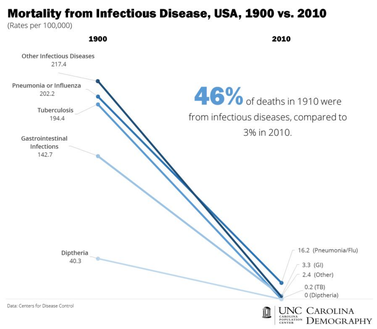
Penicillium Mold Growth in Microgravity

Principal Investigator : Gabriel McCarthy Co-Principal Investigators : Kenneth Sanders and Ryder Huskins Collaborators: Ian Ray and Ethan Moore
Teacher Facilitator: Laura Smith

Background Information

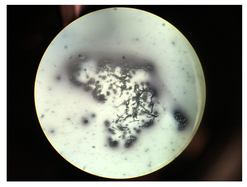


Before Antibiotics life expectancies of people who had infection like pneumonia were a lot more deadly but as antibiotics were created life expectancy rose which made the average human life better which makes a civilization more productive.

The Question to be Addressed by the Experiment

We already know penicillium mold and many other molds can be used as medicine or turned into medicine because they kill bacteria. Another thing we know is that biofilms grow faster and in greater numbers in space. Some are harmless like the ones in your body, such as some of the ones in your digestive tract, but some can have diseases. This is relevant to the question because some biofilms are made of bacteria and mold kills bacteria. We also learned from some experiments that bacteria grows faster in space. With that information, the same could possibly be with molds too.

One of our group members, Ian, suffered from Orbital cellulitis at the age of five. If not cured by common day Penicillin, he may have not survived.



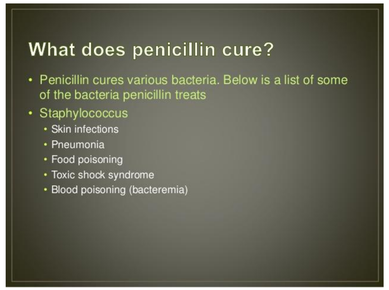
View under the microscope: Penicillium mold that we grew shows the phialide growth that Penicillium often shows

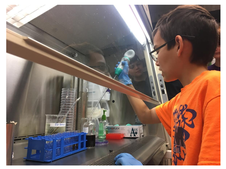
Student designed Mission 12 patch that will fly with our experiment this June

Experimental Design

Proposal Summary

Our team will answer the question how Penicillium mold grows in a microgravity environment versus Earth's gravity. The purpose of our experiment is to provide a viable solution to some bacterial infections in space. Bacteria in space tends to act more violently so good bacteria or mold might act more furiously to kill those bacteria. Our hypothesis is that it will grow better, since there is practically no major gravity or forces in space.





Fast Growth Benefits

We want to compare the two mold growths because if Penicillium mold grows well in space it could present a viable solution to some bacterial infections. A big problem is that the materials being sent to space cost thousands of dollars and time, and a sick astronaut could not have time to wait for medicine. Then there is also a chance the rocket sent to deliver the medication may fail. If these medicines were able to be made in space it would save a lot of money, time, and possibly even lives.

Benefits and Estimations

This experiment would lead to a more effective way of getting medicine in space and also help answer a few questions like, is Penicillium mold a viable solution for some bacterial medicines in space, or how do medicines like penicillin act in space against bacteria, and does Penicillium mold grow better, worse, or the same in microgravity?

Some of this information comes from things such as the polymer experiment which was a previous SSEP experiment that tested polymers absorbance of water in space, in which polymers adsorbed the water better. In result of that, the mold might absorb water better like the polymers did, making less energy going towards things like that.

Our research team being recognized for being chosen as a flight experiment for SSEP out of 240 teams, along with our science teacher/facilitator, Laura Smith and BISD Superintendent, Dr. Bret Jimerson. This summer, we will be presenting in Washington DC, discussing our experiment and current SpaceX/ISS flight mission.

