CCRM AUSTRALIA

Commercializing Living Therapies

CCRM Australia
Annual Report 2019

CONTENTS

International Supporter

Government Supporters

COLLABORATIONS

TRAINING PROGRAMS:

- Attendance to Summer by Design (Hosted at the University of Toronto by Medicine by Design and supported by CCRM and the Rotman School of Management)
  - Travel Grant awarded to Jason Limnios (Bond University)
- CCRM Global Network Exchange Program
  - Travel Grant awarded to Ms Reut Guy (Tel Aviv University)
- CCRM Australia Internship
  - Ms Aditi Singh (Monash University)

Overall, the training program has been able to support:

- **1 Student** for travel to attend an international workshop (Summer by Design) for training and engage with regenerative medicine on a global stage
- **There was a total of 18 applications** for placement into the CCRM Australia training programs.

CCRM Australia continues to engage with the Australian regenerative medicine sector and currently has:

6 Founding member organisations providing financial and support services to CCRM Australia

21 Australian partners representing 51 organisations that include providers of specialised research, academic, health, clinical trials and advisory services and specialised facilities

2 peak bodies representing more than 3,000 members

4 funders/sources of capital for investment

2 government agency supporters

ACTIVITIES AND ACHIEVEMENTS

IN THE 2018–19 YEAR THE CCRM AUSTRALIA TEAM HAS:

Directly liaised with 62 different Australian and non-Australian based regenerative medicine companies to provide specialist advice and key referrals

Directly supported companies and researchers from 11 different countries to access resources within the Australian regenerative medicine sector

Directly liaised with 17 local and international government departments and agencies

Conducted 73 discussion meetings with Industry

Represented CCRM Australia at 34 events hosted by other organisations and various meetings

Undertaken 5 promotional roadshows nationally and internationally

Organised 8 Speaking Engagements involving CCRM Australia representatives

Created 4+ Jobs

Progressed 3 Industry Based Research Projects

COMMUNICATIONS PLATFORM PERFORMANCE:

TWITTER

941 followers (an increase of 47% from the 642 followers as at end of July 2018)

LINKEDIN

269 followers (an increase of 340% on 79 followers as at July 2018)

CORPORATE MESSAGE

CCRM AUSTRALIA

CCRM Australia is an Australian not-for-profit organisation supporting the development of foundational technologies to accelerate the commercialisation of regenerative medicine products and therapies.

CCRM Australia's focus is to bridge the commercialisation gap through a network of scientists, entrepreneurs, academic institutions and industry partners and address bottlenecks in the industry.

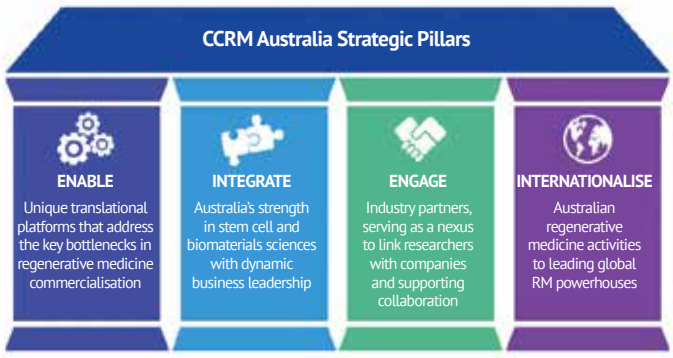
Modelled on the highly successful Centre for Commercialization of Regenerative Medicine (CCRM) based in Canada, CCRM Australia is a leader in developing and commercializing regenerative medicine, cell and gene technologies. Drawing from the organisation's expertise and industry and capital venture networks established over a five-year period, CCRM Australia is poised to take a leading role in supporting Australia's fast developing regenerative medicine sector.

MISSION

CCRM Australia is taking regenerative medicine from bench to bedside by treating and potentially curing some of the most devastating and costly diseases in the world today.

VISION

We seek to enable, integrate, engage and internationalise the Australian regenerative medicine industry.



CCRM CANADA PRESIDENT AND CEO REPORT

The philosophy at the Centre for Commercialization of Regenerative Medicine is to collaborate with leading academic and industry organisations in locations of excellent regenerative medicine science within a growing and thriving industry.

Australia is an excellent illustration of such a location, hence our support for the establishment of CCRM Australia. It's clear from the activities outlined in this report that CCRM Australia has had another successful year.

In Canada, CCRM is now able to offer contract manufacturing of cell and gene therapies for early-stage clinical trials in its newly opened Centre for Cell and Vector Production (CCVP) facility. This CCRM managed GMP facility complies with Canadian, US, and European manufacturing regulations and was built in partnership with the University Health Network.

Our facilities and services are accessible by the CCRM hubs around the world, with each hub also providing their own unique contributions to the CCRM network.

