MTP Connect
MedTech and Pharma Growth Centre

bTb PROGRAM
Biomedical
TRANSLATION BRIDGE
PROGRAM

Progress and impact summary of new Australian therapies, technologies and medical devices supported by the BTB program (2019-2022)

August 2022

Contents

Australian Government
Department of Industry, Science and Resources
Industry Growth Centres

A MESSAGE FROM MTPCONNECT CEO

I am delighted to report that MTPConnect has completed all three funding rounds of the Biomedical Translation Bridge (BTB) program for the Medical Research Future Fund (MRFF) since it was launched in May 2019. With 19 of the 21 projects successfully completing the program in the two-year timeframe, all performance indicators have been met or exceeded.

MTPConnect developed the framework of the BTB program to nurture the translation of new therapies, technologies, and medical devices through to the proof-of-concept stage, with expert industry support and mentoring. The program also pivoted quickly in 2020 to offer a specific COVID-19 research funding round.

The BTB program was the first of its kind in Australia with industry mentors and commercialisation experts to nurture the next generation of health and medical research innovators. Through our program partners BioCurate, UniQuest and the Medical Device Partnering Program and education partners, the Bridge and BridgeTech programs, we created a unique Australian-wide initiative.

These partnerships provided continuous evaluation of the funded projects, project management, focused development plans and guidance through the commercialisation process.

The program allowed opportunities to access specialised industry expertise to de-risk and advance these projects. A key theme of the program is also the emphasis on ongoing partnership and collaboration between researchers and industry.

I would like to thank our venture partners for their dedication, enthusiasm, support and commitment in contributing to the success of our BTB program, and the projects it nurtured.

It is very pleasing to outline in this report the many successes these project teams have had – they're all developing the future of new medical products/technologies into commercial opportunities to drive better health outcomes and contribute to economic and jobs growth.

The last two years navigating COVID-19 lockdowns have been particularly challenging for many of these companies, so our congratulations to the project teams for their innovation, perseverance, entrepreneurial spirit, and resilience.

I'd like to thank all members of the BTB Steering Committee and our MTPConnect team of Dr Amelia Vom and Dr Andionne Parlade – and our inaugural BTB program team of Lauren Kelly and Danielle Shand.

Enjoy reading about these innovations, some of which are now launched as products in Australia and internationally.

Mr Stuart Dignam
Chief Executive Officer
MTPConnect

EXECUTIVE SUMMARY

The $22.3 million Biomedical Translation Bridge (BTB) program is an initiative of the Medical Research Future Fund (MRFF) delivered by MTPConnect to nurture the translation of new therapies, technologies and medical devices through to the proof-of-concept stage, with expert industry support and mentoring. The program provided funding of between $100,000 and $1 million to projects for up to two years to accelerate the development of their innovation.

The key objectives of the BTB program were to:

1. increase commercialisation focus in and provide opportunities from early-stage research through to proof-of-concept stage and beyond
2. nurture, de-risk and develop competitive ventures that are attractive for further funding opportunities
3. increase national commercialisation capabilities and skills by providing ventures access to expertise and established translational platforms
4. assist in the development of ventures in the areas of preventative interventions, cures and treatments for diseases that address health problems of national significance
5. promote Australia's international ranking as a leader in biotechnology and medical technology.

By bringing key organisations together, the BTB program formed an Australian-wide initiative with partners including BioCurate (joint venture between the University of Melbourne and Monash University), UniQuest (through QEDDI, the Queensland Emory Drug Discovery Initiative, a business unit of UniQuest, the commercialisation company of the University of Queensland) and Medical Device Partnering Program (MDPP, led by Flinders University). The BTB program's education partners, the Bridge and BridgeTech programs, coordinated by the Queensland University of Technology ensured hundreds of early career researchers gained the critical skills needed to translate and commercialise their research outputs.

The BTB program was launched in May 2019 with a series of information sessions conducted in capital cities and major regional centres around Australia, reaching 1,100 individuals to promote the program and engage with the sector ahead of calls for projects. An information session was also released as a podcast episode to broaden national reach and impact.

The program held three funding rounds:

Round 1, announced in December 2019, saw eight projects selected to share in funding of $5.7 million following a highly competitive application process. Additional industry contributions of $13.9 million were secured. The careful review and assessment process involved Venture Partners (BioCurate, UniQuest and MDPP), independent national and international research, industry and investment experts.

Round 2, opened in February 2020, received an overwhelming response to calls for expressions of interest (EOIs). Eight projects were selected to share $6.2 million and leveraged a further $9.8 million in matched industry contributions.

In May 2020 not long after COVID-19 was formally declared a pandemic by the World Health Organization, Round 3 opened, specifically targeting COVID-19 related projects with the need for rapid deployment. This round was designed to support medical devices and diagnostics research, prophylactic development – such as vaccines – and therapeutic approaches that could make an impact in 12 months or less.

MTPConnect worked with the Department of Health and Aged Care on the development and deployment of this tailored funding program to fast-track support for COVID-19 related research and translation, leveraging industry collaboration to maximise commercialisation and export potential.

Being able to pivot this BTB funding round so quickly to support Australia's pandemic response was testament to the effective design and governance framework of this funding program. MTPConnect mobilised resources across its organisation to support this crucial pivot for this unprecedented national health emergency.

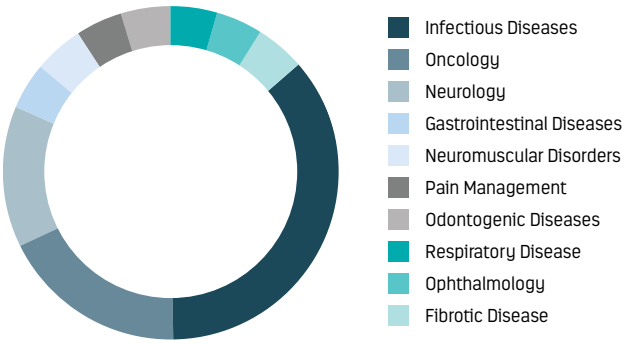
MTPConnect and the Minister for Health and Aged Care, announced the outcome of the COVID-19 funding round in September 2020, with five projects securing a total of $4.1 million and leveraging a further $12.5 million in matching contributions from industry.

Across the three rounds, 21 projects addressing clear unmet needs, priority indications or rare diseases were supported through the BTB program. Six projects were from university or medical research institutes and 15 from SMEs.

While Round 3 projects needed to achieve impact in 12 months, Round 1 and 2 projects had up to two years to deliver outcomes. And despite the significant challenges posed by the pandemic, all projects made steady progress and 85 per cent of projects successfully achieved their product development and commercialisation objectives set out at the beginning of their projects.

Of the $17.8 million in BTB funding from the MRFF, there was a fair split of 54 per cent and 46 per cent between therapeutic projects and medtech projects, respectively. Funding was varied across the states.

Therapeutic Indications



Over the 24-month period, it is important to acknowledge the resilience and perseverance of the sector as project teams were impacted by the COVID-19 pandemic in one way or another through:

- **Direct staff absenteeism** where team members contracted COVID-19 or were close contacts and had to isolate (seven projects impacted). For one project team, its premises were an exposure site and needed to close.
- **Key industry risks** such as hospital resource constraints delaying clinical studies, or constraints on collaborators delaying pre-clinical studies or independent validation studies (six projects impacted). In some cases, patient recruitment for clinical studies was challenging, with patients reluctant to participate in in-hospital studies.
- **Supply chain disruption** with air transport and freight disruptions, and higher costs stressing access to supplies/components – most projects were impacted.

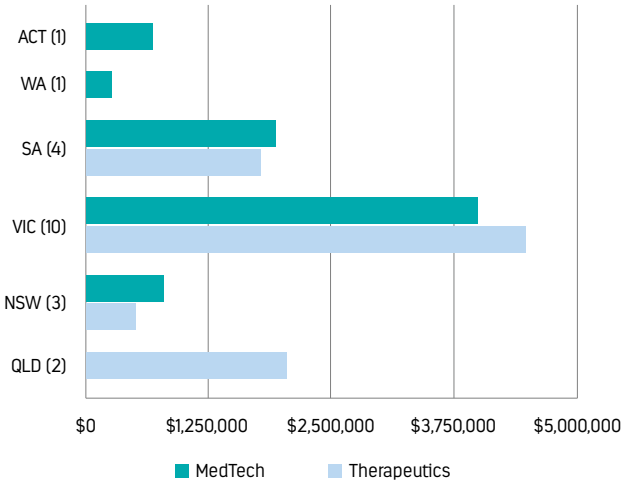
Two projects were terminated due to technical risk being realised. Unused funds were re-invested in the BTB program and made available to further support funded projects to accelerate their commercialisation strategies and outcomes.

The BTB program successfully achieved its key objective to "nurture, de-risk and develop competitive ventures that are attractive for further funding opportunities". Projects advanced through the BTB program, with regular mentoring, commercialisation advice and project management. Opportunities were given to project teams to participate in the Bridge and BridgeTech Program delivered by QUT, to enhance their commercialisation knowledge, skills, capabilities and build their network.

An in-depth commercialisation review was undertaken, facilitated by Venture Partners (BioCurate, UniQuest and MDPP) to tailor a program of value-add activities to support product development, market research/competitive intelligence analysis, intellectual property advice, business development support, regulatory support, consultancy services including technical experts, development and/or manufacturing support to de-risk, build and strengthen the commercialisation strategy and product position. A top up of $1.7 million of direct support went to project teams to address these specific challenges.

Through the $22.3 million BTB program, and with industry contributions and substantial amounts of external development capital raised, a total of $156.4 million has been injected in to the sector.

BTB awardees expenditure as reported at the end of the program per State (# of projects in parenthesis)



The BTB program has delivered real outcomes with 29 new technologies invented or progressed, seven new products launched, and 56 new jobs created.

New technologies invented or progressed	New patent, trademark applications and licenses	New products launched	New jobs created in project companies (years – direct and indirect)	Total sector investment into new companies (cash and in-kind)
29	47	7	56	$36.2M

As an outcome of the BTB program, notable achievements include:

- **AdAlta** established a partnership with Telix Pharmaceuticals to commercialise a radiolabelled AD-214 (RL-AD-214) for treatment of idiopathic pulmonary fibrosis that can effectively be monitored in pre-clinical and clinical imaging. In August 2020 the company raised $8.1 million to progress development of AD-214, and a further $3.75 million was secured in December 2021.
- **Cincera Therapeutics** developed a drug candidate that is safe and shows promising anti-fibrotic efficacy (for the liver, lungs and kidneys), as well as high selectivity against a large range of safety pharmacology targets. Data supporting the therapeutic benefits and safety of its drug candidate has enabled Cincera Therapeutics to secure an additional $2 million in funding from Brandon Biocatalyst under a Series A option.
- **Deep Brain Stimulation Technologies** has developed a "smart" human-grade bionic implant that treats the symptoms of Parkinson's disease and adaptively optimises the therapy dose, based on the patient's response. The device and other system components are now ready for manufacture and first use in humans in a Melbourne-based clinical trial. During the term of the BTB project, the company established a pathway to global commercialisation with a leading manufacturer and distributor of deep brain stimulation systems.
- **Dimerix's** lead drug candidate, DMX-200, selected for inclusion in the global REMAP-CAP trial as a possible treatment for acute respiratory distress syndrome (ARDS) associated with COVID-19, has been administered at 14 sites across the UK and the Netherlands and dosed 742 patients in the domain as at 25 January 2022. The company raised $24 million in September 2021 to fund multiple DMX-200 Phase III clinical programs.

- **Envision Sciences** developed a tissue biopsy test, using its combinatorial set of biomarkers that achieved above 95 per cent sensitivity and specificity in patient samples. This represents a huge step towards the development of a precision tissue biopsy test that outperforms the existing gold standard in accurately confirming prostate cancer diagnosis, as well as determining patient prognosis. Envision Sciences has partnered with a major global diagnostics company to facilitate the development of a Lab Developed Test (LDT) ready for clinical practice.
- **INOVIQ** successfully translated its proprietary SubB2M-based detection technology into an immunoassay format for the monitoring and detection of breast cancer, and this is now being further developed into a commercially viable assay format. In July and August 2021 INOVIQ raised a total of $18.4 million to fund the advancement of its breast, ovarian and prostate cancer diagnostic programs towards key development and commercialisation milestones.
- **LBT Innovations** automated the process of determining the antibiotic resistance or susceptibility of infectious bacteria cultured from clinical samples. This new technology can markedly improve efficiencies in pathology labs, enable timely and effective treatment of infectious diseases, and help to control the indiscriminate use of antimicrobials. The assessment module will be deployed for use on LBT Innovations' APAS Independence instrument manufactured by Planet Innovation in Melbourne.
- **MycRx** developed one of the most advanced small molecule inhibitors targeting Myc oncoprotein directly to treat oncology indications such as lung cancer. This high-quality data package has already attracted commercialisation, partnering and investment interest from international venture capital firms and transnational pharmaceutical companies, culminating in a successful Series A2 venture capital financing round in late 2021.
- **Starpharma** registered its anti-viral nasal spray Viraleze™ for sale in more than 30 countries, including in Europe and the UK. The product is available online in certain markets, making Starpharma the first ASX-listed biotech to bring a COVID-19 preventative product to the global retail market. Its application with the TGA for registration in Australia is ongoing and the company has also signed an exclusive sales and distribution agreement for Viraleze in the Middle East. Starpharma also raised $48.9 million to accelerate development of its dendrimer products including the nasal spray Viraleze.
- **UniQuest** identified a novel preclinical development candidate for the treatment of prostate cancer with a demonstrated on-target mechanism, and the project is positioned to enter preclinical development to compile a clinic-ready package to support first-in-human studies. Strong interest has prompted initial discussions with prospective partners.
- **University of Melbourne, Medihood McMonty** is listed as a medical device on the Australian Register of Therapeutic Goods (ARTG). It is currently used in more than 145 hospitals around Australia, including in regional centres, and is also enjoying early adoption overseas. The team secured a commercialisation and manufacturing partner, Evan Evans, and the patient isolation hood was the joint winner of the 'Workplace Health and Safety Solution of the Year' accolade at the WorkSafe Victoria Awards.
- **Vast Bioscience** demonstrated the versatility of its platform to develop three-dimensional (3D) small molecule inhibitors, achieving high specificity and selectivity in its candidate – a critical requirement in the development of safe and effective therapies for severe acute and chronic pain. Vast Bioscience's lead candidate outperformed competitor lead molecules in efficacy and safety data, securing more than $1 million in 2021 to further advance the product.
- **Vaxine's** COVID-19 vaccine candidate became the first Australian candidate to commence human Phase I safety trials.

Further details about the BTB program projects and the impact of the program are outlined in the following pages.

BTB PROGRAM VENTURE PARTNERS

A message from BioCurate

Linda Peterson
Chief Operating Officer
and Company Secretary,
BioCurate Pty Ltd

BioCurate is a collaborative venture, dedicated to delivering human health impact by helping to advance Australian research and innovation globally. Jointly formed by the University of Melbourne and Monash University, with support from the Victorian State Government, BioCurate was specifically created to invest in, manage and commercialise innovative Australian medical research. We provide a critical bridge between academia and industry by identifying promising research and accelerating its development for real-world clinical impact, while ensuring scientific and commercial rigour, toward maximising their potential to become commercially viable therapies.

The journey from a nascent biomedical technology to a viable product delivering clinical impact is long, high-risk, and costly; and requires a range of specialist expertise along the way.

The Program, delivered by MTPConnect, has provided the requisite skills, targeted funding, and industry best-practice to nurture the translation of new therapies, technologies, and medical devices through key go/no-go decision gates. This critical process has helped de-risk and develop ventures to the stage where they can attract further funding.

Working closely and intensively with MTPConnect, and Venture Partners (UniQuest, MDPP (Medical Device Partnering Program)) and the Bridge and BridgeTech Programs, we were collectively able to quickly establish the selection processes and systems to enable the first round of applications in mid-2019. This was enthusiastically received with many applications submitted. Since this auspicious start, the BTB Partners have successfully managed the $22.3 million MRFF-Program, delivering three high-quality funding rounds and assessing hundreds of projects across six states.

We offer our congratulations to the 21 BTB funded therapeutic and medtech projects for successfully completing their development activities and our ongoing encouragement to keep driving their projects forward. We also acknowledge all applicants to the BTB Program and trust that the review and feedback provided was informative, as they continue with their important work aimed at improving human health.

It has been an exceptional collaboration with MTPConnect and our fellow Venture Partners, and we acknowledge the commitment of the Australian Government for its overarching support of this initiative. The Program was very well subscribed and can proudly record several successful outcomes. By bringing together expertise and seeking applications from around the country, valuable insights were gained around the biomedical initiatives being undertaken nationally, providing a compelling opportunity in the future for leveraging skills and resources, and for wider collaboration.

A message from the Bridge and Bridgetech Programs, QUT

Distinguished Professor Lyn Griffiths
Director of the Bridge and BridgeTech
Programs, Queensland University
of Technology

Delivered by the Queensland University of Technology (QUT), The Bridge and BridgeTech Programs provide industry-led commercialisation training for researchers and entrepreneurs in the pharmaceutical and medtech sectors in partnership with key industry partners, Australian universities, sectoral representatives, and industry associations.

We have seen remarkable commercialisation journeys unfold thanks to the connections and collaborations established between Australian researchers and industry professionals taking part in the Bridge and BridgeTech Programs.

We are in a fortunate position at QUT to deliver the learning materials and events that offer the expert perspectives and networking opportunities participants need to progress on these journeys. But universities cannot do this alone. It is when connection between pharma and medtech companies, industry partners, researchers and innovators occur that real success within the sector is achieved.

The BTB Program has afforded this connection via its support of the Bridge and BridgeTech programs and, in doing so, has created networks that nurture and mentor the next generation of health and medical research innovators in Australia, which I am proud to be part of.

Congratulations to MTPConnect for your success in driving these and all of the crucial BTB Program initiatives.

A message from the Medical Device Partnering Program

Professor Karen Reynolds
Director,
Medical Device Partnering Program

The Medical Device Partnering Program, led by Flinders University, runs an ideas incubator driving entrepreneurial culture within the medtech sector. The Program fosters collaborations between researchers, industry, end-users, and government and develops novel medical devices with global market potential. It forms the essential links between clinical need and knowledge with technical expertise and industry know-how. MDPP is also a partner on the MRFF (Medical Research Future Fund) Targeted Translation Research Accelerator (TTRA) Program and the Researcher Exchange and Development within Industry (REDI) initiative with MTPConnect.

Many Australian universities, research institutes and companies have world-class technologies and should be congratulated for their resilience and bravery, as they attempt to commercialise their ideas on what – by international standards – would be considered shoe-string budgets.

With the input of the Australian Government's MRFF funding and MTPConnect's stewardship, the BTB program has been vital in assisting a select group of these organisations through various stages of the commercialisation process, by providing funding, expertise, and mentorship.

As Australia's longest running medtech innovation program, Medical Device Partnering Program (MDPP) has a 14-year history of working with hundreds of early stage medtech inventors, as they develop product ideas from proof of concept to early prototype stages. In delivering the BTB program, MDPP worked with other Venture Partners to mentor outstanding researchers and entrepreneurs through their various projects to more advanced stages of commercialisation.

The BTB Program projects were undertaken during the height of the COVID pandemic, creating specific challenges for each of the awardees. Clinical trials were often restricted, supply chains were disrupted, travel interstate and overseas was extremely limited, and hospitals and project collaborators were pulled into COVID-related activities. Companies had to overcome even greater obstacles to complete their projects.

It has been exciting and fulfilling to see the 21 BTB awardees develop their projects – some successfully through to market launch.

A message from UniQuest

Mark Ashton
Executive Director,
IP Commercialisation, Uniquest

UniQuest is the commercialisation company of The University of Queensland (UQ). In partnership with UQ researchers, UniQuest creates impact through the commercialisation of intellectual property. Established in 1984, UniQuest's commercialisation track record positions it as the leader of research commercialisation in Australasia.

