Antibiotic Resistance in Soil

Lin Alkader & Jacob Durrance
Florida State University Panama City

*Project completed as an independent research project with Dr. Sarah Wofford-Mares

Introduction

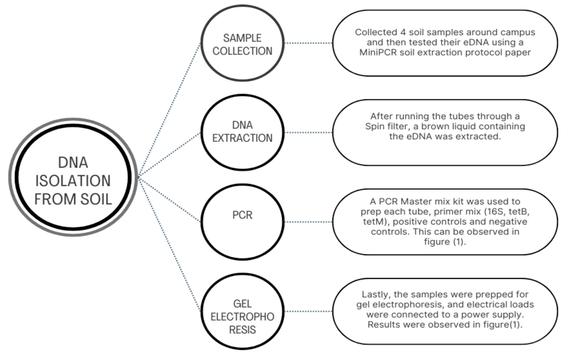
- The purpose of this experiment was to detect antibiotic resistance in soil samples around FSU PC using environmental DNA (eDNA).
- Antibiotics are created to fight off different types of disease in humans, animals or other living organisms [3]. However, bacteria can develop resistance against antibiotics.
- Soil contaminated with antibiotic resistant bacteria creates a huge hazard to public health, as it harms plants, crops, and trees that provide our food and medicine [2].
- eDNA analysis can be used to find certain genes for antibiotic resistance in environmental samples. Results can then be used to detect potential antibiotic-resistant bacteria and predict how it affects the environment.
- The hypothesis for this experiment is that antibiotic resistance was present in soil samples from the environment, and at least one sample will contain antimicrobials or be polluted with some microorganisms.

Discussion

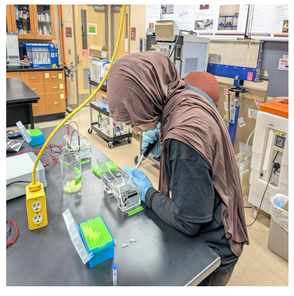
- Overall, the samples had no evidence of antibiotic resistance in our tested locations.
- Potential limitations consist of possible experimental errors like PCR kit complications, limited sample size, or potential scientific mistakes.
- Educating the public about antibiotic resistance and its effects on humans and the environment is necessary to slow the spread of antibiotic resistance.
- Future research on our campus could include re-running these samples with new materials to check for contamination and trying new locations to check for antibiotic resistance in soils.

Methods

- The experiment was performed and designed at FSU PC's Biology lab.



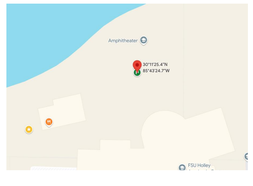
Flow chart representing the methodology of this project.



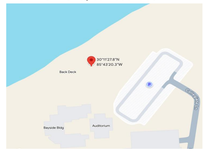
Lin Alkader and Jacob Durrance loading a gel electrophoresis sample to visualize PCR products.

SITE 1: Near the sand and beach

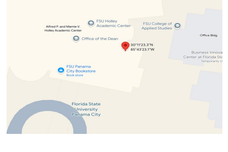
SITE 2: Ditch Dirt behind the Holley building



SITE 3: Volleyball court soil



SITE 4: Near the renegade osceola painting



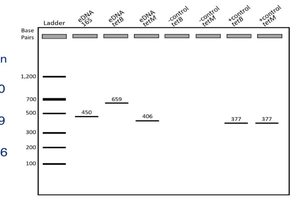
****insert figure legend for mp here.**

Results

- Gel electrophoresis results were compared to expected band images to ascertain if genes for antibiotic resistance were present in our samples.
- We did not find evidence for the presence of antibiotic resistance in our samples.
- Soil samples 1 and 2 had some positive DNA controls, this proves that PCR works, and this can be observed in the last two glowing dashes.
- Tubes were labeled A-G, A had some 16S primer and eDNA, B had tetB and eDNA, tube C had some tetM and eDNA, D & E had the negative controls, and lastly tube F & G had some positive controls.
- Samples 3 and 4 did not have antibiotic resistance, that tells us that those specific areas we chose, near the volleyball court and Holley building, lacked antimicrobial presence and the soil is likely healthier and not contaminated.

Expected results for our study

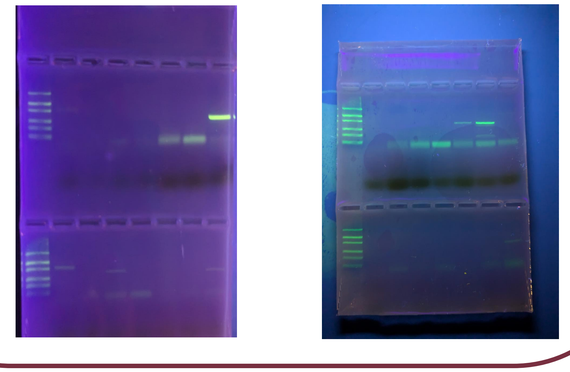
- A DNA ladder is used as a control…
  - It has known molecule sizes in the sample
- 16S primers will produce a 450 bp band
- *tetB* primers will produce a 659 bp band
- *tetM* primers will produce a 406 bp band
- *tetB* and *tetM* controls will produce a 377 bp band



* "bp" = "base pairs"

Expected gel electro bands

Gel electrophoresis results



References

1. Chinemerem Nwobodo, D., Ugwu, M. C., Oliseloke Anie, C., Al-Ouqaili, M. T. S., Chinedu Ikem, J., Victor Chigozie, U., & Saki, M. (2022). Antibiotic resistance: The challenges and some emerging strategies for tackling a global menace. Journal of Clinical Laboratory Analysis, 36(9). https://doi.org/10.1002/jcla.24655
2. Mann, A., Nehra, K., Rana, J. S., & Dahiya, T. (2021b). Antibiotic resistance in agriculture: Perspectives on upcoming strategies to overcome upsurge in resistance. Current Research in Microbial Sciences, 2(2), 100030. https://doi.org/10.1016/j.crmicr.2021.100030
3. Suza, W., Lee, D., Hanneman, M., & Namuth, D. M. (2021b). PCR and Gel Electrophoresis. Iastate.pressbooks.pub, 4(1). https://iastate.pressbooks.pub/genagbiotech/chapter/pcr-and-gel-electrophoresis/