisms to make this transition run smoothly."

The most notable difference being that the gas industry was nationalised in the 1960s and '70s, meaning that decision-making was centralised, and conversion was imposed by government on both industry and consumers.

The Barclays team shared the report with their counterparts at HSBC, who agreed to a proposal for "the banks to work together to essentially function like the National Gas Board did," said Chris Prior.

The report was presented to Barclays' CEO and used in a presentation by Barclays to Secretary of State for Energy and Net Zero, Ed Milliband. Ahead of the 2024 election Barclays' team wrote to every Labour MP, highlighting their party's role in this national energy revolution, with the aim of generating support for their proposed coalition of banks.

Applied History consultancy

The Barclays project helped the team to refine their ideas for an applied history consultancy unit.

Since producing the report, Chris Fuller has completed the first two stages of the ARC

Accelerator, which supports Social Sciences, Humanities and Arts researchers to develop their research into impactful ventures. The team has assessed and mapped History department expertise against contemporary issues where applied history could be valuable, and conducted a market scoping exercise.

Chris Fuller acknowledges the challenges of engaging in commercial activity alongside research and teaching, but says that the two can be mutually beneficial.


Chris Prior and Charlotte will produce peer-reviewed work using the Barclays project research, and the team believes consultancy work can add another dimension to teaching. The project is now a case study on the department's new MA Global Challenges: History, Policy and Practice.

"What we learned is that the credibility for this kind of work comes from being associated with a university," commented Chris Fuller. He is keen to encourage other University colleagues to consider if a historian could add value to their commercial partnerships.


An applied history consultancy promises to be a cost-effective form of income generation for the University. For commercial partners it offers a competitive alternative to engaging a large consultancy firm.

"There is nothing in this process where we have had to sacrifice our interests or our academic credentials," concluded Chris Prior. "One of the most gratifying things was Barclays' willingness to endorse the value of expertise and nuance. We were clear that our report would reflect the complexities and intricacies of historical research, and they understood that."

Charlotte added, "While lessons from history should be treated with caution, this highlights the need for historians to engage in research that speaks to contemporary issues, and to help to shape these conversations with accuracy and subtlety."

 **Find out more about the ARC Accelerator:**
www.arcaccelerator.io

This project received funding from the University's Knowledge Exchange and Enterprise (KEE) Ideas Lab.

An aerial photograph of a modern residential development. The houses are arranged in a grid-like pattern, each with a grey roof and a large solar panel array. The houses are white with grey accents. The streets are paved and have some parked cars. The overall scene is a well-planned, modern housing estate.

“While lessons from history should be treated with caution, this highlights the need for historians to engage in research that speaks to contemporary issues, and to help to shape these conversations with accuracy and subtlety.”

Dr Charlotte Riley

PLAYING THE INNOVATION GAME





Would you be surprised to learn that not flossing your teeth could increase your risk of developing dementia?

This is one of the lesser-known facts that players of a game of Snakes and Ladders for a Healthy Brain can discover. The game, developed by Professor Jessica Teeling (Biological Sciences) and Dr Sofia Michopoulou (Head of Nuclear Medicine Physics, University Hospital Southampton), uses play to improve public understanding of dementia risk factors.

Snakes and ladders

Around 1million people in the UK live with dementia, with this figure expected to rise to 1.6million by 2050. As we age, our risk of developing the condition increases. But, Jessica explained, “The recent landmark Lancet Commission report into dementia prevention, intervention, and care (Jill Livingston et al) showed that more than 45% of the risk factors for dementia are modifiable. That means you can do something about it.”

Nearly half of all dementia cases worldwide could be prevented or delayed by addressing risk factors such as smoking, high blood pressure, poor diet and inactivity. Many of the risk factors involve activation of our immune system which is consistent with scientists’ growing knowledge of the links between inflammation and dementia.

As Professor of Experimental Neuroimmunology, Jessica’s own research focuses on the role of the immune system in the onset and progression of neurodegenerative disease. Her research group investigates the contribution of bacterial infections, the oral and gut microbiome, and inflammation to conditions including Alzheimer’s and Parkinson’s disease.

The snakes and ladders game, complete with three-metre-by-three-metre board and giant foam dice, was designed to teach people about lifestyle choices that prevent (ladder) or increase (snake) the risk of dementia. As they play, a game host explains why certain factors accelerate the development of dementia, and the role played by the immune system in this process. Each player takes home a postcard-sized version of the game, with further information.

