A Prototype Bioreactor Incubation System Designed to Improve Cell Response Modeling in Microgravity

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Overview
The purpose of this project is to design and fabricate a novel prototype bioreactor that integrates a tumbler system into an incubator that can monitor and control temperature; humidity; and concentrations of oxygen, carbon dioxide, and nitrogen.

Explanation
• Cells grown in test tubes or Petri dishes have flat geometries unlike those existing in a living body, which can alter their characteristics and limit their ability to facilitate accurate models of their reactions to drugs and inoculations.
• A low-speed rotating tumbler system prevents the cells from settling in the medium and produces a culture that better mimics the three-dimensional geometry of cells found during in vivo testing.

Results
• The configuration ensures minimal error through simultaneous testing.
• The hardware is proving to sustain excellent custom atmospheric conditions.
• Initial software testing shows the system will respond appropriately to input test parameters once finalized.

Impact
• The bioreactor is a cost effective alternative design with system integration and remote operation controls.
• The test platform is capable of handling various experimental conditions.
• A successful prototype will drive a future design that can withstand launch conditions and ultimately be delivered to the International Space Station where it will be exposed to a critical factor in realistic three-dimensional culture growth: microgravity.
• Further testing with three-dimensional culture growths in microgravity offers an unmatched potential for biomedical science breakthroughs.

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