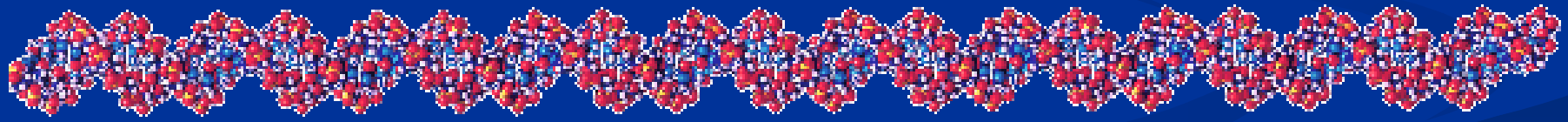
IPRO 331 -
Non-Invasive Blood Glucose Monitoring



IPRO 331 - Non-Invasive Blood Glucose Monitoring

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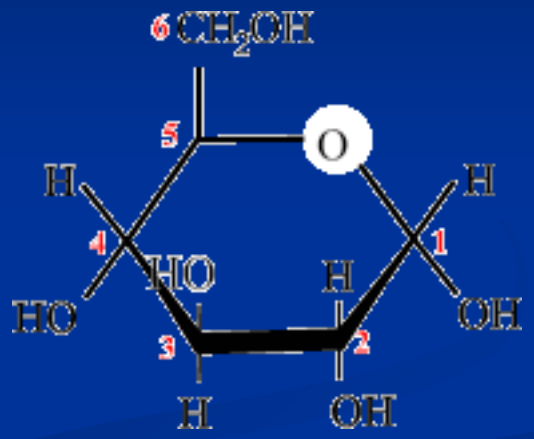
IPRO 331 - Non-Invasive Blood Glucose Monitoring

- Purpose
- Background
- Design
- Cost Analysis
- Obstacles
- Conclusion
- Recommendations for Future



Diabetes Background

- Type 1:
  - ✓ "Juvenile Onset"
  - ✓ Autoimmune Disease in which immune system attacks the Pancreatic Beta cells which produce insulin
  - ✓ Insulin is a hormone used by the body to metabolize glucose
  - ✓ Require Regular Insulin Injections
  - ✓ Must constantly monitor blood glucose to avoid both hyperglycemia and hypoglycemia.
- Type 2:
  - "Adult Onset"
  - Pancreas Still Produces Insulin, but "Insulin Resistance" prevents the body from utilizing it
  - Accounts For 90-95% of all diabetes cases

Hyper and HypoGlycemia

- Hyperglycemia
  - ✓ Blood glucose is above recommended range
  - ✓ Blurry Vision, Excessive Thirst and possible long term effects such as blindness and even early death
- Hypoglycemia
  - ✓ Blood glucose is below recommended range
  - ✓ Possible Medical Emergency
  - ✓ "Insulin Shock"
  - ✓ Can quickly lead to coma and death

Current Methods

- Require finger pricks for blood
- The blood is then blotted onto test strips
- Test strips are placed in a reader
- Very Cumbersome and stressful, particularly for young children

Project Purpose

- Invasive Procedure Elimination
- Continuous monitoring
- Cost Reduction
- Eliminate need to restock monitoring supplies

