MRes in Bioengineering

Title: The Mechanobiology of Obesity and Adipogenesis

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Project background

Obesity is a leading cause of preventable death in the world, contributing to heart disease, stroke, osteoarthritis and cancer. The primary treatment for obesity includes dieting and physical exercise, but attempts to limit pro-obesity lifestyles often does not achieve sufficient weight loss to offset the negative health effects. Obesity is defined as abnormal or excessive fat accumulation that may impair heath, but the factors regulating fat accumulation (or excessive fat accumulation) in the body remain unclear.

Recent studies in our laboratory and elsewhere have shown that mechanical forces regulate the differentiation of specialised fat-storing cells or adipocytes. This is particularly important for visceral fat, where the size and number of adipocytes serves as an indicator for the negative health effects of obesity. As visceral fat accumulates within the abdominal cavity, compressive forces feedback to regulate adipogenesis. We hypothesize that disruptions in this feedback mechanism correlate with excessive visceral adiposity.

This project investigates the mechanical feedback hypothesis of adipogenesis and how this feedback mechanism becomes disrupted in adipocytes isolated from obese individuals. Techniques include a suite of mechanobiological tools to measure the mechanical properties of living cells and tissues, as well as multi-channel bioreactors to precisely control the mechanical loading regime over long term cell culture. In this highly interdisciplinary project, the student will interface between post-docs and collaborators who are experts in the biochemical regulation of adipogenesis, engineers who develop tools to precisely control mechanical forces applied to living cells, and pharmaceutical scientists who are developing new drugs to modulate adipogenesis.

Two post-docs will assist in the development of biological assays and mechanobiological tools. A technician is available to assist with animal resources.