As a strong advocate for the Commonwealth Government's desire to translate more research outcomes through commercialisation, UniQuest worked closely with MTPConnect to design the program and has been proud to be a pivotal BTB Venture Partner representing the therapeutic stream since the BTB program inception in 2019. With each progressive year seeing a deeper exchange of knowledge and know-how.

UniQuest's drug discovery incubator, the Queensland Emory Drug Discovery Initiative (QEDDI) – a team of industry trained medicinal chemists and drug discovery scientists, was able to provide significant input into the individual projects and mentor the applicants throughout the program. Importantly, even unsuccessful applicants received mentoring from UniQuest and its QEDDI team to improve their knowledge base and chances of success in translating their research.

The BTB Program award has been an invaluable experience for UniQuest's BTB Project Manager and Operational Committee representative, Cecile Francis. It provided a unique opportunity to bring Cecile's therapeutic and commercial backgrounds together and become actively engaged in the translation of health and medical research into commercial outcomes.

Congratulations to each of the teams awarded funding in the BTB program and the significant progress they've achieved in developing their projects and the support that UniQuest has been able to provide. Awardees shared their own journey and BTB experience, sharing best practices to contribute to a growing sector in many "value add" program activities, including webinars, symposium, workshops, podcasts, and case studies.

Finally, congratulations to the BTB Program team and MTPConnect for delivering a highly effective program that engaged closely with applicants and awardees; and selected the projects to be funded through a rigorous application and selection process. And thank you to all the other BTB partners – MDPP, BioCurate and QUT, with its education component (Bridge Program, BridgeTech Program), for the collaborative effort. This program has led the way for more like this to come, with translation at the forefront.

ROUND ONE

Pioneering i-body therapy to treat lung fibrosis

PROJECT:
AdAlta Ltd

THERAPEUTIC AREA:
Respiratory Disease

START DATE: 1 February 2020	TOTAL BTB GRANT: $985,166
END DATE: 30 June 2022	TOP-UP FUNDING: $115,000
STATUS: Completed	TOTAL BTB EXPENDITURE: $1,090,955
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $1,248,909
	TOTAL IN-KIND: $276,253
	TOTAL PROGRAM: $2,616,117

Jobs within project budget (FTEs dedicated to project)	Estimate 1 FTE and 3–5 partial FTE
New jobs created because of this project, at lead applicant and/or partners	1
Number of new technologies invented/progressed	1
Number of preclinical studies commenced	10

Idiopathic pulmonary fibrosis (IPF) is a rare, degenerative, and fatal disease with a global incidence of around 13 to 20 per 100,000 people.[1] In Australia, it's estimated there are 1,250 new diagnoses each year.[2]

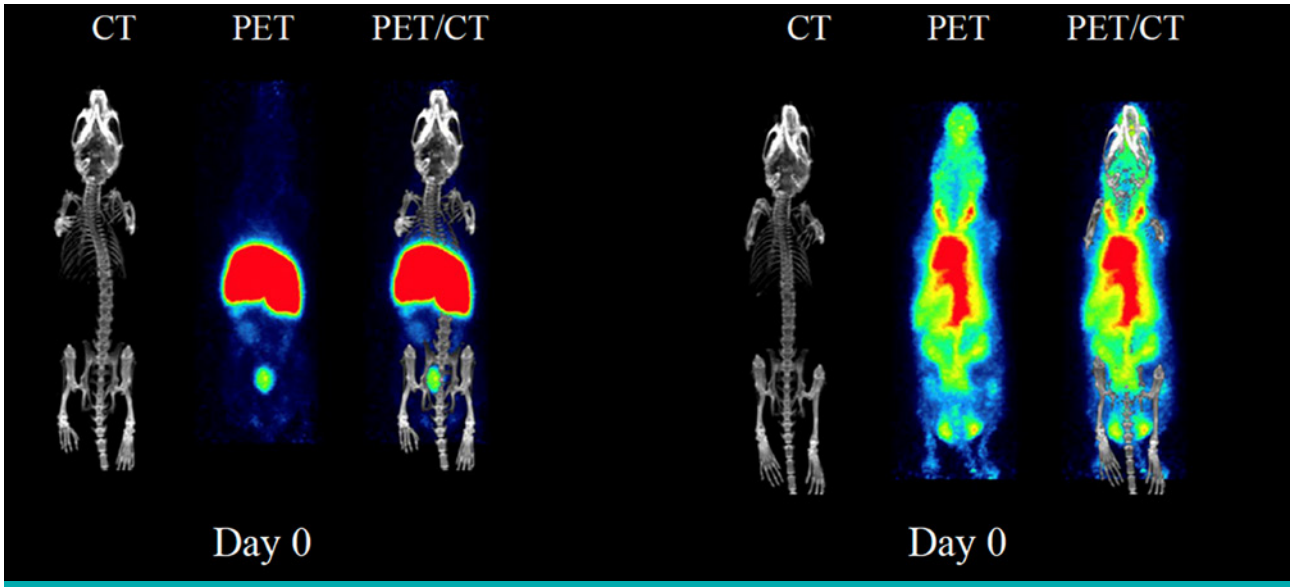
This progressive illness causes scar tissue to build up in the lungs, which reduces function and makes it difficult for patients to breathe.[3] Even with treatment, prognosis is very poor, with a median survival following diagnosis of less than four years.

Currently, there are two marketed products for IPF treatment: pirfenidone and nintedanib, which generate a combined global sales total of US$3 billion per year.[4] Despite differing modes of action, these therapies are deemed by respiratory clinicians to be equally effective, given that both slow the reduction of lung volume in patients. However, these compounds only delay disease progression; they are not curative and cannot halt or reverse the decline in lung function. Furthermore, both are accompanied by serious adverse side effects. Pirfenidone can trigger rash, nausea, and increased sensitivity to sunlight. Meanwhile, nintedanib also produces gastrointestinal side effects, including nausea and diarrhoea. Such side effects discourage continuous treatment, with some studies suggesting that as many as 50 per cent of patients are unable to tolerate the therapies for more than a year. Consequently, there is an unmet need for a therapeutic modality for IPF, with specific mechanisms of action and improved side-effect profiles. Several such products are currently in development.

Leading the charge in Australia, ASX-listed drug development company AdAlta Limited is using its proprietary i-body technology platform to generate a promising new class of protein therapeutics that have the potential to treat some of today's most challenging medical conditions. i-bodies mimic the shape and stability of a crucial antigen-binding domain, discovered initially in sharks, then developed as a human protein.[5] AdAlta's platform offers a range of benefits. Primarily, it enables highly specific binding to therapeutic targets. i-bodies are also one tenth the size of traditional monoclonal antibodies, which allows it to access complex targets, including important target classes such as G-protein-coupled receptors and ion channels that have previously been thought 'undruggable' by protein therapeutics.[5]

One target that AdAlta has been exploring with i-body technology is CXCR4: a membrane protein that has been shown to have increased expression in fibrotic tissue, including the lungs of IPF patients, but is low or absent in healthy lung tissue.[6] The modulation of this target is a viable new therapeutic approach for IPF, and AdAlta's lead drug candidate, AD-214, is the only product in development against CXCR4 for fibrotic diseases such as IPF.

AdAlta Ltd continued



One challenge of developing anti-CXCR4 therapeutics for fibrosis is the lack of a signal, or biomarker, that can be measured in patients to show that AD-214 has actually reached areas of fibrosis. To address this challenge, AdAlta established an extensive partnership to progress the development of the AD-214 i-body as an imaging reagent that will augment outcomes in early clinical trials involving IPF patients. The partnership brings together collaborators with diverse skill sets from The University of Melbourne, Monash University, Monash Biomedical Imaging, Monash Animal Research Platform, the Olivia Newton-John Cancer Research Institute and The Alfred Hospital.

In February 2020, AdAlta was awarded $985,000 in matched funding through Round 1 of the BTB program, and supported by BTB venture partner, UniQuest. The funds would be used to develop a radio-labelled form of AD-214 (RL-AD-214) for use in pre-clinical and clinical imaging. Through the program, AdAlta and its collaborators successfully developed and manufactured RL-AD-214 for PET imaging, demonstrated that the labelling procedure did not affect AD-214's ability to bind to CXCR4 and likewise collected PET images in mice, non-human primates and sheep.

Early studies during the BTB program identified a significant and unexpected clearance of intravenously administered AD-214 to the liver, rendering more than half the intravenous dose unavailable therapeutically. This led the research team to change tactics and develop an aerosol for inhalation to achieve direct lung delivery of AD-214. They successfully demonstrated AD-214 stability following mesh nebulisation of the current liquid formulation and commenced evaluation of formulations of AD-214 optimised for inhaled delivery. Several preclinical studies were then initiated to determine the local and systemic distribution of inhaled AD-214 in multiple animal models, its efficacy once in proximity to fibrotic lesions and to estimate potential effective doses in humans. These studies have already shown that nebulised AD-214 can reach the smallest airways of the lungs which are believed to be key to treating IPF.

New techniques have also been developed to complement PET imaging to further improve research translation. Monash University collaborators were also able to develop an *ex vivo* whole organ fluorescence imaging method, that can more rapidly probe gross tissue distribution of i-bodies than PET imaging. AdAlta likewise demonstrated an immunohistochemistry method that can determine tissue location of AD-214 and other i-bodies at a cellular level. Overall, the scientific results generated under the BTB project will be likely to support scientific publication of the AD-214 pre-clinical development results and the scientific techniques generated are anticipated to be integrated into AdAlta's drug discovery programs for other therapeutics.

Image: PET/CT images of radiolabelled AD-214 (left) and control i-body (right) in healthy mice. Findings showed unexpected clearance to the liver which allowed AdAlta to pivot to the development of a more effective inhaled formulation of AD-214. (AdAlta Ltd, collected at Olivia Newton-John Cancer Research Institute).

In December 2021, AdAlta was awarded an additional $115,000 in top-up funding. This enabled AdAlta to engage regulatory advisors to support development of regulatory strategies to ensure acceptability of the new inhalation route and formulation by the FDA, EMA and TGA. AdAlta were also able to engage an experienced market research firm based in the United States to support the positioning of an inhaled therapy for IPF in this major market.
A nebulised treatment for IPF is a concept well-received by clinical experts, especially considering that such a therapy would deliver treatment directly to the target organ, and thereby minimise the systemic side effects. This method is also expected to be more convenient for patients, and reduce the cost of treatment, compared to the intravenous route. Acceptable duration and frequency of administration were determined.

The key outcome of the program was positive impact that PET imaging with RL-AD-214 has had on AdAlta's development strategy. Prior focus had been on the intravenous route as the fastest and simplest pathway to market. However, imaging results suggested that the benefits of a more patient convenient inhalation route of administration were greater than expected – an important discovery that has substantially improved the product, as well as avoiding unnecessary patient exposure to AD-214 at doses that may not have been effective or commercially viable.

AD-214 is a groundbreaking first-in-class anti-fibrotic antibody. As it has already been shown to be well-tolerated when administered intravenously in Phase 1 clinical studies among healthy volunteers, development is now progressing towards a Phase 1/2a clinical trial via inhalation. AdAlta has partnered with Telix Pharmaceuticals and given the company the right of first refusal to commercialise RL-AD-214 as a diagnostic.

Given its positive outcomes to date, AD-214 is now being developed to treat a range of other fibrotic and inflammatory diseases; for example, the prevalence of lung fibrosis is expected to increase because of COVID-19 infection, prompting many clinicians to consider using anti-fibrotic therapies to minimise long-term side effects, and fibrosis is a major cause of blindness for patients with age related macular degeneration and a major complication of chronic kidney disease. The early development of inhaled AD-214 provides the opportunity to establish disease specific partnerships with the AD-214 product differentiated by route of administration – something not possible with an intravenous only product.

Clearly, the timing of AD-214's progression couldn't be better, and thanks to the support of the BTB program, AdAlta is now one step closer to delivering increased commercial and therapeutic benefits to multiple fibrotic conditions.

Dr Tim Oldham, CEO and Managing Director of AdAlta Ltd commented: "The BTB Grant has enabled AdAlta to learn more about AD-214 prior to expensive clinical trials than would have otherwise been possible, and these learnings have significantly improved the product design, patient convenience and the commercial potential of this asset. We have taken significant steps towards bringing a new therapy for IPF patients who desperately need better treatment options. We have integrated the new techniques into our research and they continue to inform our development strategies.

"We are enormously grateful to the Medical Research Future Fund, MTPConnect and UniQuest for supporting our work through the BTB program and to our collaborators at University of Melbourne, Monash University and Olivia Newton-John Cancer Research Institute whose expertise and collaboration has made this work possible."

Sources

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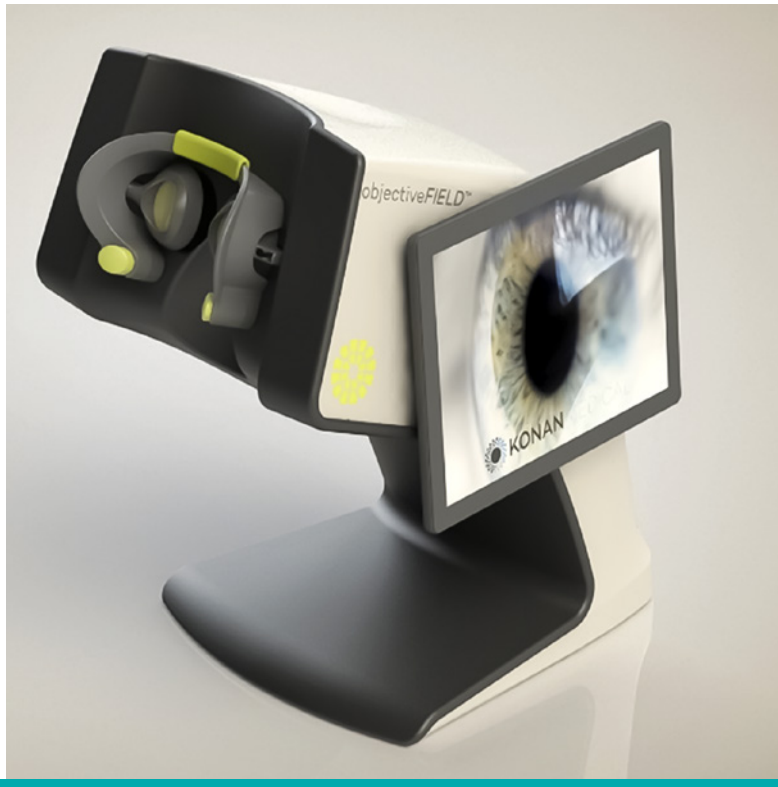
Rapid and objective testing for better management of ophthalmic and neurological diseases

PROJECT:
Australian National University

THERAPEUTIC AREA:
Neuro-ophthalmological Disease



START DATE: 1 February 2020	TOTAL BTB GRANT: $653,812
END DATE: 31 May 2022	TOP-UP FUNDING: $100,000
STATUS: Completed	TOTAL BTB EXPENDITURE: $680,819
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $595,526
	TOTAL IN-KIND: $4,321,143
	TOTAL PROGRAM: $5,597,489

Jobs within project budget (FTEs dedicated to project)	8
New jobs created because of this project, at lead applicant and/or partners	3
Number of new technologies invented/progressed	2
New patent applications resulting from this project (distinguish granted and provisional)	1
Number of preclinical studies commenced	2

Image: New desktop ObjectiveFIELD Analyser. Patient head-rest to top left. Operator touch screen on right.

Blindness and vision impairment are severely debilitating conditions that affect 2.2 billion people globally.[1]

One of the major causes of vision impairment is diabetic eye disease. In Australia, one million adults have diabetes, and about 60 per cent of them show signs of eye damage within 20 years of diagnosis.[2] Other common causes are glaucoma and age-related macular degeneration (AMD), each of which affect about two percent of Australians over the age of 50.[3] There are significant social and economic costs associated with vision loss; in Australia, the annual economic burden is estimated to be $16.6 billion, or $28,905 per person with vision loss aged over 40.[4] Currently, there are no cures – only ongoing management therapies that are delivered through drugs and/or surgery.

One of the challenges linked to the management of vision impairment is that tools for monitoring changes in function across the visual field are highly limited. Many eye and brain diseases benefit from maps of visual function being made of central or wider parts of the visual fields. Visual field mapping devices, known as perimeters, operate by patients pressing a button hundreds of times in response to stimuli that are presented slowly, one by one, to different parts of the visual field. This unreliable, time-consuming and subjective measurement technique means that about 10 percent of tests fail quality assurance criteria, and all these instruments have extremely poor reproducibility, interfering with the ability to determine disease progression.

A research team led by Professor Ted Maddess at the Australian National University (ANU) has been developing a ground-breaking, rapid, non-contact visual field device to address this unmet need in neurology and ophthalmology.

Professor Maddess and his colleagues have long been interested in formulating new multifocal methods of visual field assessment that can objectively generate visual field maps, thereby providing important information about the progression of a range of serious ophthalmic and neurological diseases. They have previously collaborated with Australian company Seeing Machines to develop the non-contact device that measures patients' pupillary responses to transiently expressed multifocal stimuli. Given that it is non-contact, this novel device removes the need for patients to press buttons, allowing for more objective and reproducible measurements.

ANU's commercial partner in this project, Konan Medical, is an experienced developer and distributor of innovative ophthalmic diagnostic devices. Its products are globally recognised by eye-care professionals, and more than 20,000 of its devices are used in 60 countries worldwide.

The initial device developed by ANU (now marketed by Konan Medical as the ObjectiveFIELD Analyser [OFA]) can perform tests in six to seven minutes, which is considerably faster than traditional perimeter devices. Yet Professor Maddess' research revealed that testing times could be reduced even further, given that many eye and brain disorders do not need the level of spatial detail generated by the original OFA tests. Having fewer regions to test means less data needs to be collected, and tests can be completed in as little as 80 seconds.

To advance its new tests, the ANU team was awarded $654,000 in matched funding through Round 1 of the BTB program, supported in its work by BTB venture partner, the Medical Device Partnering Program (MDPP). The project team set out to assess four new and promising 80-second non-contact tests in six major diseases: Alzheimer's disease, glaucoma, concussion, type 1 diabetes, multiple sclerosis and epilepsy. If most of the stimuli met strict diagnostic power key performance indicators (KPIs), then the project would progress to the collection of large normative datasets for the successful tests. At the same time, several discoveries suggested that further improvements could be made to the analytical methods, to extract more accurate responses. Additionally, the project team planned to assist Konan Medical in the creation of new OFA desktop pre-production units, in addition to portable models, with the aim of expanding the market.

The project endeavoured to have three of the four 80-second tests pass the diagnostic performance benchmarks – all four were successful. These diagnostic measures are based on comparisons with age- and sex-matched normal control subjects. Measuring the area under receiver-operator (ROC) plots, the four tests showed ROC areas up to 95 per cent, well above the minimum criterion of 85 per cent, indicating strong diagnostic power.

Having received additional top-up funding of $100,000, the ANU team was able to further develop and evaluate new analytical methods, and to implement the analysis of new Alzheimer's and glaucoma tests in the device software. The team also gathered additional clinical data to identify new disease severity biomarkers for type 1 diabetes.

Prior to starting the BTB project, ANU had four patent families granted in up to six jurisdictions each: Australia, Canada, China, Japan, the US, and Europe. As an output of the BTB project, one additional patent application has been lodged and another is anticipated. The first application relates to new analytical methods, while the second relates to the specifics of Alzheimer's diagnosis.

The team's work is set to revolutionise the ophthalmic and neurological diagnostic field, with faster and more reliable tests enabling improvements to diagnosis and patient management.

"The new rapid tests could be a game changer in management of important eye and brain disorders," according to Professor Maddess. Aside from benefitting patient care immediately, the new tests facilitate faster clinical end points for drug trials, especially for earlier-stage disease. These faster tests, alongside tests that are tailored to retinal and neurological diseases beyond glaucoma, will create many new opportunities. Portable units and features not available on standard perimeters (like regional response delays or asymmetries between eyes) are set to expand the market from today's annual total of US$275 million, which is mainly directed at glaucoma.[5]

Beyond this, ANU's testing devices could potentially be developed for application in other settings, to enable longitudinal monitoring of various chronic diseases.

