**Introduction**

- Research reveals that microgravity could provide phenotypical or genomic changes to bacteria, thus affecting antibiotic resistance and pathogenicity. Additionally, spaceflight stress factors can further weaken immune function and increase infection chances (Tirumalai et al., 2019).
- As we hope to explore space for longer durations, information on how cells respond during and after exposure to space conditions is necessary to improve the design of protective and living systems for future space exploration.
- Chronic microgravity exposure on bacteria can alter their biofilm development, phenotypical growth, and responses to pH and oxidative stress.
- *Escherichia coli* is used as a model bacteria to analyze chronic microgravity exposure.
- A 2D clinostat can accurately simulate microgravity.

**Preliminary Methods**

- Overnight culture was prepared using a streak plate sample, with four replicates, inoculated at 37°C for 24hr.
- Samples were diluted in 1:10 nutrient broth with 1% NaCl in Eppendorf tubes, with two of each replicated, transferred daily.
- A 2D clinostat (image left) was used to simulate microgravity, at 8rpm (setting 40°), for 24 days, including gravity control.

**Weekly Methods**

- Transferred samples 1:100 NB + 1%NaCl, incubated in clinostat at 30°C for 24hr
- Recorded OD at 630nm
- **TIMEPOINT Taken:** 25% Glycerol stock, stored at -80°C
- Transferred samples 1:100 NB + 1%NaCl, incubated in clinostat at 30°C for 24hr
- Recorded OD at 630nm
- Transferred samples 1:100 NB + 1%NaCl, incubated in clinostat at 30°C for 24hr
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- Recorded OD at 630nm
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**Materials, Methods, and Results**

**Oxidative Stress**

**Results:**

- Overall, Oxidative stress produces a reduction in growth of *Escherichia coli*.
- On average, after 4 days of microgravity growth, there is more sensitivity to hydrogen peroxide.
- Cells grown under microgravity showed a decline in adaptation to oxidative stress when compared to cells grown under gravity conditions.

**Acidic Stress**

**Results:**

- Growth remained consistent, despite duration of microgravity exposure.
- On average, microgravity had ~50% of growth compared to gravity when exposed to 4.5 pH.

**Reference**