This is just one example of how CCRM is catalysing a global network of highly integrated commercialization centres working together to enable viable and cost-effective patient access to revolutionary new treatments.

It is a pleasure to be involved with CCRM Australia. I would like to thank Silvio and his team for successfully establishing the Australian hub which serves as a good template for newer CCRM hubs to adopt.

I look forward to continuing to work with everyone at CCRM Australia and in the Australian regenerative medicine sector as we look to integrate the different hubs around the world and bring these exciting new advanced therapies to the patient.

CCRM AUSTRALIA CEO REPORT

Through its connection with CCRM and other developing CCRM hubs, CCRM Australia is uniquely positioned to support Australia's regenerative medicine sector.

This is made possible through direct access to an existing international network of business and scientific leaders and specialist product development and commercialisation teams.

CCRM Australia is now progressing beyond the establishment phase to the delivery stage that will result in several benefits for Australia. These include:

- developing local expertise by recruiting and training key personnel with analogous skills to the CCRM product development and commercialisation teams,
- increased access to investment funds to manage and guide new company creation,
- exposure to the international CCRM network as it further develops on a global scale, and
- the attraction, recruitment, training, and retaining of a pool of world-class talent.

The increased national recognition, key networks formation, strategic alliances and linkages with CCRM and its Global Network have been essential foundational steps.

CCRM Australia can now accelerate Australia's leadership in this growing sector by

- **Accessing** world-class expertise in the development and commercialisation of regenerative medicine technologies from CCRM Canada, including specialist technical and financial support,
- **Promoting** specific capabilities and opportunities in Australia's state of the art discoveries, facilities and expertise to a growing international regenerative medicine industry partner network to facilitate foreign investment attraction and opportunities for trade partnerships,
- **Supporting and validating** locally developed IP through technology evaluation workshops,
- **Increasing deal flow** through liberating funding and resources arising from strategic alliances with local and international investors, including CCRM.

We have already seen an increased demand for our services. In the last twelve months, the CCRM Australia team has

- Directly liaised with sixty-two different Australian and non-Australian based regenerative medicine companies to provide specialist advice, collaborator referrals to promote Australia's and CCRM's specialised facilities,
- Directly supported companies and researchers from eleven different countries to access resources within the Australian regenerative medicine sector,
- Directly liaised with seventeen local and international government departments and agencies,
- Conducted seventy-three discussion meetings with Industry, and
- Represented CCRM Australia at thirty-four events hosted by other organisations and attended various meetings.

Our activities and programs for the coming and future years will allow us to continue

- **Building** a commercially focussed team to advance Australia's regenerative medicine technologies with international licensing and regulatory expertise to manage and guide new company creations with the support of investment funds,
- **Incorporating** Australia's infrastructure and relevant platform technologies within the CCRM service capabilities that will be promoted to CCRM's global industry partners,
- **Supporting and validating** locally developed IP and enhancing its commercial value through combination/bundling, preferably with IP generated by CCRM Australia partner organisations, but also with IP generated from international partners sourced through the CCRM Global Network,
- **Attracting and preparing** a new generation of world-class talent to support and drive Australia's regenerative medicine sector,
- **Leveraging** our national network of academic, healthcare and Industry partner organisations and CCRM's international consortium of world-leading regenerative medicine companies to seek complementary business expertise and leadership to guide company creation, harness funds for product development and receptor capacity for technologies and products, and
- **Applying** CCRM's proven commercialisation model and sector-specific expertise focussed on regenerative medicine to be utilised for the benefit of Australia's regenerative medicine discoveries.

Additional funding for investment, accessible through the international investor network established by CCRM, is also becoming available as a result of a vibrant CCRM Australia.

CCRM Australia proposes to deliver these set of outcomes to ensure technical support at a local level. Providing national service delivery and developing a local skill base for regenerative medicine focussed commercialisation expertise will help lead to an increased number of start-ups/companies.

While we work to a sustainability plan, government funding (both state and federal) will be essential, consistent with the experience of the successful CCRM in Canada. This support will allow the continued development of CCRM Australia's local expertise and capabilities while accessing the significant resources available through CCRM and its global network.

The support of the federal government (through MTPConnect) and the Victorian State Government has been instrumental to the development of CCRM Australia.

I would also like to acknowledge the ongoing support and advice from members of the CCRM Australia Council, the Scientific Advisory Board and the Industry Interface Committee, which has been essential in helping us to direct our limited resources effectively.

None of the great progress to date would have been possible without the ongoing support of Dr Michael May and his team at CCRM and the hard work and dedication of Dr Chih Wei Teng and Heather Marriott at CCRM Australia.

My heartfelt thanks to all.