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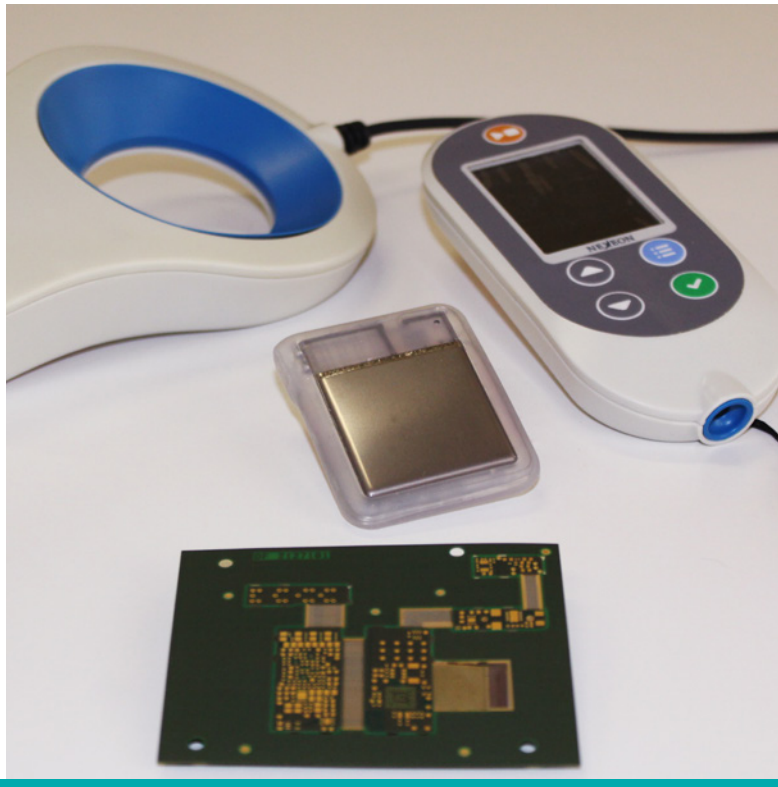
Innovative device set to improve treatment for Parkinson's disease



PROJECT:
Deep Brain Stimulation Technologies Pty Ltd (DBS Tech)

THERAPEUTIC AREA:
Neurologic Diseases

DBS TECH

START DATE: 1 February 2020	TOTAL BTB GRANT: $1,000,000
END DATE: 30 June 2022	TOP UP FUNDING: $100,000
STATUS: Completed	TOTAL BTB EXPENDITURE: $1,064,063
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $1,615,402
	TOTAL IN-KIND: $348,003
	TOTAL PROGRAM: $3,027,468

Jobs within project budget (FTEs dedicated to project)	4
New jobs created because of this project, at lead applicant and/or partners	1
Number of new technologies invented/progressed	1
New licenses resulting from this project	1

More than 10 million people worldwide are currently living with Parkinson's disease. In Australia, this degenerative neurological disorder affects 100,000 people, and 38 new cases emerge each day.[1] Around 20 per cent of patients are diagnosed before the age of 50, which understandably has a life-altering effect on the individual, but also contributes to lost economic productivity.[2]

Parkinson's disease is characterised by progressive and debilitating loss of control of movement, with symptoms including tremors, slowness, and muscle rigidity. Although helpful, medications do not adequately control motor symptoms in approximately 20 per cent of patients. These patients can be helped by Deep Brain Stimulation (DBS): an established electronic therapy that is delivered via electrodes implanted into the brain. Although DBS improves quality of life, conventional devices have limitations that diminish patient outcomes.

The main limitation of present day DBS systems is the fixed setting for stimulation, regardless of each patient's continually changing needs. Under-stimulation can increase motor symptoms, while over-stimulation can increase side effects, including cognitive-motor (e.g., speech) and psychiatric (e.g., depression) disturbances.

Image: Prototype ASTUTE deep brain stimulation system. Shown are the Printed Circuit Board Assembly (PCBA; front) that goes within the Implantable Pulse Generator (IPG; centre) at the heart of the system; the IPG is compatible with commercial DBS electrode leads. Also shown are the battery charger (back left) and remote control used to program the IPG (back right).
Credit: Paul Minty

Almost all users of conventional DBS systems require the settings to be adjusted frequently. These adjustments are performed manually by experienced clinicians approximately every two months; however, it is not feasible for clinicians to explore all available setting combinations during each adjustment, so the optimum benefit is often not achieved. Yet sometimes even a small change can suddenly liberate a patient from months or years of poor function.

One organisation that's making headway in this space is Deep Brain Stimulation Technologies Pty Ltd (DBS Tech) – a start-up company that was spun out of the Bionics Institute in late 2019. Professor Hugh McDermott, Chief Scientific Officer, and Dr Paul Minty, Chief Operations Officer, lead and manage the company's variety of research and development streams.

Seeded by private investment, the company was founded with the goal of improving the lives of people living with neurological disorders through agile research and development of innovative forms of electrical therapies, including the DBS therapy used for Parkinson's disease. DBS Tech is developing extensions to a break-through discovery made by the Bionics Institute of a novel brain signal. Known as Evoked Resonant Neural Activity (ERNA), this robust and reliable brain signal is evoked in the brain by DBS. The team's previous work showed that its properties change systematically as DBS efficacy increases – making it an ideal electric biomarker.

DBS Tech is now working to develop an innovative deep brain stimulation device called ASTUTE: Adaptive Stimulation Technique Upgrading Therapeutic Efficacy. This device will use the ERNA brain signal to adjust stimulation automatically: this adaptive feature, overcomes the limitations of conventional systems, reducing the need for adjustment visits and improving quality of life for people living with Parkinson's disease.

DBS Tech was awarded $1 million in matched funding during Round 1 of the BTB program, and was supported by venture partner, the Medical Device Partnering Program (MDPP), to help it produce the first prototype ASTUTE system for initial clinical trials. Project goals included the development of the implantable pulse generator (IPG) at the heart of the system – which can sense and respond to neural signals – as well as a battery charging device and an external programming device. DBS Tech successfully met all these milestones, with the design of the implant, battery charging unit and programming unit all translated to the manufacturer. These components are now ready for manufacture and implant into the first patients.

Thanks to the BTB funding award, DBS Tech gained new IP and knowledge from overseas; the team also enhanced its capability for future collaborations and clinical trials involving other brain disorders. The research version of the prototype ASTUTE device, which consists of a 'smart' human-grade bionic implant, will be attractive to other researchers and companies that are developing new active implantable medical devices. An additional top-up funding of $100,000 facilitated the preparation of safety documentation required for future clinical trials and regulatory submissions, and review of these documents by a specialist auditor to give assurance that the safety validation work is up to current standards.

The prototype ASTUTE deep brain stimulation device is set to be trialled in Melbourne, therefore benefitting Australians living with Parkinson's disease, as well as the local clinical trial sector. Ultimately, the main beneficiaries will be people living with the condition, who will be able to access a commercial product with DBS Tech's technology within the next five years.

DBS Tech has established a pathway to global commercialisation with a leading manufacturer and distributor of DBS systems. After commercialisation, the research and development team will be integrated into global supply chains for the ongoing enhancement of brain signal analysis and adaptive control algorithms for the commercial products. These products will be marketed by DBS Tech's global partner – paving the way for better treatment outcomes for people with Parkinson's disease all around the world.

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Targeting Myc to improve cancer treatment

PROJECT:
MycRx Pty Ltd

THERAPEUTIC AREA:
Oncology

MycRx

START DATE: 1 Feb 2020	TOTAL BTB GRANT: $900,000
END DATE: 30 June 2021	TOP-UP FUNDING: $121,000
STATUS: Completed	TOTAL BTB EXPENDITURE: $1,021,000
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $920,000
	TOTAL IN-KIND: $1,260,686
	TOTAL PROGRAM: $3,201,686

Jobs within project budget (FTEs dedicated to project)	10
New jobs created as a result of this project, at lead applicant and/or partners	2
New patent applications resulting from this project (distinguish granted and provisional)	4 provisional patents filed
Number of preclinical studies commenced	1

Cancer treatments are constantly diversifying and improving, yet many potential therapies remain untapped. One of the most elusive, yet important, therapeutic targets in cancer is the oncoprotein Myc: a protein that causes cancerous cells from a wide range of organs and tissues to divide uncontrollably.

The Myc protein orchestrates a range of cellular functions, including metabolism, cell death and the cell cycle. Its expression, transcribed from the MYC oncogene, is deregulated in many human cancers, including lung, cervix, breast, prostate, colon, bladder, pancreas, brain and stomach; it is also implicated in melanoma, as well as certain leukaemias and lymphomas. It's particularly prevalent in lung adenocarcinoma, where Myc amplification occurs in 31 percent of samples. Meanwhile, in laboratory studies, genetic deletion of Myc shows that lung cancer cells are strongly dependent on this protein for survival.

Despite the huge potential for Myc inhibitors to revolutionise cancer treatment, there are currently no approved drugs or small molecule drugs in clinical development that specifically serve this purpose. The market for such a treatment would be substantial – easily eclipsing that predicted for the recently approved kRas inhibitor Lumakras™, which only targets one particular kRas mutant, but is expected to gross US$4.5 billion by 2028.[1]

Image: Part of the MycRx team – Dr Alison Thistlethwaite, Operations Manager, and Dr Christopher Burns, Senior Vice President of Research and Development, in Melbourne. Photo Credit: Julian Dolman jules@juliandolman.com

Seeking to fill this void, early-stage drug development company MycRx is on a mission to advance first-in-class small molecule Myc inhibitors. Formed in 2013, the Melbourne-based team secured $4 million in Series A1 funding from the Medical Research Commercialisation Fund (MRCF) and CSIRO in 2015. The team was later awarded $900,000 in matched funding through Round 1 of MTPConnect's BTB program, through which it was also supported by BTB venture partner BioCurate.

At the initiation of the BTB funding period, MycRx had identified novel compounds with confirmed Myc inhibitor activity and tumour-growth inhibition in a mouse model of Burkitt lymphoma. The company had also developed a proprietary platform of assays and counter screens, which had reinforced the activity of its series of Myc inhibitors. Although these were promising leads, the properties of the frontrunner compounds required refinement and optimisation before they could be considered as potential candidates for clinical studies.

The primary goal of the BTB project was therefore to assist in the optimisation of the existing MycRx compounds to help create a safe and effective drug-like compound with potent and selective activity against Myc, which could be deployed in a range of state-of-the-art lung cancer models, with the ultimate goal of generating a dataset to support a candidate molecule progressing into formal preclinical studies for the treatment of various cancers, including lung cancer.

Supported by the BTB program, MycRx developed a selection of active Myc inhibitors with promising *pharmacokinetic* (PK) properties in rodents, including oral bioavailability. The team also spent significant time optimising biomarker readouts and in vivo models, enabling them to demonstrate that Myc-driven activity was driving efficacy in these models.

Through the project, MycRx was able to build a fulsome dataset demonstrating the compounds' activity in a panel of orthogonal assays, as well as mechanism-of-action data. This high-quality data package has already attracted commercialisation, partnering and investment interest from international venture capital firms and transnational pharmaceutical companies, culminating in a successful Series A2 venture capital financing round in late 2021.

In January 2022, additional top-up funding of $121,000 enabled MycRx to conduct work to strengthen MycRx's existing data package in the key areas of: *in vivo* pharmacodynamic readouts of compound efficacy and Myc inhibition; interactions of MycRx's small molecules with Myc protein constructs; and ADME-PK characterisation of MycRx's novel compounds. The data generated in each of these areas supplemented the work previously conducted by MycRx as part of the initial BTB project funding and added significant value to the data package compiled by MycRx to support the future fundraising and commercialisation activities of the company as it pursues the development of a Myc inhibitor for the treatment of cancer.

As Dr Chris Burns, MycRx's Senior Vice President of Research and Development, explained: "The research enabled through the BTB funding has allowed us to further progress our promising drug candidates to generate, with our collaborators, encouraging data showing the potential of these molecules in cancer treatment."

Excitingly, the BTB grant has prompted collaboration between MycRx and a number of research institutes and organisations, including the Peter MacCallum Cancer Centre, CSIRO, the Centre for Drug Candidate Optimisation (CDCO), Monash University, RMIT University and Griffith University.

According to Professor Ricky Johnstone, Executive Director of Cancer Research at the Peter MacCallum Cancer Centre, these collaborations have accelerated important advances in anti-cancer drug discovery.

"The research collaboration between MycRx and Peter Mac is strategically important, mutually beneficial and scientifically very exciting. For many years, drugging Myc has been great in theory, but almost impossible to achieve. We believe that our partnership with MycRx provides a great opportunity for us to finally achieve this aspirational goal," said Professor Johnstone.

To date, MycRx's work is to the company's knowledge among the most advanced in targeting Myc directly with small molecule drugs, placing it in a viable position to deliver a first-in-class drug that targets the Myc oncoprotein.

The critical role Myc deregulation plays in treating cancer would make such a drug hugely beneficial for patients that are presented with limited treatment options and/or a poor prognosis. While the team's initial work focuses on the drug's efficacy in treating lung cancer, if successful, it would have broad application in a large number of other cancers as well.

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Diagnosing IBS and other gut disorders with acoustic-sensing technology

PROJECT:
Noisy Guts Pty Ltd

THERAPEUTIC AREA:
Gastrointestinal Diseases

START DATE: March 2020	TOTAL BTB GRANT: $1,000,000
END DATE: March 2021	TOTAL BTB EXPENDITURE: $260,186
STATUS: Terminated	TOTAL CASH CO-CONTRIBUTION: $620,266
DELIVERABLES COMPLETED: 42%	TOTAL IN-KIND: $38,800
	TOTAL PROGRAM: $919,252

Jobs within project budget (FTEs dedicated to project)	3
New jobs created as a result of this project, at lead applicant and/or partners	3
Number of new technologies invented/progressed	2
New trademark applications resulting from this project	1
New patent applications resulting from this project (distinguish granted and provisional)	3
New licenses resulting from this project	1
Number of clinical trials commenced	3
Patients treated/diagnosed with new product/ technology/therapeutic	85

Termites and gastrointestinal disease aren't an obvious pairing; nevertheless, over the past few years, these destructive insects have provided the inspiration for pioneering research into bowel sound analysis.

Back in 2014, Nobel Laureate Professor Barry Marshall – an expert in gut health – was introduced to acoustic-sensing microphones that could detect the tiny sounds of munching termites. He decided to explore whether similar technology could be used to analyse peoples' abdomens, to identify the presence of gastrointestinal disorders.

Such technology had the potential to fulfil an unmet need for a cost-effective, non-invasive diagnostic tool for irritable bowel syndrome (IBS): a chronic and debilitating gut disorder that affects 11 percent of the world's population and around one in five Australians.[1] Despite the size and scale of the problem, positive diagnosis of IBS remains a challenge, with many doctors only able to diagnose the condition through a process of exclusion. Typically, GPs refer patients for a colonoscopy to rule out other disorders – a procedure that is costly, uncomfortable, carries risks and, frustratingly, doesn't even provide a positive diagnosis for IBS.

Image: The Noisy Guts Co-Founders:- CEO Dr Josephine Muir, Dr Mary Webberley and Professor Barry Marshall, Nobel Laureate 2005 & Director of UWA's Marshall Centre for Infectious Diseases, Research and Training in Perth.

Inspired by Professor Marshall's work, in 2019, Dr Josephine Muir and Dr Mary Webberley founded Noisy Guts: a medtech start-up that aims to empower and support people with chronic gut health issues. Having found a correlation between the gut noise patterns recorded by microphones and particular gastrointestinal disorders, the team developed a wearable 'acoustic belt' that would enable clinicians to accurately screen and diagnose gut disorders using artificially intelligent (AI) analysis. Worn around the abdomen, with four sensor heads held in place by a flexible and biocompatible harness, the device filters and transfers sounds to an accompanying recording unit. Data is then transferred wirelessly to either a desktop (for diagnosis) or mobile app (for monitoring) and then to a secure server for processing. Multiple sound features in the recording are analysed to provide a predictive index value for IBS, with the device's proof-of-concept study demonstrating 91 percent accuracy. The recordings can also be analysed to provide users with an overall gut wellness index, or to monitor symptoms.

At the end of 2019, Noisy Guts was awarded $1,000,000 in matched funding through Round 1 of MTPConnect's BTB program, which also provided access to training and mentorship from BTB venture partner the Medical Device Partnering Program (MDPP).

Hoping to register the acoustic belt as a regulatory compliant device with the Therapeutic Goods Administration (TGA), Noisy Guts planned to use the BTB funding to develop the device under the ISO13485 quality management system framework and to test the pilot device.

Work on the BTB project took place during the COVID-19 pandemic; as a result, the team faced a number of setbacks, including supply chain constraints and limited access to patients for clinical performance trials. Noisy Guts' goal was to develop a highly robust device that could diagnose IBS with more than 90 percent accuracy; however, despite a comprehensive workplan and collaborations with specialist acoustic consultants and data scientists, the device did not perform to the high standards required.

Various models picked up some interesting and encouraging trends in the data, but none were sufficiently discriminatory between IBS and healthy samples to proceed with commercialisation plans. Consequently, the Noisy Guts Board agreed in March 2021 to cease work on bowel sound analysis.

Despite terminating this line of research, Noisy Guts continues to explore other avenues to develop a non-invasive and accurate IBS diagnostic test.

While researching its initial device, the team uncovered the potential for a digital health tool that could achieve its diagnostic ambitions. The digital app now being developed will enable users to screen for red flags quickly and safely for serious organic gastrointestinal disease and, for those without red flags, accurately diagnose IBS.

"Noisy Guts is a great example of a female-founded startup that failed fast, iterated and pivoted," said Noisy Guts co-founder Dr. Josephine Muir. "I can't wait to see where NG 2.0 takes us."

Empowering people to take ownership of their diagnosis in this way will hopefully reduce the number of colonoscopies that need to be performed and give patients the information and confidence they need to manage their condition.

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Diagnostic tool for bacterial infection improving outcomes for cystic fibrosis patients

PROJECT:
SpeeDx Pty Ltd (ResistancePlus® MABSC/MAC)

THERAPEUTIC AREA:
Infectious Disease

START DATE: 1 April 2020	TOTAL BTB GRANT: $275,000
END DATE: 30 June 2022	TOTAL BTB EXPENDITURE: $213,299
STATUS: Completed	TOTAL CASH CO-CONTRIBUTION: $214,650
DELIVERABLES COMPLETED: 100%	TOTAL IN-KIND: $268,000
	TOTAL PROGRAM: $695,949

Jobs within project budget (FTEs dedicated to project)	2
New jobs created as a result of this project, at lead applicant and/or partners	1
Number of new technologies invented/progressed	1
Number of preclinical studies commenced	2

***Mycobacterium abscessus* complex (MABSC) and *Mycobacterium avium* complex (MAC) are highly antibiotic-resistant bacteria species that can cause life-threatening respiratory infections. Although MABSC is an environmental organism, found in soil and water, it can act as an opportunistic pathogen in susceptible populations.**

People with structural lung disease are particularly vulnerable, including those with cystic fibrosis. This life-shortening genetic disease affects more than 70,000 people worldwide, and 3,500 people in Australia.[1] Although significant medical advances in recent years have made these conditions more manageable, the average life expectancy is still just 38 years. Given that people with cystic fibrosis are already immunocompromised, infection is their primary threat, and 90 per cent of illness and death among patients is attributed to lung failure due to bacterial infections.[2] People with cystic fibrosis are also at risk of infections that develop resistance to antimicrobial drugs, because of increased antibiotic use over their lifetime.

Image: Image of a SpeeDx product

Accurate and timely diagnosis is crucial in determining the appropriate antimicrobials to treat infection. Current gold standard methods for the recovery and characterisation of MABSC and MAC bacteria are culture-based and have several key drawbacks, including their fastidious growth requirements and risk of false-negative results. These culture-based tests are highly labour-intensive and can have a turnaround time of one to two weeks, which inevitably delays treatment. Due to the challenges involved in culture-dependent methods, there is an urgent need for rapid and reliable culture-independent techniques.

