

# Science Fair 2024

Question: How does the implementation of Arduino technology affect the accuracy and efficiency of an artificial pancreas regulating glucose levels?

Hypothesis: I hypothesize the using Arduino technology into the design of an artificial pancreas will result in more precise and rapid glucose regulation compared to traditional methods leading to improved overall performance in glycemic control.

Purpose: This experiment aims to explore the functionality of an artificial pancreas system in regulating blood glucose levels. By creating a simplified model using Arduino microcontroller and electronic circuitry, the experiment aims to mimic the pancreas's natural function of insulin regulation. Through this, the project seeks to understand and potentially contribute to diabetes management technology.

# VARIABLES

## Manipulated

→ The simulated blood glucose levels, which I control by adjusting the conductivity of the "blood" solution. (distilled water)

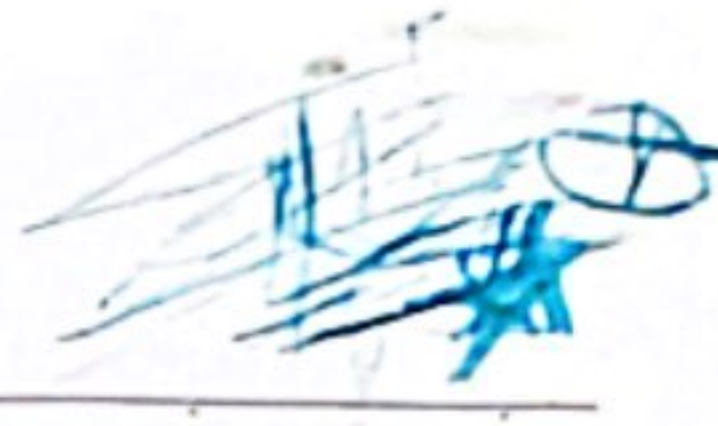
## Responding

→ The action of the pump, which is activated/deactivated by the Arduino based on the conductivity readings, mimicking the release of insulin in response to blood glucose levels in a real pancreas. The effectiveness in this would be observed/measured.

## Controlled

→ The volume/concentrations of the simulated blood and insulin solutions, the type of materials, and the settings of the Arduino microcontroller.

# MATERIALS



\* In a ordered kit

- Arduino-compatible microcontroller board
- USB cable
- Breadboard
- Jumper wires

\* Other items

\* Computer with

- Tap water
- Distilled water
- Alligator clip leads
- Multimeter
- Bowls / food containers (2)
- Aluminum foil
- Tape
- Corks / styrofoam
- 100 k $\Omega$  resistor
- N-channel MOSFET
- Toothpicks
- Food colouring
- Paper bowls
- Marker
- 5V peristaltic liquid pump or a 12V pump but needs external power supply

\* Had some trouble but overall a huge success!

## Conclusion -

Higher voltage for distilled water compared to tap water. In the future, I will like to add more improvements to my code and overall system.

The use of Arduino tech enables the creation of a system that can respond to changes in simulated blood glucose levels, mimicking the natural function of the pancreas more effectively.

## Logbook

### Dates

Jan 12	-	Deciding topic
Jan 29	-	Question
February 2	-	Finished my research
February 19	-	Ordered kit
March 3	-	Gathered materials
March 9	-	Experiment
March 14	-	Final touches

# \* SCIENCE FAIR 2024

## Experiment Readings Voltage Readings

\* Convert it to an equivalent analog Read value by dividing it by 5, then multiplying by 1023 and rounding.  
→ e.g. Reading = 4v      $4/5 \times 1023 = 818.4$   
Rounded  $\Rightarrow 818$

### VOLTAGE READING (higher voltage)

2.6                      1.73

2.57

2.58

2.56

3.33

3.34

2.8

2.4

### Tap Water (lower voltage)

0.83                      0.76

0.82                      0.81

0.80