The team has taken the game to science and humanities festivals, dementia cafés and training events, Southampton’s Pride and Mela events, Eastleigh’s Unwrapped festival, and the Romsey Dementia Festival. The activity is also part of the Public Engagement with Research unit’s roadshow. The project was recognised with a Vice-Chancellor’s Award for Knowledge Exchange in 2023.

“The recent landmark Lancet Commission report into dementia prevention, intervention, and care (Jill Livingston et al) showed that more than 45% of the risk factors for dementia are modifiable. That means you can do something about it.”

Professor Jessica Teeling

Continued on page 46 →



Pin badges at Southampton Pride

“It’s a real attractor at public events,” said Jessica. “It’s very helpful for starting conversations.”

Evaluation following these events showed that 80% of participants changed their perception of the risk factors for dementia. The ones which most surprised people were, not flossing teeth, and hearing loss, both topics of research at the University.

Public engagement highlighted barriers in some communities, both to talking about dementia, and to taking part in some of the activities, such as exercise, that can help reduce the risk.

“At the Mela festival [which celebrates Southampton’s South Asian community], we had some wonderful conversations with younger participants, but it was harder to talk to some of the older people about dementia; you could see their unease,” commented Jessica.

“We particularly want to take the game to underrepresented communities such as the Asian, Black African and Caribbean communities, because they are at higher risk of developing dementia,” she said.

From awareness to action

Armed with this learning, the team agreed that follow-up was needed to turn awareness into action. Commercialisation Manager Chris Buckingham from the University’s Research and Innovation Services (RIS) suggested that commercialisation could help to make the project financially sustainable.

Jessica applied for the ARC Launch programme, which supports researchers from the social sciences, arts and humanities to develop entrepreneurial skills and test their ideas. As a biological scientist, the programme helped her to take a creative approach to developing follow-up activities, and to identify stakeholders and audiences.

“It’s about raising awareness of these risk factors at a stage of your life where you can contribute to better brain health.”

Professor Jessica Teeling

Having already shared the game with partners and the public, the team made the follow-up activities the focus for commercialisation and are exploring options aimed at people in mid-life. “It’s about raising awareness of these risk factors at a stage of your life where you can contribute to better brain health,” Jessica explained.

The commercial route “may be through a social enterprise, or by working with a charity to provide support, tools and educational materials based on our research,” she said. Ideas range from creating a series of exercise videos, to activities such as cooking classes to explain how the gut biome contributes to the risk of developing dementia. “We also want to bring in those elements of gamification, because we know that it breaks down barriers.”

The team is working with Southampton Voluntary Services, charities, and public health

experts, on ways to use the game and other resources to raise awareness of dementia risk factors. They are also exploring how to engage with healthcare providers and GPs.

Enterprising approach

This is not the first time that Jessica has taken the commercial route to translate her research into practical applications.

Following her PhD, she was part of a team at biotech company, Genmab, that developed a monoclonal antibody all the way from research to approval by the U.S. Food and Drug Administration. “As an academic, that’s been very helpful in terms of seeing the big picture,” commented Jessica.

Working with the Technology Transfer and Intellectual Property team in RIS, Jessica has recently prepared a patent application on engineered antibodies for the safe treatment of Alzheimer’s Disease.

Her enterprise capability feeds directly into student education. The School of Biological Sciences introduced a Bioscience and Business module at undergraduate level, something which has been well-received by employers. Taught by Jessica, students develop transferable skills and learn about the commercialisation process, and how to recognise commercial opportunities.

Researchers should start thinking about these opportunities early, said Jessica. “If you’ve found something interesting or innovative, disclose it as soon as possible; RIS can help you to identify if it’s truly innovative. If you’ve published, or talked about it at a conference, you may be too late to apply for a patent, because your work is in the public domain.”

Snakes and Ladders for a Healthy Brain received funding from the British Society for Immunology and the Higher Education Innovation Fund.



Professor Jessica Teeling and PhD student Juwairiyah Shazzad at the Southampton Arts and Humanities Festival 2024

PRESERVING OUR DIGITAL PASTS

From the 1990s onwards a seismic shift occurred in the way we communicate, organise, and record our lives. Email was replacing letters, the internet began to allow us to explore and research without opening a book, and documents were no longer stored in filing cabinets. The digital age had come into our work and home lives.