Hoping to bridge this gap, Australian molecular diagnostics company SpeeDx is using its proprietary PlexZyme® and PlexPrime® technologies to develop highly adaptable, accurate and sensitive polymerase chain reaction (PCR) tests with a superior capacity to detect multiple targets and differentiate point mutations. Founded in 2009, the company is certified to develop, manufacture, and sell a range of regulatory-approved, multiplex real-time molecular tests, which can simultaneously measure multiple genetic markers. Their rapidly expanding Sydney-based company has subsidiaries in the UK and the US and has also established manufacturing laboratories in Australia.

Leveraging its proprietary technology and working in close collaboration with The University of Queensland, SpeeDx is developing the ResistancePlus® MABSC/MAC – a test for the detection of the infecting organism, as well as gene markers associated with resistance or susceptibility to specific antibiotics. These molecular diagnostic tests can be performed in a matter of hours, and are advantageous when compared to traditional culture-based methods. The availability of such knowledge, in a timely manner, empowers clinicians to make informed decisions for patient management, thereby improving outcomes for people with underlying lung conditions like cystic fibrosis.

The University of Queensland has been an invaluable partner throughout this project. Associate Professor David Whiley, from The University of Queensland Centre for Clinical Research, has been working directly with cystic fibrosis clinicians and the Queensland Mycobacterium Reference Laboratory on research projects for several years. The preliminary data supporting SpeeDx's research and development (R&D) project was obtained via the 'Mycobacterium in Children with Cystic Fibrosis (MiCCy)' study, for which Associate Professor Whiley was Chief Investigator. SpeeDx also has access to an extensive range of clinical collaborators throughout Australia and further afield.

In April 2020, SpeeDx was awarded $275,000 in matched funding through Round 1 of the BTB program, and was supported by BTB venture partner, the Medical Device Partnering Program (MDPP). This funding was directed towards product development for the ResistancePlus® MABSC/MAC test, encompassing research, design, and development.

Through the BTB Funding, SpeeDx was successful in the design lock and manufacture of research-grade oligonucleotide mixes for pre-clinical studies. Clinical evaluation of several subspecies of MABSC and MAC was done, showing high concordance with sequencing results. One hundred MABSC and MAC isolates were extensively and successfully used in refinement of the analysis algorithms, demonstrating the performance of the test.

Preclinical studies for full workflow testing and preliminary determination of clinical specificity of an R&D prototype were initiated at The University of Queensland, and negotiations are ongoing to undertake more testing at two other external sites. The UQ study has so far demonstrated successful detection of bacterial mutations associated with resistance to macrolide and amikacin antibiotics.

Upon completion of preclinical testing, SpeeDx will be ready to commence clinical assessment of the new test, aiming to have it available to market by the end of 2023. At the end of the program, SpeeDx has developed a comprehensive data package to support final development and regulatory work.

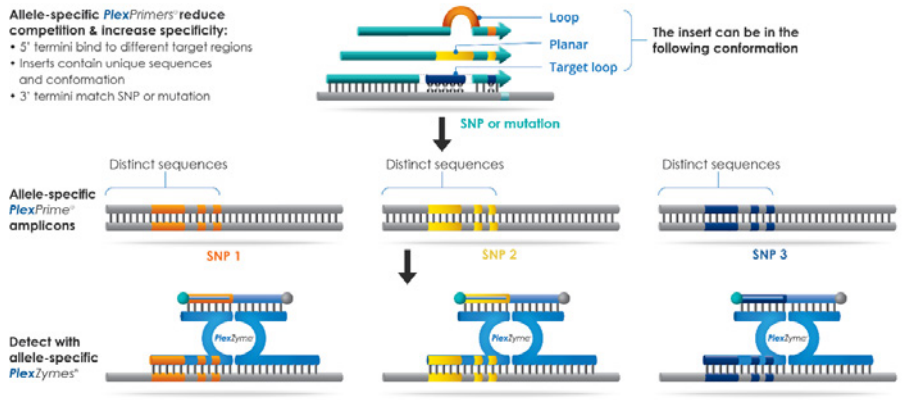
SpeeDx Pty Ltd (ResistancePlus® MABSC/MAC) continued

According to Associate Professor David Whiley:
"This collaboration epitomises the successes that can be achieved by pooling the expertise and know-how from an extensive academic Mycobacterium research program with that of a R&D-focused biotech company. The resulting SpeeDx rapid assay offers new means to identify MABSC infection and associated antimicrobial resistance, to improve clinical management and outcomes for these children [with cystic fibrosis]."

SpeeDx's suite of existing PCR tests for cancer, respiratory illnesses, and sexually transmitted infections, are already marketed globally through direct sales and the company's commercialisation partners, and it is envisioned that once this new test has completed clinical trial assessment, it too will be readily adopted by the market.

When this transpires, the newly developed molecular tool could be applied directly to clinical samples to detect MABSC and MAC, and relay fast and reliable information about their resistance profile. This will create opportunities for new, individualised treatment strategies, and enable appropriate infection control measures to be made earlier, thus preventing further transmission, and minimising harm and distress to patients.

PlexPrime® is a novel nucleic acid amplification method for challenging targets or mutation hotspots. This technology enables amplification of multiple mutations in a single reaction, with high sensitivity and specificity.



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New dental implant for patients incompatible with conventional devices

PROJECT:
University of Melbourne, Melbourne Dental School

THERAPEUTIC AREA:
Odontogenic Diseases

START DATE: 1 February 2020	TOTAL BTB GRANT: $100,000
END DATE: 30 June 2022	TOTAL BTB EXPENDITURE: $94,806
STATUS: Partially completed	TOTAL CASH CO-CONTRIBUTION: $94,806
DELIVERABLES COMPLETED: 70%	TOTAL IN-KIND: $486,722
	TOTAL PROGRAM: $676,334

Jobs within project budget (FTEs dedicated to project)	1
Number of new technologies invented/progressed	1

The ability to chew properly and eat a wide variety of foods is considered essential to wellbeing and optimal quality of life. Teeth play a critical role in these functions, and even when a single tooth is lost or extracted and not replaced, it can have a serious effect on our oral – and overall – health.

Dental implants are the preferred standard of care for people requiring replacement teeth, and millions of implant operations are performed by general dentists each year, including around three million in the US in 2021.[1] A typical dental implant is approximately 8–14 mm long and features a cylindrical or cone shape, with an external thread to help lock it in place and assist with integration into the bone (a process known as osseointegration).

Frustratingly, traditional implants cannot be used in around 10 per cent of cases, where the patient has insufficient jawbone density, volume, or strength. This is particularly common in cancer patients who have undergone treatment, as well as in ageing populations, or among people who have had historical trauma or teeth extractions. This is further complicated by the proximity of nerves and blood vessels which, if damaged, could lead to permanent impairment and numbness. In some cases, complex bridging is needed to replace multiple teeth, which requires cantilevering or similar methods. Cantilever bridges are used when there are adjacent teeth on only one side of the missing tooth or teeth; this generally applies to cancer patients and/or patients who have had major facial trauma.

University of Melbourne Dental, Melbourne Dental School continued

Melbourne Dental School at The University of Melbourne has developed a novel dental implant that retains the mechanical properties of traditional implants, but can be used in these more challenging cases, thus addressing an important medical and social need.

The University of Melbourne's solution is a horizontally aligned rectangular block implant (RBI), which has a similar surface area to a traditional implant but offers several advantages. Primarily, it does not require the depth of a traditional implant (4–5 mm vs 8–14 mm). Due to its shape, it has a greater surface area in which to connect with bone, compared to short implants that are placed in low-height sites. It also has better distribution of horizontal, vertical, and torsional forces when chewing, and is more amenable to bone filling (that is, rebuilding of bone volume and structure), where necessary.

Melbourne Dental School was originally formed by a group of dentists in 1884 and has officially been part of The University of Melbourne since 1904. It is regarded as one of the leading dental schools globally, teaching some 200 students and postgraduates annually. The school has a proud tradition in oral health education and research, and has pioneered several game-changing innovations, including Recaldent®, MouthMap™, Drugs4dent™, a periodontal vaccine for humans, a periodontal vaccine for companion animals, and now the RBI.

Chief Investigators Dr Tim Gazelakis, Associate Professor Joseph Palamara and Associate Professor Roy Judge designed and developed the RBI to solve an unmet need in their patient populations. The device was refined and rigorously tested in the lab and in an animal model as part of Dr Gazelakis's PhD project.

The University of Melbourne was awarded $100,000 in matched funding through Round 1 of the BTB program and was supported by BTB venture partner, the Medical Device Partnering Program (MDPP), towards the further development of the RBI.

One challenge confronting this technology is the high level of skill required by dentists to perform the operation to install the implant. This increased complexity may deter uptake, despite the obvious benefits to patients. To overcome such opposition, as part of the BTB project, the team created a custom tool and clinical guide to simplify the operation, thus reducing risk and improving patient outcomes. During the funding period, the dedicated tool tip was developed and tested, and clinical protocol was finalised, making the RBI accessible to a greater number of implant dentists.

As part of the BTB project, the team originally planned in-patient clinical evaluation of the RBI; however, the COVID-19 pandemic posed a significant challenge, restricting the number of elective surgeries being undertaken in Victoria. This meant that the RBI could not be implanted into any patients. Despite this setback, two patients have been scheduled for implantation in the second half of 2022.

According to Associate Professor Roy Judge, "Through involvement in this program, the team has come to a thorough understanding of all the aspects required to bring a new product to market. The complexities of commercial surface preparation, designing and manufacturing a bespoke surgical tool and delivery to a patient are well beyond the normal activities of an academic team and have presented unique challenges throughout our journey. The construct of this novel implant has certainly increased the awareness of the team as to its ultimate application, which are far greater than initially envisaged. We are grateful for the opportunity to participate".

To facilitate global market penetration and registration of the RBI, The University of Melbourne has already identified an industry partner that is the world leader in specialised dental implants. The product will likely be purchased as a kit comprising the implant device, custom tool tip, template, and instructions for dentists to perform the operation simply and efficiently.

Uptake of the RBI will potentially benefit many people. There are several additional markets not yet explored that could be suited to this innovative device, particularly among ageing populations, given that people now live longer and are increasingly retaining their original teeth. RBIs could also be used more generally as stabilisers for dentures in elderly patients with jawbone reduction, thus improving their quality of life.

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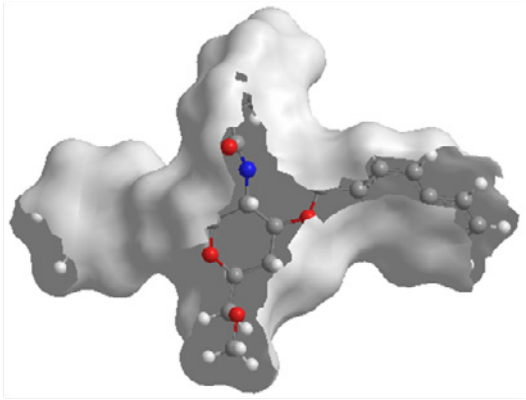
Modernising pain management with 3D drug discovery technology



PROJECT:
Vast Bioscience Pty Ltd

THERAPEUTIC AREA:
Pain Management

START DATE: 1 February 2020	TOTAL BTB GRANT: $822,451
END DATE: 25 January 2022	TOP-UP FUNDING: $114,250
STATUS: Completed	TOTAL BTB EXPENDITURE: $936,702
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $827,202
	TOTAL IN-KIND: $794,166
	TOTAL PROGRAM: $2,558,070

Jobs within project budget (FTEs dedicated to project)	4
New jobs created as a result of this project, at lead applicant and/or partners	3
New patent applications resulting from this project (distinguish granted and provisional)	2 provisional

Pain is a debilitating condition that affects approximately 20 per cent of the global adult population.[1]

Over the past few decades, escalating use of opioid therapeutics to manage pain has become a cause of concern in many countries. In Australia, 15.4 million opioid prescriptions were dispensed under the Pharmaceutical Benefits Scheme (PBS) to 3.1 million people between 2016 and 2017. Each day during this period, nearly 150 hospitalisations and 14 emergency department presentations were attributed to opioid harm, and three people died from drug-induced deaths involving opioid use.[2]

The situation in the US is even more dire, with the opioid crisis causing significant health and socio-economic problems. The latest data estimates that overdose deaths from opioids increased to 75,673 in the 12-month period ending April 2021, up from 56,064 the year before.[3]

Post-surgical use of opioids is a common source of addiction. Around the world, over 300 million major surgical operations are performed each year[4] and approximately six per cent of these opioid-treated patients become addicted to pain medication.

Image of a typical VAST molecule. VAST molecules are uniquely three-dimensional in shape, a characteristic that is strongly associated with safety in therapeutic drugs. Credit: Vast Bioscience

Vast Bioscience continued

Though pain was once viewed as a necessary side effect of surgery, it is now understood that prompt and effective treatment not only reduces suffering, increases healing, and limits complications, but is essential to the success of the surgical intervention. Failure to adequately manage pain postoperatively is associated with a higher likelihood of developing chronic pain – which, in Australia, was estimated to cost $139 billion in 2018, mostly due to reduced quality of life and productivity losses.[5,6]

Frustratingly, post-surgical pain is still treated ineffectively for a large percentage of patients, and opioids continue to be administered as standard care despite their negative side effects, such as nausea, vomiting, constipation, dependency, and even respiratory depression. Clearly, there is an urgent need to cultivate more effective postoperative pain-management treatments – both for the purpose of improving patient outcomes and overcoming the opioid crisis.

Aiming to establish alternative pain-relief therapies, Brisbane-based biotechnology company Vast Bioscience Pty Ltd is using a proprietary technology platform called VAST (Versatile Assembly on Stable Templates) to develop three-dimensional (3D) small molecule sodium channel inhibitors. VAST technology provides a turnkey chemistry solution to access a diverse world of complex 3D drug-like molecules for the systematic discovery of 3D drugs, which deliver superior specificity, selectivity and potency when compared to two dimensional (2D) molecules, and hence a higher chance of safety in the clinic.

One possible target is hNav1.8 – one of the nine Voltage-gated sodium channel (VGSC) subtypes, which plays a critical role in the initiation and propagation of pain signals along nerve fibres. Using VAST technology, Vast Bioscience has developed a Nav1.8 inhibitor that fully reverses pain in an in vivo model of post-surgical pain following oral dosing, outperforming competitor lead molecules in efficacy and safety.

The key challenge when developing hNav1.8 inhibitors lies in obtaining specificity and selectivity while maintaining drug-like properties. Some of the other sodium channel subtypes are critical for heart function or muscle function, and hence selectivity for the hNav1.8 subtype is paramount to obtaining effective and safe pain relief.

To progress its efforts in this space, Vast Bioscience was awarded $822,451 in matched funding during Round 1 of the BTB program and was supported by BTB venture partner, BioCurate. The project started with a lead molecule that exhibited exceptional efficacy and safety in an in vivo model of post-surgical pain at very low exposure. Through the BTB program, Vast Bioscience set out to optimise this lead molecule to an Investigational New Drug (IND) candidate – ultimately hoping to develop an effective non-opioid treatment for post-surgical pain through selective hNav1.8 inhibition with an excellent safety profile, and with a robust data package suitable for commercialisation.

Over the course of the project, the versatility of the VAST platform was demonstrated, with the optimisation of the five available positions on the lead scaffold. More than 400 3D hNav1.8 inhibitors have now been synthesised, with many having affinity at the target (hNav1.8), while demonstrating high selectivity at related off targets (hNav1.x's and hERG). This has allowed the team to improve on its original compound, with the new compound demonstrating efficacy in several mouse models. Pharmacokinetic (PK) studies linked the efficacy with low free drug concentration, which was an attractive quality to maintain in a prospective analgesic.

Vast Bioscience was further awarded $114,000 in top-up funding, which enabled them to carry out critical activities in the commercialisation process. These included engaging a business development manager to drive a professional commercialisation process with several potential partners now in confidential discussions. The funding also enabled the successful completion of scale-up chemistry and formulation experiments to address specific requests from potential partners.

According to Vast Bioscience's Chief Scientific Officer, Dr Wim Meutermans, the BTB program has enabled the team to take its project through lead optimisation to achieve high specificity and selectivity in its candidate – a critical requirement in the development of safe and effective therapies for severe acute and chronic pain. "VAST is to our knowledge the only well-established drug discovery technology that enables systematic moulding of the shape and function of its 3D molecules, and this is paramount to delivering potent lead molecules of high 3D complexity," Dr Meutermans said. "In this project, we have been able to produce highly selective VAST compounds by using the unique characteristics of the 3D scaffold, while maintaining drug-like qualities."

In 2021, more than $1 million was raised to further advance the product, based on the research progress and achievements made during the BTB program. A business development outreach campaign was initiated later that year and commercialisation discussions with several pharma and specialised biotech companies are ongoing. Two new provisional patent applications were lodged in 2021, covering the broad invention of selected VAST molecules as Nav1.8 inhibitors and their application to treat pain. The patents cover new composition of matter discovered in this project, as well as their method of use, and support the commercialisation process.

The successful development of a 3D hNav1.8 inhibitor has the potential to revolutionise how pain is treated in the future. Further to that, success in this project would have a significant impact on Vast Bioscience's drug discovery opportunities, providing validation of the 3D approach and enabling application in other areas of unmet medical need.

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ROUND TWO

Australian biotech developing first-in-class drug candidate to treat fibrotic diseases

PROJECT:
Cincera Therapeutics Pty Ltd

THERAPEUTIC AREA:
Metabolic and Fibrotic Disease

START DATE: 20 July 2020	TOTAL BTB GRANT: $1,000,000
END DATE: 30 September 2021	TOP-UP FUNDING: $225,000
STATUS: Completed	TOTAL BTB EXPENDITURE: $1,225,000
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $1,225,170
	TOTAL IN-KIND: $1,164,151
	TOTAL PROGRAM: $3,614,321

Jobs within project budget (FTEs dedicated to project)	9.28
Number of new technologies invented/progressed	1
New patent applications resulting from this project (distinguish granted and provisional)	1
Number of preclinical studies commenced	3

Around the world, chronic liver disease is a major cause of morbidity and mortality. Each year, more than two million people die as a direct result of liver-related conditions.[1]

Non-alcoholic fatty liver disease (NAFLD) and its severe form, non-alcoholic steatohepatitis (NASH), account for a significant proportion of the global liver disease burden, affecting 34 per cent and 12 per cent of the US populations, respectively.[2,3] NASH is characterised by fibrosis, which is the accumulation of scar tissue in the liver following an injury or inflammatory insult, such as in obesity and other metabolic disorders. NAFLD can progress irreversibly to NASH, which in turn can lead to serious liver damage, including cirrhosis, liver failure, hepatocellular carcinoma, and ultimately death. Currently, there are no treatments for NASH and it represents a major unmet medical need in our society, not to mention a leading trigger for liver transplant surgery and liver cancer.

In seeking to curb the impact of these diseases, Australian biotech Cincera Therapeutics Pty Ltd (Cincera) is working on a new NASH treatment that, if successful, has the potential to save the lives of many NASH sufferers and reduce the economic burden of this and other related liver conditions. Cincera is a spin out of Monash University and University of South Australia, funded under a Series A investment from Brandon BioCatalyst, formerly known as Medical Research Commercialisation Fund (MRCF).

Image: Drug discovery research at Cincera.

Cincera Therapeutics continued

In September 2020, the company was awarded $1 million in matched funding through Round 2 of MTPConnect's BTB program; it was also paired with BTB venture partner BioCurate for mentoring and commercialisation support. Cincera also had the opportunity to test its leading drug candidates in an industry recognised pre-clinical NASH model with world renowned CRO, Gubra, through an additional $225,000 in matched top-up funding.

At the initiation of the funding period, Cincera was in the early stages of lead optimisation, having so far only completed cell-based experiments to show that its compounds were suppressing identified targets in the molecular pathways of fibrosis. Promising lead compounds were discovered; however, their properties required refinement and optimisation before they could be considered as candidates for clinical studies.

The primary objective of the BTB project was therefore to complete the optimisation of the properties for the existing frontrunners and alternative scaffolds to develop safe, effective drug-like compounds with potent activity in a range of fibrosis models. These studies aimed to establish a preclinical proof-of-concept in NASH and other fibrosis diseases. Ultimately, Cincera's goal for the BTB project was to generate a compelling dataset to support the nomination of a drug candidate, identify suitable backup compounds, and to complete the highly regarded Gubra CDAA-HFD NASH model.

