NIMBUS

Near-Earth, Investigative Mycological
& Bacteriological Ubiquity Surveyor

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Introduction or Overview

Astrobiologists are searching for biosignature gases that may allude to microbial life present in the atmosphere of other planets. Recently, astrobiologists detected high levels (parts per billion, ppb) of the biosignature gas PH_3 in the atmosphere of Venus. If microbes may occupy the Venusian clouds, can we say the same of our very own skyline? We are looking to sample our sky for microbes.

Research Hypothesis/Objectives

We believe that we will be able to find that microorganisms are present in our skyline, with greater biodiversity near the ground. We hypothesize that we might find more fungal spores at higher elevations compared to bacterial endospores as many fungal clades have spore dispersal mechanisms.

Methodology or Approach

In cooperation with the Physics and Engineering Department at Gannon University, we designed an aerial drone and canister sampling complex. After assembling the hexacopter drone, a canister capable of holding petri dishes was 3D printed and assembled. We then sterilized the chamber and performed a sterility experiment and breach test to manufacture a magnetic seal that can be opened by a radio-frequency-controlled servo. Now we can control the opening and closing of the canister from the ground and be confident that we are only sampling at the specific height specified. Lastly, we generated a custom set of bacteriological and mycological nutritional media to select for specific types of microbes to examine biodiversity in the air at different altitudes.

Our initial test flight to sample aerial microbes took place in mid-December of 2021. We sterilized and loaded the payload canisters with nutritional media, then headed out to Harborcreek Community Park. The drone collected samples for six different treatment groups: control closed, ground level (0 ft), 100 ft, 200ft, 300ft, 400ft. After sampling, we incubated the plates at room temperature for three weeks in either aerobic or anaerobic (Brewer Jar) conditions. After growth occurred, we examined biodiversity of colony morphotypes across our various nutritional media and sampled altitudes.

Major Outcomes, Results and Conclusion

We found much more yeast than expected, with a remarkably low amount of anaerobic bacteria, and very little growth on our photoautotrophic media. Most of the growth on our C-fern agar resembled fungal contaminants. This is likely due to seasonal time in which we collected our aerial microbial samples. We are redesigning our current canister to ensure more sterility and will also have media to select for bacteria for our next flight. A flight during summer solstice might reveal a much larger amount of biodiversity, including photoautotrophs.