For the historians, archivists, curators, and researchers responsible for collecting, describing, and understanding our history, this flip from paper to digital offered a wealth of opportunities, and a new set of challenges.

Historian James Baker, University of Southampton Professor of Digital Humanities, has had a long-standing interest in digital preservation. His research, 'Legacies of Catalogue Descriptions and Curatorial Voice,' investigated the opportunities that extensive digital and digitised collections offer to scholars, and the challenges digital preservation represents for the cultural and heritage sector.

James is now set to launch Digital Preservation Southampton, a new venture from Southampton Digital Humanities, which will support the sector to develop new forms of digital preservation best practice.

The challenge of digital preservation

Digital preservation is the process of ensuring that digital information remains accessible and useable long term. It involves the active management and maintenance of digital materials beyond the limits of media failure or technological or organisational change, so that they can be accessed by future users.

Though many of the technical challenges of digital preservation have been solved, difficult

questions remain about what we collect and how we describe it.

"It concerns me that our cultural institutions are struggling to collect the contemporary world," said James.

"There are so many choices to be made. Do you preserve just the thing you would read on screen – so you could turn an email into a PDF – or do you preserve the email as an email? It's not the same as a letter: there are things about the digital file itself that you can investigate, not just the content.

"When it comes to more complex things like an author or scientist's personal papers – do you collect the whole personal computer and boot that up in future? Or do you just collect the individual files?"

Digital preservation is also raising questions about the way information about objects is recorded.

With contemporary archives of 'born digital' materials, there is sometimes an assumption that technical metadata can be used in place of cataloguing, explained James. But this is at odds with the traditional role of the cataloguer, who must take into account their institution's mission and the needs of different users when organising and describing collections.



Ammandeep Mahal



Laurisa Pabon



“It concerns me that our cultural institutions are struggling to collect the contemporary world.”

Professor James Baker



Professor James Baker

Through an AHRC IAA Fellowship, Amandeep is seconded to the University’s Technology Transfer team, developing commercialisation skills that should benefit both the project and the School. And James hopes that exposing students to more commercially-focused partnerships with external organisations will help prepare them for the culture and heritage sectors where commercial skills are increasingly valuable.

Organisations digitising historical collections must also pay attention to the role of cataloguing. For example, digitising legacy catalogues written in another age could result in prejudicial language being presented, out of line with the institution’s contemporary aims of engaging diverse publics.

James’s research underlined the fact that the GLAM sector – galleries, gardens, libraries, archives, and museums – often lacks the resource and capability to address the complexity of digital preservation. Subsequent market research identified a commercial opportunity to offer expert, targeted training, guidance, and support.

James secured Arts and Humanities Research Council (AHRC) funding for a ‘research commercialisation follow-on project’, Critical Cataloguing for Digital Preservation, which set out to embed his findings in a commercial solution. Along with Commercialisation Project Officer Joash Johnson, James engaged with the GLAM sector to further understand its digital preservation needs and refine the business model.

With a background in product commercialisation within tech companies, Joash also identified an opportunity to create an AI-based digital preservation assistant. The prototype, currently offered free to institutions, is designed to support individuals

charged with the sometimes lonely job of digital preservation within hard-pressed cultural and heritage institutions.

Digital Preservation Southampton

Digital Preservation Southampton is set for launch towards the end of 2024. The team, comprising James as academic lead, digital preservation training officer, Laurisa Pabon, and enterprise fellow, Ammandeep Mahal, sits within Southampton Digital Humanities, giving access to wider expertise and contacts.

They are identifying opportunities to respond to calls for tenders and grants for digital preservation projects, such as those put out by JISC (the UK digital, data and technology agency for education, research and innovation). Digital Preservation Southampton will also support or partner with cultural institutions submitting grant applications.

Bespoke training will be available to cultural and heritage institutions, as well as consultancy, offering guidance on developing workflows for digital preservation or policy, for example.

In addition to building capacity in the GLAM sector, James intends the new unit to boost enterprise and employability within the School of Humanities where, he said, thinking commercially “doesn’t always come naturally.”

James is cautious about taking a commercial proposition to a hard-pressed sector with which the University has long-established partnerships. “Recognising that these institutions are not wealthy,” his approach is to create supportive relationships which may, over time, provide pathways to commercial opportunities.

It’s a complex balance, he said, but “it is realistic for us to think about how some of the activities in Arts and Humanities could generate income.”

For James, income generation is an aim, but not the main purpose of Digital Preservation Southampton.