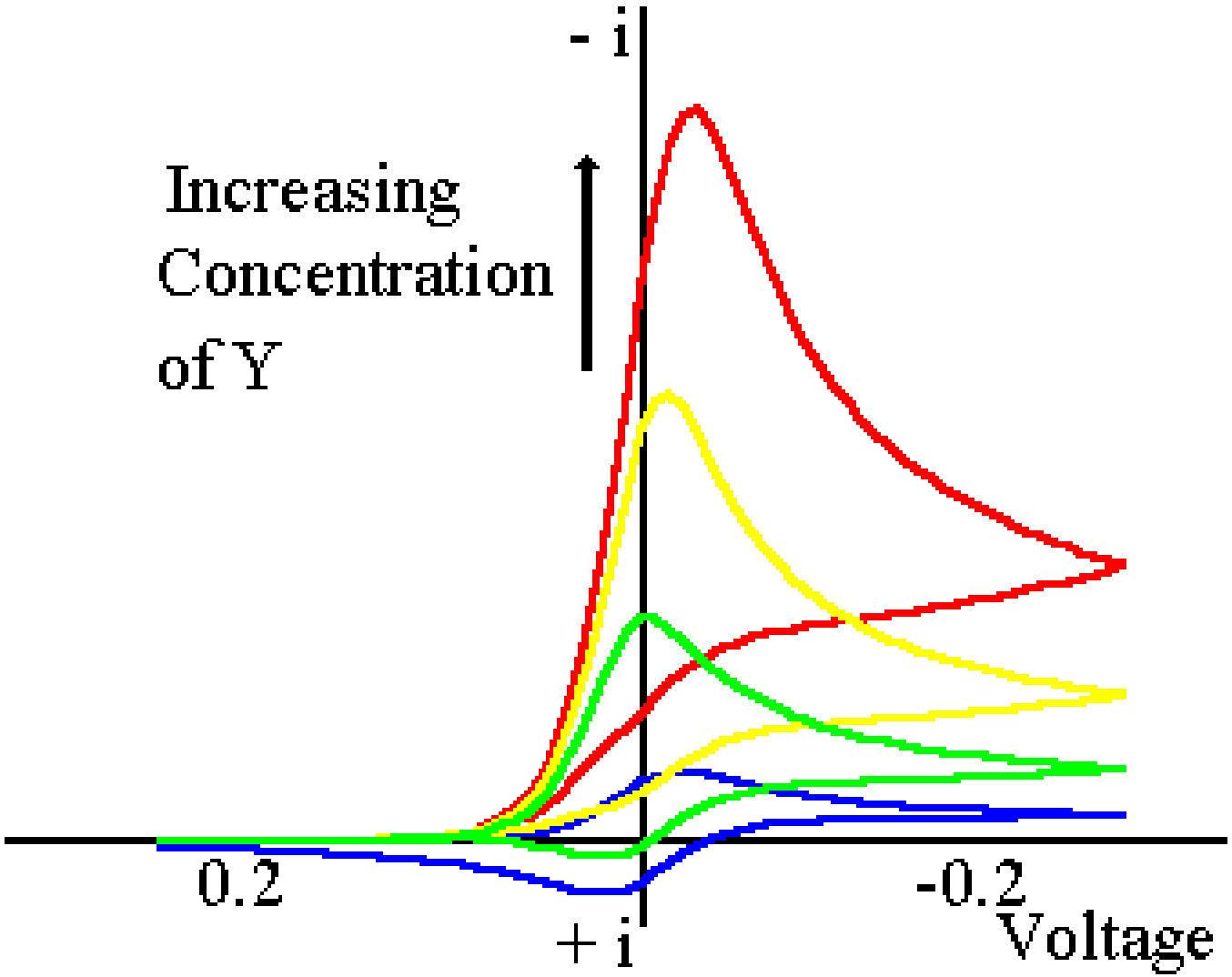
Design Possibilities

- Measurement Medium
  - ✓Interstitial Fluid
  - ✓Blood
  - ✓Saliva
- Medium Extraction
  - ✓Vacuum
  - ✓Ultrasound
  - ✓Iontophoresis

Design Possibilities

- Measurement
  - Infrared Spectroscopy
    - ✓Near Infrared
    - ✓Far Infrared
  - Photo-acoustic glucose measurement
  - Impedance Spectroscopy

