

Small Animal Barostat Instrument Design

Team 7

Facilitator: Dr. Virginia Ayres



IBS Study

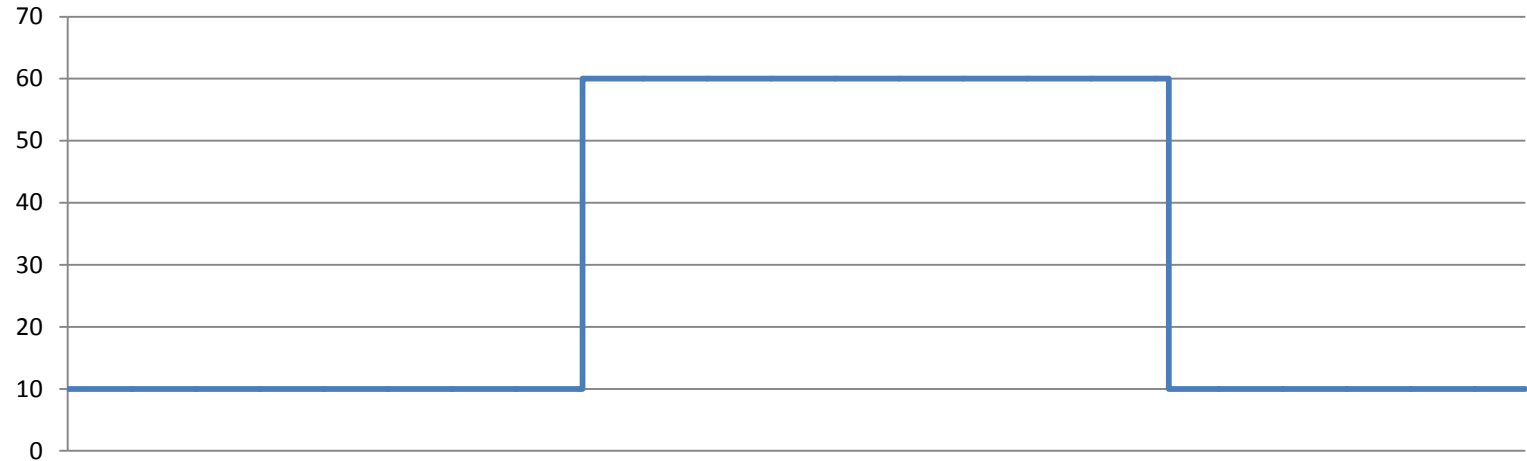
Dr. James J. Galligan, Associate Director of Neurosciences

- 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



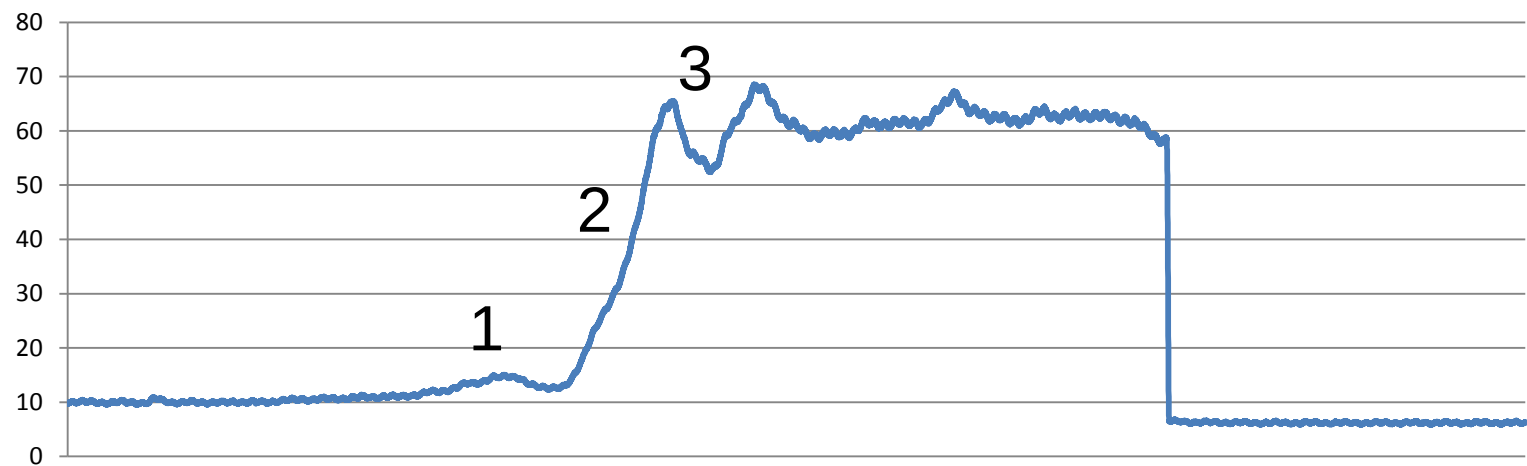
60 mmHg Pressure Test

Ideal:



60 mmHg Pressure Test

Current:



Barostat

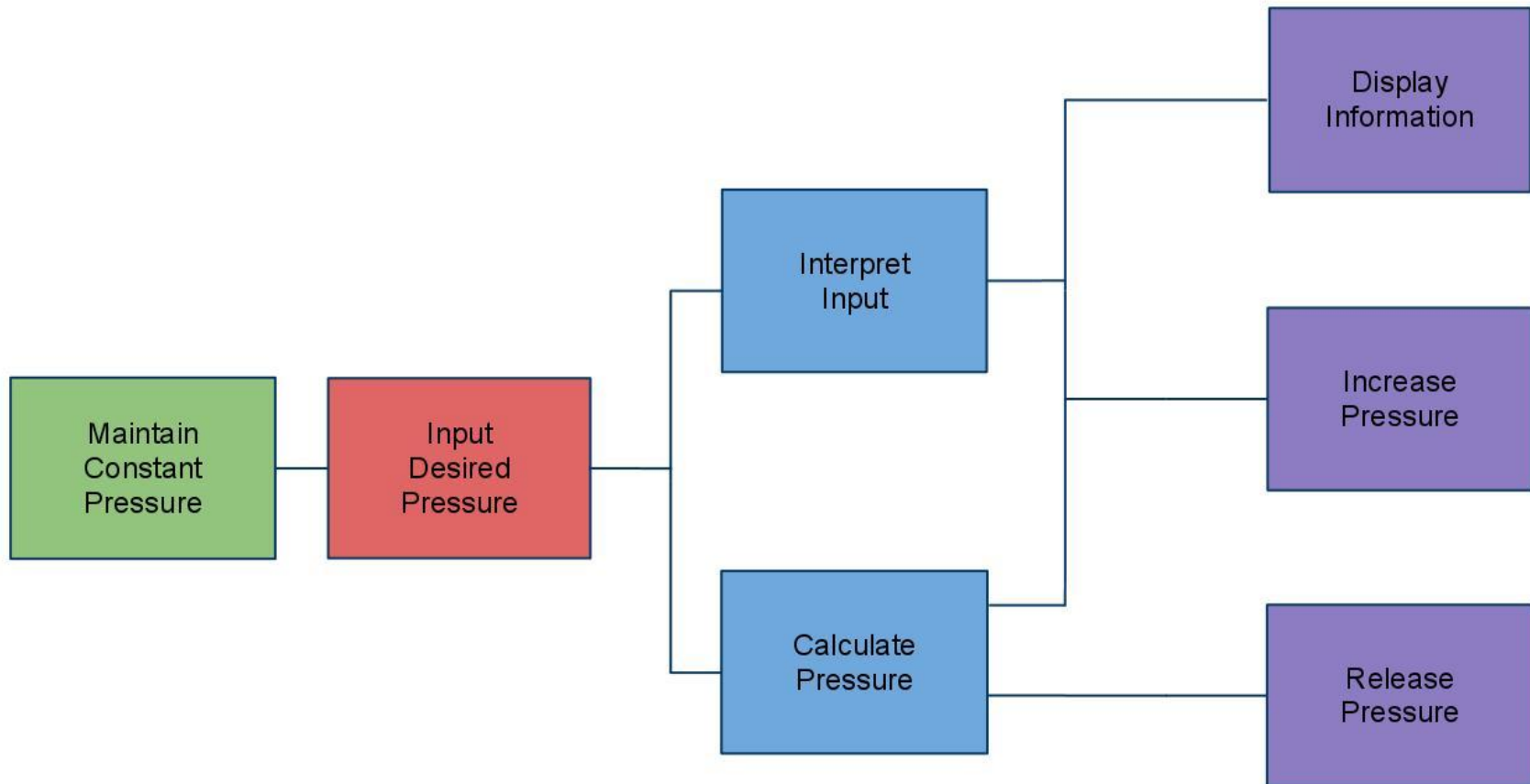
- Distender IIR
 - Dual cylinders, control panel, and screen: has all necessary features and is designed specifically for rats