“These are important issues in sectors I care about,” he said. “If we can help shift the dial a bit, then I think we’ll have done good.”

 **Find out more about Critical Cataloguing for Digital Preservation:**

critcatdigipres.github.io

Visit Southampton Digital Humanities website:

www.southampton.ac.uk/research/institutes-centres/digital-humanities

Feature

THE MEXICAN PRACTICE SPARKING CRUCIAL CONVERSATIONS



Starting conversations about death hardly seems like the basis for a commercial venture. But in the right niche, even the most surprising project can have enterprise potential.

Dr Jane Lavery, Associate Professor in Latin American Studies in the School of Languages, Cultures and Linguistics in the Faculty of Arts and Humanities, is a leading expert in the Mexican *Day of the Dead*. “It’s a ritual that is celebrated annually in Mexico on the 1–2 November. It commemorates those who have died in a way that’s joyous but also respectful; it’s an intergenerational celebration where communities come together to make crafts and share stories.”

Jane’s research has led her to look at how the UK Mexican diaspora celebrates the *Day of the Dead*, and how, even though the practice ‘belongs’ to Mexicans, its themes and images resonate with different community groups – from the LGBTQ community to schoolchildren. This work has become even more pertinent in the aftermath of COVID-19, given the pandemic’s impact “on funerary and commemorative practices, and views about death more widely,” said Jane.

Taking the *Day of the Dead* into care homes has been particularly fruitful, leading to the development of a toolkit which could have a commercial future. “I spoke at a hospice conference two years ago, proposing that the *Day of the Dead* could be a platform for encouraging people to talk about death more openly, grief and commemoration, personal

wishes and potentially to encourage end-of-life planning. I was approached by a Client Liaison Manager from one of the UK’s leading care home chains, who said that they’d love to work with me to help tackle the cultural barrier that they sometimes face against people talking openly about death and dying, and preparing for end of life more broadly.”

Fostering conversations

Jane began a pilot with a care home in Hampshire in 2023, creating a toolkit which included talks, crafts linked to the mythology of the *Day of the Dead* – such as making marigolds and hummingbirds – and performances by Mexican artists. These activities are all aimed at fostering inter- and cross-generational conversations, as well as providing cultural enrichment and fostering a sense of wellbeing via community co-creation.

The toolkit’s development is informed by cross-disciplinary knowledge transfer and exchange, involving collaboration and co-production with Mexican and British artists and performers, charities, hospices, schools, care home professionals, and service users (residents, families and carers). The toolkit also aims to upskill in-house wellbeing managers and activities providers, equipping them to deliver the workshops confidently on their own.



“The *Day of the Dead* commemorates those who have died in a way that’s joyous but also respectful; it’s an intergenerational celebration where communities come together to make crafts and share stories.”

Dr Jane Lavery



Above and right: Care home residents’ commemorative *Day of the Dead* crafts

Continued on page 52 →

The Mexican practice sparking crucial conversations



Colores Mexicanos at a Southampton care home

After beginning the project, the Client Liaison Manager transferred to another care home in Dorset as part of the same chain, where Jane “delivered an even more ambitious package based on the feedback we’d received in the previous care home.”

This feedback, based on dozens of testimonials from service users, residents, families, staff, managers and artists, testifies to how the resources have helped to create a more empowered and empathic environment. “I think these activities will benefit all involved, sparking insightful and healing conversations,” said one carer. “Personally, I never talked about this topic with my children,” said a care home resident. “I have postponed these conversations for a long time, but now I think it is something everybody should discuss, and I will do so.”

For Jane, rolling out the workshops and overall toolkit more widely in British care homes would be an opportunity “to gather incredible data around the current dearth of research into questions of death, personal and end-of-life wishes and planning, and cultural enrichment provision in care homes. And to look at how *Day of the Dead* and

Mexican cultural studies can contribute positively to end-of-life, cultural enrichment and people-centred strategies, which are key to care homes’ Care Quality Commission (CQC) ratings.”

Considering commercialisation

This research dimension has helped secure grant funding for the work to-date, including support from the Southampton Institute for Arts and Humanities (SIAH) and the University’s Public Engagement with Research unit (PERu) and Impact Fund. But Chris Buckingham, Commercialisation Manager for the Faculty of Social Sciences, believes that the project might have a commercial future.

