

Problem & Solution

There are no affordable, accurate, or accessible/easy to use devices on the market that allow individuals with diabetes to quickly evaluate insulin potency and degradation in and outside of the clinical setting. We **created a device to test insulin potency** prior to usage. By creating this device, our product should prevent hyperglycemia symptoms.

Background

- Insulin degrades due to heat and improper storage
- Current ways of testing for insulin (HPLC, Spectroscopy) are **not easily accessible**

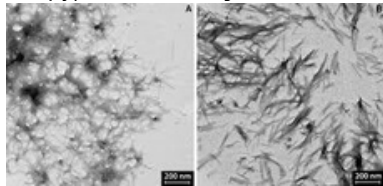


Figure 1: Fibrillation in Insulin (Noormägi)

Objectives

Hardware Team

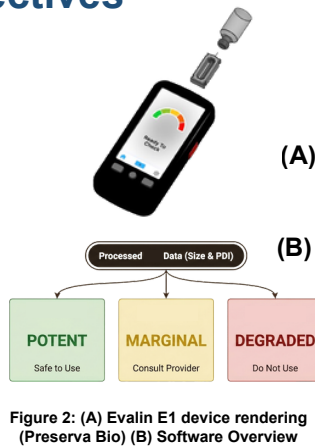
Design an **auto cartridge mechanism** to accurately load and retain insulin in the device

Preserva Bio

Develop a **handheld device** that tests for insulin potency using light scattering methods

Software

Design a secure **software application** for data processing and output



Subproject #1: Automated Syringe



Figure 3: Exploded view of syringe components

- (1) Medical grade needle
- (2) Luer
- (3) Glass Capillary
- (4) Cap
- (5) Spring
- (6) Plunger

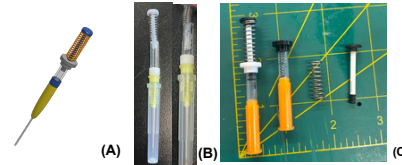


Figure 4: (A) Compact view of syringe, (B) Custom-Built Syringe Assembly, (C) Cam Mechanism Testbed

Subproject #2: Housing with Automation Mechanism

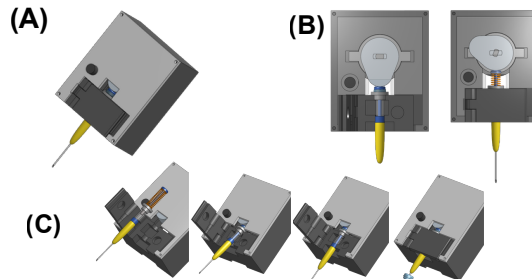


Figure 5: (A) Housing for fluid draw, (B) Cam in loaded and unloaded position, (C) Loading process for cartridge

Subproject #3: Real-Time Test Data Webapp

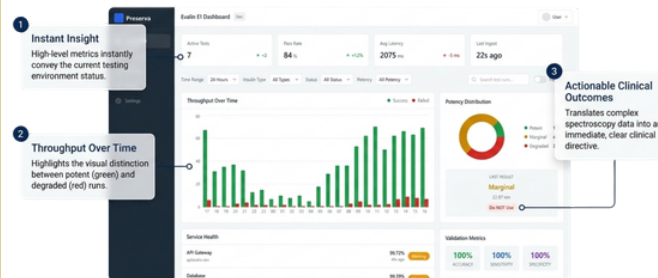
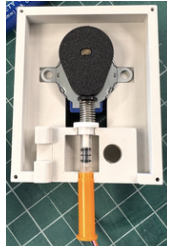


Figure 6: Center Command Overview

Expected Outcomes

Hardware Team

- Accurately draws **required volume** of Insulin
- Automated draw motion** within ~5 seconds
- Cartridge transports insulin to vial and aligns it for **in-device testing**



Software Team

- Clinical dashboard, class distribution, and acceptance criteria
- n = 100 synthetic samples | IEC 62304 Class B Framework



Figure 7: Software Validation Results

Conclusions and Future Directions

- Successfully developed a functional prototype
- Integrate hardware device with software to enable automated insulin testing and data analysis
- Optimize ergonomics and cartridge design
- Patient testing and feedback

Acknowledgements & References



Ethan Vosburg, Micaela Moreira, Dr. Taylor, BENG 187 Teaching Team!

Figure 1: Noormägi, Andra & Veimaa, Karin & Toqou, Vello & Palumaa, Peep. (2015). Insulin Fibrillation at Acidic and Physiological pH Values is Controlled by Different Molecular Mechanisms. *The protein journal*. 34. 10.1007/s10950-015-9634-z