CCRM AUSTRALIA MILESTONES

OCTOBER 2016

- CCRM Australian Initiative Announced – received funding from MTP Connect

JANUARY 2017

- CCRM Australia Website launched

MARCH 2017

- 5 year strategic plan endorsed by CCRM Australia's Steering Committee and MTPConnect

JULY 2017

- Silvio Tiziani appointed Chief Executive Officer of CCRM Australia
- Published CCRM Australia's 5 Year Strategic Plan

SEPTEMBER 2017

- CCRM Australia led a delegation of Australian stakeholders to the official launch of CCRM's advanced manufacturing facilties in Toronto, Canada
- Monash's Regenerative Medicine Industry Interface (RMI^2) Steering Committee agrees to become responsible for CCRM Australia's Industry Consortium activities

OCTOBER 2017

- CCRM Australia successful in securing additional funding in MTPConnect Grant Funding Program (Round 2)

2018

JANUARY 2018

- Heather Marriott joins the Executive Team as Events Coordinator and Executive Assistant

FEBRUARY 2018

- Establishment and first meeting of the CCRM Australia Council
- Establishment and first meeting of CCRM Australia's Industry Interface Committee

MARCH 2018

- Dr Chih Wei Teng appointed as Chief Operating Officer of CCRM Australia

APRIL 2018

- Formalisation of Scientific Advisory Board for CCRM Australia with 14 clinicians and researchers

MAY 2018

- International Mentoring Program with IMNIS commences, with five pairs of mentees and mentors

JUNE 2018

- MoU signed with Therapeutics Innovation Australia (TIA) to collaborate on a regenerative medicine database

JULY 2018

- Australian Alliance for Cell and Gene Therapies (AACGT) announced: a joint initiative of CCRM Australia with St Vincent Hospital Melbourne, Cell Therapy and CTM CRC

OCTOBER 2018

- CCRM Australia supports the development of the 'Regenerative Medicine: Opportunities for Australia' Report

DECEMBER 2018

- Agreement with Industry Alliance for Advanced Cell Applications, Israel (INACA)
- Agreement with BioCurate

CCRM AUSTRALIA HIGHLIGHTS

OCTOBER 2018

The 'Regenerative Medicine: Opportunities for Australia' report was released at 2019 showing that regenerative medicine could be worth AUD$6 billion in annual revenue and create 6,000 new jobs in Australia by 2035.

CCRM Australia played an active part in the consultative process leading up to the plan's publication, participating in the survey and data analysis and national workshop sessions.

This is the first blueprint that has been prepared for Australia's regenerative medicine industry.

DECEMBER 2018

CCRM Australia partnered with the Israeli Network for Advanced Cell Applications (INACA); the first significant step to demonstrate the collaborative possibilities associated with being involved with CCRM and its Global Network.

CCRM Australia is now working with a number of leading Israeli regenerative medicine companies to support their activities in Australia.

DECEMBER 2018

CCRM Australia signs MOU with partner organisation BioCurate to advance the translation and commercialisation of life changing therapies in the Australian regenerative medicine sector.

The first project will be a combined technology evaluation program (the 'SuperPitch') that utilises the complementary capabilities and funding available from both organisations to assess emerging Australian regenerative medicine technologies.

FEBRUARY 2019

CCRM Australia partnered with the NSW Stem Cell Network to jointly organise the 2020 Business of Regenerative Medicine – Asia Pacific Symposium.

To be held in April 2020 in Sydney, Australia, the Symposium will welcome up to 120 delegates from Asia Pacific and around the world; including executives, junior and senior bio-entrepreneurial research scientists, managers in the for-profit, not-for-profit and Government sector as well as technology transfer personnel. Modelled on the successful equivalent program held annually in North America, this will be a signature training event for CCRM Australia.

APRIL 2019

CCRM Australia continues to provide support for Australian students to attend Summer by Design. For three consecutive years, CCRM Australia has been helping early career researchers and high-achieving PhD candidates to gain the skills needed to commercialise and translate their regenerative medicine research into thriving business ventures.

From a national pool of applicants, PhD candidate, Mr Jason Limnios, Clem Jones Centre for Regenerative Medicine, Bond University, was successful in his application to attend the 2019 Summer by Design workshop. Hosted by Medicine by Design, the Rotman School of Management at the University of Toronto and CCRM Canada, this workshop brought together 21 high-performing post-docs and PhD students from around the world to learn the fundamentals of taking research from the idea stage through to the listing stage.

MAY 2019

CCRM Australia welcomed its first international exchange student from Israel stemming from its arrangement with INACA.

As part of the exchange program, first-year PhD student, Ms Reut Guy, was able to spend just over five weeks in Australia where she attended the International Society for Cell and Gene Therapy Conference (ISCT), learned new experimental methods and met with collaborators from across multiple CCRM Australia affiliated institutions.

Dr Chih-Wei Teng and Ms Reut Guy.

