IPRO308: The Artificial Pancreas

IPRO Day Progress Update
November 30th, 2007

Diabetes

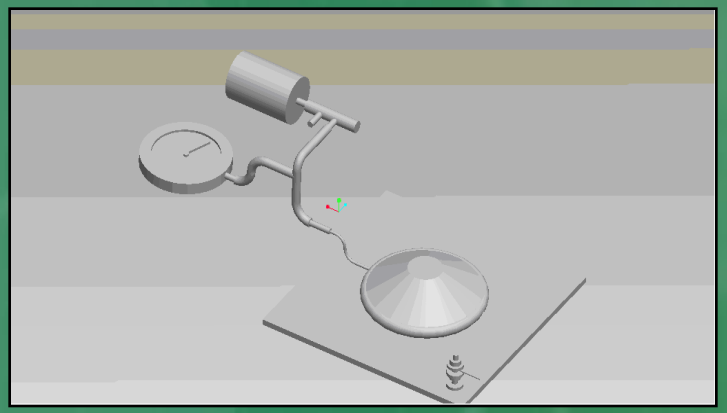
- **Diabetes:**
  - Type 1: Deficient Insulin Production
  - Type 2: Insulin Resistance
  - Manifestations: Poor Circulation, Weight Gain Complications
- **Insulin:**
  - Regulates glucose absorption into tissues for metabolic needs
  - Improper balances may be fatal

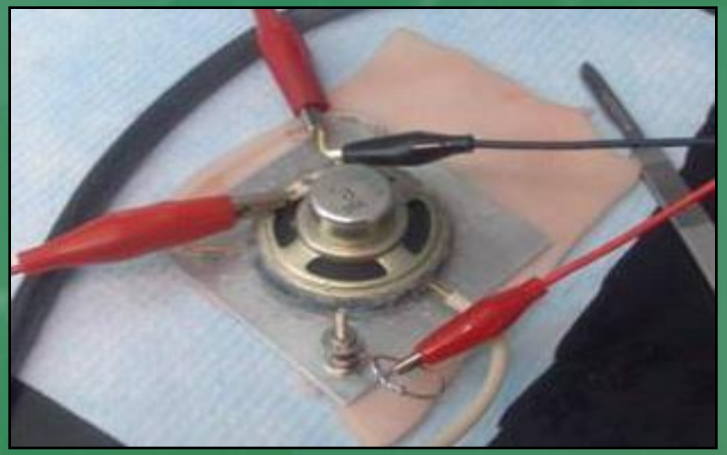
Glucose Pumps and Sensors

- Current Glucose Pumps and Sensors
  - Invasive and uncomfortable
  - Non-Invasive sensor research

IPRO 308: Unique Approach

- Sonophoresis
- Reverse Iontophoresis
- Vacuum
- Spectroscopy
- Iontophoresis





Team Structure

- Team Leader (Michael)
  - Comm. Leader (Linda)
  - Webmaster (Rohan)
  - Research Sub. Leader (Margaret)
    - Patent Research David/Linda
    - Grant App. Marg./David
  - Msrment Sub. Leader (Kirthi)
    - Bndct Sol. Emis. Spect. Amir/Wal./ Kirthi
    - Gluc. Oxid./ Imp. Spect. Michael/ Kirthi
  - Extrct. Sub. Leader (Bhavin)
    - Vacuum Suct. E-Faan, Amanda
    - Sono. Bhavin, Rohan, Dev
    - Ionto. Bhavin, Rohan, Maryum

