Small Animal Barostat Instrument Design

Team 7

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IBS Study
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• Symptoms: nausea, diarrhea, abdominal bloating and pain
• Serotonin control link
  • Study conducted using biologically altered female rats
• The problem:
  • Human operated syringe with pressurized balloon
60 mmHg Pressure Test

Ideal:

60 mmHg Pressure Test

Current:
Barostat

- Distender IIR
  - Dual cylinders, control panel, and screen: has all necessary features and is designed specifically for rats

- The problem:
  - Very old (1992) technology costing $25,968.00!
FAST Diagram

- Maintain Constant Pressure
- Input Desired Pressure
- Interpret Input
  - Display Information
  - Increase Pressure
- Calculate Pressure
  - Release Pressure
Initial Design

• **Air pump driven system**
  - Uses low-pressure air pump to pressurize system
    • System filling/venting controlled by air solenoids
      • Precision air pressure sensors provide feedback
    • Pressure reservoir used to compensate for pump issues
  • System and user interface driven by PIC microcontroller

• **Advantages**
  • Low Maintenance

• **Disadvantages**
  • Unable to measure dispensed volume
  • Complex
  • High cost
Team 7 Design Solution

• Syringe driven system
  • Disposable syringe coupled with stepper motor
  • Single air solenoid for venting at end of test
  • Two precision pressure transducers
  • System and user interface similar to initial design

• Advantages
  • Allows for precision control of air volume
  • Simpler than initial design
  • Lower cost than initial design

• Disadvantages
  • Syringe must be periodically replaced
  • Pressurization of system could be slower
Part Selection

- **ET-PIC Stamp Module Development Board**
  - Cost Efficient
  - Compatible with hardware/software
  - 65 I/O pins
  - 16 Channel 10 bit A/D converters
  - Operational at 5 Volts
  - 5 timers

- **Pressure Sensor**
  - Operational at low pressure (0 - 2 psi)
  - Built in amplifier
  - Accurate to +/- 0.05%
  - Reference input available
Additional Parts

- Stepper Motor with Lead Screw
- Syringe
- LCD Display
- Numeric Keypad
- Power Supply
- Enclosure
## Costs

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<tr>
<th>Item</th>
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GANTT Chart

Part Selection

Software Coding

Prototype System Testing

Lab Testing
Challenges

• Over pressure

• System response time

• Sensor calibration

• Motor precision

• Use of a standard syringe
Benefits

- IBS research leading to improved treatment options
- Cost efficiency $\Leftrightarrow$ wider availability for:
  - University research labs
  - Small commercial labs
Questions?