CCRM AUSTRALIA IN FOCUS

1. REGENERATIVE MEDICINE: OPPORTUNITIES FOR AUSTRALIA

A report released during the CCRM Australia sponsored regenerative medicine session at Ausbiotech 2019 shows that Australia's regenerative medicine sector has all the necessary elements to become a competitive, lucrative and global industry. So much so, that ongoing success in regenerative medicine could be worth AUD$6 billion in annual revenue and create 6,000 new jobs in Australia by 2035.

This is the first time that a blueprint has been prepared for Australia's regenerative medicine industry and it's one that everyone in the sector can get behind. This very timely publication demonstrates that Australia is well placed to take an active role in this growing segment of the health industry. I congratulate my colleagues on the Ausbiotech Regenerative Medicine Advisory Board for initiating this project.

CCRM Australia played an active part in the consultative process leading up to the plan's publication, participating in the survey and data analysis and national workshop sessions. With the 6-point plan to move to regenerative medicine therapies from discovery to delivery, CCRM Australia is excited to work with key stakeholders, including MTPConnect, to transform the industry. For CCRM Australia, this support will be provided through:

- **Enabling** unique translational platforms that address the key bottlenecks in regenerative medicine commercialisation
- **Integrating** Australia's strength in stem cell and biomaterials sciences with dynamic business leadership
- **Engaging** industry partners, serving as a nexus to link researchers with companies and supporting collaboration
- **Internationalising** Australian regenerative medicine activities by connecting to leading global regenerative medicine powerhouses

CCRM Australia CEO, Silvio Tiziani, chairing the Regenerative Medicine Stream, with speakers from the local regenerative medicine sector including John Martin from Regeneus, Craig Newton from Vivazome, Prof Paul Simmons from Mesoblast and Prof Alan Trounson from Cartherics at the 2018 AusBiotech Conference in Brisbane.

2. TRAINING PROGRAMS

CCRM Australia's 2019 training program began early in the year with a nationwide call for participants to attend the Summer by Design workshop. Summer by Design is an annual commercialisation workshop managed by Medicine by Design in Toronto, Canada. CCRM Australia is proud to once again support the workshop by awarding Australian representatives travel awards.

More than 20 applications were received. After rounds of evaluation by both internal and external reviewers, Mr Jason Limnios from the Clem Jones Centre for Regenerative Medicine at Bond University joined 21 high-performing post-docs and PhD students from around the world to take part in the Summer by Design workshop, where industry and academic experts imparted their knowledge on the commercialisation of cell and gene therapies. The intensive program featured learning on commercialisation strategies, managing intellectual property, market analysis and regulatory compliance and clinical trials and investments.

Jason reflected later that, "Summer by Design helped me to understand stakeholder priorities at various stages of the commercialisation process. Now, when I interact with potential partners, I have a much better idea of what they are seeking. This means that I'm thinking about how to build a compelling case for partnerships, be that in the problems our research might address, the IP portfolio needed to attract partners, and even affects how I prioritise my experiments and their design."

CCRM Australia's training programs are designed for Australian industry stakeholders, especially aspiring biotechnology entrepreneurs who have ambitions to translate their research into treatments to benefit the public. For participants like Jason, CCRM Australia hopes that the workshop also presents opportunities to network and collaborate with other researchers around the world. We look forward to working with Bond University in the future.

In addition to the annual Summer by Design Workshop, CCRM Australia experimented with a new training program designed to increase the exposure and understanding of how different jurisdictions' regenerative medicine ecosystems work to commercialise innovative treatments. With that in mind, CCRM Australia held the inaugural CCRM Australia Global Network Exchange Program where Tel Aviv University PhD candidate, Ms Reut Guy, spent five weeks in Australia understanding the Australian ecosystem, attended the ISCT 2019 conference and spent over a week at the Florey Institute learning new experimental methods.

Participants at the 2019 Summer by Design workshop. Photo courtesy of Mr Jason Limnios.

This exchange program leverages the strength of the CCRM Global Network of Hubs. Each hub works in partnership to accelerate the commercialisation of regenerative medicine both locally and globally by having their representative's team up with emerging scientists and premier regenerative medicine researchers in the host country. Ms Guy attended no less than five meetings with CCRM Australia's scientific and industry committees, BioCurate and the State Government of Victoria. Ms Guy also participated in the 10th Anniversary Celebration of the Australian Regenerative Medicine Institute, interacting with both research and industry partners.

The exchange program was a stimulating experience for Ms Guy, who was excited to share stories about her travels and research when she reflected, "I think the visit has given me more specific direction, and some ideas about what to do next. I have just started my PhD in October, so I have time to do those modifications and get some shape to my degree … There are multiple models for stroke, and this one is very different to what we currently use in our lab. This model enables prediction of outcomes based on observed behavioural changes as they occur during stroke induction, and therefore holds a great value for translation."

