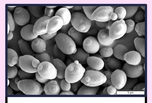
Yeasty Beasties: Identification of Wild Type Yeasts Found in Various Environments

Callista Perry[2], Claire Behning[2], Emma Tobin[1], Eric M. Young[1]
[1]Department of Chemical Engineering, Worcester Polytechnic Institute
[2]Collaborator Affiliation

Young Lab
emyoung@wpi.edu

#ResearchGoals


Saccharomyces cerevisiae, SEM image[1]

Our intent is to identify yeast from a broad survey of various environments. Through isolating a variety of species, we hope to contribute to a growing catalog of organisms suitable for a variety of functions and biotechnological manipulation.

Currently, synthetic biologists work with a limited number of model organisms. Specifically, *Saccharomyces cerevisiae* (Baker's yeast) is one of the most commonly used model organisms for synthetic biology research. *S. cerevisiae* only thrives in conditions of high-sugar and low-light. By relying exclusively on a limited number of model organisms, research is limited by specific conditions required by the organisms. Access to a wider range of organisms would be advantageous for a variety of reasons.

Did you know that yeast is everywhere?

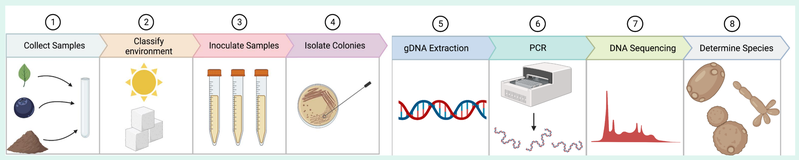
Yeast are fungi that can be found in a variety of habitats around the world, however they are commonly seen on flowers, fruits, and soil. Yeast is an essential organism for synthetic biology research because yeast can be used as a cell factory for many different bioprocesses which can be beneficial for healthcare, food, and other industries, including production of components for pharmaceuticals, food additives, and more (Nandy and Srivastava, 2017).

Research Background

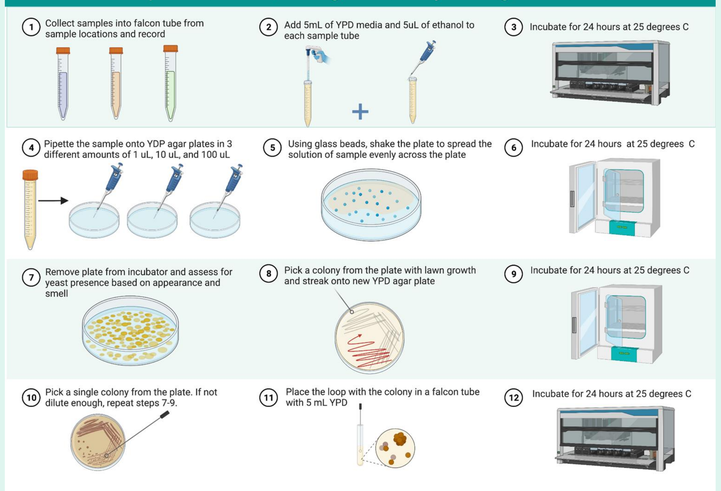
- The Young Lab's mission is to understand organisms that produce compounds and materials, in the pursuit of new bio-based economies.
- "Cell factories" are a method of biological engineering which allows for the optimization of cellular processes, in order to produce desired quantities of bio-products.

Methods: Inoculation, Plating and Colony Selection

Yeast cultures in the lab are identified by fermentation, bubbles in the media, colony appearance on the plate, and, using modern techniques, by the DNA sequence.

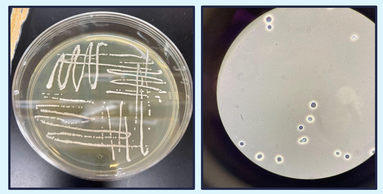


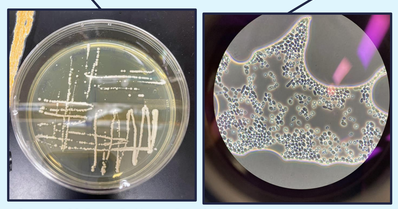
Sample Inoculation, Plating, and Colony Picking Procedures