Administrative Structure

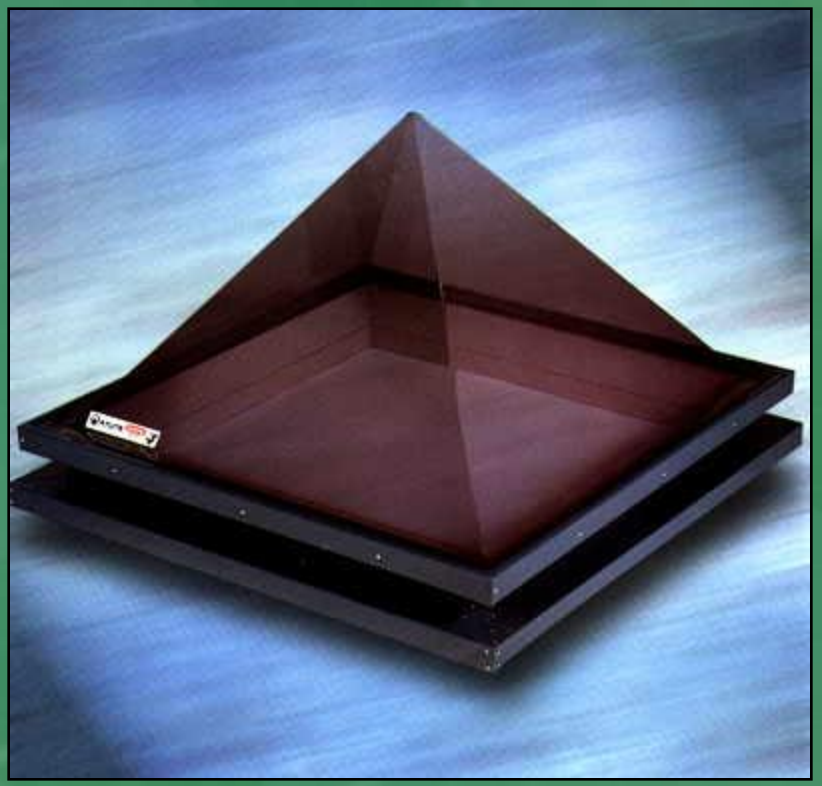
- **Team Leader:** Michael Morley
- **Secretary:** Linda Goldstein
- **Webmaster:** Rohan Mathews
- **Subcommittee Leaders:**
  - Bhavin Patel (Extraction)
  - Kirthi Reddy (Measurement)
  - Margaret Kochanek (Research)

Research Subcommittee

- Patent Search
- Research for various committees
- Grant Applications
  - National Collegiate Inventors & Innovators Alliance (NCIIA)
  - Ford Foundation
- Deliverables
  - Project Plan
  - Mid-Term Report
  - Code of Ethics

Ethical Levels of IPRO 308

1. Moral Values
2. Personal Relations
3. Community
4. Industrial Standards
5. Professional Codes
6. Contracts
7. Law



Extraction Subcommittee

OINK OINK!!

EXPERIMENTATION

- Pig Skin - Closest available substitute for Human skin
- Difficulty obtaining fresh skin for every experiment
- Thickness and age of the skin vital to success of experiment

THE PROTOTYPE

The Basics

- Tweeter speaker
- Hole through magnet for vacuum
- Conductive epoxy for iontophoresis

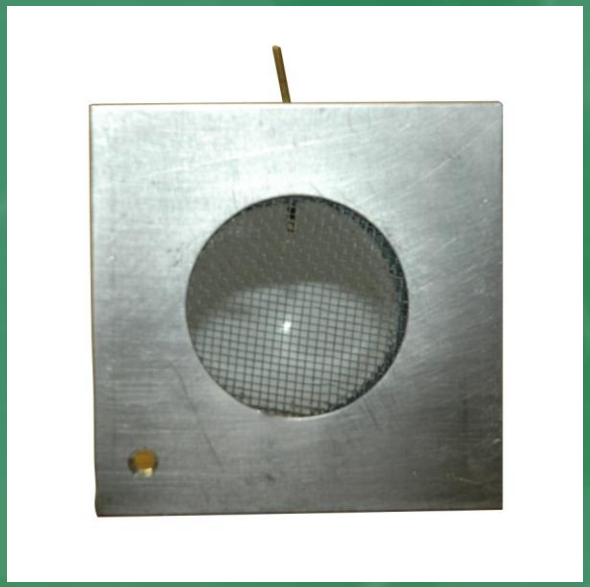
THE PROTOTYPE

Initial Design

- Speaker without hole
- Vacuum pulled through gasket
- Base-plate for iontophoresis
- RTV to seal the vacuum and prevent air gaps