Discovering and developing a first-in-class drug has always been the most difficult part of the drug discovery process, as researchers are inevitably navigating uncharted waters. A novel approach to treating a complex and challenging disease state like fibrosis requires careful analysis of the biological effects of the drug, both in terms of therapeutic benefit and adverse effects. For this reason, Cincera pulled together a world-class team of drug discovery professionals, scientific advisers and key opinion leaders. The team comprised professionals with venture capital, biotech and big pharma experience, as well as clinician researchers in fibrotic and metabolic disease, and other scientists with a track record in fibrosis drug discovery.

Image: Cincera Board of Directors and Management Team (L to R). Top row: Dr Michael Bettess (Chair), Dr Melissa McBurnie (Director), Dr Katherine Nielsen (Director), A/Prof. Bernard Flynn (CEO); Bottom row: Prof. Stuart Pitson (CSO), Dr Giang Le (Head of Medicinal Chemistry), Dr Melissa Pitman (Senior Scientist), Dr Cassandra Yong (Operations Manager). Credit: Supplied by Cincera

Benefitting from a consortium of Australian and international collaborators – including Monash University, University of South Australia and the Baker Heart and Diabetes Institute – the BTB project enabled more than 200 novel compounds to be evaluated, with thousands of data points acquired in various in vitro and in vivo studies. It took three years of intensive medicinal chemistry and drug-lead optimisation to allow Cincera to emerge from the lead optimisation process to the nomination of a drug candidate that is safe and shows promising anti-fibrotic efficacy (for the liver, lung and kidney), as well as high selectivity against a large range of safety pharmacology targets.

This result represents a completely novel and unique anti-fibrotic mechanism of action. The efficacy and therapeutic index of the Cincera drug candidates based on the experimental models compare very favourably to other leads in advanced clinical trials. Data supporting the therapeutic benefits and safety of its drug candidate has enabled Cincera to access an additional $2 million in funding from Brandon Biocatalyst under a Series A option. This funding will allow Cincera to continue mechanism of action studies and initiate formal preclinical development, while undertaking further fundraising to bring its drug candidate to the clinic.

Arriving at a safe and efficacious drug candidate for the treatment of fibrotic disease is a triumph of Australian drug discovery ingenuity. Cincera is now well-positioned to present a comprehensive and convincing data pack to prospective big pharma partners. Early interactions with such groups have been extremely encouraging, with great interest being expressed by a number of leaders in the field. Cincera is undertaking discussions with these groups, though the company may opt to bring the program to clinical trials prior to partnering.

In parallel to Cincera's work to optimise its drug candidate, considerable effort has also been directed towards the company's intellectual property strategy to achieve strong and broad protection around the drug candidate, its analogues and methods of use, with multiple patent applications filed and being progressed in major markets globally.

Given that approximately 46 percent of disease-related deaths and the majority of disease-related hospitalisations are attributable to fibrosis, the importance and potential impact of Cincera's discovery cannot be overstated.[4] Metabolic disease can induce fibrosis in multiple organs, particularly the liver, heart and kidney; end-stage organ failure brought about by these diseases claim many lives each year and are a major economic burden. While it will still be some years before this drug candidate has suitably progressed through clinical trials to see therapeutic benefits in patients, preclinical studies in animal models demonstrate clear benefits over other anti-fibrotic drugs under evaluation, both in terms of safety and efficacy.

According to Cincera's CEO, Associate Professor Bernard Flynn, developing this first-in-class drug treatment has been an enormously challenging, but deeply satisfying, effort.

"While we still have some way to go to demonstrating therapeutic benefit in humans, it all starts with having the right molecule to bring into the clinic and I am confident that our drug candidate is that molecule. It is well-positioned to address the major unmet medical needs of patients living with NAFLD/NASH, heart failure, diabetic nephropathy and/or pulmonary fibrosis."

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Cutting-edge discovery creating accurate tests for prostate cancer

PROJECT:
Envision Sciences Pty Ltd

THERAPEUTIC AREA:
Oncology

START DATE:
3 September 2020

END DATE:
30 June 2022

STATUS:
Completed

DELIVERABLES COMPLETED:
93%

TOTAL BTB GRANT:
$1,000,000

TOP-UP FUNDING:
$100,000

TOTAL BTB EXPENDITURE:
$1,071,986

TOTAL CASH CO-CONTRIBUTION:
$971,986

TOTAL IN-KIND:
$300,000

TOTAL PROGRAM:
$2,343,972

Jobs within project budget (FTEs dedicated to project)	8
New jobs created as a result of this project, at lead applicant and/or partners	3
Number of new technologies invented/progressed	1
New patent applications resulting from this project (distinguish granted and provisional)	1
Number of preclinical studies commenced	4
Number of clinical trials commenced	1

Prostate cancer is the second most common form of cancer in men worldwide, and the fourth most common cancer overall. In 2020, more than 1.4 million people were diagnosed with the disease, and each year, it causes over 300,000 deaths. In Australia, it's predicted that 2022 will see the highest number of diagnoses ever recorded, with 24,217 people expected to be impacted, at a rate of 150.8 cases per 100,000 males.[1,2]

Prostate-specific antigen (PSA) tests are a type of blood test used primarily to screen for prostate cancer. Diagnosis is confirmed through a biopsy and then graded by severity using a Gleason score. Unfortunately, this method leaves much to be desired, as screening tests have a specificity of 85 per cent, and a sensitivity of only 32 to 68 per cent for detecting cancer; and can also generate false-positive and false-negative results.[3] Moreover, the histology stains used on biopsies do not give optimum visualisation of the cancer, and a Gleason score determined by biopsy has an accuracy of only 58 per cent.[4] In addition, none of these tests can predict which patients will have clinical recurrence or metastasis.

These as-yet insurmountable problems contribute to less-than-optimal clinical assessment, resulting in substandard patient management and poor decision-making for therapeutic intervention. Prostate cancer patients require accurate screening and confirmatory tests to ensure correct diagnosis and prognosis. Yet there remains a severe lack of innovative technology available to urologists, oncologists and pathologists in diagnostics companies or hospital laboratories – to the detriment of patients.

Image: Dr Ian Johnson and Envision's team.

One potential solution is under investigation at Envision Sciences – a cell biology company linked to the University of South Australia's Cancer Research Institute. Formed in 2017, the organisation focuses on finding unique pathways that define the primary pathogenesis of various forms of cancer; and enable the development of tests that provide a full-spectrum cancer pathology solution.

Using cutting-edge technology, Envision Sciences' novel biomarker discovery program has uncovered a fundamental change in the cell biology of prostate cancer. Three biomarkers were found to identify two distinct metabolic stages of prostate cancer. By employing combinatorial analysis, these biomarkers can be used to accurately confirm the diagnosis of prostate cancer and identify specific stages of cancer progression. This breakthrough has the potential to increase the reliability of current grading scores, improve patient outcomes, generate cost savings, and give greater insight into which patients are most likely to experience clinical recurrence.

With proof-of-principle for these specific biomarker assays, Envision Sciences was awarded $1 million in matched funding through Round 2 of the BTB program, and was supported by BTB venture partner, BioCurate. The funding was directed to the development and validation of a tissue biopsy test for the diagnosis and prognosis of prostate cancer.

Over the 22-month funding period, Envision Sciences made numerous advances towards its goals. The company's tissue biopsy test, using its combinatorial set of biomarkers, achieved above 95 per cent sensitivity and specificity in patient samples. This represents a huge step towards the development of a precision tissue biopsy test that outperforms the existing gold standard in accurately confirming prostate cancer diagnosis, as well as determining patient prognosis.

These results give Envision Sciences a significant market advantage. The company has already partnered with a major global diagnostics company to facilitate the development of a Lab Developed Test (LDT) ready for clinical practice. It has also signed a term sheet with this diagnostics company as the first step in the commercialisation process and plans to launch the tissue biopsy tests in 2022.

Throughout the BTB project, Envision Sciences also made considerable progress with its blood diagnostic test, making procedural improvements for extracting human plasma to facilitate blood biomarker analysis; developing a mass spectrometry protocol for enhanced biomarker detection; and progressing multiplex technology for precision biomarker analysis. These novel methods could be used for the discovery of biomarkers for detecting prostate cancer through liquid blood-based biopsies, generating novel intellectual property for the company. To date, Envision Sciences has filed two patents to protect its innovative technology.

Envision Sciences is making strides towards creating a complete pathology solution for prostate cancer, which involves a multiplexed blood test to detect the cancer and provide an indication of prognosis. This technology will directly complement the tissue biopsy tests to confirm diagnosis and prognosis, and the tests will be used sequentially in clinical practice. The company has presented detailed clinical claims and utility data packs to major diagnostics companies, who have coordinated groups of pathologists, oncologists, and urologists to assess the technology, with positive feedback already generated from these interactions. Envision Sciences has likewise engaged a US Diagnostic Laboratory to demonstrate the efficacy of its new technology in a retrospective study; and is also working towards a pilot prospective clinical trial with a major laboratory in the US. This successful translation into the US diagnostic market was also supported by an additional top-up funding of $100,000, that has enabled Envision Sciences to appoint a US commercial market expert and consult with McDonald Hopkins LLC for US regulatory advice.

According to Professor Doug Brooks, Chief Scientific Officer at Envision Sciences, the team's efforts to facilitate accurate diagnosis and prognosis of prostate cancer patients will directly impact clinical practice and enable timely and effective life-saving intervention. "This technology will revolutionise prostate cancer tissue pathology assessment and improve patient outcomes," Professor Brooks said.

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First-in-class liquid biopsy tests to detect and monitor breast cancer

PROJECT:
INOVIQ Ltd (previously known as BARD1 Life Sciences Ltd)

THERAPEUTIC AREA:
Oncology

START DATE: 6 Sept 2020	TOTAL BTB GRANT: $372,654
END DATE: 30 June 2022	TOP-UP FUNDING: $89,331
STATUS: Completed	TOTAL BTB EXPENDITURE: $407,519
DELIVERABLES COMPLETED: 90%	TOTAL CASH CO-CONTRIBUTION: $346,870
	TOTAL IN-KIND: $491,000
	TOTAL PROGRAM: $1,245,389

Jobs within project budget (FTEs dedicated to project)	4
New jobs created as a result of this project, at lead applicant and/or partners	1
Number of new technologies invented/progressed	2
New patent applications resulting from this project (distinguish granted and provisional)	1 - US Patent
Number of preclinical studies commenced	1

Image: Professor Michael Jennings, SubB2M project lead researcher and co-inventor of the SubB2M technology platform, at Griffith University's Institute for Glycomics.
Photo courtesy of Griffith University, Marketing and Communications.

In the US, approximately 80 million women qualify for routine mammography screening, yet each year only around 38 million mammograms are performed.[1,2]

A key challenge in providing effective breast cancer screening is participation. Data from the National Health Interview Survey in 2013 showed that only 51.3 per cent of American women aged 40 years and older reported having had a mammogram in the previous 12 months. Breast cancer screening rates differed by ethnicity, ranging from 45.9 per cent in Hispanic women to 52.6 per cent in non-Hispanic Black women. Screening rates among insured populations were more than twice those of the uninsured, at 54.8 per cent and 22.3 per cent respectively.[3]

Low screening uptake means many women are diagnosed with breast cancer at stage 3 or later, which unsurprisingly results in poor prognosis. In addition to low survival rates, the cost of treating and maintaining these patients is significant.

There is substantial evidence that early diagnosis leads to prompt treatment intervention, which improves patient prognosis and reduces treatment costs. It's generally agreed that a blood test for breast cancer would improve access to, and participation in, screening, and would consequently facilitate early detection and better patient outcomes.

INOVIQ Ltd (ASX:IIQ) – an Australian diagnostics company headquartered in Melbourne and with offices in Minneapolis, USA – is progressing a SubB2M-based blood test for breast cancer. The target marker is a sialic acid called Neu5Gc, which is only found in humans in the presence of cancer. The intellectual property (IP) resides more specifically in the engineered SubB2M protein, a lectin that binds to and detects Neu5Gc.

A preliminary breast cancer study has shown exceptional discrimination between 96 patients at all four stages of cancer,from 22 cancer-free control individuals (100 per cent sensitivity and 95 per cent specificity).

To develop this technology, INOVIQ was awarded $372,654 in matched funding during Round 2 of the BTB program, through which it was supported by BTB venture partner, the Medical Device Partnering Program (MDPP). The objective of the project was to apply the SubB2M technology to the development and commercialisation of blood tests for the monitoring and detection of breast cancer, based on the ELISA assay platform, which is commonly available in hospital pathology laboratories worldwide.

It is viewed that the new test will make the currently available CA15.3 test for breast cancer monitoring significantly more accurate and reliable in identifying women with breast cancer and assessing the cancer's progression.

The project will produce a highly sensitive and specific blood test for breast cancer that can be rapidly incorporated into clinical practice worldwide – firstly, for breast cancer monitoring, and subsequently, as an adjunct to mammography, to improve sensitivity and specificity of detection.

The BTB project initiated a new collaboration between INOVIQ, Griffith University and The University of Adelaide. Researchers from both universities had previously used site-directed mutagenesis to improve the specificity of binding of the E. coli toxin B sub-unit to Neu5Gc. They chose one of the mutants (SubB2M) with the highest specificity of binding to Neu5Gc; and used surface plasmon resonance (SPR) to demonstrate that it was extremely accurate in binding Neu5Gc in the serum of breast and ovarian cancer patients – revealing 100% specificity and over 95 per cent sensitivity to all stages of cancer.

Given that SPR is not currently used in commercial pathology settings, the aim of the BTB-funded project was to transfer the use of SubB2M from an SPR platform to an ELISA platform.

The collaborative partnership established between INOVIQ, Griffith University and The University of Adelaide has now been extended into non-BTB project areas to support INOVIQ's other R&D efforts. This robust research and industry relationship has allowed the universities an opportunity to gain insight into what is required to develop a commercial diagnostic product from the beginning of a project.

As an outcome of the BTB project, the translation of the SubB2M-based Neu5Gc detection technology into an immunoassay format for the monitoring and detection of breast cancer initially, has been successfully carried out at Griffith University. This SubB2M-based CA15.3 ELISA (based on the measurement of CA15.3) is now being further developed into a commercially viable assay format under a contract research agreement at ResearchDx in Irvine, California (USA) for the analytical and clinical validation of the CA15.3-SubB2M assay.

Upon awarding of an additional top-up funding of $89,000, INOVIQ has also progressed, via the Monash Antibody Technologies Facility, Monash University, Clayton, the generation of 6 proprietary monoclonal antibodies specifically for use with the SubB2M assay technology. INOVIQ has also successfully completed technology transfer for the production of the SubB2M protein from the University of Adelaide to MP Biomedicals (Singapore), under a contract manufacturing agreement. This agreement will ensure consistency in supply of GMP quality material for future needs.

The development pathway for INOVIQ's SubB2M-based breast cancer test, using SubB2M in conjunction with an existing biomarker, provides a template for the scientific and commercial development of other more accurate blood tests for prostate cancer, ovarian cancer and others.

In the US, under the Clinical Laboratory Improvement Amendments program, CLIA certified pathology laboratories can develop and commercialise new tests under a simpler regulatory pathway. Known as a Laboratory Developed Test (LDT), it enables laboratories to offer tests developed and validated in a single laboratory to clinicians and hospitals. INOVIQ is aiming to have a test ready for use in US laboratory settings as an LDT by mid-2023.

According to INOVIQ CEO, Dr Leearne Hinch, this innovation could radically improve how breast cancer is detected and monitored, addressing an important unmet need in women's health, while also benefiting patients living with other forms of cancer.

"Our SubB2M technology is a revolutionary platform with potential for developing tests for monitoring and detection of multiple cancers," Dr Hinch said. "A non-invasive, accurate and reliable blood test for monitoring breast cancer has the potential to improve treatment outcomes in women diagnosed with cancer and to enable earlier detection of recurrence to improve women's health outcomes."

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Fighting antimicrobial resistance with AI-driven technologies

PROJECT:
LBT Innovations Ltd

THERAPEUTIC AREA:
Infectious Disease

LBT INNOVATIONS

START DATE: September 2020	TOTAL BTB GRANT: $744,518
END DATE: June 2022	TOP-UP FUNDING: $115,000
STATUS: Completed	TOTAL BTB EXPENDITURE: $859,107
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $749,104
	TOTAL IN-KIND: $203,000
	TOTAL PROGRAM: $1,811,211

Jobs within project budget (FTEs dedicated to project)	8
New jobs created because of this project, at lead applicant and/or partners	3
Number of new technologies invented/progressed	6
New products launched	1
Number of preclinical studies commenced	2
If any, number of awards or other recognitions for this project/product*	1

*Clinical Study evaluating the performance of the APAS-AMR module was selected for presentation at the European Congress of Clinical Microbiology & Infectious Diseases

Antimicrobial resistance (AMR) is an escalating global health challenge, identified by the World Health Organization (WHO) in 2019 as one of the top 10 public health threats facing humanity.

Hospital-acquired infections from multi-resistant organisms continue to rise, with an associated increase in mortality and morbidity. In the US alone, over 2.8 million AMR infections occur each year, causing more than 35,000 deaths. By 2050, the annual impact of AMR on the Australian economy is estimated to reach between $142 billion and $283 billion. Globally, AMR is on track to claim 10 million lives per year and put at risk a cumulative US$100 trillion of economic output, if no action is taken.[1]

Clinical laboratories play a critical role in combating AMR, by providing timely and accurate information on antimicrobial susceptibility and resistance, which allows clinicians to quickly determine the most appropriate treatment for patients. This not only supports the fight against life-threatening conditions like sepsis, but also prevents the escalation of resistant bacteria.

Image: the Automated Plate Assessment System (APAS) Independence Automated Plate Assessment System for Antimicrobial Resistance (APAS-AMR) is a groundbreaking AI-driven image analysis platform that accurately reads and interprets antimicrobial susceptibility tests (ASTs).

The current standard of care for diagnosing bacterial infections and determining antimicrobial susceptibility relies on a highly manual and time-consuming process of inoculating and culturing bacteria on agar plates, with each plate assessed individually by a clinical scientist. Since 2004, Adelaide-based medical technology company LBT Innovations (LBT) has been exploring ways to automate these workflows, such as by automating culture plate streaking and inoculation with its MicroStreak system, which has been divested and successfully commercialised.[2]

In 2010, LBT identified an opportunity to automate the screening and interpretation of culture plates through its innovative platform technology, the Automated Plate Assessment System (APAS) Independence. The APAS is the world's first and only culture plate reader for clinical microbiology that automatically images, detects, and interprets bacterial growth on culture plates. In 2016, it became the first diagnostic medical device in clinical microbiology that uses artificially intelligent (AI) algorithms for clinical decision-making to achieve regulatory clearance in the US.

The APAS reduces routine screening work by removing negative results (where there is no growth or no significant growth) from the workflow, thereby allowing microbiologists to dedicate their limited time resources to more important work.[3]

Leveraging this technology, LBT has developed the Automated Plate Assessment System for Antimicrobial Resistance (APAS-AMR): a groundbreaking AI-driven image analysis platform that accurately reads and interprets antimicrobial susceptibility tests (ASTs). The APAS-AMR analysis module is a unique proposition; using AI to deliver rapid, high-throughput automated reading, it promises to address the AMR burden by increasing the efficiency and accuracy of AST result interpretation.

In recognition of its pioneering work, LBT was awarded $745,000 in matched funding through Round 2 of the BTB program, and was supported by BTB venture partner, the Medical Device Partnering Program (MDPP). The funding was used to take LBT's proof-of-concept AMR plate assessment technology and advance it to a commercial-ready stage, available to be deployed on LBT's existing clinical laboratory device. Additionally, the BTB program gave two LBT employees an opportunity to participate in the BridgeTech Program, to enhance the commercial skill set and capabilities within the team. LBT also undertook an in-depth commercialisation review using the Guidance and Impact Tracking System (GAITS) analysis. The internal assessment tool provided a useful measure of progress and ensured the team reflected on the progress made to date. Engaging with the MDPP generated useful feedback and highlighted several areas that could be strengthened as the team moved forward with the commercialisation plan for its product.