CCRM Australia is continuing to experiment with different training programs and repeating successful ones to impart commercialisation skills as part of the stakeholder's professional development and encourage more PhD students and academics to commercialise their research. CCRM Australia will be providing the well-received International Mentoring (IMNIS) program in 2020, as well as an internship program for postgraduate students, which we look forward to sharing with our readers in our next annual report.

3. GROWING THE CCRM AUSTRALIA NETWORK – COLLABORATIONS WITH KEY ORGANISATIONS

The Western Australia Health Translation Network (WAHTN)

In 2018, we were pleased to welcome the WAHTN to CCRM Australia. The WAHTN, led by Executive Director Professor Gary Geelhoed, is making waves in Australia's regenerative medicine sector. The core focus of the WAHTN is to advance the translation of evidence based health and medical research into changes in policy, practice, training and innovation, with the goal to benefit the health and well-being of all Western Australians.

The WAHTN brings together Western Australia's major universities, medical research institutes and hospitals, with 21 state-wide contributing members. By collaborating together, the WAHTN's mission is to strengthen health translation enterprise in Western Australia through integrated programs amongst partner institutions.

"When it comes to science in this country, Australia punches well above its weight", commented Gary at the time of the announcement. "With our network, we hope to break down the barriers preventing our notable research commercialising – and by entering into this partnership with CCRM Australia, we hope that job will become even easier."

CCRM Australia and the WAHTN share common goals; to fill gaps in expertise, connect institutions and offer training opportunities. Working together, both CCRM Australia and WAHTN can look forward to reaching their goals faster.

Joint activities undertaken during the year included CCRM Australia's sponsorship of "Science on the Swan", the pre-eminent Western Australian Science Health Translation event of the year, with the theme "Neuroscience & The Senses – Healthy Ageing across the Life Course" and the inaugural CCRM Australia – WAHTN Technology Evaluation Workshop, held in May.

CCRM Australia is a national initiative to support the development of Australia's regenerative medicine sector. Our work with the WAHTN will ensure we have the opportunity to highlight and provide support to the excellent ecosystem that has been developed in and around Perth and its world leading regenerative medicine sector."

BioCurate

We were also proud to work with partner organisation, BioCurate, to advance the translation and commercialisation of life changing therapies in the Australian regenerative medicine sector.

Whilst Australia has a vibrant and world-class regenerative medicine eco-system and is internationally recognised for its discovery and translational research, the developmental path of promising regenerative medicines is often fragmented, opportunistic and ad hoc. The commercially relevant skill set and dedicated financial capital of CCRM Australia and BioCurate are critical resources available to assist researchers and start-ups as they navigate through this challenging development path.

An MOU signed between CCRM Australia and BioCurate lays the foundation for joint activities including identification of suitable opportunities to leverage our combined expertise, networks and financial resources, with the goal of joint translation of regenerative medicines and related therapies. Where appropriate, both CCRM Australia and BioCurate will support each other's programmes to train the next wave of entrepreneurs on the business of regenerative medicine.

Israeli Network for Advanced Cell Applications (INACA)

During the year, CCRM Australia also reached out to international connections. One initiative was partnering with the Israeli Network for Advanced Cell Applications to initiate an exchange program. This program builds upon the memorandum of understanding signed between CCRM Australia and INACA at Tel Aviv in December 2018. This memorandum laid the foundation for joint commercialisation programs between Australia and Israel and seeks to promote collaborations in research and education.

CCRM Australia's CEO Silvio Tiziani noted, "our international exchange program with Israel is the first significant step to demonstrate the collaborative possibilities associated with being involved with the CCRM and its Global Network. As more CCRM hubs emerge from Europe, Asia Pacific and other major jurisdictions, opportunities to collaborate and learn from each other can only get better."

CCRM Australia is now working with a number of leading Israeli regenerative medicine companies to support their activities in Australia. This support includes facilitating research collaborations with researchers from partner organisations, sourcing specialised facilities in Australia and helping with relocation and establishment in Australia.

Professor Daniel Offen and Silvio Tiziani (centre) following the signing of the agreement with the Industry Alliance for Advances Cell Applications, Israel (INACA).

4. A PERSONAL REFLECTION OF THE 11TH BUSINESS OF REGENERATIVE MEDICINE SYMPOSIUM

It was a sunny Philadelphia that greeted the 11th Business of Regenerative Medicine Symposium. Hosted at the University of Pennsylvania's Similow Center for Translational Research, the two-day symposium revealed the broad range of insights into innovation, clinical translation and entrepreneurship within the regenerative medicine industry.

The event, including informative presentations (covering experience through to commercialisation), discussions of current trends, practical advice and the sharing of cutting-edge science, was a great success. For us at CCRM Australia, this experience, mesmerised by the science of regenerative medicine and awed by the bold approaches undertaken by physicians, engineers and scientists who are advancing the field, inspired us.

