AUTONOMOUS, DUAL CHAMBER BIOREACTOR FOR THE GROWTH OF 3-D EPITHELIAL-STROMAL TISSUES IN MICROGRAVITY

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RADIATION
PROJECT BACKGROUND

• Using 3D organotypic models
  • Closely linked to characteristics of normal human tissue
  • Model for effect of microgravity
  • Stressors combined with microgravity

• Critical Air Liquid Interface
  • Bioreactor available for microgravity cell culture does not accommodate
  • This project creates autonomous dual chamber bioreactor allowing for research on 3D tissue models
METHODS AND PROCEDURES

• Spent time working at Rice University

• Responsibilities:
  • Researching Parts
  • Electronics and Coding

• Skills and Techniques:
  • Arduino
  • Troubleshooting Code/Circuit
  • Design Process
  • Teamwork
  • Building a System
Case 1: What Happens At T=0 (when the Media Fills The Entire Chamber)

- Media is in the input reservoir
- Valve 2 opens
- Peristaltic Pump turns on, pumps media
- Valve 4 opens
- Valves 5 and 6 both open
- Both chambers fill with media
- Pump turns off
- Valves 2, 4, 5, 6 close
- Is the top chamber full?
  - No
  - Yes
    - Is the bottom chamber full?
      - No
      - Yes

ELECTRONICS AND CODING

• Needed to control 12 VDC devices with Arduino
• Built a solid state relay to act as an electrical switch
• Troubleshooting
RESULTS

• Valves Opening, Pump
  Turning On According to Code

• Putting it All Together in the System
DISCUSSION

• Contributions:
  • Integral part of the system
  • ISS experimentation

• Lessons Learned:
  • Arduino Coding
  • Technical Ordering
  • Patience in Troubleshooting
  • Working in a Team to Build a System
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