THE PROTOTYPE

A new approach to Iontophoresis



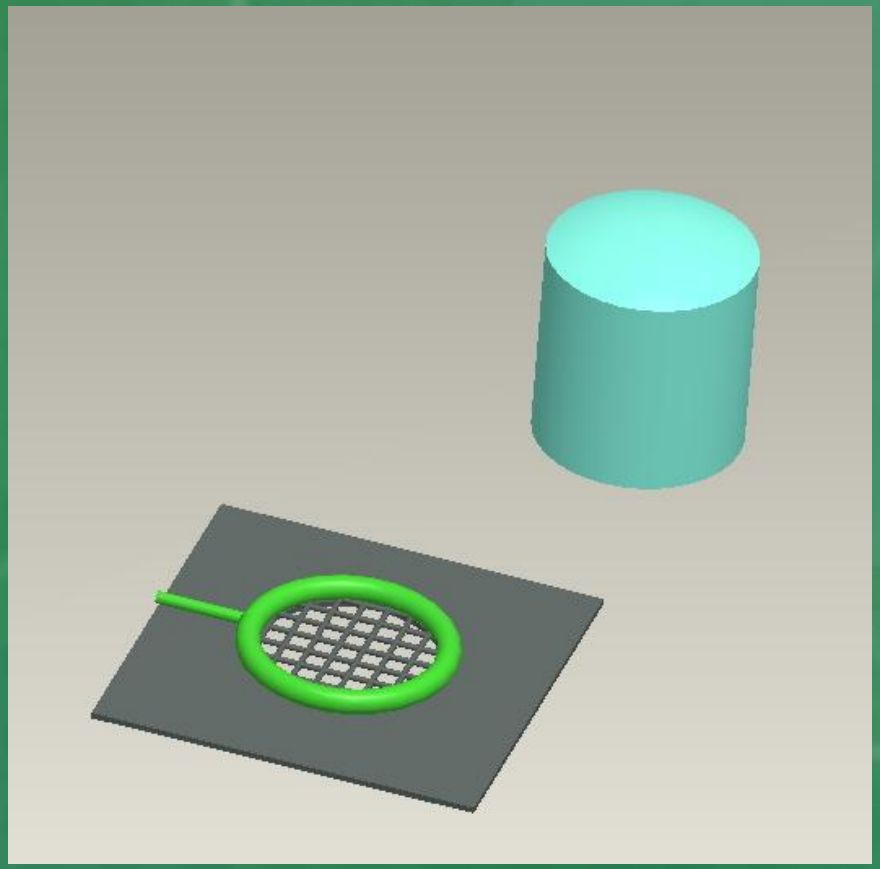
•Epoxy unlevel and inadequate

•Aluminum base-plate

•Conductive and adhesive foil on speaker coil

THE PROTOTYPE

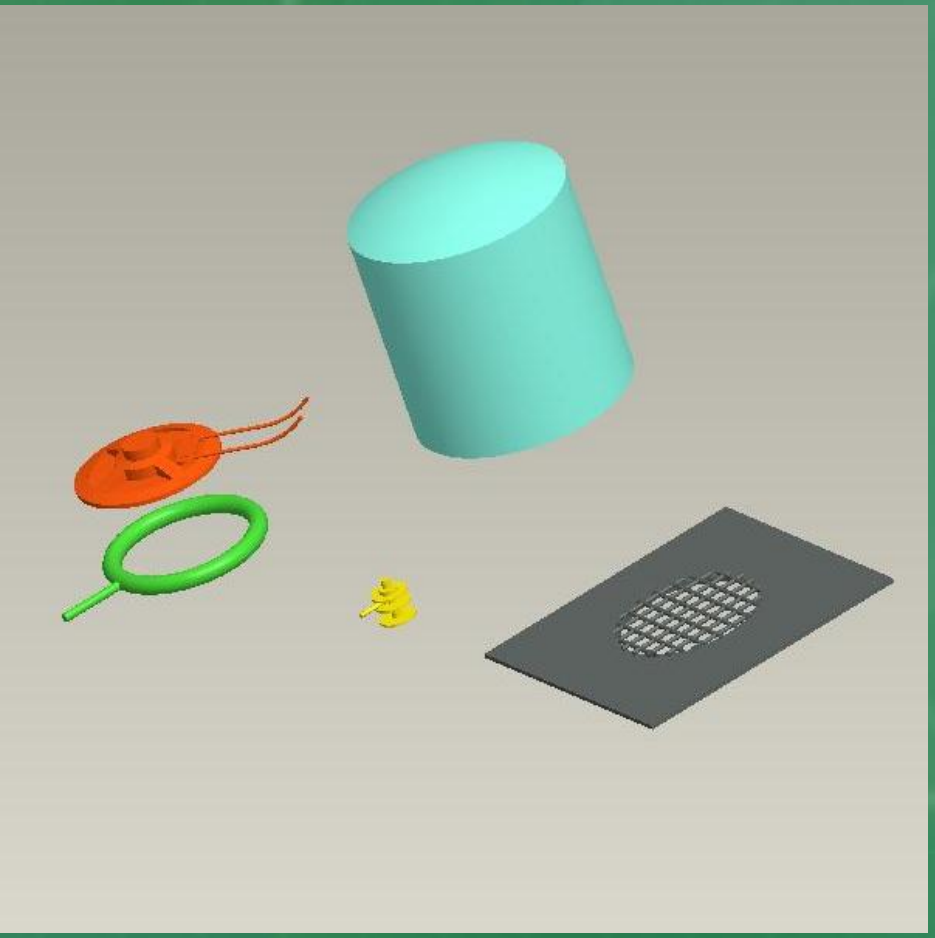
A new approach to Vacuum suction



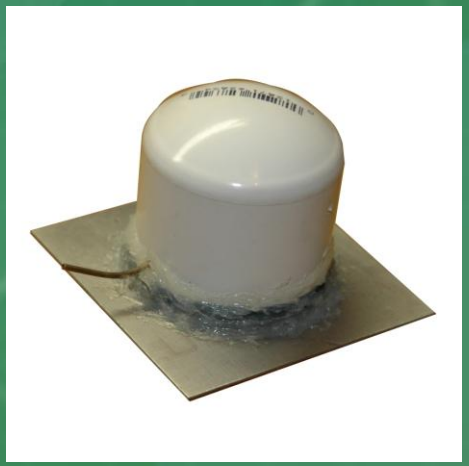
- Extraction group worked to maximize vacuum suction
- Modeled with a PVC pipe cover
- Tested grid design
- 13 in Hg

