

APPLICATION MNCYCBVS

1. Describe your project in tweetable form

Sesquiterpene lactones are bitter chemicals that plants secrete in response to stress. I will study which plant creates the most in space.

2. Describe the scientific problem that you propose to address

While in space, the fluids in your body, which are usually pulled down by gravity, are evenly distributed around your body. Therefore, there are more fluids in your head, causing slight but persistent sinus congestion. This affects your sense of taste, so astronauts actually want stronger tasting foods, including those that are bitter. In my experiment, I want to find out which type of lettuce—romaine lettuce, iceberg lettuce, Boston lettuce, and summer crisp lettuce—will produce the most sesquiterpene lactones while under stress in the environment of space. Sesquiterpene lactones are not only good because they are bitter, but they also have many health benefits. They can be used to reduce inflammation and tumorigenesis and are also an active ingredient in folk medicines that treat diarrhea, burns, influenza, and neurodegeneration. Whichever type of lettuce produced the most sesquiterpene lactones could be grown more frequently on the ISS and can be enjoyed by astronauts!

3. State your hypothesis

Lettuce (*Lactuca sativa*) produce a milky latex in specialized cells called laticifers, which contain several sesquiterpene lactones. This milky latex is the reason why lettuce is bitter. Some types of lettuce are more bitter than others. For instance, Boston lettuce is more bitter than romaine or iceberg lettuce, while summer crisp doesn't even have a bitter taste. Since Boston lettuce is the most bitter out of the four and that means that there are more sesquiterpene lactones to cause that bitterness, my hypothesis is that the Boston lettuce, while in space, will create the most sesquiterpene lactones in reaction to stress.

4. Explain how the unique environment aboard the International Space Station is required to test your hypothesis

The unique environment aboard the International Space Station is needed in my experiment because the plants will not produce sesquiterpene lactones unless in a stressful environment such as microgravity. Plants will experience stress if environmental conditions are outside of an ideal range.

5. Outline your experimental plan

In my experiment, I will grow romaine lettuce, iceberg lettuce, Boston lettuce, and summer crisp lettuce on the ISS. After they have grown, I will take a sample of each of the lettuce and use qPCR to find out how active the gene that creates sesquiterpene lactones is. This gene is GAO1 and it encodes an enzyme that is crucial in the biosynthesis of sesquiterpene lactones. Also, I could grow the same types of lettuce on Earth to see the difference between how active the GAO1 gene is in comparison to how active it is while the plant is reacting to the environment of space. I expect the Boston lettuce to produce the most sesquiterpene lactones in space, as I have explained above in Question 3.

6. How did you hear about Genes in Space?

Teacher

7. Citations

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3709812/>

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0065030>

<http://www.jbc.org/content/286/24/21601.long>

<https://www.uniprot.org/uniprot/D5J9U8>