Islet transplantation offers an improvement in the quality of life for those suffering from type 1 diabetes. It is found that islet cells may die during or soon after transplantation. Studies in our lab have shown that small islets are superior to large islets as they maintain viability and result in long-lasting insulin independence in diabetic rats. Large islets show areas of cell apoptosis and necrosis within 24 hours in cell culture, while small islets remain viable. The purpose of this study was to engineer optimal islet tissue for transplantation as a means to cure type 1 diabetes.

Isolated rat islets were measured for cell viability, islet survival, glucose diffusion, and insulin secretion. It was found that core cell death occurred in 100% of the large islets, resulting in poor survival within several days. Small islets (diameter < 100 µm) exhibited better survival rates. To engineer islets with this optimal diameter, large islets were dispersed into single cells and subsequently seeded onto the engineered mold. These molds were fabricated using photolithography and wet etching to create conical-shaped recesses that allowed for reaggregation of cells into a defined islet size. Results show that single cells aggregate into small islets and maintain cell viability. This method allows for creation of islet tissue of optimal shape and size for transplantation.