During the BTB program, the APAS-AMR was successfully completed in line with the initial project plan, and the final execution of clinical and analytical testing is underway. Following the completion of market research, the project progressed in two parallel streams focusing on the formal development of the APAS-AMR analysis module and separately executing updates to the core APAS software. These activities were both completed within the project timeframe, and the APAS-AMR module was released to two key opinion leaders for user testing.

The first customer evaluation – conducted in April 2022 by Labor Dr Wisplinghoff in Cologne, Germany – was presented at the European Congress of Clinical Microbiology and Infectious Diseases (ECCMID) in Portugal. The performance not only demonstrated the accuracy of the device when performing ASTs at standard incubation times (18 to 24 hours), but also showed excellent performance for Rapid-AST (reading at six hours), which was beyond expectations.

LBT's Australian key opinion leader, Lisa Brenton, Deputy Principal Scientist, Microbiology at St Vincent's Hospital Melbourne commented on the usability of the device. "The flexibility and simplicity of APAS-AMR is a huge potential benefit to laboratories. The device allows for the customisation of antimicrobial panels, and results are automatically generated for each drug, saving the laboratory time and removing manual handling errors"

The project will now enter a formal testing phase, requiring studies to be completed overseas prior to regulatory submission.

LBT's Scientific Director, Dr Steven Giglio, has revealed that the company's suite of technologies has already attracted extensive interest from clinicians and laboratory professionals alike. "The potential benefit of APAS-AMR to enable laboratories to deliver rapid and accurate antimicrobial susceptibility tests is huge and will be a great boost in our growing fight against antimicrobial resistance," said Dr Giglio.

Significantly, the APAS-AMR project adds important clinical utility to the existing LBT laboratory product, allowing customers to run new tests through the instrument. This creates new revenue opportunities with existing customers and makes the technology more attractive to LBT's commercial partners for international distribution.

LBT Innovations Ltd continued

The APAS-AMR is currently manufactured in Australia by LBT and deployed for use on its APAS Independence instrument manufactured by Planet Innovation in Melbourne. Implementing the APAS-AMR within the laboratory is simple due to the minimal disruption caused to existing laboratory workflows, as well as its affordability and ability to provide a combination of solutions to address AMR testing needs.

Moving forward, technologies such as APAS-AMR will play a pivotal role in antimicrobial stewardship – helping to control the indiscriminate use of antimicrobials and enable effective treatment of infectious diseases. Delivering rapid, accurate and repeatable AST results to clinicians decreases the time it takes to optimise antimicrobial administration, directly benefitting patients and supporting improved AMR practices. This will reduce the economic burden on health systems by minimising the duration of hospital stays and will also lead to a reduced risk of mortality and extended consequences, especially in sepsis cases.

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Dual-action compound aims to improve (and extend) life for people with Duchenne Muscular Dystrophy

PROJECT:
Pharmaxis Ltd

THERAPEUTIC AREA:
Neuromuscular Disorders

pharmaxis

START DATE: 8 September 2020	TOTAL BTB GRANT: $871,962
END DATE: 11 March 2022	TOTAL BTB EXPENDITURE: $505,390
STATUS: Terminated	TOTAL CASH CO-CONTRIBUTION: $505,390
DELIVERABLES COMPLETED: 70%	TOTAL IN-KIND: $465,114
	TOTAL PROGRAM: $1,475,894

Jobs within project budget (FTEs dedicated to project)	1.8
Number of new technologies invented/progressed	1
New patent applications resulting from this project (distinguish granted and provisional)	1 (provisional /PCT)
Number of preclinical studies commenced	10

Duchenne Muscular Dystrophy (DMD) is a devastating genetic disorder that occurs primarily in boys, affecting around one in every 3,500 male births worldwide.[1] The condition is characterised by muscular degeneration and weakness, caused by alterations of the protein dystrophin, which helps to keep muscle cells intact. Symptoms can appear as early as age two or three, impairing mobility and daily functioning, not to mention reducing life expectancy and placing a terrible burden on patients and caregivers alike.

While existing DMD therapies focus on the alleviation of symptoms and management of complications, new treatments such as splicing modulation and gene therapy are currently being explored, though the long-term benefits of these appear limited, and a critical need for alternative or additional options remains.

One company hoping to make headway in this space is Pharmaxis Ltd (ASX:PXS) – an Australian pharmaceutical research group that specialises in the development of drugs for inflammatory and fibrotic diseases. The Sydney-based organisation has a highly productive drug discovery engine built on its expertise in the chemistry of amine oxidase inhibitors. Its drug development pipeline includes PXS-5505, for the treatment of myelofibrosis as well as other cancers, and PXS-6302, for the treatment of scarring and burns. Pharmaxis has also formulated two respiratory products, Aridol and Bronchitol, which are approved and available in global markets.

Another recent prospect in the company's curation of amine oxidase inhibitors is PXS-4699 – a highly developable and drug-like small molecule with potent dual pharmacology, which is expected to protect muscle through direct effects on inflammation and oxidative stress, and indirectly, on fibrosis. If proved viable, this discovery has the potential to make a huge difference to people living with DMD – not only improving their daily functioning and quality of life, but also lengthening their life expectancy.

To progress PXS-4699, Pharmaxis was awarded $501,500 of matched funding in Round 2 of the BTB program and was supported by BTB venture partner, BioCurate. At the beginning of the project, the inhibition of the two enzyme targets, namely MAO-B and SSAO, was expected to lead to a functional improvement in patients, through a complementary mode of action targeting key aspects of DMD disease progression, inflammation, oxidative stress and fibrosis. The BTB funding allowed Pharmaxis to investigate this potential by generating a comprehensive data package. Animal studies conducted showed that the safety profile and tolerability of PXS-4699 was excellent. A pre-Good Manufacturing Practice (GMP) multi-kilogram batch of drug product was made, and stability and formulation data were generated to enable manufacturing for future clinical studies.

Pharmaxis continued

The mode of action of PXS-4699 was confirmed in two independent studies carried out in *mdx* mice, with the treatment leading to a significant reduction in the disease biomarkers muscle inflammation, reactive oxygen species and fibrosis. Target engagement was confirmed for both pharmacological targets. However, these one-month studies showed no significant improvements in muscle function.

To assess the drug's viability, the team met with a neuromuscular disease expert advisory board (the TREAT-NMD Advisory Committee for Therapeutics) during the first half of 2021. Though the overall data package was viewed positively, it lacked evidence of clear muscle function improvement; consequently, the board recommended Pharmaxis conduct an extended three-month *mdx* mouse study, including comparison with, and dosing on top of, the clinical standard-of-care steroid treatment. This additional study was carried out, but again, the lack of improvement to muscle function led the team to conclude that rapid benefits to muscle function in DMD may not be expected from a dual MAO-B/SSAO inhibitor.

The project was terminated in March 2022, and the Pharmaxis team continues to investigate the lack of translation from positive anti-oxidative stress and anti-fibrotic data to functional improvements. Given the consistent effects on disease biomarkers and good drug-like properties of PXS-4699, alternative options for the development of this compound as a drug are also now being evaluated. A Patent Cooperation Treaty (PCT) patent application has been filed, claiming priority from the Australian provisional application. From a commercial viewpoint, the strong intellectual property position, consistent anti-fibrotic efficacy, near completion of preclinical safety/Investigational New Drug (IND)-enabling studies, and available pre-GMP drug substance may allow for swift progression of the candidate once the most appropriate therapeutic opportunity has been defined.

Despite not meeting the original objectives of the BTB project, Pharmaxis's Head of Chemistry, Dieter Hamprecht, has said that the program enabled the team to make considerable advancements in drug discovery. "Without the help during the BTB program, we would not have been able to advance this drug candidate so speedily," Mr Hamprecht said. "We confirmed its profile to be ideally suited to fully explore this unique mode of action. Moving forward, selection of the best clinical indication will be key, and the data generated during the BTB program will greatly help that process."

Image: The Drug Discovery team at Pharmaxis. Image credit: Pharmaxis

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Taking AIM - a new measurement tool to diagnose and guide therapy for ataxia and imbalance

PROJECT:
The Florey Institute of Neuroscience and Mental Health

THERAPEUTIC AREA:
Neurological Diseases

THE FLOREY

START DATE: 28 September 2020	TOTAL BTB GRANT: $500,000
END DATE: 30 June 2022	TOP-UP FUNDING: $122,500
STATUS: Completed	TOTAL BTB EXPENDITURE: $610,114
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $495,114
	TOTAL IN-KIND: $485,433
	TOTAL PROGRAM: $1,590,660

Jobs within project budget (FTEs dedicated to project)	3
New jobs created because of this project, at lead applicant and/or partners	3
Number of new technologies invented/progressed	1
New patent applications resulting from this project (distinguish granted and provisional)	1
New products launched	3
Number of preclinical studies commenced	1
Number of clinical trials commenced	1

Image: Ataxia Instrument Measurement-Spoon Cup and Pendant

Ataxia is a neurological condition that is caused by injury to the cerebellum, the area of the brain concerned with co-ordination and balance. Affecting around one in 10,000 people globally – and approximately 2,500 people in Australia – it is characterised by a lack of voluntary coordination of muscle movements, which can lead to imbalance, speech and swallowing changes and abnormal eye movements.[1] The disorder is associated with a range of diseases, including hereditary neurodegenerative disorders, multiple sclerosis and stroke, as well as inner ear or vestibular conditions.

One form of ataxia, hereditary cerebellar ataxia (HCA), encompasses a group of fatal, progressive disorders that are typified by incoordination of gait, limb movements, eye movements, speech and swallow. Although clinical presentation and progression are variable, a universal feature of HCA is the progressive and complex deterioration of function, which can bring about early death. Based on estimates of HCA incidence in Australia, the disorder costs $960 million each year; this encompasses expenditure related to productivity loss, caregiver salaries and in-patient care.[2] While there is no treatment capable of altering the devastating effects of HCA, significant progress is well underway to find therapies that will halt its progression.

Up until now, treatments for ataxia have been hampered by the inability to accurately measure symptoms. Currently, patients are assessed by a codified clinical examination, which requires great skill and experience on the part of the clinician and involves the patient performing tasks that have little relevance to their daily activities. Consequently, this assessment does not fully measure the severity and progression of the disease and the manner in which it affects the patient's quality of life.

The Florey Institute of Neuroscience and Mental Health continued

Similarly, there is no objective measurement tool capable of assessing whether new treatment modalities are improving patient symptoms or slowing disease progression. Clinicians and researchers agree that, to progress understanding of ataxia, they need to be able to measure the disease throughout its trajectory, in a home or clinic setting, in a way that objectively reflects its impact on patients' daily activities and quality of life.

The Florey Institute of Neuroscience and Mental Health is one of the organisations working to address this gap. As one of the largest and most respected brain research centres in the world, its teams study a range of serious diseases, including stroke, epilepsy, Alzheimer's disease, Parkinson's disease, motor neurone disease, depression, and addiction.

The Florey, with Associate Professor David Szmulewicz and Professor Malcolm Horne as the leads in a collaboration with Professor Pubudu Pathirana of Deakin University and Associate Professor Louise Corben of the Murdoch Children's Research Institute (MCRI), is working to develop a medical device that serves as an objective measurement tool for ataxia. This collaboration brings together expertise in clinical medicine, movement pathophysiology, machine learning technologies and internet of Things (IoT) towards the development of the Ataxia Instrumented Measurement (AIM) system project.

The AIM system comprises a spoon, pendant and cup instrumented with accelerometry and inertial sensors that use machine-learning algorithms to extract measures of movement during tasks performed by people with ataxia. A single 'score' is provided that is of significant utility to both the clinician and researcher. The AIM system measures ataxia while people undertake daily tasks which the condition renders challenging, such as drinking, eating and standing.

In September 2020, The Florey was awarded $500,000 in matched funding during Round 2 of the BTB program, alongside an additional $122,000 in top-up funding. Throughout the funding period, it was supported by BTB venture partner, the Medical Device Partnering Program (MDPP). The funding allowed the team to develop product software and hardware for the AIM system, to undertake initial product manufacture of units, and recruit patients for a clinical trial. The Florey also began development of a regulatory strategy.

By the time it applied for funding, the team had already developed prototypes – specifically, the AIM-Spoon (AIM-S), the AIM-Cup (AIM-C) and the AIM-Harness (AIM-H). The next step was to convert the algorithms to medical-grade software and build hardware which met regulatory standards, enabling the system's use in key research trials.

During the 21-month funding period, working with Professor Pubudu Pathirana and the Deakin University Biomedical Engineering team, The Florey successfully achieved all its project objectives, including hardware development, the conversion of existing machine-learning software into commercial-grade applications, and validation of the devices for manufacturing and use in clinical trials. Patient recruitment and trial participation coordinated by MCRI's Associate Professor Louise Corben have now commenced in Australia and overseas, and a provisional patent covering the AIM system has been filed, with full patents set to be lodged in the near future.

Using the top-up funding, the team undertook a market analysis to identify commercial opportunities for extending AIM measures beyond use in clinical research. The resulting Market Analysis Report, business model and commercialisation strategy can be used to pitch the investment opportunity to potential investors. The team has also entered a collaborative research agreement with the Friedreich's Ataxia Research Alliance in the US, to further develop the AIMS for longitudinal disease measurement.

The importance of using an objective system to assess ataxia progression while patients perform daily tasks has been recognised internationally by leading researchers and clinicians, who seek simpler, more accurate tests that require less of their time. Further highlighting this need, the US Food and Drug Administration (FDA) has recommended that end points for clinical trials should reflect patient perspectives and have relevance to daily life.

The AIM system enables researchers to have an objective quantitative measurement of ataxia and imbalance in clinical trials, with potential to become a universal biomarker for ataxia, just as 'blood glucose' is for diabetes. This project is the first outcome measure that uses machine learning and sensor technology to assess ataxia during activities of daily living.

According to project lead Professor Horne, this will likely have flow-on effects, whereby the system can be used to assess people at risk of falls, or to inform physiotherapy strategies for people living with vestibular disease. "Although our ultimate aim is to find effective treatments, the ability to monitor ataxia progression will allow everyday lifestyle improvement for many people," he said. "Falls, injuries and movement challenges are common for people living with ataxia. We expect that the device can become used in routine clinical care and to inform clinical decisions."

Sources

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Developing first-in-class oral, small molecule inhibitors to treat prostate and other cancers

PROJECT:
UniQuest Pty Ltd

THERAPEUTIC AREA:
Oncology

UNIQUEST

START DATE: 1 July 2020	TOTAL BTB GRANT: $989,410
END DATE: 30 June 2022	TOP-UP FUNDING: $111,250
STATUS: Completed	TOTAL BTB EXPENDITURE: $1,100,660
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $1,256,247
	TOTAL IN-KIND: $367,397
	TOTAL PROGRAM: $2,724,304

Jobs within project budget (FTEs dedicated to project)	11
Number of new technologies invented/progressed	1
Number of preclinical studies commenced	7

Image: Pictured, from left, Dr Raphael Rahmani, Dr Brian Dymock and Dr Claire Levrier. Photo credit: Image courtesy of UniQuest

Prostate cancer is the most commonly diagnosed cancer in Australian men, and the second most common cause of cancer death. Recent data from the Australian Institute of Health and Welfare estimates that 24,217 Australian men will be diagnosed with prostate cancer this year, which is a 34 per cent increase compared to 2021.[1] Meanwhile, in the US, the American Cancer Society predicts there will be 268,490 newly diagnosed prostate cancer cases this year, and about 34,500 deaths.[2]

Currently, the standard first-line treatment for prostate cancer is androgen deprivation therapy, however, it is not curative, and developing resistance is common. In some cases, the cancer can metastasise, even when testosterone is below castrate levels, leading to metastatic castration-resistant prostate cancer (mCRPC). In such cases harsher systemic chemotherapy is required, and antineoplastic drugs such as docetaxel are used as standard of care.[3]

Though mCRPC only represents nine percent of prostate cancer diagnoses, treatment options for such cases account for up to 50 percent of the addressable market. Yet the treatment paradigm is rapidly evolving, thanks to the development of new androgen receptor–targeting therapies, which inhibit the growth of prostate cancer by blocking the ligand–binding domain of the androgen receptor. In 2018 and 2019, androgen receptor-targeted agents (ARTAs) such as Xtandi (enzalutamide) and Zytiga (abiraterone acetate) were approved in the US and five European countries and had global sales of USD$4.3Bn and USD$2.4Bn respectively in 2020.[4] These marketed drugs remain the gold standard treatment for mCRPC, but they are not curative, and within 12 months the disease returns as lethal ARTA–resistant prostate cancer. At this point, patients progress to chemotherapy, with adverse side effects and significantly diminishing quality of life.

UniQuest continued

According to clinical advisers, the future treatment landscape for prostate cancer will comprise multiple combination therapies; consequently, there is an urgent need to discover and advance therapies with new mechanisms that could be combined with existing therapies. With this objective in mind, the Queensland Emory Drug Discovery Initiative (QEDDI) is working to develop a novel, first-in-class non-hormonal oral therapy for mCRPC patients who have become resistant or unresponsive to any prior ARTA.

QEDDI is the drug discovery incubator of UniQuest, the commercialisation company of The University of Queensland, which features a team of industry-experienced medicinal chemists and biologists, who collaborate with academic researchers to translate biomedical research to drug candidates – improving and expanding treatment options for patients with considerable unmet need.

The development of a non-hormonal oral inhibitor targeting a novel mechanism has been built on research initially carried out by The University of Queensland's Professor Greg Monteith, in collaboration with clinician researcher Professor Sunil Lakhani. Their research had identified a key mechanism involved in major cancers; a new protein was identified that had increased expression in prostate and breast cancer and correlated with decreased survival rates. Based on this compelling body of data, QEDDI initiated a collaboration with Professor Monteith to design and develop new inhibitors of the protein target with high potency and structural novelty, to treat prostate cancer and potentially other cancers. QEDDI's Director of Chemistry, Dr Brian Dymock, and his team have advanced the project through lead optimisation stage towards the selection of a preclinical drug candidate.

In July 2020, the QEDDI team was awarded $989,000 in matched funding from Round 2 of the BTB program. This funding allowed the team to validate the efficacy of the lead inhibitors in prostate cancer, identify and extensively profile preclinical development candidates, and demonstrate translation in other solid cancer indications.

According to UniQuest CEO, Dr Dean Moss, the BTB award has been invaluable to the project. "Funding support from the BTB program has enabled the team to progress quickly through advanced lead optimisation and candidate selection, allowing the project to progress much faster towards the clinic and ultimately, the patient, than would have been possible otherwise," Dr Moss said. "We are very grateful for this support and excited to see the project progressing – potentially improving the care of prostate cancer patients in Australia and around the world."

At the end of the project, a preclinical development candidate had been identified together with two back-up candidates demonstrating tumour growth inhibition in multiple cancer models. The candidate compounds and back-ups demonstrate good selectivity and potency against the target; multiple dose tolerability in rodents; and good single dose pharmacokinetic and tolerability in dogs.

With the support of the BTB program, QEDDI has now extensively profiled the preclinical candidate and the back-up compounds in early development assays and characterised their efficacy in cancer cell lines that are resistant to ARTA therapies, providing differentiation from the current standard of care. This potentially addresses a key target patient cohort – thereby supporting the proposed clinical line of sight as required by potential partners. Inevitably, patients will still progress onto chemotherapy; however, the team envisions that the mechanism of the novel inhibitors will allow them to be used in combination with chemotherapy, such as docetaxel, to extend life expectancy.

Having achieved the identification and extensive characterisation of a novel preclinical development candidate with a demonstrated on-target mechanism, the project is positioned to enter preclinical development to compile a clinic-ready package to support first-in-human studies.

A high level of interest has already prompted initial discussions with prospective partners. "We are seeking a partner with the experience and capacity to take a prostate cancer therapy through clinical development and to the market," Dr Moss said. "This could be via a partnership with a pharmaceutical or biotechnology company or alternatively via a venture capital investment to progress the candidate into clinical development within a start-up company."