Impedance Spectrum



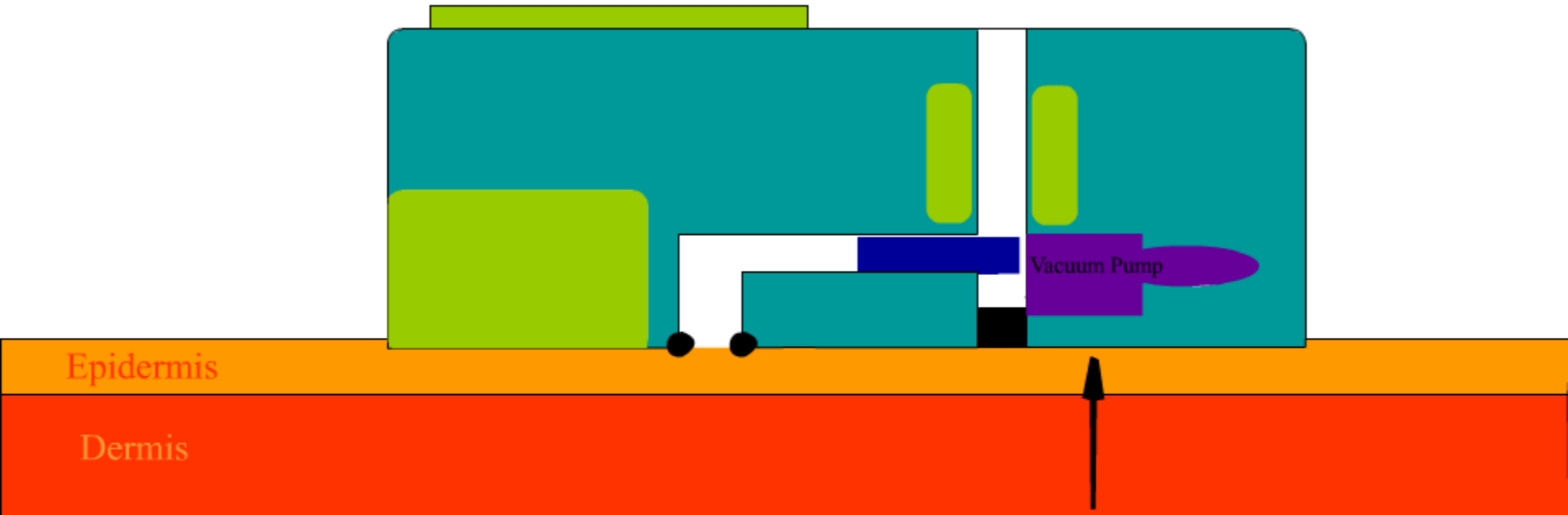
Design possibilities

- Cleaning the device
  - Self-cleansing sensors

IPRO 331 Design

- Interstitial fluid
- Ultrasound permeation
- Vacuum extraction
- Impedance spectroscopy
  - ✓Resonates Glucose Molecule
  - ✓Specific Frequency isolation

The vacuum pump then begins its first phase by drawing up any sweat



IPRO 331 Non-Invasive Blood Glucose Monitor

Flash animation by Jude Kieltyka

Cost Analysis

Equipment Needed

- Ultrasound
  - ✓ Transducer
  - ✓ Amplifier
- Vacuum Unit
  - ✓ Batteries
  - ✓ Vacuum Pump
- Cleaning Components
  - ✓ Sensors
  - ✓ Titanium Oxide Film
- Impedance Spectroscopy
  - ✓ Circuit Components
  - ✓ Impedance Sensors

Cost Analysis

Current Technology

- Invasive Blood Glucose Monitoring
  - ✓ 50 Test Strips: $ 30 (replenish every 25 days or less)
  - ✓ 200 Lancets: $ 10 - $ 50 (replenish every 3 months)
  - ✓ Testing Apparatus: $ 50 - $ 100 (Lower Level Monitors)
  - ✓ Consumable Auto-Sensors (certain machines): ~ $ 70
- Replenishment of Supplies required
- Average Cost per Test: $ 0.70 - $ 0.80

Cost Analysis

Our Technology

- Non-Invasive Blood Glucose Monitoring

Items	Cost Range ($)
Ultrasound components	25-100
Vacuum device including batteries	15-20
Cleaning Components	~ 10
Impedance Materials	~ 150

- Total Cost Range: $ 200 to $ 280
- No replenishing of supplies. <u>One Time Purchase!</u>

Obstacles

- Vacuum pressure
- Sweat convolutions
- Concentration Convolutions
- Cleaning measurement chamber
- Who is on the patent?

Future Direction

- Develop Working Prototype
- Obtain patent rights for the idea
- NCIAA biomedical engineering award
- Obtain Sponsorship for further development

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