Major takeaways from the symposium

Kicking off with an opening address by the Food and Drug Administration (FDA), the symposium appropriately drew focus to the recent approvals of Novartis' Kymriah (the first CAR-T cell therapy to receive FDA approval) and Kite Pharma's Yescarta (a close second). The event also highlighted the University of Pennsylvania's critical role in the development of Kymriah.

Amongst the many topics covered, there were a number that left strong impressions, including:

- Reni Benjamin's analysis of the current trends in the US Investment landscape and advice on raising capital,
- An explanation of the Multi-Luminance Mobility Test by Katherine High from Spark Therapeutics,
- Arnold Caplan's passionate pitch to rename mesenchymal stem cells to medicinal signalling cells, and
- A bioengineered device presented by Dan Huh that simulates a blinking eye.

However, as the Symposium continued, we found ourselves continually thinking about the Kymriah journey, presented by Pascal Touchon and Bruce Levin of both Novartis and the University of Pennsylvania. This inspiring journey led to a closer analysis on the developmental pipeline for regenerative medicine therapies and what it means for other therapies in the future.

Unveiling the developmental pipeline for regenerative medicine therapies

While literature in the field estimates varying lengths of time from the point of clinical development to regulatory approval (ranging anywhere from 8 to 12 years), Kymriah's record of five years to approval has, without a doubt, captured the interests of scientists, biopharmas and investors.

Over the next two days, possible reasons to explain this phenomenon became clear— great science begets efficacy and without great science, there would be no product. From that baseline, we would list our key takeaway messages to be the need to have 1) a multidisciplinary team, 2) good data, 3) a focus on manufacturing and 4) a partnership with the regulator.

Bringing a therapy or device to market is the sum total of basic research, clinical development, process engineering, commercial expertise, legal advice, capital raising and partnerships. This developmental pipeline is so difficult that a number of books have been written in the attempt to decode this arduous effort. A multidisciplinary approach, perhaps akin to a 'by design' approach, presents many benefits, especially when it comes to problem solving.

It has been impressed frequently that bio-entrepreneurs have achieved success 'by misadventure'. If our aim is increase the speed at which products enter the market in this highly regulated industry, where we do not have the luxury of continuous product improvement as in the automobile industry, the formation of a multidisciplinary team at the onset may result in more benefits than cost.

Perhaps we see a reflection of this multidisciplinary collaboration in the form of disease teams and alpha clinics, or through facilitation of public-private partnerships. A shortened time to market also means less time spent on process development and manufacturing to address the tenets of quality, safety, scalability, preservation and shipment.

Coupled with potentially low patient accruals for autologous therapies, having robust data is ever more crucial for characterisation, regulatory approval and subsequent compliance, attracting capital investment and potential problem solving in the future.

Lastly, the importance of a partnership with the regulator became more evident from an insightful presentation by Spark Therapeutics. Our lofty goals of regeneration and restoring function sometimes present challenges in determining the most appropriate endpoints, in finding distinct differentiation and in the protection of our value proposition(s) against competitors that develop large and small molecule therapies.

As a consequence, can there be an appropriate measure of functional testing that potentially addresses the above? The Multi-Luminance Mobility Test by Spark Therapeutics for their Luxturna gene therapy is an enlightening example of the possibilities that could arise and I highly encourage everyone to read.

A future in Asia Pacific

In addition to its lecture-style program, the Business of Regenerative Medicine Symposium further provided opportunities to network with peers and start-ups from the major hubs of California and Boston. No doubt there will be discussions leading to collaborations in the future.

We are sure to see rising numbers of biotechnology companies, spinouts and investments into the Asia Pacific region in the near future. Given the Asia Pacific market is more diverse in its regulations, business culture, and resource levels, a localised Business of Regenerative Medicine Symposium would be of significant benefit to many; this has driven CCRM Australia to form a partnership with the NSW Stem Cell Network to organise and host an inaugural Business of Regenerative Medicine Asia Pacific Symposium in April 2020.

CCRM AUSTRALIA: LEADING OPINION

ADDING CAR-T TO CART: WHAT ARE THE HURDLES IMPACTING PATIENT ACCESS TO CELL AND GENE THERAPIES?

Innovative and curative treatments continually push the boundaries of treating known medical conditions. However, as the world changes gears, shifting from small molecules to cellular and gene therapies, now is an excellent time to take stock. With the increasing complexities of manufacturing and delivering cellular and gene therapies to patients, now is the time to interrogate emerging CAR-T therapies and ask: what does it take to access these lifesaving treatments?

Australia is an innovative country. With inventions from the Cochlear implant to the HPV vaccine all originating from our proverbial backyard, Australian scientists have made a significant impact on the health and wellbeing of millions around the world. With our innovative spirit driving our transnational contributions to medicine, it would make sense for us to also be on the receiving end. And yet, Australians have lamented about lack of access to some of the most innovative therapies in the world.

