

PHD SCHOLARSHIP RECIPIENT

STEPHANIE YEE

Stephanie Yee is a first year PhD student at the University of Sydney. Stephanie graduated with First Class Honours in her Mechanical Engineering (Biomedical) and Medical Science degrees, also at the University of Sydney. Stephanie is currently pursuing a PhD in tissue engineering with Prof. Hala Zreiqat, focusing on the development of a novel tissue engineered cardiac patch and accompanying culture system for treating heart disease.

Research

Heart conditions are one the most significant health problems today. Heart disease is the leading cause of death worldwide, accounting for 20% of deaths, while congenital heart defects are the most common form of congenital defect, occurring in as many as 1.4% of live births. Given the difficulty of surgical procedures and limited supply of donor organs for heart transplants, tissue engineering is an attractive alternative that has significant potential as a future treatment for these conditions.

One of the primary developments in cardiac tissue engineering is the cardiac patch. This consists of a thin, flexible scaffold upon which heart cells can be seeded. The patches are grafted onto the damaged heart tissue, after which they will integrate into the existing tissue to restore function to the damaged area. Advantages of the cardiac patch include the use of the patient's own cells in the treatment process, which prevents organ rejection and the need for lifelong immune suppressants as would be the case with heart transplants, and the ability to generate patches of a range of sizes and shapes to suit the patient's needs.

However, there are several challenges that current cardiac patches face. One challenge is selecting the right cell type to use. Another is the difficulty of developing a scaffold that can mimic the biological function of native heart tissue, while at the same time possessing similar biomechanical properties. Culture systems for the constructs must also be developed and optimised. Finally, vascularisation, or penetration of blood vessels through the construct after it is implanted, is also a major challenge.

Thus, the aim of this project is to develop a novel cardiac patch that is able to address these issues. The approach will involve the development and of a polymer-based, fibre composite scaffold. The scaffold will then be characterised and modified to promote tissue growth. The construct then will be tested with a range of cell types, and a culture system to mature the cells into heart tissue will be developed. Finally, the constructs will be tested in animal models to determine their effectiveness at restoring function to damaged heart tissue.