

IPRO 308: Developing an Artificial Pancreas *“Making Life Sweet for individuals with Diabetes”*

The Problem

Current insulin replacement regimes for Type 1 diabetes require multiple venepunctures a day. Indeed, up to seven times each day, a diabetic must lance their skin in order to extract a drop of blood for glucose measurement, then again, to inject appropriate quantities of insulin. This treatment modality is both cumbersome and painful, and accordingly, patient compliance is less than desirable.

Proposed Solution

The objective of this project is to design and test a novel transdermal artificial pancreas, capable of both indirectly measuring blood glucose concentrations and delivering commensurate quantities of insulin. Unlike traditional insulin maintenance regimes, which utilize venepuncture as a means of extracting blood for glucose measurement and to deliver the hormone, in our proposed design both tasks are performed virtually painlessly through the skin. Specifically, we intend to combine ultrasound, iontophoresis/reverse iontophoresis, and vacuum/pressure for extraction/delivery in an innovative and electronically integrated device. Although much research has been undertaken on similar projects, we believe that our inventive combination of these existing technologies will offer substantial advantages over existing approaches, including a marketable final product.

Market Opportunity

Millions of Americans use insulin therapy to treat their diabetes. As such, the treatment market is exceptionally large, with estimates ranging from \$44 billion and \$100 billion per year. We believe that an efficient, non-invasive, and easy to use artificial pancreas would prove very competitive in this substantial market.

Faculty & Advisors: Dr. Emmanuel Opara, Mr. Ray Deboth

Team Leader: Maje Nazim, MBB

Team Secretary: Medhavi Gudivada, BME

Student Members: Sean Callahan, CS; Jason Devgun, BME; Christie Ferraro, BME; Anthony Ferrese, CHEE; Renen Manuntag, BME; Neil Mashruwala, BME; Dukmin Park, BME; Alok Patel, BME; Bhavin Patel, BME; Nathaniel Schuh, PSYC