“I first saw Jane present at a PERu showcase, and I immediately thought, there’s potential here!” said Chris. “The resources tap into something so universal. We’ve all experienced death in the family. Imagine being able to have conversations about death, personal wishes and end-of-life in a supported way, and learning what your loved ones really want.”

Jane is interested in offering the resources via a charitable or social enterprise route, to ensure that the toolkit is available to care

homes across the financial spectrum. But this does not necessarily preclude a commercial model. Chris sees potential for free resources to act as a ‘shopfront’ for premium, paid-for content such as an app for care home managers, offering videos and workshop upskilling outlines which could be adapted for use in their own contexts.

For a wider free offering, Jane could opt for a Creative Commons (CC) license, ensuring that she and the University are credited wherever the resources are used; that no other party can make money from the materials; and that any changes or additions made by users are publicly available. (Any copyright held by Jane would be for the novel methodology used in care homes, not for the cultural practice itself.) A commercial model could then be the next step on the journey.

For Jane, whether she ultimately chooses a profit-generating route for her project or not, the most important thing is impact – and this is already apparent, even at the development stage. “The programme fosters a community of empathy and kindness. The care homes I have worked with have already said to me, ‘you have created a cultural shift.’”

RESEARCH AWARD HIGHLIGHTS

FACULTY OF ARTS AND HUMANITIES

Prof Lucy Blue; School of Humanities

MarEA (Endangered Maritime Archaeology in the MENA) Phase II
Arcadia Fund; £1,199,992 over 36 months

Dr Rachel Pistol; School of Humanities

EHRI-UK – The UK Holocaust Research Infrastructure
AHRC; Minimum of £1,050,000 over 57 months

Dr Heather Browning; School of Humanities

Measuring Animal Welfare
Open Philanthropy; £38,000 over 12 months

Dr Erin Johnson-Williams and Dr Benjamin Oliver; School of Humanities

AHRC MusicHub University of Southampton, Centre for Music Education and Social Justice
AHRC; £620,932 over 24 months

FACULTY OF ENGINEERING AND PHYSICAL SCIENCES

Prof William Powrie; School of Engineering

Health benefits of Low Carbon Transport
EPSRC; £5,499,445 over 60 months

Associate Prof Sergio Vernuccio; School of Chemistry and Chemical Engineering

Rational screening of carbocation scavengers to enhance lignocellulosic biomass valorisation
Royal Society; £12,000 over 24 months

Prof Hugh Lewis; School of Engineering

Space Environmental Modelling
UK Space Agency; £24,927 over 3 months

Dr Julie Herniman; School of Chemistry and Chemical Engineering

EPSRC Strategic Technical Platform
EPSRC; £38,682 over 36 months

Prof Simon Coles; School of Chemistry and Chemical Engineering

Rejuvenating the Crystal Sponge method
EPSRC; £990,969 over 36 months

Dr Yue Zhang; School of Engineering

Assessment of small-scale bioreactors and low-flow gas meters for hydrogenotrophic fermentation using a novel inoculum
BBSRC; £19,974 over 6 months

Prof Hywel Morgan; School of Electronics and Computer Science

Miniature and Multiparameter Sensor for Autonomy
Natural Environment Research Council (NERC); £14,167 over 18 months

Dr Ben Mills; Optoelectronics Research Centre

Hearing Light
EPSRC; £252,819 over 18 months

Prof Sumeet Mahajan; School of Chemistry and Chemical Engineering

Holistic Optical Biomarkers for Early Differential Dementia Diagnosis (HOPe)
UK Research and Innovation Cross Research Council;
£854,982 over 24 months

Prof Lindsay-Marie Armstrong; School of Engineering

Industrial Decarbonisation Research and Innovation Centre (IDRIC) – Frontiers Impact Report
EPSRC; £13,528 over 6 months

Prof Bharath Ganapathisubramani; School of Engineering

Flow Facilities with Refractive-Index-Matched Solution (FoRMS)
EPSRC; £2,249,596 over 36 months

Prof Bharath Ganapathisubramani; School of Engineering

An adaptive surface for improved modelling of rough wall turbulence
Australian Research Council; £14,807 over 24 months

Prof Edward Richardson; School of Engineering

Contrail assessment of future aircraft and propulsion systems
Natural Environment Research Council (NERC); £829,983 over 24 months

Prof Edward Richardson; School of Engineering

Ortho-Para Conversion of Hydrogen Demonstrator (OPCHD)
EPSRC; £95,681 over 6 months