In 2018, the prostate cancer market was valued at US$9.3 billion in the eight major markets (the US, France, Germany, Italy, Spain, UK, Japan and China) and is predicted to reach US$12.8 billion by 2028.[4] The availability of a first in class, orally administered drug with a novel mechanism represents a considerable commercial opportunity either as a monotherapy or in combination with other agents.

More importantly, the BTB supported project has the potential to make a difference to the growing number of patients diagnosed with prostate cancer each year – providing a safer alternative to chemotherapy and a better quality of life.

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Solid dose needle-free vaccine to combat Zika virus

PROJECT:
University of Adelaide

THERAPEUTIC AREA:
Infectious Disease

THE UNIVERSITY of ADELAIDE

START DATE: 14 October 2020	TOTAL BTB GRANT: $675,000
END DATE: 30 June 2022	TOP-UP FUNDING: $103,750
STATUS: Completed	TOTAL BTB EXPENDITURE: $778,750
DELIVERABLES COMPLETED: 100%	TOTAL CASH CO-CONTRIBUTION: $780,000
	TOTAL IN-KIND: $0
	TOTAL PROGRAM: $1,558,750

Jobs within project budget (FTEs dedicated to project)	4
New jobs created because of this project, at lead applicant and/or partners	4
Number of new technologies invented/progressed	1
Number of preclinical studies commenced	6

Zika virus is a viral disease primarily transmitted by the bite of an infected Aedes mosquito, though it can also be passed from mother to fetus during pregnancy. Sexual transmission of Zika virus has likewise been documented, with the virus able to infect, damage and persist in testes.[1]

Though the symptoms associated with Zika virus are relatively mild, the World Health Organization (WHO) has designated it a priority disease, because it can trigger catastrophic complications, such as Guillain-Barré syndrome. It can also cause severe congenital defects, like microcephaly, if infection occurs during pregnancy.

During the most recent Zika virus outbreak, which occurred between 2015 and 2016, about 174,000 cases of infection were confirmed in Central and South America, with most of them reported in Brazil. To date, a total of 89 countries and territories have documented evidence of autochthonous mosquito-borne transmission of Zika virus, distributed across five of the six WHO regions (all except the Eastern Mediterranean Region).[2]

Currently, treatment for Zika virus is directed only towards relieving symptoms, and despite intensive efforts, there are no licensed vaccines that completely prevent infection. One of the key challenges of developing a vaccine platform is ensuring its safe application during pregnancy; other considerations include its feasibility and scalability for deployment in an epidemic situation.[3]

Image: Dr Makutiro Masavuli, working in the lab.

University of Adelaide continued

Under the leadership of A/Prof Branka Grubor-Bauk, Head of Viral Immunology at the Adelaide Medical School, a team from The University of Adelaide has taken on the challenge of developing a DNA vaccine for Zika virus. DNA vaccines not only induce humoral and cellular immunity against the virus but are also less expensive to manufacture than traditional vaccines. DNA-based vaccines, which are produced using standardised manufacturing, have several features that make them attractive for managing epidemics in resource-poor settings – namely, they don't require cold-chain storage, and they offer long-lasting immunity. A DNA-based Zika virus vaccine would therefore ensure long-term efficacy and enable rapid deployment during future outbreaks.

According to A/Prof Grubor-Bauk, such a vaccine has the potential to significantly restrict maternal-foetal transmission of Zika virus.[4] "Zika virus is extremely dangerous if you're pregnant, as severe birth defects such as microcephaly cannot be corrected, and the accompanying disabilities are lifelong and catastrophic. This research aims to develop a novel needle-free vaccine to prevent infection of pregnant women and the resulting devastating congenital effects in the unborn child," said A/Prof Grubor-Bauk.

The University of Adelaide team secured a valuable non-exclusive partnership with Enesi Pharma to provide its proprietary intradermal, needle-free vaccine delivery system. Enesi Pharma is an award-winning biotech company based in the UK, where it develops a range of next-generation, ImplaVax®-enabled, needle-free injectable unit solid dose vaccines.

In 2020, The University of Adelaide was awarded $675,000 in matched funding through Round 2 of the BTB program, and was supported by BTB venture partner, Uniquest, to complete preclinical evaluation of its novel Zika virus DNA vaccine. Ultimately, the project aimed to evaluate a needle-free, solid dose formulation for its Zika virus vaccine, in partnership with Enesi Pharma.

During the 20-month grant period, The University of Adelaide successfully completed an in vivo evaluation of the optimal dose and vaccination regime required to achieve protection with the naked Zika virus DNA vaccine. This was done by measuring Zika viral loads in mice that had been vaccinated with two or three doses of the DNA vaccine. The studies showed that the naked vaccine conferred protection after two doses at a standard dose, or three doses at a lower dose. A pregnancy study was also done in a mouse model of Zika infection, which demonstrated that the vaccine conferred protection to both the mother and fetus, and prevented fetal brain damage, microcephaly and intrauterine growth retardation. The vaccine also demonstrated efficacy in eliminating the persistence of Zika virus in the male reproductive tract. Naked Zika DNA vaccine progressed through to evaluation in NHP and whilst studies are underway early data shows vaccine to be immunogenic in this model.

Vaccine dose optimisation was also done in mice for the Zika solid dose implant, and its delivery method was further investigated with better outcomes intradermally in mice. Formulation of the Zika vaccine into a solid-dose implant showed efficacy and protection in mice vaccinated with the standard dose. Thermostability studies at a range of temperatures over a period of 6 months for both naked and solid-dose Zika vaccines demonstrated excellent thermostability for both formulations.

The development of the solid dose implant formulation of the vaccine is ongoing. The University of Adelaide has continued its partnership with Enesi Pharma, and if the delivery platform is successful, it may secure a licensing arrangement. Alternatively, Enesi Pharma will license the vaccine for further development.

An additional top-up funding of $103,750 allowed the University of Adelaide to engage several consultants towards meeting their commercial goals, including a technical expert to assist them in developing a Go to Market Model (GTM), business strategy and competitor landscape benchmarking analysis. An IP consultant was also engaged to enhance their strategy and strengthen their IP position. Two regulatory consultants were also engaged to provide advice that puts the team in a good position to expand their reach to market, accelerate clinical programs, increase the value of their assets, and position their start-up for future capital raise.

Although the initial target population for the vaccine is females of childbearing age, given the favourable safety profile anticipated, and longevity of protection provided, there is also potential for it to be used in younger age groups.

While cases of Zika virus have significantly declined in recent years, it's expected that further transmission may still occur, particularly in areas with a large naïve population and abundant Aedes mosquitoes.[5] In the event of its re-emergence or future epidemics, it's anticipated that initial uptake of The University of Adelaide's vaccine would most likely occur in endemic countries across many age groups, before moving into annual cohort-driven national immunisation programs. The next market segment would be travellers to endemic areas, and eventually – depending on disease epidemiology and mosquito movement with climate change – the vaccine could potentially be introduced routinely in national immunisation programs globally.

Image: Viral Immunology Group

Sources

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ROUND THREE

Innovative potential new drug therapy for respiratory complications linked to COVID-19

PROJECT:
Dimerix Bioscience Pty Ltd

THERAPEUTIC AREA:
Infectious Diseases

Dimerix

START DATE:
15 September 2020

END DATE:
31 January 2022

STATUS:
Completed

DELIVERABLES COMPLETED:
100%

TOTAL BTB GRANT:
$1,000,000

TOP UP FUNDING:
$122,500

TOTAL BTB EXPENDITURE:
$1,122,500

TOTAL CASH CO-CONTRIBUTION:
$1,166,849

TOTAL IN-KIND:
$1,679,137

TOTAL PROGRAM:
$3,968,486

Jobs within project budget (FTEs dedicated to project)	1
New jobs created as a result of this project, at lead applicant and/or partners	3
Number of new technologies invented/progressed	1
New patent applications resulting from this project (distinguish granted and provisional)	3 PCT filed
Number of clinical trials commenced	1
Patients treated/diagnosed with new product/technology/therapeutic	742 patients dosed in the domain as at 25 January 2022

As of 16 January 2022, there were more than 323 million confirmed COVID-19 cases worldwide and over 5.5 million deaths. Data from the World Health Organization (WHO) revealed that over 18 million new cases were reported across the six WHO regions for the week ending 16 January; this marked a 20 per cent increase compared to the previous week, with more than 45,000 new deaths also reported.[1]

COVID-19 is not the only respiratory condition placing a significant strain on the global healthcare system. Community-Acquired Pneumonia, caused mostly by bacterial and viral infections, is the fourth most common cause of death from infection globally, and the leading cause of death in developing countries. In the US, the healthcare costs of pneumonia amount to USD 17 billion each year.[2]

To address this global challenge, an international network of leading experts, institutions, and research groups collaborated on an international adaptive platform called the REMAP-CAP (Randomised, Embedded, Multifactorial Adaptive Platform trial for Community-Acquired Pneumonia). This platform, recognized and endorsed by the World Health Organization (WHO), utilises a unique trial design to be able to simultaneously evaluate different treatments for community-acquired pneumonia.[3] In March 2020, following the emergence of COVID-19 as a novel coronavirus – and due to urgent medical need – a new appendix was added to the protocol to incorporate novel treatments for patients with suspected, or confirmed (via microbiological testing) COVID-19 as part of the race to control the spread of the pandemic.

Image: DMX-200 single capsule.

Dimerix continued

Melbourne-based biopharmaceutical company Dimerix (ASX: DXB) was selected to join this global study. Dimerix had initially developed their lead drug candidate, DMX-200, for a different target – namely, in types of kidney disease. DMX-200 interrupts the signalling for inflammatory immune cells, thereby reducing inflammation and preventing the subsequent onset of fibrosis.

In the early days of the COVID-19 pandemic, it was identified that the respiratory complications in COVID-19 patients was caused by the human immune response to the virus. As the virus enters the lung, the immune system signals for inflammatory cells to the lungs, causing a feedback loop that floods the lungs and results in fibrosis, or scarring of the lung tissue. Essentially an overreaction of the body's own immune system which causes breathing complications.

Global experts saw DMX-200 as a compelling treatment option to reduce the damage caused by SARS-CoV-2 in the lung by dialling down the immune response, and therefore preventing the flooding and lung damage. This has the potential to also reduce the long-term impact and health burden once patients leave hospital, what has been termed 'long-COVID', where symptoms persist well past recovery from the viral infection. Dr. Patrick Lawler, a clinician at Toronto General Hospital and Working Group Chair of the REMAP-CAP stated that "There is a compelling biologic rationale to imbed DMX-200 into the RAS domain of the REMAP-CAP COVID trial, where its potential therapeutic effects may combine with those of angiotensin receptor blockers to reduce the organ support requirements, including ventilation and death in patients hospitalized with COVID-19."

In June 2020, the company announced that its lead drug candidate, DMX-200, had been selected for inclusion in the REMAP-CAP trial, as a possible treatment for acute respiratory distress syndrome (ARDS) associated with COVID-19.

Dimerix's inclusion in this smart, innovative trial is a remarkable achievement and an enormous undertaking for the company. In support of this, the BTB Program awarded Dimerix $1 million in matched funding during Round 3 of the program, throughout which it was supported by BTB venture partner, UniQuest.

The BTB award funded multiple activities, including the manufacture, testing and distribution of DMX-200 clinical trial supplies to clinical sites, and the development and submission of regulatory dossiers to relevant authorities. Through the BTB program, Dimerix also engaged in commercial discussions globally in preparation for the release of the REMAP-CAP study data, which is expected this year. More specifically, Dimerix prepared and supported the equivalent of an Investigational Medicinal Product Dossier (IMPD), which was submitted in selected countries (the UK and the Netherlands) and includes summaries of information related to the quality, manufacture, and control of the investigational medicinal product (IMP).

Through the REMAP-CAP study, patients hospitalised with COVID-19 pneumonia were recruited and randomised to receive one of the treatments under investigation, including DMX-200; simultaneously, Dimerix worked with the REMAP-CAP team on logistics and distribution of DMX-200 to those countries and sites for treatment initiation. REMAP-CAP investigators wanted to ensure that Dimerix was able to produce its drug in quantities ready for the trial, and for these to be distributed around the world shortly after regulatory approval. The BTB funding allowed Dimerix to manufacture DMX-200 clinical supplies (also called IMPs) for shipment to Europe. The selected global manufacturer in the US prioritised manufacture for COVID-19 studies and was able to produce the drug substance and the drug product in capsule form in the required timeframes. A new formulation for the drug was also developed, and studies have confirmed that DMX-200 is compatible with delivery via nasogastric tube.

The successful manufacturing and distribution of DMX-200 in capsule, as well as a formulation suitable for nasogastric delivery, was a momentous accomplishment that resulted from a collaborative effort – a particularly impressive feat, rising against the logistic challenges and time constraints posed by the COVID-19 pandemic.

To date, REMAP-CAP has completed 17,986 randomisations in patients with suspected or proven COVID-19 across 332 clinical sites in 21 different countries and across multiple study domains. In October 2021, the first patients were randomised to DMX-200 in the RAS domain, and the drug has now been administered at 14 sites across the UK and the Netherlands. The results are anticipated later this year.

An additional $122,000 in top-up funding, awarded to Dimerix in December 2021, funded the engagement of an international transaction advisory firm to initiate and co-ordinate Dimerix's international outreach and business development activities. This was very valuable as it provided access to the transaction advisory firm's network of contacts, along with providing Dimerix with additional business development resources which were utilised to prepare and revise marketing materials, conduct outreach to potential licensees and attend meetings and presentations.

The potential impact of DMX-200 on patient and economic outcomes is considerable. Despite the introduction of vaccines that aim to reduce the viral burden of COVID-19, improving treatments for hospitalised patients remains crucial. Importantly, if the damage caused by COVID-19 in the lung is reduced, so too will the post-viral complications, allowing for a better quality of life for patients. This may also prove beneficial for patients with other infection related respiratory complications, such as pneumonia and influenza – validating DMX-200 as a valuable tool in the fight against seasonal viruses and bacterial infection, as well as future pandemics.

Image: Dimerix team in 2021.

Sources

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Australian innovation curbing the spread of COVID-19 in hospital settings

PROJECT:
University of Melbourne, Medihood McMonty

THERAPEUTIC AREA:
COVID-19, Infectious Disease

START DATE:
14 September 2020

END DATE:
31 December 2021

STATUS:
Completed

DELIVERABLES COMPLETED:
100%

TOTAL BTB GRANT:
$605,000

TOP UP FUNDING:
$85,000

TOTAL BTB EXPENDITURE:
$690,000

TOTAL CASH CO-CONTRIBUTION:
$607,030

TOTAL IN-KIND:
$1,317,457

TOTAL PROGRAM:
$2,614,487

Jobs within project budget (FTEs dedicated to project)	7
New jobs created as a result of this project, at lead applicant and/or partners	14
Number of new technologies invented/progressed	1
New trademark applications resulting from this project	1
New licenses resulting from this project	1
New products launched	1
Number of preclinical studies commenced	3
Number of clinical trials commenced	1
Patients treated/diagnosed with new product/ technology/therapeutic	100+
If any, number of awards or other recognitions for this project/product	2

In mid-2020, as the number of COVID-19 patients requiring hospitalisation skyrocketed around the world, healthcare systems buckled under the pressure. The pandemic had exposed an unmet need in respiratory infection control; healthcare workers were at significant risk of cross-contamination, either through direct patient expulsion of infected droplets, or through the application of known high-risk aerosol-generating procedures, such as non-invasive ventilation, high-flow oxygen and nebulisers.

As of early July 2020, it was estimated that Australian healthcare workers were 2.7 times more likely to contract COVID-19 than the general community; as a result, they either missed work due to infection, or avoided work altogether – worsening already high levels of staff absenteeism.[1] The introduction of risk-mitigation protocols in hospital settings likewise meant that COVID-19 patients were unable to receive important respiratory therapies to manage their condition.

At the time, the College of Intensive Care Medicine recommended that infected patients admitted to hospital should be cared for in negative pressure isolation rooms; however, most hospitals weren't equipped with such facilities to handle the high volume of patients that required them, and scaling this solution wasn't a viable option.

Image: The Medihood being used in an Australian hospital.
Photo credit: Penny Stephens

A team from The University of Melbourne presented a novel alternative: a personal ventilation hood, dubbed the "McMonty", which could be fitted to hospital beds to enclose the upper body of patients, in order to contain and filter their infectious air. Made from clear PVC plastic, the fold-back cover was designed to create a physical barrier between patients and anyone in close proximity, such as healthcare workers or fellow patients. The device's fully transparent material allowed staff to conduct visual welfare checks on patients and maintain communication with ease.

Led by Professor Jason Monty and Professor Ivan Marusic, the multidisciplinary team brought together world-leading fluid dynamicists, clinicians and aerosol chemists with engineering and aerosol science expertise in a spin-off business called Medihood. The group also worked in collaboration with Western Health through intensive care physician and anaesthetist Associate Professor Forbes McGain, and colleagues, to progress research infrastructure and conduct preliminary clinical trials to validate the hood.

Melbourne-based flag and banner manufacturer Evan Evans (co-designer of the Australian flag) came on board as product development and commercialisation partner, repurposing its flag-making technology to manufacture the device.

The first demonstrations of the early McMonty prototype were conducted at Footscray and Sunshine hospitals. Later, the device was trialled for usability, nurse acceptance and patient comfort at Western Health during Victoria's second wave of the COVID-19 pandemic.

Associate Professor McGain confirmed that the innovative hood gave hospital patients greater peace of mind. "We had a patient who has chronic health issues and was suspected of having COVID-19, who normally comes in and stays by himself in an isolation room," he said. "His feedback was that he quite enjoyed [being under the device] because he wasn't alone in a room, he felt more cared for, he could talk to staff and feel part of the ward."

In September 2020, the Medihood project was awarded $605,000 in matched funding during Round 3 of MTPConnect's BTB program, with top-up funding of $85,000 and was supported by BTB venture partner the Medical Device Partnering Program (MDPP). This funding not only enabled the team to bring the McMonty to market within 12 months, but also facilitated further research towards optimising patient comfort and proving – in collaboration with the Doherty Institute and Western Health – a reduction in the spread of disease-carrying aerosols and viruses.

The funding also supported Evan Evans to improve the device with respect to infection control, durability, ease of use and design for manufacturing. Moreover, the BTB program provided commercialisation expertise and financial support to help Evan Evans develop the quality management system required to manufacture a medical device. The company has now licensed the rights from The University of Melbourne to manufacture and distribute the product and has appointed dedicated sales and marketing staff for this purpose.

Now listed as a medical device on the Australian Register of Therapeutic Goods (ARTG), the McMonty by Medihood is the first commercially available, unsealed, portable and scalable personal isolation solution capable of limiting the spread of respiratory infection within a hospital ward. It is currently in use in more than 145 hospitals around Australia, including in regional centres, and is also enjoying early adoption overseas.

In 2021, it was awarded the `Excellence Award in Interdisciplinary Research' by The University of Melbourne's Faculty of Engineering and Information Technology; and was the joint winner of the 'Workplace Health and Safety Solution of the Year' accolade at the WorkSafe Victoria Awards.

Though the Medihood project completed its BTB program activities in December 2021, The University of Melbourne and Evan Evans are still collaborating on various new medical devices, with the latter organisation now formulating a more portable ventilation hood to fit onto and be transported with a hospital bed in an emergency department.

Medihood's success is testament to the collaborative efforts of multidisciplinary experts, who came together under extraordinary circumstances to develop a world-class and life-saving product. This groundbreaking device has enabled healthcare workers to perform their roles safely and effectively against the backdrop of a pandemic and will no doubt be a valuable tool in the event of future outbreaks.

