How can bacterial species of *Pseudomonas*, *Rhodococcus* and *Corynebacteria* be used in the bioremediation of plastics?

Background:

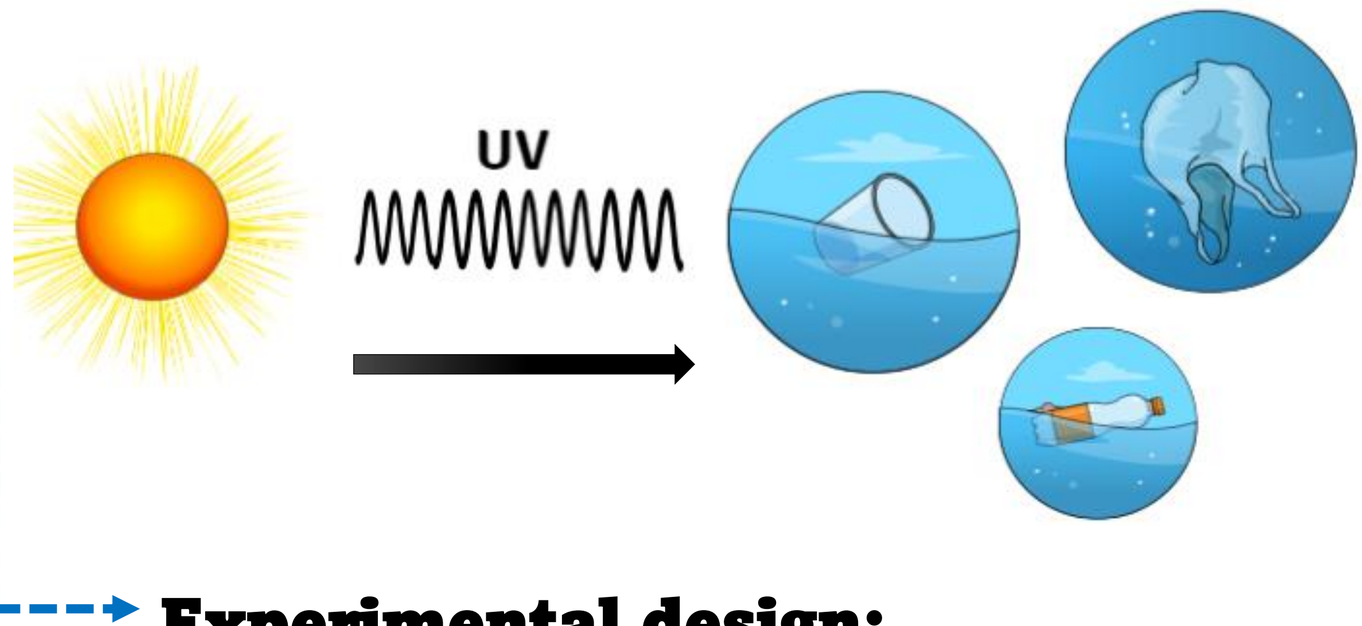
Plastics are the most ubiquitous pollutant in the environment [1]. It has shown to affects a large variety of organisms in different ways, and the effects are far from fully understood [2]. Macroplastics (>5 mm) to nanoplastics (1-100(0) nm) have been found in many different environments [1, 2].

- Plastics degrades slowly into smaller fragments, not simpler substances [3].
- Plastic has a low recycling percentage, it is mostly disposed of in landfills, where it is degraded into smaller pieces [3, 4].
- Smaller plastic pieces are difficult to remove from the environment.

Bacteria use different substrates as carbon sources, and some bacteria have shown to have genes encoding plastic degrading enzymes [5, 6]. Some of these bacteria are known to be present in the gut of other organisms, like *Zophobas morio* [6]. These organisms may have potential to remove plastics from the environment in plastic degrading technology [5, 6].

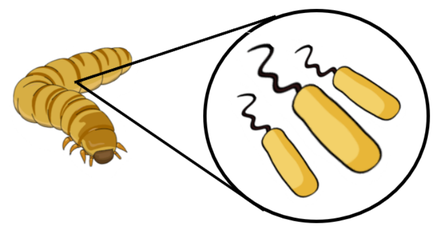
Aims:

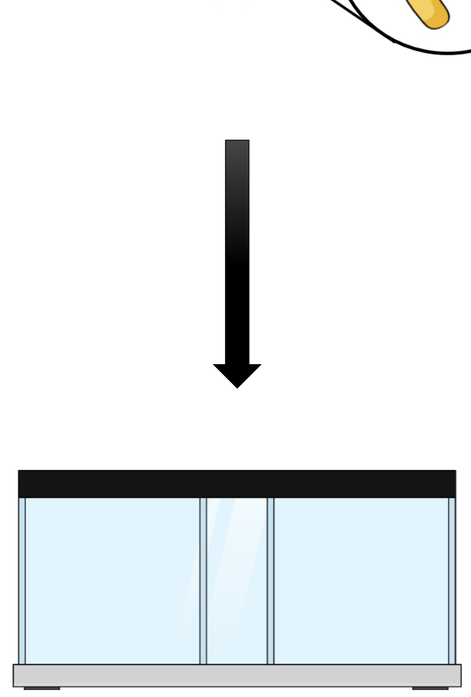
- Investigation of the microbial strains involved in plastic degradation.