While there is a special access scheme under the auspices of the Therapeutic Goods Administration (TGA), some might argue that patients' desire to access innovative medicines is more akin to the controversial 'Right-to-try' access scheme. The 'right-to-try' scheme allows terminally ill patients the opportunity to access experimental therapies that have successfully concluded Phase 1 safety trials.

Compounding this issue is the difficulty of enrolling in international clinical trials or lack of a local site in Australia as a means to access novel treatments. This has been a major obstacle for Australian patients. However, the situation has been improved due to the efforts of lobby organisations such as MTPConnect and, in no small part, the attractiveness of the Federal Government's Research and Development Tax Incentive. Despite this, there is a long way to go to bring new and emerging therapies to our shores.

One such treatment is Chimeric Antigen Receptor (CAR) T-cell therapy. Currently one of the most prominent of the cancer immunotherapies, CAR-T therapy is attracting the interest of both healthcare providers and investors, especially after the FDA's approval of Novartis' Kymriah and Kite Pharma's Yescarta, respectively. To ensure that Australian patients benefit from this lifesaving treatment, the two leading Australian political parties, the Australian Labor Party and the Liberal Party of Australia, both pledged their commitment before the 2019 election to provide cancer patients access to innovative cancer treatments. At the time of writing, Australians can soon access CAR-T therapy at the Peter MacCallum Cancer Centre and at the Royal Children's Hospital, both in the state of Victoria.

Importantly, facilitating patient access to novel treatments is not merely a political issue but also an economical one. With CAR-T therapies, the hurdle of cost immediately comes to mind. Kymriah is estimated to be more than $AUD500,000 or less if indication-based pricing is practised. This means that the ability to deliver Kymriah at the Peter MacCallum Cancer Centre has required an $AUD80 million investment from the Australian Government. It is reassuring that both federal and state governments have repeatedly reaffirmed their commitment to providing Australians access to the latest therapies.

However, we should consider the supporting systems, infrastructure and reimbursement schemes that make it commercially attractive for biopharmaceutical companies to register their therapies in Australia. These initiatives would act in concert with health policy, reimbursement agencies guided by health technology assessments, and the TGA to lower barriers and expand Australian access to new, potentially lifesaving drugs. To this end, we can imagine electronic medical records being an agent of change by acting as a catalyst and enabler of more creative reimbursement models.

Electronic medical records would not only track clinical outcomes associated with novel therapeutics, but they could also gather and collate the pharmacovigilance data required to differentiate between any medium to long term adverse reactions from other acquired afflictions during the remainder of a patient's natural life. With this, we can accurately match the cost of the therapy against its benefits and thereby be in a stronger position to shape, update and reinvent reimbursement models.

Electronic medical records have been tried and tested globally to mixed results. The Australian Government's MyHealth Record was met with scepticism. Over 2.5 million Australians have opted out over reported concerns about cybersecurity and potential misuse of data. Such criticisms of the system were understandable and well-founded. A Victorian hospital was hacked in early 2019 and, more recently, approximately 37,000 medical histories belonging to Australians may have been exposed after security vulnerabilities within an Australian company offering clinical trial matching services were exploited.

Nevertheless, if new forms of reimbursement are necessary to subsidise high-cost treatments, it is then necessary to rethink the opportunities of electronic medical records.

Innovation is not only restricted to the therapies themselves. There is a need for more innovative funding models and regulatory frameworks, otherwise carrying the financial cost of these treatments will simply get too expensive. To avoid negatively impacting patient eligibility, changing how we pay for novel therapeutics will be of paramount importance to maintaining and even improving access.

SENSORS, THE LONG-DESIRED SAFETY NET FOR REGENERATIVE MEDICINE

Regenerative medicine is a risky business. The decades-long development pipeline and the expenditure of millions of dollars presents itself as an insurmountable mountain for many researchers. The regenerative medicine commercialisation roadmap is fraught with risks and with a notorious high cash burn rate, the prospect of realising a cure for an aggressive disease can be very daunting.

As an industry, we must begin to address future challenges faced by cell therapies that will reach the market in the next five years and beyond. As an industry, we need to recognise that these challenges cannot be addressed using today's technology. We must forecast and begin to develop the next generation of tools and protocols that are not therapy-specific but will be designed to benefit the industry as a whole or classes of therapies.

With the ingenious idea of harnessing the body's cells to facilitate wound healing, the curative potential (and profits) of stem cell-based technologies and innovations are boundless. However, a lack of risk mitigation and quality control in the process of cell therapy development and manufacturing can constrict not only treatment outcomes and the bottom line but also the viability of the industry.

The sector has identified the development of cutting-edge sensor technology to be the next logical step in improving risk mitigation, quality control and operational efficiencies. Not only can novel sensors form the safety net for day-to-day function, but they also create a new stream of valuable, highly sensitive and high-resolution data that can inform future regenerative medicine research.