Sources

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Viral respiratory biomarker test – a potential triage tool for COVID-19

PROJECT:
SpeeDx (Rapid Response COVID-19 Assay)

THERAPEUTIC AREA:
COVID-19, Infectious Disease

SpeeDx
Diagnostics Defining Therapy

START DATE:
2 November 2020

END DATE:
31 March 2022

STATUS:
Partially completed

DELIVERABLES COMPLETED:
31/34 (91%)

TOTAL BTB GRANT:
$531,411

TOTAL BTB EXPENDITURE:
$513,630

TOTAL CASH CO-CONTRIBUTION:
$513,630

TOTAL IN-KIND:
$240,000

TOTAL PROGRAM:
$1,267,260

Jobs within project budget (FTEs dedicated to project)	6
New jobs created as a result of this project, at lead applicant and/or partners	1
Number of new technologies invented/progressed	1
New licenses resulting from this project	1
Number of preclinical studies commenced	2

Image: SpeeDx and Nepean researchers in the lab. Pictured, left to right: Tiana Pelaia (Nepean) and Nicole Lima (SpeeDx).

The COVID-19 outbreak caused by the SARS-CoV-2 virus is an ongoing global health issue. As of July 2022, there have been approximately 564 million cases worldwide, with approximately 1 million new infections being reported each day.[1]

Early in the pandemic, health services around the world were overwhelmed by an influx of patients, with high infection and fatality rates highlighting an urgent unmet need for triage tools. Since that time, the distribution of effective vaccines has drastically reduced the proportion of severe disease caused by the virus in Australia and many other regions globally. However, the relaxation of social distancing regulations, coupled with the emergence of new variants, has seen disease transmission and fatality rates fluctuate, and generally remain high. Consequently, it is still important for healthcare workers to be able to identify which patients require the highest level of care, as early detection may lead to faster delivery of treatment and better patient outcomes. In scenarios with uncontrolled community transmission, a tool that enables healthcare workers to allocate resources to those most in need would no doubt relieve some of the pressure in overburdened hospitals.

Leveraging its expertise in formulating molecular diagnostic tools, Sydney-based SpeeDx Pty Ltd (SDx) was quick to identify a possible solution. Partnering with researchers from the Nepean and Blue Mountains Local Health District (NBMLHD), it set out to create a rapid test that would enable risk-based management of COVID-19, as well as influenza and other severe respiratory diseases.

The test measures a single-gene biomarker, IFI27 – which was first discovered and has been validated since the swine flu epidemic of 2009. In the early days of the COVID-19 pandemic, the level of IFI27 detected in a patient's

blood was found to be a good predictor of the severity of their symptoms. It was therefore hypothesised that a test capable of measuring this biomarker would serve as a useful triage tool in hospitals, helping healthcare workers differentiate between patients most likely to require intensive-care treatment, and those who could safely be sent home to self-isolate.

Hoping to fast-track progression of such a valuable tool, SpeeDx was awarded $531,000 during Round 3 of the BTB program and was supported by BTB venture partner, the Medical Device Partnering Program (MDPP).

At the time of the award, a commercial test for triaging COVID-19 patients did not exist. Although some virus detection assays were commercially available, such as nucleic acid amplification by PCR, these only imparted information regarding the presence or absence of the virus in the patient's airways. It was widely recognised that this was not a reliable predictor of clinical outcomes. By comparison, IFI27 provided an excellent candidate biomarker for measuring the host response to COVID-19 and prognosticating symptoms. Utilising its game-changing propriety technologies, PlexZyme® and InSignia™, SpeeDx therefore aimed to create the world's first biomarker test to predict the risk of severe disease in COVID-infected patients.

Initially, the team had access to a research prototype based on the IFI27 biomarker, but for mass testing, it would need to be converted into a commercial in vitro diagnostic product. The project encompassed assay development and methodology optimisation, verification and validation, and clinical evaluation. If successful, SpeeDx planned to manufacture the test locally – a move that would not only align with the Australian Government's Modern Manufacturing Strategy (MMS), but also re-enforce the nation's position as a global leader in COVID-19 assay development, not to mention help futureproof pandemic preparedness against outbreaks of any novel respiratory viruses.

Through the BTB program, SpeeDx successfully designed and optimised two formats of a test for IFI27 expression levels. The first was a high-throughput test that could produce automated results within three hours, as opposed to the five hours offered by a conventional research based molecular test. This test was devised to analyse multiple patient samples at one time, in a centralised testing facility.

The second format was an assay that enabled testing of a patient at the point of care, such as a GP practice, aged care facility or small regional hospital – any facility that didn't have access to the large, centralised testing equipment required for the high-throughput assay and in cases where expedited results were needed.

SpeeDx completed validation studies to ensure the high-throughput test met specifications and reproducibility standards for use. It also optimised the point-of-care test and validated it on a common testing platform.
The test was determined to perform at a high standard, and accurate quantification of IFI27 levels by the assay was confirmed by use of mock samples and concordance testing with clinical samples. Sample processing workflow was optimised, and companion software analysis developed. To assess the clinical utility of the tests, SpeeDx and NBMLHD collected more than 300 samples of COVID-positive and non-COVID patients and tested the samples in the high-throughput assay format.

Unfortunately, the clinical data did not support the original intended use of prognosis. By this point in the pandemic, understanding of the immune response to SARS-CoV-2 had evolved and it was now generally acknowledged that IFI27 levels were unlikely to offer accurate insight into the subsequent progression of the disease.

Despite this outcome, the BTB project provided an invaluable opportunity to explore the complexities specific to host biomarker prognostic assays. SpeeDx progressed its understanding of its InSignia™ technology and its applicability to human gene normalisation, demonstrating its accuracy in comparison to traditional research methods. The company likewise developed a robust assay, which can be easily re-engineered to accommodate alternative or additional biomarkers, thus evolving its capabilities to meet future challenges. Although this assay cannot be used for COVID-19 prognostication, it remains a strong predictive marker for influenza infection and may be highly valuable in the event of a future influenza epidemic. Furthermore, the collaboration between SpeeDx and NBMLHD brought together industry and clinical researchers. A clinical testing site was established at Nepean Hospital and is still running to date, and patients who present with respiratory symptoms are enrolled into clinical studies on an ongoing basis.

Although the assay was not able to be commercialised for the initial objective of generating a COVID-19 triage tool, it has been developed and validated for use as a research tool and is available for future investigation into the use of the IFI27 biomarker. IFI27 may have potential to be incorporated as part of a panel of biomarkers in a test for differentiating between viral and bacterial respiratory infections, and SpeeDx is now investigating the commercial viability of this approach.

"The project drove the development and advancement of InSignia™ technology; a novel, improved strategy for analysis of human gene expression which is likely to find broad application in diverse clinical settings," According to Alison Todd, Chief Scientific Officer of SpeeDx Pty Ltd.

Sources

1. https://covid19.who.int/?mapFilter=cases

Australian biotech takes broad-spectrum antiviral nasal spray to the world

PROJECT:
Viraleze™ Antiviral Nasal Spray – Starpharma

THERAPEUTIC AREA:
COVID-19, Infectious Disease

starpharma

START DATE:
7 September 2020

END DATE:
31 August 2021

STATUS:
Completed

DELIVERABLES COMPLETED:
100%

TOTAL BTB GRANT:
$1,000,000

TOP-UP FUNDING:
$103,750

TOTAL BTB EXPENDITURE:
$1,103,750

TOTAL CASH CO-CONTRIBUTION:
$1,737,398

TOTAL IN-KIND:
$416,772

TOTAL PROGRAM:
$3,257,920

Jobs within project budget (FTEs dedicated to project)	3
New jobs created as a result of this project, at lead applicant and/or partners	3
Number of new technologies invented/progressed	1
New trademark applications resulting from this project	20
New patent applications resulting from this project (distinguish granted and provisional)	1
New licenses resulting from this project	1
New products launched	1
Number of preclinical studies commenced	8
Number of clinical trials commenced	1
Patients treated/diagnosed with new product/ technology/therapeutic	40

During the first year of the COVID-19 pandemic, as case numbers around the world accelerated week on week, governments were spending billions of dollars in the race to develop a vaccine. In the absence of ready solutions, there was urgent demand for preventative therapies that could be used to complement existing safety measures, such as personal protective equipment (PPE) and physical distancing.

Melbourne biotech Starpharma sought to contribute to the global effort to generate a solution by repurposing an existing antiviral agent that had already been approved for use in its range of women's health and sexual health products. As a leader in dendrimer-based drug delivery, Starpharma had reformulated an antiviral agent, known as SPL7013, which directly binds to viruses and prevents viral attachment and entry into human target cells. By adapting SPL7013 for use in a nasal spray, the team created a cost-effective and scalable product that would form a physical barrier between SARS-CoV-2 'spike' proteins and the nasal mucous membrane, trapping and irreversibly inactivating the respiratory virus, helping to reduce the risk of infection.

Image: VIRALEZE™ antiviral nasal spray registered for sale in Europe.
Photo credit: Mike Baker.

As Europe was experiencing high case numbers early on in the pandemic, Starpharma initially focused its regulatory and commercialisation activities in that region – aiming to curb transmission, particularly among high-risk groups such as healthcare, aged-care and airline workers.

Leveraging its vast body of existing technical data and regulatory approvals and building on the potential of SPL7013 for use against respiratory viruses, Starpharma was awarded $1 million in matched funding during Round 3 of MTPConnect's BTB program, through which it was supported by BTB venture partner UniQuest.

The overall objective of the project was to develop, validate, register and commercialise the antiviral nasal spray (Viraleze™) in less than 12 months. To achieve this goal, Starpharma collaborated with The Scripps Research Institute in the United States; a partnership that enabled rapid testing of the product against new variants of the SARS-CoV-2 virus as they emerged.

Starpharma successfully accomplished its goals within the target timeframe. Various in vitro[1] and in vivo[2] experiments showed that SPL7013 had potent antiviral activity against SARS-CoV-2 and its many variants, including Alpha, Beta, Gamma and Kappa; likewise, in laboratory studies, it demonstrated inactivation of more than 99.9 percent of the highly infectious Delta variant.

With additional top-up funding provided by the BTB program, further testing has confirmed the potent virucidal activity of SPL7013 against the Omicron variant, as well as other important respiratory viruses, including influenza A and B viruses, which are the two most common influenza viruses and responsible for flu epidemics and pandemics.

In commenting on the significance of these findings, Professor of Immunology and Microbiology at The Scripps Research Institute, Philippe Gallay, said: "Our antiviral studies have found that SPL7013 can abolish infection with all nine SARS-CoV-2 variants tested. These include the most highly infectious Omicron, and the virulent Delta variant. In fact, it appears that SPL7013 is even better able to block the more highly infectious variants than the early variants of SARS-CoV-2. This effect appears to be due to the mechanism of action of SPL7013 that involves interaction with multiple regions of the virus spike protein. Mutations in the highly infectious virus variants appear to have introduced even more potential binding sites for SPL7013 to interact with. Omicron has over 30 mutations in the spike protein that have made it extremely highly transmissible in the community. To suppress this transmission, we need to have additional tools that can block SARS-CoV-2 infection of the nose, and SPL7013 can play an important role."

The Starpharma team found that Viraleze demonstrated a high level of protection against SARS-CoV-2 in a highly demanding humanised mouse model of coronavirus infection, which is one of the few animal models endorsed by the World Health Organization (WHO) to accelerate the testing of vaccines and therapeutic agents for COVID-19. In the study, Viraleze reduced viral load by more than 99.9 percent in the lungs when it was administered nasally.[2,3]

As part of the BTB project, the team also completed a randomised, double-blind, placebo-controlled, safety, tolerability and absorption study of Viraleze in 40 healthy volunteers, who used the product four times a day for 14 days. The product was very well tolerated, with no notable or serious adverse events reported, and no participants discontinuing use. The study also confirmed that SPL7013 was not absorbed into the bloodstream following repeated nasal application.[4]

Viraleze is now registered for sale in more than 30 countries, including in Europe and the UK, and is available online in certain markets. It is marketed in the UK via national chemist chain LloydsPharmacy – making Starpharma the first ASX-listed biotech to bring a COVID-19 preventative product to the global retail market. When the product was launched, the UK was just emerging from lockdown restrictions and many people were eager to make use of innovative products that could minimise COVID-19 transmission, said Starpharma's CEO, Dr Jackie Fairley.

"Viraleze works rapidly without being absorbed into the bloodstream," Dr Fairley explained. "If you are about to walk into the supermarket, you would use it. The same is true for pubs and restaurants, public transport, elevators, workplaces and planes."

The company has also signed an exclusive sales and distribution agreement for Viraleze in Saudi Arabia and eight other countries, including the Gulf Cooperation Council region (United Arab Emirates, Qatar, Kuwait, Oman and Bahrain).

With the top-up funding, Starpharma is also progressing with regulatory activities in other regions, including Australia, where an application for registration of the nasal spray is under review by the Therapeutic Goods Administration (TGA). The additional funding also helped support the commercialisation of Viraleze through the conduct of studies that broaden the potential applications beyond SARS-CoV-2 to other respiratory infections, including influenza and common colds. Comparative studies that showed that SPL7013 is more potent than other nasal sprays and ingredients, help strengthen the commercial positioning of the product in the existing and future markets.

Viraleze™ Antiviral Nasal Spray – Starpharma continued

Through the support of the BTB program, Starpharma was able to expedite the development and commercialisation of Viraleze; now, it plans to further develop the product for use in future pandemics and seasonal flu outbreaks.

According to Dr George Kinghorn, Infectious Disease Adviser to Starpharma and former Clinical Director of the Sheffield Teaching Hospitals NHS Foundation Trust, Viraleze will likely continue to serve as a valuable preventative measure against COVID-19 and other respiratory viruses, given that multiple studies confirm that the nasal cavity appears to be the most important route of initial infection.

"Recent experience suggests that viral pandemics will occur again, so the availability of broad-spectrum antiviral agents, like Viraleze, could prove extremely useful," said Dr George Kinghorn.

Image: Aynaz Seta, CMC Project Manager – Project management oversight, analytical studies.

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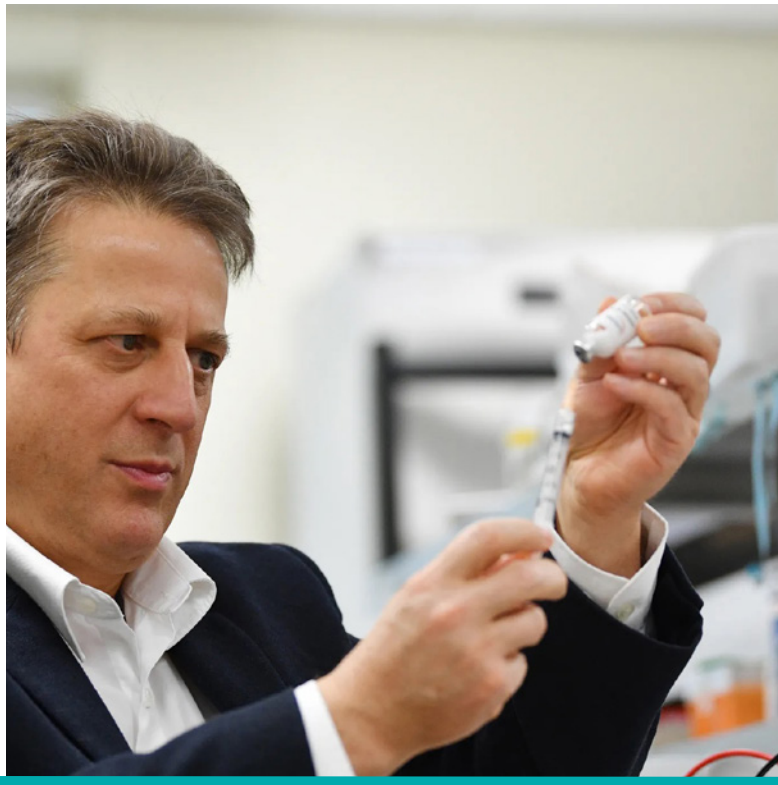
COVAX-19 leading the way in Australian vaccine discovery



PROJECT:
Vaxine Pty Ltd

THERAPEUTIC AREA:
COVID-19, Infectious Disease

START DATE: 1 December 2020	TOTAL BTB GRANT: $1,000,000
END DATE: 30 September 2021	TOTAL BTB EXPENDITURE: $1,000,000
STATUS: Completed	TOTAL CASH CO-CONTRIBUTION: $1,000,000
DELIVERABLES COMPLETED: 100%	TOTAL IN-KIND: $3,830,379
	TOTAL PROGRAM: $5,830,379

Jobs within project budget (FTEs dedicated to project)	14
New jobs created because of this project, at lead applicant and/or partners	6
Number of new technologies invented/progressed	3
New trademark applications resulting from this project	1
Number of start-up companies formed because of the project	1
New products launched	1
Number of preclinical studies commenced	5
Number of clinical trials commenced	3
Patients treated/diagnosed with new product/ technology/therapeutic	16,876

Image: Vaxine Founder Professor Nikolai Petrovsky.

Despite two years having passed since the start of the COVID-19 pandemic, it remains a global health crisis.

In 2021, the World Health Organization (WHO) set a target for 70 per cent global vaccination coverage by mid-2022. As of June 2022, only 58 of WHO's 194 Member States had reached this threshold, and in low-income countries, just 37 per cent of healthcare workers had received a complete course of primary vaccination. The global health community desperately needs more vaccines to be approved, so there are suitable options available to a diverse range of people globally.

Lending its expertise to this mission, South Australian vaccine technology developer Vaxine is hoping to progress a safe, reliable and effective COVID-19 vaccine that's suitable for use in developing countries.

Founded in 2002, Vaxine is focused on pandemic vaccine development and vaccine adjuvants, which are added to vaccines to enhance the response of the immune system. Having initially worked with avian influenza vaccines, the Vaxine team has also undertaken projects involving severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and swine flu.

Vaxine began its COVID-19 vaccine development efforts in January 2020, using a protein-based vaccine approach, which has been highly successful against many viral and non-viral diseases.[1] Its novel vaccine, called COVAX-19®, is comprised of innocuous insect cell-based recombinant spike proteins of SARS-CoV-2, in combination with the company's proprietary non-inflammatory Advax™. After designing the vaccine, the team instigated initial animal testing, and in July 2020 became the first Australian candidate to commence human Phase 1 safety trials for a COVID-19 vaccine.[2]

Vaxine continued

In December 2020, Vaxine was awarded funding through special COVID-19 focused Round 3 of the BTB program to support the early development of Vaxine's COVID-19 vaccine candidate. The project supported ongoing animal studies (involving mice, hamsters, ferrets and non-human primates) and facilitated Phase 1 human trial data analysis, manufacturing scale-up, and regulatory activities. These were all key steps towards the development of a COVID-19 vaccine and demonstrated protection and feasibility for the scale-up of supply to meet potential global demand.

The Phase I study involving 40 healthy patients (aged 18 to 65 years) confirmed the COVAX-19 vaccine was safe, well tolerated and effective in healthy adult subjects, and was able to induce a humoral immune response against the SARS-CoV-2 spike protein in both preclinical and clinical settings.[3,4] No safety or tolerability issues were identified, and the COVAX-19 vaccine advanced to human Phase II clinical trials in March 2022, by which time the Therapeutic Goods Administration (TGA) had granted provisional determination for the vaccine.[5]

Later clinical trials (phases II and III) were beyond the scope of BTB program funding.

Partnering with Iran-based biotechnology company CinnaGen, Vaxine undertook Phase II and Phase III clinical trials of COVAX-19 in the Middle East.[6,7] Under the trade name Spikogen®, CinnaGen's vaccine received emergency-use authorisation from the Iran Food and Drug Administration (IFDA).

As one of the initial cohorts of recombinant protein-based COVID-19 vaccines, COVAX-19 offers potential safety and tolerability benefits. Vaxine's proprietary Advax-SM adjuvant is a key component of the vaccine and plays a vital role in maximising protection.

Based on these results, Vaxine is planning the next stages of development for its COVID-19 vaccine. It aims to extend population groups to include the elderly and young children, and to promote the use of COVAX-19 as a booster with differentiated mechanism of action. The company also plans to progress its platform to ensure effective protection against new variant strains as they emerge.

Vaxine reports it has entered negotiations with Indian manufacturers to establish large-scale manufacturing capabilities, and additional partner negotiations are ongoing in Pakistan, the UAE, South and Central America, Eastern Europe, Africa, the UK, and the US.

Pending the results from its latest trials, Vaxine expects global market demand for COVAX-19 to be significant – an outcome that would help edge communities around the world closer to their immunisation targets.

Sources

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