ARC CTET

TRAINING CENTRE FOR Cell & Tissue Engineering Technologies

Director's Message

Welcome to our industry partners and other stakeholders as we approach the beginning of our fourth year as CTET and the upcoming 3rd Centre workshop, this year in Brisbane on the QUT campus. The annual workshops provide critical opportunities to engage, network, hear about some great science, receive some training, hear from some of our industry partners and have some social time together.

As we approach the end of the year we have now finalised all our project agreements with partners and are close to finalising recruitment of the remaining HDR students and postdoctoral fellows. We already have some students who have graduated and are starting on the next phase of their careers. We will be following their path with keen interest.

We have had some fantastic CI success with A/Prof Laura Bray, the Deputy Director of CTET being promoted, nominated for a Museums Australia Eureka Award and receiving a Future Fellowship. Prof Nico Voelcker was awarded a prestigious Laureate Fellowship and Distinguished Prof Dietmar W. Hutmacher is a Clarivate highly cited researcher for the sixth year in a row. Prof Gail Risbridger, along with her multidisciplinary team was awarded a $5 million NHMRC Synergy grant to develop a CAR T approach to tackle prostate cancer.

The coming year will focus on our HDR placements, continued training in industry relevant topics such as GMP and impactful science. We look forward to hearing more about the results from the use of the seed funds we provided to the Centre postdoctoral fellows to establish new collaborations. We continue our efforts to improve CTET visibility, impact from research and outreach into the community.

The leadership team and Centre CIs are committed to delivering on collaborative projects which meet Partner Organisation goals and provide the students, postdoctoral fellows and CIs the opportunity to work closely with industry on projects with impact. Please read on for more information on all these topics and also some highlights from our research.

Prof. Laurence Meagher
CTET Director

In this newsletter:

NEWSLETTER
VOLUME 3 - DECEMBER 2023

ARC CTET
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ANNUAL WORKSHOP

Save the date:
February 20-21, 2024

Join us in Brisbane in 2024 for two days of research and partner updates, strategic planning and collaboration.

Gardens Theatre Complex, QUT Gardens Point campus
Brisbane, Australia

CTET WORKSHOP 2024:
Gardens Point Theatre, QUT

MEMBERS ONLY EVENT

The CTET Annual Workshop is an excellent opportunity to hear about the progress of CTET, collaborate with Centre members, and participate in strategic planning for the future.

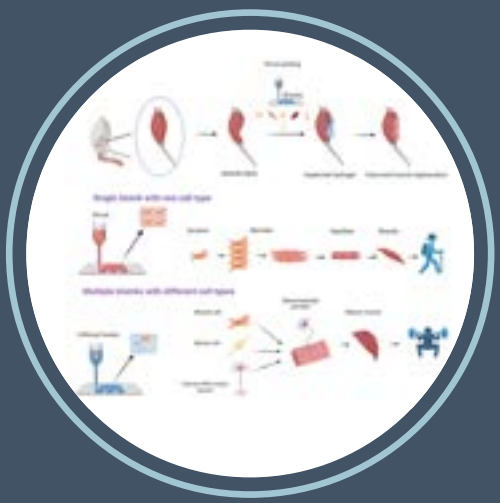
The workshop will take place over two days, on Feburary 20-21. All CTET students, postdoctoral fellows, Chief Investigators, Partner Investigators and affiliates are invited to attend. Students and postdoctoral fellows will also attend a half day of training on February 19.

Accommodation will be provided at the Royal on the Park hotel for the duration of the workshop.

Expressions of interest are now open for planning purposes. Please register your attendance and requirements here.

RESEARCH HIGLIGHT:
Recent Trends in 3D Bioprinting Technology for Skeletal Muscle Regeneration

Shabnam Sabektish



Shabnam's project aims to examine different bioink carrier components useful for 3D bioprinting of skeletal muscle.

Shabnam's project is being completed in conjuction with Industry Partner, Gelomics.

