Microbiological Analysis of Atmospheric Samples Collected Using Balloon Payloads

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LaSPACE FELLOWSHIP

• Financial support
• Field work
• Presentations
• Mentorship opportunities
• 100% focus on research
• Make new friends
MARSLIFE

Modes of Adaptation, Resistance, and Survival for Life Inhabiting a Freeze-dried-radiation-bathed Environment

• Collect and characterize microorganisms from the troposphere and stratosphere

• Determine the cell concentrations with increasing altitude

• Examine modes of desiccation, freezing, and radiation tolerance in microbes recovered from the atmosphere

• Use the atmosphere as an analogue for a Mars-like environment
Research Enhancement Award

- Develop new research projects and/or directions
- Obtain special training and exposure
- Foster collaborations among the campuses as well as with NASA centers, other federal labs and the aerospace industry
Payload Evolution

1 Chamber
Spring Action
No Doors

2 Chambers
Motor Driven

4 Chambers
Linear Actuators

Sounding Balloon Flight
Rotorods® for Atmospheric Sampling

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Lightweight substrate</td>
<td>Low efficiency of collection</td>
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<tr>
<td>Multiple analyses are possible</td>
<td>Microbes impacted “grease”</td>
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<tr>
<td>Minimal handling during analysis</td>
<td>Heat sensitive</td>
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**Epifluorescence**

**SEM**

**Culturing**
Total ATP Concentration Collected from 1.5-27 km

**Calibration Curve**

- **Controls**
- Sample 1
- Sample 2
- Sample 3

<table>
<thead>
<tr>
<th>Rods (n=5)</th>
<th>Volume sampled (m³)</th>
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<tbody>
<tr>
<td>Sample 1</td>
<td>1.90</td>
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<tr>
<td>Sample 2</td>
<td>1.85</td>
</tr>
<tr>
<td>Sample 3</td>
<td>1.60</td>
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Filter Sampling at 36 km

Experimental Setup

A: Air Intake
B: Air Exhaust
C: Engine
D: Photogate
E: Filter
F: D/C Motor

LSU Payload

HASP

Launch vehicle Big Bill
Environmental Conditions at 36 km

% Pressure and RH

Altitude (km)

Celsius

Temperature
% Pressure
% RH
Ultraviolet Radiation Measured During Flight

Irradiance (mW/cm²)

Altitude (feet)

Time (GMT)
Conclusions

• Atmospheric microbial abundance measurements agree with available data

• Possible we sampled above the biosphere

• Characterize polyextremophiles recovered from the atmosphere