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



FAST Diagram



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

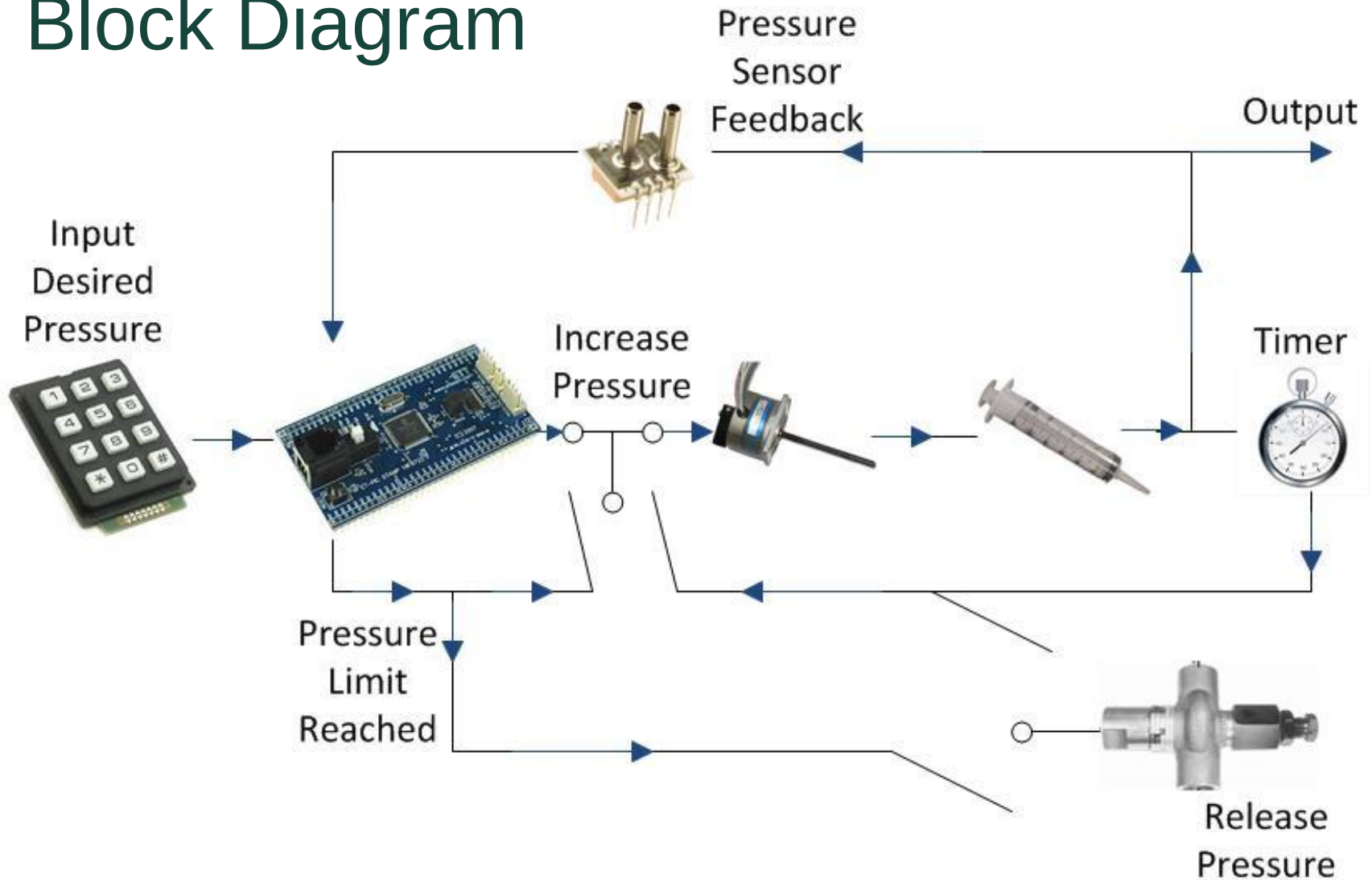


Team 7 Design Solution

- 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



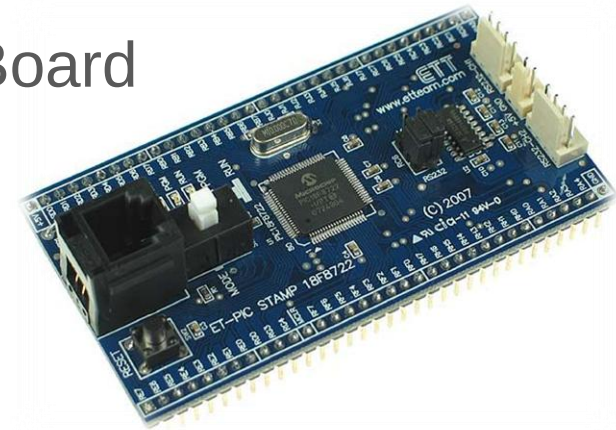
Block Diagram



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

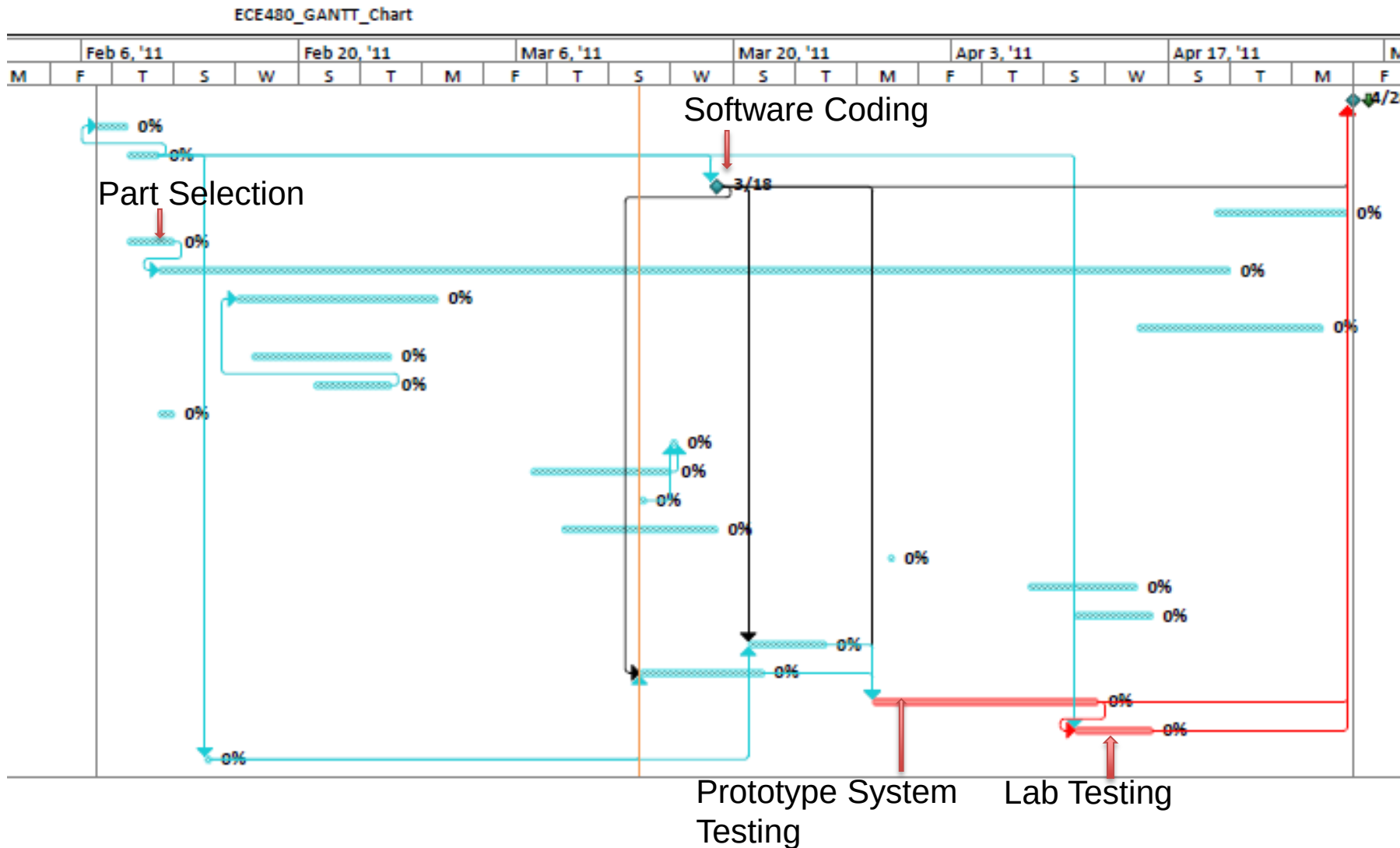
- Stepper Motor with Lead Screw
- Syringe
- LCD Display
- Numeric Keypad
- Power Supply
- Enclosure



Costs

Item	Price	Quantity	Source
Pressure Sensor	\$29.25	2	http://www.mouser.com
LCD Display	\$16.90	1	http://www.futurlec.com
Push Buttons	\$0.45	7	http://www.futurlec.com
Numeric Keypad	\$17.90	1	http://www.futurlec.com
Development Board	\$32.90	1	http://www.futurlec.com
Prototyping Board	\$10.78	2	http://www.mouser.com
Stepper motor w/ Lead Screw	\$33.00	1	http://www.ebay.com
Syringe	\$0.00	Donated	MSU Department of Pharmacology and Toxicology
Medical Tubing	\$0.00	Donated	MSU Department of Pharmacology and Toxicology
Pressure Release valve (estimate)	\$40.00	1	TBA
Power Supply (estimate)	\$30.00	1	TBA
Enclosure (estimate)	\$35.00	1	TBA
TOTAL	\$288.91		

GANTT Chart



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?

