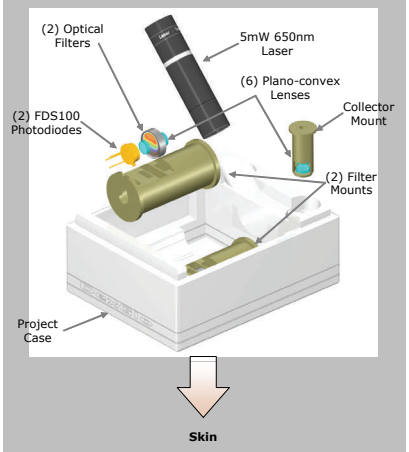
BIOE 451/452: Bioengineering Design

An opportunity for students to tackle and solve a design problem in bioengineering

Fluorescent Glucose Monitor

May 2007



"The main competitive advantage we wanted in our device was accuracy in detecting fluorescence and therefore glucose concentration from the sensor and the ability to continuously monitor to lead to better treatment of the patients condition."
— Drew McUsic

Team Members:
Jaskaran Gill Jonathan Martinez, Drew McUsic, Joseph Valdez, Al-

BIOENGINEERING DESIGN AT RICE

Rice University
Dept. of Bioengineering
6100 S, Main St. - MS142
Houston, TX 77005

Phone: 713-348-4156

HSEMB 2007
1st Place Design Award

This initiative is made possible by BioTex, Inc. and the Department of Bioengineering at Rice University.

Bioengineering Design Challenge

Nearly 300 million people worldwide suffer from diabetes mellitus, a condition characterized by a lack of insulin production or insulin-resistance, resulting in unregulated glucose concentrations in the blood. Patients with diabetes must regularly measure their blood-glucose levels and manage it with diet, exercise, medication, and when necessary, insulin injections. The conventional method for measuring blood-glucose concentration, the finger-prick method, is invasive and necessitates frequent and sometimes painful blood withdrawals. Although non-invasive monitoring techniques are available, they require a daily blood sample for calibration and the results are highly variable and therefore, inaccurate.

Appropriate Solution

Recently BioTex, a Houston-based biotech company, created an implantable sensor that utilizes fluorescence resonance energy transfer (FRET) to emit fluorescence based on the amount of glucose present. Team GQ of BIOE 451 designed a portable detector that interfaces with BioTex's implantable sensor to measure the emissions. First, the detector will measure fluorescence through the skin using fiber optic cables. Then it will filter, amplify, and convert the signal into a glucose concentration. Finally, it will store and display the data for the user. The design allows for continuous monitoring of glucose concentrations that is easy to use, accurate, and minimally invasive. Guidance and support was provided by Dr. Ralph Ballerstadt, Dr. Bill Jackson, Dr. Ashok Gowda, Dr. Roger McNichols, Colton Evans, Dr. Maria Oden, Carlos Amaro, Joseph Gesenhues, Tim Muldoon, Mark Pierce, and Margaret Bate.

Current Status

A prototype of the design is complete and is able to adequately excite and detect fluorescence and amplify the signal. Team GQ also constructed a rapid prototype of the mount where the components of the detector will be placed. Improvements still need to be made on the sensitivity of the fluorescent detection to achieve more accurate results. In addition, data storage, an LCD screen, and user input buttons need to be integrated into the design. Eventually Team GQ would like to have the design approved by the FDA and patented.