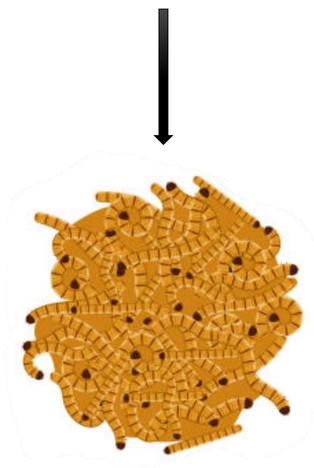


Experimental design:

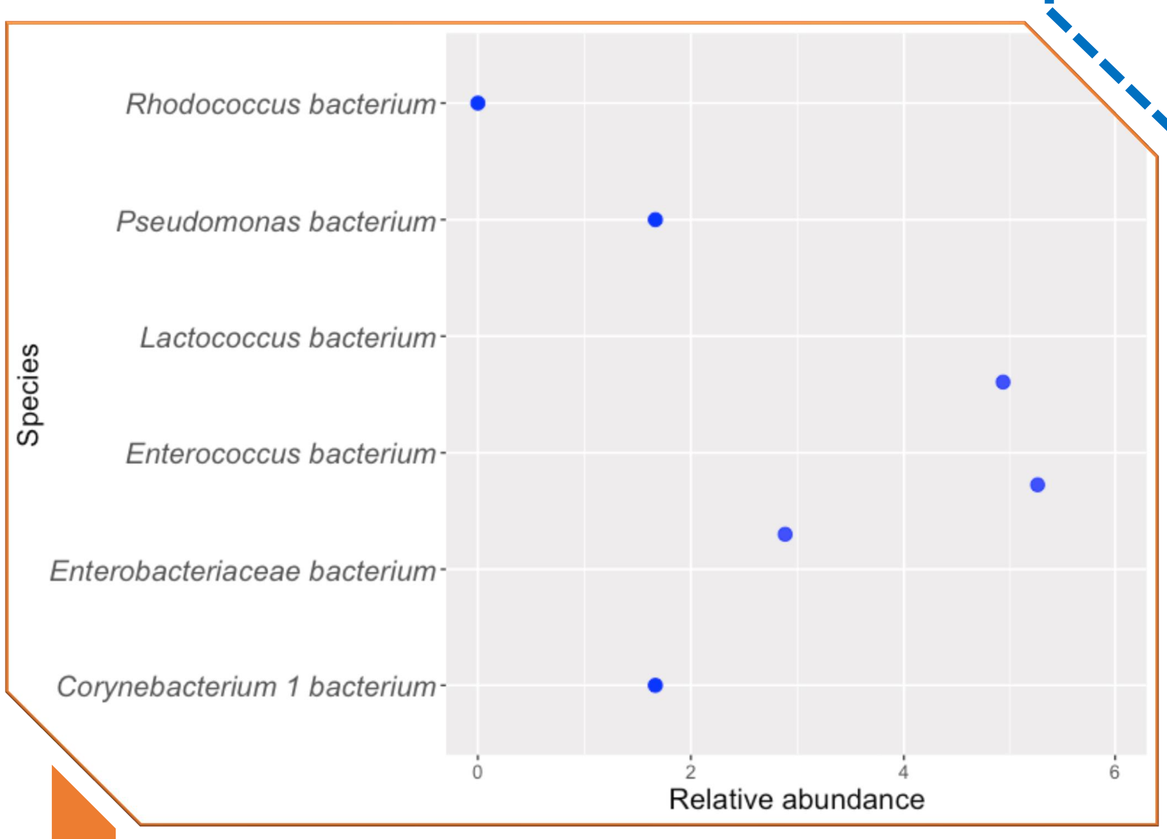
Feed (3 weeks):







Results:



Abundance Figure: Comprised heatmap of bacteria in the superworm *Zophobas morio* gut microbiome that were on polystyrene feed. Included are species with high relative abundance, and species that are know to be polystyrene degrading.

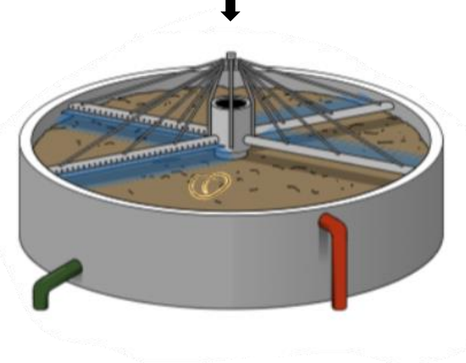
Future goals:

Bioreactor:

- Can a bioreactor be used to facilitate polystyrene degradation with the *Zophobas morio* worm?

Extended research:

- Will the polystyrene fed worms create a shift in the natural microbial environment if released in nature?



References:

1.Magrì D, Veronesi M, Sánchez-Moreno P, Tolardo V, Bandiera T, Pompa PP, et al. PET nanoplastics interactions with water contaminants and their impact on human cells. Environmental Pollution. 2021;271:116262. 2.Bucci K, Tulio M, Rochman C. What is known and unknown about the effects of plastic pollution: A meta-analysis and systematic review. Ecological Applications. 2020;30(2):e02044. 3.Li P, Wang X, Su M, Zou X, Duan L, Zhang H. Characteristics of plastic pollution in the environment: a review. Bulletin of environmental contamination and toxicology. 2021;107(4):577-84. 4. Zhou D, Chen J, Wu J, Yang J, Wang H. Biodegradation and catalytic-chemical degradation strategies to mitigate microplastic pollution. Sustainable Materials and Technologies. 2021;28:e00251. 5.Shahnawaz M, Sangale MK, Ade AB. Bioremediation technology for plastic waste. 2019. 6.Sun J, Prabhu A, Aroney S, Rinke C. Insights into plastic biodegradation: community composition and functional capabilities of the superworm (Zophobas morio) microbiome in styrofoam feeding trials. bioRxiv. 2022. 7.Madin JS, Nielsen DA, Brbic M, Corkrey R, Danko D, Edwards K, et al. A synthesis of bacterial and archaeal phenotypic trait data. Scientific Data. 2020;7(1):170.