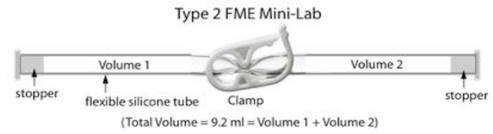
Hypothesis and Expected Results

Our hypothesis is that the mold will grow better due to the lack of forces upon the organism. The idea behind it growing faster is because in space there is minimal gravity and less forces holding the organism back whilst on earth you have gravity. Water is also absorbed better in space so the organism faces less problems . We also believe that the growths will look different and more sporadic due to the lack of forces That is our hypothesis on the growth rate of the mold and the growth patterns.

Procedures and Special Transportation

It is important that our team will be growing a larger colony of Penicillium mold to use for both our ground and microgravity experiments, making sure that both samples are genetically the same. We will be using a mini test tube to place our agar and mold in, so that later on we are better able to conduct observations of growth.

Volume two will contain formalin. This will terminate any more mold growth a couple days before the departure from the ISS so that the growth is only in a microgravity environment.



Transportation requirements for our experiment to be delivered to the International Space Station.

Travel0	Location and destination	Refrigeration	Ambient Condition
PRE-FLIGHT	Shipping from your Community to NanoRacks in Houston	X	
	At NanoRacks until Handover to NASA	X	
FLIGHT	Handover to NASA Until Arrival at ISS	**X (required)**	
	Onboard ISS		**X (required)**
POST-FLIGHT	From ISS until Arrival at NanoRacks		**X (required)**
	At NanoRacks through Return Shipping to Community	X	

Resources

Amazon.com. (2018). *Malt Extract Agar*. [online] Available at: https://www.amazon.com/Chloramphenicol-Cultivation-Inhibits-Hardy-Diagnostics/dp/B071JS8J2V/ref=sr_1_11?s=industrial&ie=UTF8&qid=1509917614&sr=1-11&keywords=agar [Accessed 27 Mar. 2018].

Amazon.com. (2018). *Tissue Pro*. [online] Available at: https://www.amazon.com/TissuePro-NFB03-32R-Neutral-Buffered-Formalin/dp/B018REELP0/ref=sr_1_1?ie=UTF8&qid=1509917477&sr=8-1&keywords=formalin&dpID=41AvYEePQ9L&preST=_SY445_QL70_&dpSrc=srch#feature-bullets-btf [Accessed 28 Mar. 2018].

Kung'u, J. (2018). *Mold Sampling: How To Select Sampling Media*. [online] Moldbacteriaconsulting.com. Available at: http://www.moldbacteriaconsulting.com/fungi/mold-sampling-how-to-select-agar-media.html [Accessed 28 Mar. 2018].

Kung'u, D. (2018). *Penicillium - Mold & Bacteria Consulting Laboratories*. [online] Moldbacteria.com. Available at: https://www.moldbacteria.com/mold/penicillium.html [Accessed 27 Mar. 2018].

NASA. (2018). *Microbial Creatures in Space*. [online] Available at: https://www.nasa.gov/exploration/humanresearch/Microbial-Creatures-in-Space.html [Accessed 27 Mar. 2018].

Nasa.gov. (2018). *NASA - Bacteria Sent Into Space Behave in Mysterious Ways*. [online] Available at: https://www.nasa.gov/centers/ames/news/2013/bacteria-sent-into-space.html [Accessed 27 Mar. 2018].

Science Buddies. (2018). *All About Agar*. [online] Available at: https://www.sciencebuddies.org/science-fair-projects/references/grow-microbes-agar [Accessed 27 Mar. 2018].

Space.com. (2018). *What would life be like on TRAPPIST-1 planets*. [online] Available at: https://www.space.com/35811-life-on-trappist-1-Earth-like-exoplanets.html [Accessed 27 Mar. 2018].

Visagie, C., Houbraken, J., Frisvad, J., Hong, S., Klaassen, C., Perrone, G., Seifert, K., Varga, J., Yaguchi, T. and Samson, R. (2018). *Identification and nomenclature of the genus Penicillium*. [online] ScienceDirect. Available at: https://www.sciencedirect.com/science/article/pii/S0166061614000074?via%3Dihub [Accessed 27 Mar. 2018].