A fluorescence microscope is essential when studying bacterial viability and stress responses, particularly when using fluorescent staining techniques. These microscopes allow us to detect specific molecules or cellular features that are not visible with traditional light microscopy. Here are the key reasons why a fluorescence microscope is important for your experiment:

Enhanced Visualization of Cell Health: Fluorescence microscopy enables the use of fluorescent stains that differentiate live and dead cells, or highlight specific cellular structures, such as the cell membrane, nucleus, or spores. This can help you directly assess the viability of bacteria after exposure to environmental stress, like high altitudes or UV radiation from the weather balloon’s flight. Common stains like SYTO 9 (for live cells) and Propidium Iodide (for dead cells) emit distinct fluorescence, making it easier to identify healthy versus damaged cells.

Study of Bacterial Stress Responses: When bacteria are exposed to stress (like UV radiation, temperature changes, or other extreme conditions), fluorescent markers can be used to track specific proteins or genes involved in the stress response. This provides a deeper understanding of how bacteria adapt to harsh environments and helps you evaluate their resilience under experimental conditions. Without a fluorescence microscope, observing these specific cellular changes is challenging.

High Sensitivity and Specificity: Fluorescence microscopy is more sensitive than traditional light microscopy, allowing you to observe subcellular details that would be otherwise invisible. This can help you detect even small changes in the bacteria’s structure or function after exposure to environmental stresses, such as those during the weather balloon experiment.

Quantitative Analysis: Many fluorescence microscopes are equipped with camera systems that allow for quantitative analysis of fluorescence intensity. This means you can not only visually examine the bacterial samples but also analyze how much of the bacterial population is alive, dead, or undergoing stress. This is particularly useful when comparing the survival rates of bacteria under different conditions (e.g., those exposed to UV light versus those that were not).

Visualization of Cellular Components: Fluorescence microscopy can be used to track specific cellular components, such as membrane integrity or DNA damage, using fluorescent dyes that bind to those structures. This ability can provide more detailed insights into the effects of environmental stress on bacterial cells.

The problem: Fluorescence microscopes start at 3000$, which is way out of our budget. Sadly most of the interesting thing you can observe on bacteria, are observed with a fluorescence microscope. The alternative is just using a normal microscope but that wont get us the same results as we would get with the other one. Another problem is the visualisation with a normal microscope is way harder depending on what youre doing.