Gelatin methacryloyl (GelMA) is comprised of modified natural ECM components and is a hypothetically suitable bioink for tissue engineering applications, with cell-binding motifs such as RGD peptide sequences, crucial for efficient 3D bioprinting. Xanthan gum (XG) has high viscosities with shear-thinning properties which are helpful for the preservation of shape and structure in 3D bioprinting. Furthermore, the biocompatibility and low cost of this polymer make it an ideal material to use in a bioink. However, XG contains no cell attachment moieties and the molecular interactions are relatively weak, allowing dissociation of the gel. Thus, material modification and a method to incorporate cell attachment motifs are required to create a stable hydrogel. Acellular ECM can provide structure, native tissue cell adhesion proteins, growth factors, and glycosaminoglycans to direct site-appropriate remodeling in the host. Furthermore, porcine skeletal muscle is willingly accessible and therefore appropriate for large-scale experimental and further clinical practice.

This project sought to describe a technique for the decellularization of porcine skeletal muscle to generate an acellular ECM for use as a hydrogel. While there are several different decellularization methods, they are mostly time-consuming and contain the repeated and long-term use of chemical reagents and enzymes that tend to damage the vital constituents of the ECM and structure of the gel, weakening hydrogel formation. Therefore, I will seek to modify and improve upon methods of porcine skeletal muscle decellularization. Hence, in this project, we will develop a shear thinning XGMA-GelMA-dECMMA composite bioink, with intrinsic ability to self-assemble, good printing accuracy, sequence motifs that support material-cell attachment, with improved stability provided by secondary photo-cross-linking.

In summary, my study aims to understand how the combination of three different novel bioink carrier components can be useful for the 3D bioprinting of skeletal muscle. I will also try to increase my understanding of the best approaches to achieve functional muscle tissue via a bioprinting approach, demonstrate the possibilities of decellularized ECM as an adjunct to more traditional bioink materials e.g. GelMA, and investigate the applicability of bioink viscosity modifiers to assist in maintaining high printing shape and fidelity as well as the applicability of mechanical tension systems as flexible micro-post models to enable high-quality bioprinting and retain cell viability with uniformly organized contractile myofibers.

We hope to further push the boundaries of our system by incorporating different cell types and characterizing their responses in the volumetric muscle loss model.

STUDENT HIGLIGHT:
Women entrepreneurship in Bio&MedTech

Jovanna Nathalie Cervantes Guzman

Dr Jovanna Nathalie Cervantes Guzman is a PhD student at QUT, under the supervision of Distinguished Prof. Dietmar W. Hutmacher and A/Prof. Shane Matthews. Her project is on the examination of women entrepreneurship in biological and medical technologies (Bio&MedTech).

This work falls under Research Theme 4: Value Chain and Commercialisation, a theme designed to provide researchers with insights in how to take ideas from benchtop through to market.

The research objective of this work is to provide new insights into the industry characteristics that shape women's entrepreneurial intention in the Bio&MedTech sector. The current data shows only 7.3% of businesses in the Bio&MedTech industry worldwide are owned by women (Startup Muster, 2020).

This underrepresentation not only limits women's economic opportunities but also difficult innovation and progress in critical health challenges. The increment in female entrepreneurship should not only focus on increasing the enrolments of female students.

Currently women are enrolled in the university STEM fields at 35%. Of those enrolled in STEM, only 29% founded a business. When we look at biotechnology (as opposed to all STEM fields), women represent 50% of the enrolments, but only 10.2% of those become entrepreneurs (Hopkins& Lodish, 2018; Piva& Rovelli, 2021). Some data suggests that the small number of women entrepreneurs in Bio&MedTech result in a loss in Australia of $250 million dollars, which means a loss of 0.02% in GDP.

In this project, the CTET team aims to quantitively determine the underrepresentation of women in the Bio&MedTech industry through a comprehensive analysis of factors influencing their entrepreneurial intentions.

While previous research has acknowledged the complex regulatory environment and high barriers to entry in this industry for any start up project, our study emphasizes their specific impact on women entrepreneurs. We hypothesize that our study's outcomes will allow to develop more effective programs and strategies that empower women in Bio&MedTech sector to not only think but to action to become entrepreneurs.

Nathalie's work has been recognised and presented a number of different forums over the past couple of years.

This project has so far:
- participated in "Youth solutions program 2022" (the world's biggest network of young leaders working to accelerate solutions towards sustainable development goals)
- been a finalist in "University Startup World Cup 2022"
- been selected by the "Queens Commonwealth Trust Network" (a network of global leaders creating a positive social change in the commonwealth)
- won the audience award in 2023 Falling Walls Brisbane, the only project to represent QUT this year

We look forward to seeing the results produced in her research and the practical and positive steps women can take to enter entrepreneurship in biotech.

