

# IPRO 332:

## Design & Analysis of a Longitudinal Oscillator for Cardiac Arrest Victims

Advisor: Dr. Francisco Ruiz

Graduate Assistant: Harshbir Sidhu

Sponsor: IIT Pritzker Institute of Biomedical Engineering

### Background:

Cardiac arrest is one of the leading causes of death among American adults, killing approximately 350,000 people a year or 1,000 people per day.



To increase survival, CPR and rapid defibrillation must be started immediately. If the heart is not restarted within the first four to six minutes, the victim may sustain irreversible brain damage. CPR has a success rate of only 5%-10%. It is only meant to circulate oxygenated blood, and keep the heart in a position to be shocked. IPRO 332 and researchers from the University of Chicago are working on a longitudinal oscillator which acts as an alternative to CPR.

Presently, tests are being conducted in mice. Previous trials show that with the proper force and amplitude pigs can be successfully resuscitated. This technology sets the stage for human applications.

### The Human Team

Jake Krynski

Alok Patel

Hazel Ramirez

Yun Wei

### Objective:

To create a Human medical device that provides a better alternative for current CPR techniques based on the research and design from the mice and pig models.

### Option 1: Paramedic Use

- Portable design
- Small and lightweight



### Option 2: Ambulatory Use

- Integrate with stretcher
- Acts as a bridge to advanced care



### Option 3: Hospital Use

- Integrate with hospital bed
- Built in sensor to start with the presence of arrhythmia



### Option 4: Home Use

- Integrate with bed
- Built in sensor to start with the presence of arrhythmia
- Ideal for nursing homes, assisted living, or those at risk

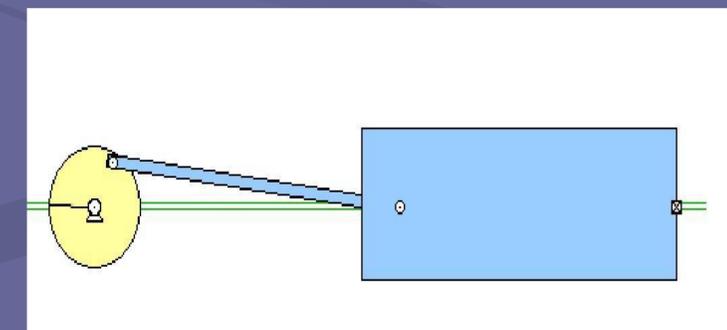
### Guidelines:

- Must be user friendly
- Quick and easy to start up
- Ability to accommodate different weights
- Rails for the wheels to maintain direction and eliminate friction

### Materials:

- Motor
- Reduction Gear
- Links
- Stretcher
- Rails

### General Design :



A motor coupled to a bed which would oscillate the victim head to toe at a set frequency.

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**Background:** Researchers have discovered that it is possible to keep a pig alive after its heart had been stopped by placing it upon a vibrating platform. Essentially it replicates the CPR, except it carries no risk of rib or chest injury.

The physical mechanism behind this effect, as produced by linear periodic acceleration (i.e. "shaking"), is under investigation. To that end, researchers at IIT and the University of Chicago are conducting similar research on mice.

I PRO 332 assists their research by developing the mechanical device to shake the subject. The I PRO will also investigate the scaling and adaptation of this technology to potentially be used by emergency medical personnel.

## The Mouse Team

John Burica

Patrick Folz

Grant Justice

Maribel Valdez

- Objectives:**
- Design oscillator for experiments with mice
  - Construct prototype

### Option 1: Mechanical

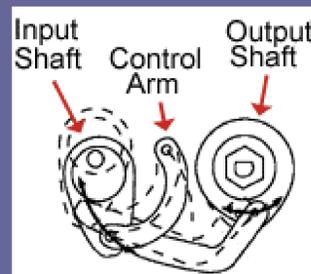


Image courtesy of Zero-Max, Inc.

- Pros:**
- Cost-effective
  - Simple mechanical interface/manipulation
  - Compact design

- Cons:**
- Requires excessive lubrication
  - Lower precision
  - Requires custom-made parts

### Option 2: Electrical



- Pros:**
- High precision
  - Electronic interface
  - Automatic feedback
  - Little Maintenance
- Cons:**
- Very expensive
  - Interface must be programmed
  - Must be modified to improve heat dissipation

**Decision:** Due to the significantly lower cost and simpler operation, the mechanical design is being built.