The Importance of Sensors in Regenerative Medicine

With in-reactor sensors providing real-time measurements of both cellular and environmental parameters, such as cellular composition, specific biomarkers in situ, and media conditions, the information they provide to researchers would significantly enhance the ability to evaluate mechanisms of function and lower the risk involved in the development pathway. For Dr Dawn Driscoll, CEO of Cell Therapies, a cell contract manufacturing company, sensors are critical in risk mitigating and ensuring the quality of cellular products.

Sensors are currently being used but their capabilities are in their infancy. "We have a large variety of sensors that we incorporate into our processes," commented Dr Driscoll. "They serve a variety of functions to ensure that the cells we produce are of the highest quality, utility, and are as controlled as possible. For example, we have sensors that track temperature and pH levels for cultures."

The data currently being captured is in essence low hanging fruit and does not represent the complexity of information that could be unlocked with more sophisticated sensor technology. It is these types of sensors that we see having an impact on the evolution of the industry. For example, Gerry McKiernan, Quality Manager from Cell Therapies explained, "the time from collection of cells to the administration of finished products is proving to be a key factor in both effective patient treatment and gaining market share for many current cell therapy products. In-process sensors that can provide release for supply assay results for cell count, cell viability, phenotype, transduction, endotoxin, mycoplasma and microbial contamination would greatly assist in reducing these timelines and would be a huge benefit to the industry as a whole."

What next?

CCRM Australia would like to form a working group to identify the challenges faced in research and commercial activity that can't be resolved with the implementation of the sensors of today. We see the opportunity to craft the specifications for the next generation of sensor technology. To date, only preliminary discussions between research and industry in the US have been held. There is a genuine opportunity for the local Australian innovation system to leverage this commercialisation opportunity to look beyond solving the issues of today, but in creating a globally exportable product (with relatively low freight costs).

Michael May, Shir Mnuchin and Silvio Tiziani (L to R) pictured in Tel Aviv following discussions on the development of a CCRM Israel Hub, May 2019.

GOVERNANCE

CCRM AUSTRALIA COMMITTEE AND NETWORKS STRUCTURE

CCRM Australia Council

- Prof Peter Currie (Director, Australian Regenerative Medicine Institute),
- Dr Dawn Driscoll (CEO, Cell Therapies Pty Ltd),
- Dr Megan Robertson, Director of Research, St Vincent's Hospital Melbourne
- Prof Keith Maclean (Director, CSIRO Manufacturing Flagship),
- Dr Michael May, (CEO and President, CCRM),
- Ken Sloan (Pro Vice Chancellor, Enterprise, Monash University),
- Silvio Tiziani (CEO, CCRM Australia)

CCRM Australia Industry Interface

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- Dr Tom Howitt, AusBiotech Limited
- Dr Kilian Kelly, Cynata
- Adj. Prof David Rhodes, ReNerve
- Dr Geraldine Storton, Mesoblast
- Dr Chih Wei Teng, CCRM Australia
- A/Prof Jan Tennent, BioMedVic
- Silvio Tiziani, Australian Regenerative Medicine Institute and CCRM Australia

Finance/VC Network (Future)

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- Dist. Prof Dietmar Hutmacher, Director ARC Centre in Additive Biomanufacturing Chair in Regenerative Medicine, Institute of Health and Biomedical Innovation, QUT
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- Dr Jelena Rnjak-Kovacina, Senior Lecturer, Graduate School of Biomedical Engineering, UNSW
- Prof Bernie Tuch, Director, Australian Foundation for Diabetes Research
- Dr Dominic Wall, Chief Scientific Officer, Cell Therapies Pty Ltd
- Dr Anna Waterhouse | Group Leader and Discovery Early Career Researcher Award, The University of Sydney and Heart Research Institute
- Prof Ernst Wolvetang, Group leader, Stem Cell Engineering Group, Australian Institute for Bioengineering and Nanotechnology, University of Queensland

EXECUTIVE TEAM

Chief Executive Officer
Silvio Tiziani

Chief Operating Officer
Chih Wei Teng

Executive Assistant and Events Coordinator
Heather Marriott

Front cover image: "Your Cells Love You" by Elli Kubarakos. Embryonic stem cells have this crazy capacity to become any cell in your body and we study how they choose to go down the path to become heart stem cells by checking along the "path" for certain indicators to show us that they're headed in the right direction. Stem cells in general are very delicate and require lots of love. When we were staining these ones (looking for pluripotency genes like Oct4 and Sox2 – indicators that they're true stem cells), they wanted to show that reciprocated love.

CCRM Australia accelerates the commercialisation of Australian regenerative medicine therapies and related technologies. We do this through engagement and fostering local and international collaboration between industry, clinicians and academia; thereby nurturing local regenerative medicine companies for the international market.

CCRM AUSTRALIA
Commercializing Living Therapies

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