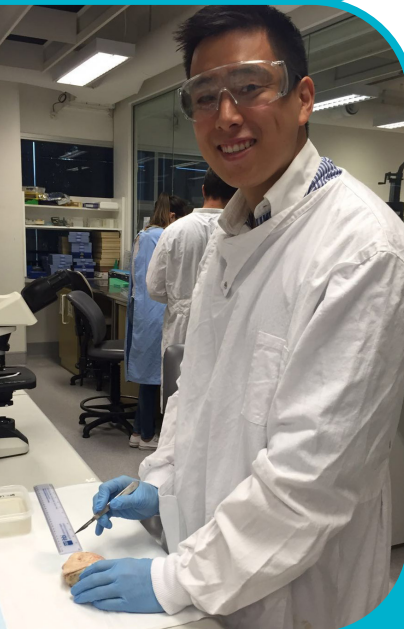


# Doctors in Training Grant

## PRELIMINARY REPORT



Laboratory work with explanted scaffolds at the Institute of Health and Biomedical Innovation

**Dr Matthew Cheng**

**Clinical Research Fellowship**  
Plastic and Reconstructive Surgery

**Princess Alexandra Hospital**  
Brisbane, Queensland, Australia



I have always been interested in dedicating time to pursue research but have been concerned about taking time away from clinical training. The MIGA Doctors in Training Grant has generously assisted me in my Clinical Research Fellowship to achieve this goal whilst allowing me to continue gaining clinical experience. Through the Research Fellowship I have been able to commence a PhD part-time, whilst also working clinically in the Plastic and Reconstructive Unit at the Princess Alexandra Hospital in Brisbane, Australia. I am pleased to report my progress.

### My research work

My PhD research is trying to establish a new method of breast reconstruction after breast cancer surgery using tissue engineering and regenerative medicine to stimulate the body to grow new breast tissue. Tissue engineering and regenerative medicine is an exciting field of research as it holds the possibility to regenerate lost tissue. Our goal is to use these principles to regenerate new breasts for patients who have lost theirs through breast cancer surgery. Specifically, we are using 3-dimensional (3-D) printed breast scaffolds and implanting them after breast cancer surgery. We then fill them with fat from the patient and allow the fat to grow and populate the scaffold to regenerate breasts.

My interest in pursuing research into new methods of breast reconstruction and in plastic and reconstructive surgery stemmed from early experiences as a medical student. I had the opportunity to observe a breast reconstruction using a TRAM (Transverse Rectus Abdominis Myocutaneous) flap for a patient with a double mastectomy. I was able to interview the patient after the surgery, where she described how important the reconstruction was to her, and how it was going to give her the confidence and positive attitude to complete the remaining parts of her breast cancer treatment. I came to realise that breast reconstruction is an integral component of breast cancer therapy which is often overlooked.

The innovation of this research is that it describes a method to reconstruct breasts by regenerating tissue, rather than replacing it. Current techniques for breast reconstruction use implants or tissue from another part of the body to form new breasts.

*Our method regenerates breasts by stimulating the growth of fat. We believe that this will give the patient the most natural shape and feel to her reconstructed breasts, and will also be less invasive and more cost-effective meaning that more women will have access to breast reconstruction.*

An additional benefit of this method is the incorporation of 3-D scanning. We hope to integrate 3-D scanning in the fabrication of our breast scaffolds. This means that we have the ability to scan women prior to their breast cancer surgery and generate an accurate 3-D model of their breasts which our breast scaffolds can be based off when printed. Additionally, the patient has the ability to modify the design of her breast scaffold model to give the shape and size of her preference. Therefore, we have the ability to create a bespoke breast reconstruction which is not available with current methods of breast reconstruction.

I am fortunate to be working in a large multidisciplinary research team including world leaders in research and surgery at the Institute of Health and Biomedical Innovation (Queensland University of Technology). I am under the supervision of Professor Dietmar Huttmacher, who is world-renowned for his research in tissue engineering and regenerative medicine. His work not only includes breast reconstruction, but also regenerative medicine in the field of orthopaedics and maxillofacial surgery. I am also supervised by Dr Michael Wagels who is an

experienced plastic and reconstructive surgeon, and well-respected for his strong research background. I have also been provided with clinical guidance from Professor Owen Ung and Dr Clement Wong who are both accomplished breast and endocrine surgeons.

Our research group has commenced initial animal trials using this technique with encouraging results. My role is to continue from this and conduct long term animal studies which is important to generate long term efficacy and safety data. We have received approval to commence our study which will occur from July. In the near future, we will then plan to conduct clinical trials with this technique. Ongoing work is being conducted to optimise the design of our 3-D printed breast scaffolds, as well as improving the technique of implantation and fat grafting. All these are important steps to translating our research to clinical application. We are hopeful that this will be revolutionary in the way we approach breast reconstruction.

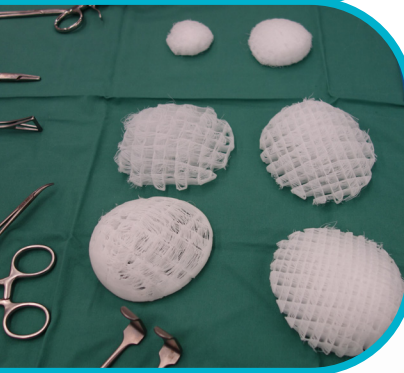
#### **My clinical work**

Through the Clinical Research Fellowship which has been assisted by MIGA, I have also been able to continue gaining clinical experience by working part-time with the Plastic and Reconstructive Unit under Dr David Theile Jnr at the Princess Alexandra Hospital. This experience is extremely valuable as it has allowed me to still remain clinical whilst researching. I have been able to continue developing my surgical and clinical skills which are essential on my journey to training in plastic and reconstructive surgery. Additionally, by working in a clinical setting, I have the opportunity to share my research with patients. I have found this extremely encouraging as patients have described a need for a reconstruction technique which gives them the closest shape and feel to their breasts prior to breast cancer.

*Sharing our method of breast reconstruction using 3-D printed breast scaffolds to achieve this with patients has been a rewarding experience. There is a synergy between conducting research and working in the clinical setting.*

#### **Final thoughts**

I am extremely grateful to MIGA for providing this Doctors in Training Grant. In the realm of research, trials are costly and funds to support research are extremely limited. This Grant has been put towards expenses for our animal trial. Significant expenses include housing and care for the animals, purchasing a liposuction machine, 3-D printers and a 3-D scanner. I believe this research has the opportunity to positively influence the outcomes of women with breast cancer. We have the opportunity to provide women with a method to regenerate breast from their own tissue, which we believe will have the most natural shape and feel. Much more work needs to be done before this becomes a clinical reality, but I am determined to realise this goal.



1. Prototype of various 3-D printed breast scaffolds for trial implantation
2. Performing an endoscopic procedure at Princess Alexandra Hospital

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