THE PROTOTYPE

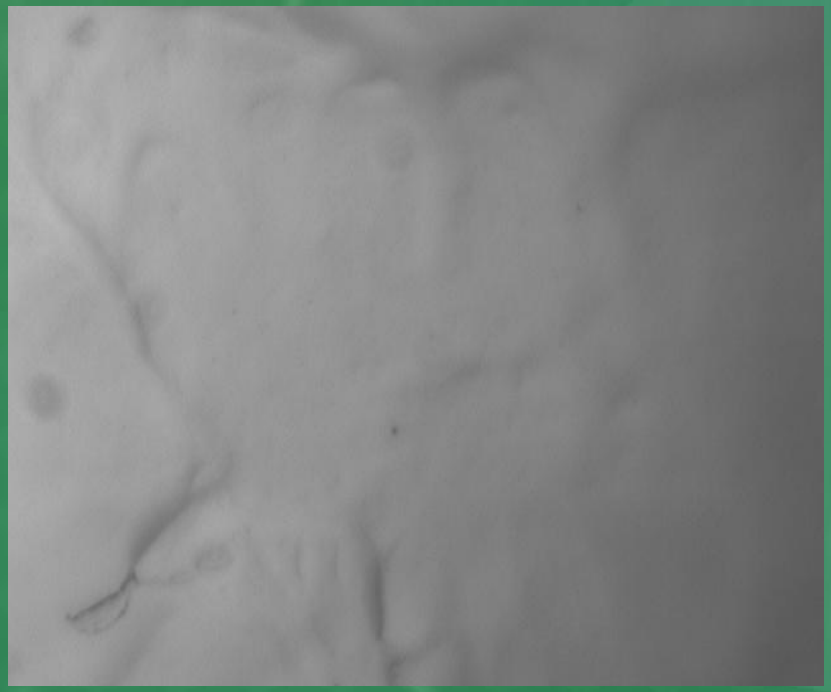
The Final Design



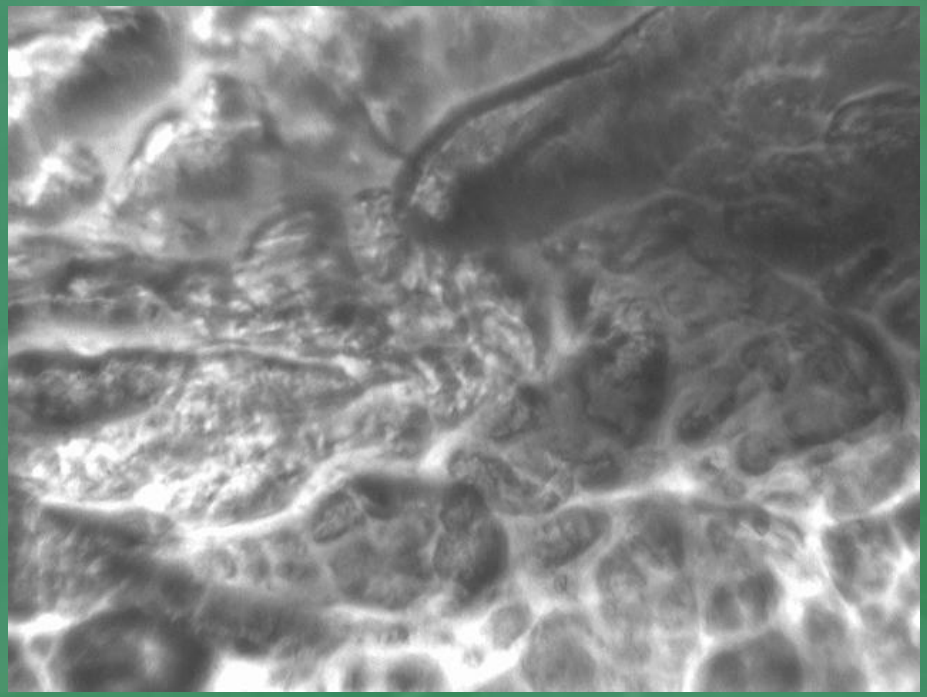
- Base-plate
- Gasket with tube for vacuum
- Speaker with wires to leads
- PVC piping



Extraction: Results



Normal pig skin before experiments.

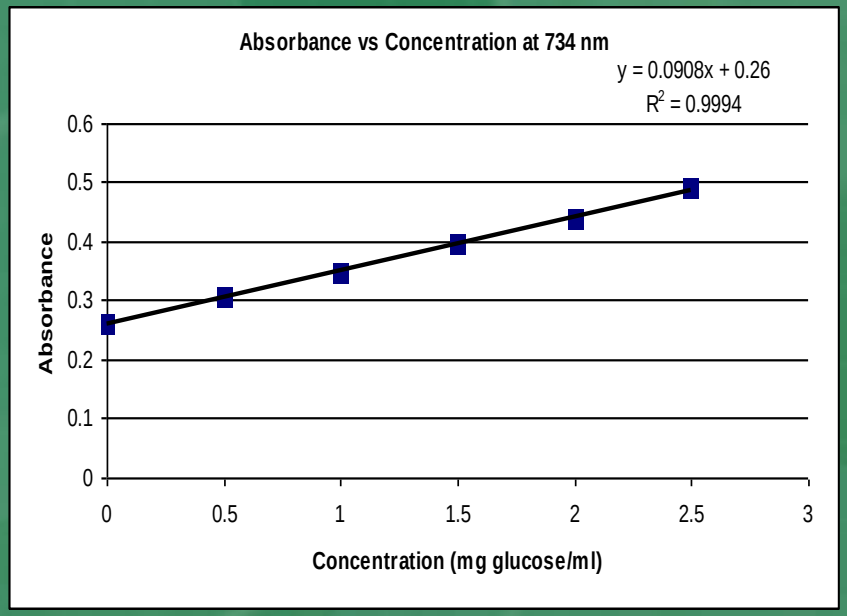


After iontophoresis, sonophoresis, and vacuum

20X Magnification with a compound microscope
15 Min

Measurement: Results

- Past: Spect. methods
  - Beer Lamberts Law
- Problems:
  - Glucose absorbance at 3000 nm, while spectrophotometers only measure accurately to 1500 nm. Non-linear relationship produced
- Solution:
  - Use of Glucose Benedicts Solution. Absorbance at 730 nm



Looking to the future

- Attain rat skin for better results
- Miniaturize technologies to fit prototype
- Identify methods for:
  - Preparing Benedict's Sol.
  - Cleaning chamber
  - Interstitial glucose-insulin algorithm
  - Administering Insulin

Special Thanks..

- Dr. Emmanuel Opara
- Mr. Ray Deboth
- Dr. Stark
- Dr. Bishnoi
- Dr. Williams
- Dr. Myron Gottlieb
- Dr. Jennifer Derwent
- Dr. Promilia Dhar
- Dr. Khaleil

Questions?