Dr Chao Xu; School of Electronics and Computer Science

Affine Frequency Division Multiplexing for 6G Communications and Sensing
EPSRC; £76,528 over 9 months

Prof Goran Mashanovich; Optoelectronic Research Centre

Efficient silicon optical modulators
EPSRC; £1,232,371 over 36 months

Prof Ilya Kuprov; School of Chemistry and Chemical Engineering

Taming the algebraic instability of molecular conformation analysis
Leverhulme Trust; £275,426 over 48 months

Dr Yongqiang Liu; School of Engineering

Biofilm based immobilisation of strains for the production of succinic acid from lignocellulosic waste sugars
BBSRC; £47,753 over 9 months

Dr Ömer Gürdoğan; School of Physics and Astronomy

Cluster bootstrap beyond scattering amplitudes in N=4 super Yang-Mills
Royal Society; £20,000 over 12 months

Prof Diego Altamirano and Dr Ruican Ma; School of Physics and Astronomy

Exploring Black Hole X-ray Binaries: Bridging EP and Insight-HXMT through Southampton for Spectral and Timing Analysis
Royal Society; £278,046 over 24 months

Dr. João Mendonça; School of Physics and Astronomy

Horizon Europe – Foundation – Building Virtual Worlds that Follow Universal Laws of Physics
UKRI (Research England) – EU Horizon Guarantee Scheme;
£1,740,117 over 60 months

Dr Tasmiat Rahman; School of Electronics and Computer Science

Network Plus for Sustainable Solar Energy Systems Deployment (SESD)
EPSRC; £23,024 over 30 months

Dr Sergi Pallejà Cabré; School of Engineering

Aeroacoustics Of Novel Aircraft Architectures
Royal Academy of Engineering; £624,974 over 60 months

Dr Dimitra Georgiadou; School of Electronics and Computer Science

Teaming for Capacity Development and Synergies in Micro-nanofabrication and Flexible Electronics for Widespread Impact (TEAM-NANO)
European Commission; £1,318,059 over 72 months

Dr Patrick Ledingham; Optoelectronics Research Centre

Integrated Quantum Networks Research Hub
EPSRC; £274,745 over 60 months

Research award highlights

Prof Yannis Ieropoulos; School of Engineering

Horizon Europe- MET-C – Microbial Electrochemical Technology Commercialisation

European Commission; £96,074 over 12 months

Dr Silvia Genaro Motti; School of Physics and Astronomy

Resolving lattice dynamics in low-dimensional hybrid semiconductors
EPSRC; £349,863 over 36 months

Dr Silvia Genaro Motti; School of Physics and Astronomy

Determining the nature of excitons in hybrid low-dimensional semiconductors
Royal Society; £19,516 over 12 months

Dr Ysobel Baker; School of Chemistry and Chemical Engineering

Alternative approaches for oligonucleotide-based gene silencing
BBSRC; £411,300 over 36 months

Dr Gregory Perry; School of Chemistry and Chemical Engineering

Late Stage Carbon and Nitrogen Isotope Labelling
Royal Society; £20,000 over 12 months

Dr Jie Yuan; School of Engineering

Controlling limit cycle oscillations for complex aerospace systems using programmable synthetic shunt circuit absorbers
Royal Society; £20,000 over 12 months

Dr Nery Riquelme-Granada; School of Electronics and Computer Science

Reliable railway data summaries for enhanced decision support and productivity
Innovate UK; £50,000 over 6 months

Dr Chao Huang; School of Electronics and Computer Science

Cross-Layer Uncertainty-Aware Reinforcement Learning for Safe Autonomous Driving
EPSRC; £163,108 over 24 months

Dr William Waites; School of Electronics and Computer Science

Rule-based epidemic modelling
MRC; £386,249 over 24 months

FACULTY OF ENVIRONMENTAL AND LIFE SCIENCES

Prof Julian Leyland; School of Geography and Environmental Science

HIDDEN SAND: Holistic Investigation of the Distribution, Extraction, And Networks Associated With SAND
UK Research and Innovation; £936,611 over 24 months

Prof Emma Roe; School of Geography and Environmental Science

Jonas House: How things become food: Towards a theory of edibility
Leverhulme Trust; £93,369 over 36 months

Prof Emma Roe; School of Geography and Environmental Science

Confronting Antimicrobial Resistance in Malawian Poultry Farming: Policy and Practice Post – Pandemic
British Academy; £24,529 over 18 months