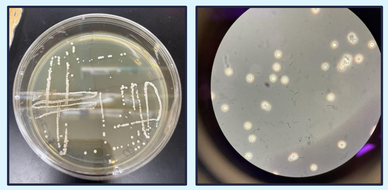
Preliminary Results

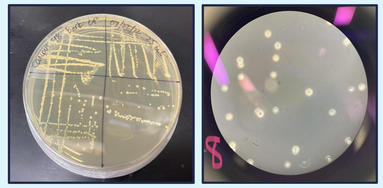
Yeast Isolation Examples

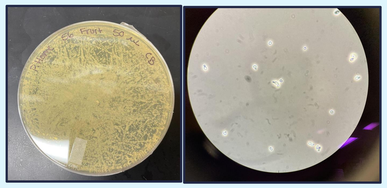

Sample 73 From WPI Campus Ground Leaf



Sample 69 From B. Home Plastic Bag

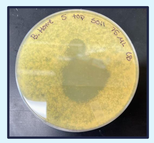

Sample 53 From P. Home Flower

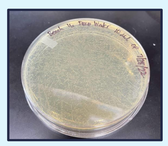

Sample 48 From WPI Campus Tree Bark

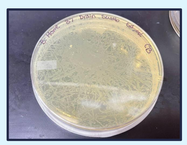

Sample 56 From B. Home Fruit

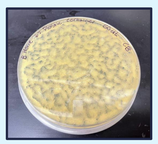
Yeast Characteristics	Bacteria Characteristics
• Matte in Color • More Opaque • Raised from Agar • Fruity or Alcohol Smell	• Shiny in Color • More Transparent • Flatter to Agar • Sharp, Distinct Smell

Bacteria Isolation Examples


Sample 5 From B. Home Top Soil


Sample 46 From Beach Deep Water


Sample 37 From B. Home Drain Swab


Sample 67 From B. Home Plastic Container

Sample Sources

Samples were sourced from a variety of environments. Environments were categorized by light and sugar levels as seen in the charts below.

High Light, Low Sugar

Sample	Location
Bench	WPI Campus
Roof	Perry Home
Top Sand	Beach
Top Soil	Perry Home
Top Soil	Behning Home
Top Soil	WPI Campus

High Sugar Environment, Unknown Light Factor

Sample	Location
Fruit	Perry Home
Fruit	Behning Home

Low Light, Low Sugar

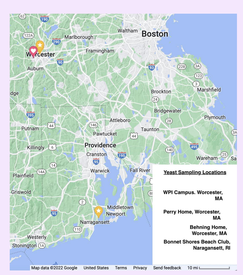
Sample	Location
Deep Sand	Beach
Deep Soil	Perry Home
Deep Soil	Behning Home

High Light, High Sugar

Sample	Location
Tree Bark	Perry Home
Tree Bark	WPI Campus
Wilting Flower	Perry Home
Wilting Flower	WPI Campus
Ground Leaf	Perry Home
Ground Leaf	WPI Campus
Plant Leaf	Perry Home
Plant Leaf	WPI Campus

Low Sugar Environment, Unknown Light Factor

Sample	Location
Tupperware	Perry Home
Tupperware	Behning Home
Plastic Container	Perry Home
Plastic Container	Behning Home
Plastic Bag	Perry Home
Plastic Bag	Behning Home



Discussion

Our results demonstrate that there is potential to isolate yeast from the environment from a variety of locations and sample types:

- Selected organisms likely to be yeast from 13 samples using qualitative visual and olfactory comparative assessment
- Currently awaiting results of DNA sequencing
- Limited our scope of variables to light and sugar levels due to difficulty in finding environments that were high in S. cerevisiae stressors
- Majority of yeast isolated were from high-sugar, low-light environments
- Isolated two yeast samples from environments (tree bark and plastic bag) with one or more of *S. cerevisiae's* stressors (high light or low sugar) present

Potential for future research:

- DNA sequencing to confirm yeast identification and specify species and strain
- Isolate yeast from a wider array of locations to vary samples more
- Testing additional variables of environment such as temperature, pH, or pollutant levels

Connections: Classroom and UN SDGs

Our lesson draws on and is was informed by:

- Young Lab's use of yeast as a model organism
- Exploring environments which contain yeast
- UN Sustainable Development Goals "Climate Action" and "Restoring and Protecting Life on Land"

In our lesson, students will:

- explore the role of yeast in ecosystems
- complete a lab to test yeast's resilience to different environments
- apply their knowledge to a real-world scenario
- assess potential environmental causes and propose possible solutions

SUSTAINABLE DEVELOPMENT GOALS
13 CLIMATE ACTION
15 LIFE ON LAND

Acknowledgements & Funding Sources

This material is based upon work supported by the National Science Foundation under Grant No. EEC-2055507.

For their support and guidance, we would like to thank:

- Prof. Eric Young (faculty mentor)
- Emma Tobin (graduate student mentor)
- Young Lab staff
- STEM Education Center at WPI.

References

[1]By Mogana Das Murtey and Patchamuthu Ramasamy - [1], CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=52254246

Subir Kumar Nandy, R.K. Srivastava, A review on sustainable yeast biotechnological processes and applications, Microbiological Research, Volume 207, 2018, Pages 83-90, ISSN 0944-5013, https://doi.org/10.1016/j.micres.2017.11.013.