Nathalie's work has been in conjuction with Industry Partner, CCRM.

CTET INDUSTRY PARTNER: Gelomics

The problems with drug development

Drug development faces significant challenges: it's a lengthy (10-15 years) and costly (average US $2.6bn) process with high reliance on animal models, used annually by the hundreds of millions. These models have limitations; about 30% of drugs safe in animals are toxic in humans, and 60% effective in animals fail to benefit humans. Over 90% of drug candidates, even after extensive cell- and animal-based testing, fail in human trials, leading to an average loss of US $1.3bn per candidate. Recognizing these issues, global policies are shifting towards non-animal testing methods. The EU aims to eliminate animal model testing by 2030, and the US FDA Modernization Act 2.0 endorses non-animal alternatives.

Pioneering animal-free biomedical R&D

Based in Brisbane, Gelomics is a start-up revolutionizing drug development and biomedical research. We provide pharmaceutical firms and academic institutions with a cutting-edge solution: the creation of sophisticated human tissue models in petri dishes. Since 2021, our flagship LunaGel™ 3D Tissue Culture System has been embraced by over 200 labs across 22 countries, marking a significant shift in research methodologies. Gelomics, in partnership with CTET, is actively advancing the LunaGel™ technology. Our focus is on developing new variations of this proven system to offer scalable and fully integrable 3D tissue culture models that ensure reproducibility across various applications.

LunaGel™ 3D Tissue Culture System: A revolutionary 3D tissue culture system by Gelomics, enabling the growth of highly realistic human tissue models *in vitro.*

Collaborating for the future

The collaboration between Gelomics and the ARC CTET represents a strategic alignment of expertise and resources that propels advancements in tissue engineering and regenerative medicine. This partnership leverages CTET's strong foundation in industry-specific training and research, aligning it with Gelomics' innovative 3D tissue culture technology. Together, we are tackling the challenges in drug development by creating more reliable and ethical alternatives to animal testing.

Dr Christoph Meinert
CEO & Co-Founder
Gelomics

CTET's focus on developing an industry-ready workforce in regenerative medicine and tissue engineering complements Gelomics' mission to innovate in drug development. By integrating and progressing Gelomics' technologies through CTET's research themes, such as advanced materials and manufacturing, the collaboration enhances the practical application of this technology in the industry. This synergy not only accelerates the refinement of Gelomics' technologies but also provides valuable real-world experience for CTET's trainees, equipping them with the skills and knowledge necessary for the future of biomedical research.

This collaborative effort marks a crucial step in our shared vision to reshape the landscape of biomedical research and drug development. By harnessing CTET's academic prowess and Gelomics' technological innovation, we are not only advancing scientific methodologies but also nurturing a new generation of industry experts. Our journey towards a more ethical, efficient, and effective future in drug development continues to unfold, and we invite you to explore this exciting path with us. Discover more about our groundbreaking work and stay updated with our latest advancements at Gelomics' website.

CTET TRAINING PROGRAM: Intellectual Property and Good Manufacturing Practice

Students and postdoctoral fellows in CTET are given the opportunity to complete additional training programs, above and beyond the resources provided at their home universities. CTET has a range of Training Partners, who provide these opportunities. Recently, CTET members and affiliates have had the opportunity to attend webinars given by Training Parters - Spruson & Ferguson, and MIltenyi Biotec.

CTET's aim is to produce industry-ready graduates, and these opportunities are just another way to allow members to gain skills and knowledge in different areas to make them more employable.

Dr Daniel Sieveking has now participated in two webinars for CTET members and affiliates. Together with patent attorney Sylvie Tso, they provided an introduction to intellectual property, patents and licensing.

The provided a number of real-life examples of a variety of situations to help provide attendees with practical advice when planning patenting work.

Miltenyi Biotec's mission is to advance scientific understanding and medicine by providing solutions for cell and gene therapy and biomedical research. Partner Investigator, Paula Stoddart provided a webinar about GMP - GMP in a nutshell - everything you need to know.

This session provided extensive detail on the set up and use of GMP facilities, as well as many online resources CTET members can use to help develop their skills in this area.

CTET Training Partners and Partner Investigators provide this training as part of in-kind agreements with the Centre. CTET is very thankful for the opportunity to work with these partners, and to gain access to their extensive knowledge in their various areas of expertise.

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