Prof Emma Roe; School of Geography and Environmental Science

Towards Resilient Industrial Socio-Metabolic relations
BBSRC; £1,375,521 over 36 months

Prof Alison Richardson; School of Health Sciences

NIHR Applied Research Collaboration Wessex – Knowledge Mobilisation Capacity Building
National Institute for Health and Care Research; £560,000 over 36 months

Prof Andrew Tatem; School of Geography and Environmental Science

Constructing high spatial resolution population projections and supporting the provision, access and updates of WorldPop spatial demographic datasets
Wellcome Trust; £5,601,734 over 84 months

Prof Maeve Lohan; School of Ocean and Earth Science

Iron and Manganese Impacts on the Future of Southern Ocean Ecosystems (Iron-Man)
Natural Environment Research Council (NERC); £1,050,587 over 48 months

Dr Attila Lazar; School of Geography and Environmental Science

GRID3 DRC Zero Dose Children
United Nations Office for Project Services; £604,715 over 18 months

Dr Natalia Tejedor Garavito; School of Geography and Environmental Science

Mapping zero-dose populations: conflict, remote rural, urban poor (Phase III)
GAVI, the Vaccine Alliance; £694,563 over 24 months

Dr Monica Sood; School of Psychology

Utilising Attachment-Based Experimental Research to Understand and Reduce Paranoia in the General Population and Clinical Groups
ESRC; £114,375 over 12 months

Dr Zoë Thomas; School of Geography and Environmental Science

The View from the South: New approaches for understanding mechanisms and impacts of climate tipping points
UK Research and Innovation; £1,598,135 over 48 months

Dr Ralph Gordon; School of Health Sciences

Skin tolerance to mechanical shearing at the heel: the role of temperature, moisture, and interface material properties.
The Physiological Society; £9,870 over 12 months

Dr Triana Amen; School of Biological Sciences

Molecular regulation of peroxisome formation and function in Peroxisome Biogenesis disorders
Wessex Medical Research; £18,124 over 24 months

Dr Kathryn Gunn; School of Ocean and Earth Science

SeisMix: Unlocking Ground-Breaking Observations Of Antarctic Mixing With Legacy Data
Advanced Research and Invention Agency (ARIA); £499,111 over 31 months

FACULTY OF MEDICINE

Prof Keith Godfrey; School of Human Development and Health

NIHR/461 NIHR Challenge contract
National Institute for Health and Care Research; £50,000 over 12 months

Prof David Baldwin; School of Clinical and Experimental Sciences

Home-based transcranial direct current stimulation in major depressive disorder: a multi-centre, two-parallel group, controlled, superiority randomised controlled trial
National Institute for Health and Care Research; £174,998 over 36 months

Prof Issy Reading; School of Primary Care, Population Sciences and Medical Education

NIHR Research Support Service National Collaborative Strategic Lead Function
National Institute for Health and Care Research; £88,210 over 63 months

Prof Delphine Boche; School of Clinical and Experimental Sciences

T-cell Response in Cerebral Amyloid Angiopathy-Related Inflammation
British Neuroathological Society; £4,953 over 18 months

Prof Jane Lucas; School of Clinical and Experimental Sciences
LifeArc National Translational Centre for Rare Respiratory Diseases
LifeArc; £403,430 over 60 months

Associate Professor Rami Salib; School of Clinical and Experimental Sciences
Intracellular bacteria – the trojan horse of chronic airway disease?
ENT UK; £1,500 over 48 months

Dr Carmen Jacob and Prof Ian Galea; School of Clinical and Experimental Sciences
Haemolysis in Multiple Sclerosis (HIMS) study
Wessex Medical Research; £20,000 over 24 months

Prof Ian Galea; School of Clinical and Experimental Sciences
Preclinical modelling of cerebral vasospasm
Kedrion Biopharma; £301,218 over 24 months

Mrs Louise Stanton; School of Cancer Sciences
MYC transactivation by neighbouring enhancer re-targeting in aggressive B-cell lymphoma
Blood Cancer UK; £20,698 over 36 months, part of a total award of £298,684 with the University of Cambridge

Mrs Louise Stanton; School of Cancer Sciences
Precision Prognostic Utility of MYC translocation in Aggressive B-cell lymphomas
Cancer Research UK; £19,005 over 36 months, part of a total award of £308,603 with the University of Cambridge

Prof Andy Davies; School of Cancer Sciences
Cost-effective multi-cancer early detection by measuring patient plasma amino acid cross sections with the Enlighten test
National Institute for Health and Care Research; £1,501,538 over 24 months

Dr Adam Dale; School of Clinical and Experimental Sciences
Utilising complementary human challenge studies to elucidate the immune-modulating effects of Neisseria commensals in virus-exacerbated asthma.
MRC; £21,802 over 12 months

Dr Jay Amin; School of Clinical and Experimental Sciences
Claire Gee Determining the subtype of cerebral T cells in dementia with Lewy bodies
British Neuropathological Society; £5,000 over 18 months

Dr Michael Head; School of Cancer Sciences
Emerging infectious diseases, and behaviours in high-risk areas in Ghana such as market places
UK Research and Innovation; £113,545 over 24 months, part of a total project award of £840,000 led by the University of Warwick

Dr Ka Ng; School of Clinical and Experimental Sciences
Using single cell RNA sequencing and proteomics to uncover novel immunotherapeutic targets for implantation disorders.
Wessex Medical Research; £19,973 over 24 months

Dr Hilda Hounkpatin; School of Primary Care, Population Sciences and Medical Education
Understanding the impact of single disease resolution in Multiple Long-Term Conditions (MLTC) on long-term trajectories towards hospitalisation and all-cause mortality: A cohort study
National Institute for Health and Care Research; £131,198 over 12 months

Dr Natalie Cox; School of Human Development and Health
A feasibility study to explore the relationships between modifiable influences and anorexia of ageing.
The Academy of Medical Sciences; £29,102 over 18 months

Dr Ben Gaastra; School of Clinical and Experimental Sciences
The sphingosine-1-phosphate signalling pathway and outcome after aneurysmal subarachnoid haemorrhage
Wessex Medical Research; £20,000 over 24 months

Dr Hannah Schiff; School of Clinical and Experimental Sciences
Integrating plasma proteomics with clinical phenotype to define diagnostic biomarkers of pulmonary tuberculosis
The Academy of Medical Sciences; £29,528 over 12 months

Dr Zoë Walters; School of Cancer Sciences
Harnessing The Immune Response in Paediatric Rhabdomyosarcoma
Children with Cancer UK; £329,067 over 36 months

Dr Zoë Walters; School of Cancer Sciences
Establishing novel models of SDH-deficient/Wild-type GIST for the testing of novel therapeutic strategies
GIST Cancer UK; £31,463 over 24 months

Dr Jodie Ackland; School of Clinical and Experimental Sciences
Epigenetic Insights in Difficult Asthma: The Impact of NTHi on DNA Methylation
Asthma and Lung UK; £98,718 over 15 months

Dr Colleen Deane; Human Development and Health
Using nutri-omics to identify mechanisms of muscle anabolic resistance to nutrition and exercise
The Physiological Society; £9,987 over 12 months

Mr Christopher Hurt; School of Cancer Sciences
ColoCap: determining the diagnostic accuracy of colon capsule endoscopy compared to standard colonoscopy in patients at risk of colorectal disease
National Institute for Health and Care Research; £90,461 over 42 months

FACULTY OF SOCIAL SCIENCES


Prof Christian Bokhove; Southampton Education School
Technology Use in Japanese and English Mathematics Education
The Daiwa Anglo-Japanese Foundation; £3,000 over 12 months

Dr Sarah Lewthwaite; Southampton Education School
Teaching Accessibility in the Digital Skill Set
UK Research and Innovation; £564,438 over 36 months

Dr Yi-Ling Lai; Southampton Business School
An investigation into the Fountain Centre organisational culture in cancer care
The Fountain Centre; £3,193 over 3 months

Prof Lisa Roberts; School of Health Sciences
The use of minimising language in musculoskeletal consultations
Musculoskeletal Association of Chartered Physiotherapists & Elsevier Research Award; £4,986 over 12 months

This list encompasses a selection of awards logged with University of Southampton Finance from May to August 2024 that are not considered commercially sensitive.

 **Find out more:**
www.southampton.ac.uk/ris

riscomms@soton.ac.uk
+44 (0)23 8052 3095

Research and Innovation Services (RIS) facilitates academic collaborations, research funding bids, industrial interactions and knowledge exchange activities, including commercialisation and business acceleration. RIS also supports research ethics and integrity, research contracting and the REF.



Please recycle this publication
when you have finished with it.