



Boosting Yeast's Appetite for Sugars

Featured scientists: Dr. Trey Sato and Dr. Audrey Gasch

Scientific Question:

1. What scientific question are the scientists trying to answer in this experiment?

Answers will vary. The basic question: "Is the evolved or mutant strain of yeast more efficient at fermenting xylose into ethanol?"

2. What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

This passage contains the hypothesis (expected results and scientific explanation):

Through the process of evolution, they expected that some yeast cells in the population would develop genetic mutations that allowed them to ferment the xylose and that those mutants would become dominant over time. This is because mutants with the ability to ferment xylose should be able to grow and reproduce faster than yeast without the beneficial mutations.

Scientific Data: To answer their question, the scientists organized the results of the fermentation experiment in the table below.

| Strain | Time (hrs) | Xylose (g/L) | Ethanol (g/L) |
|---------------|-------------------|---------------------|----------------------|
| Parent | 0 | 22.86 | 0.01 |
| Parent | 14 | 22.81 | 0.18 |
| Parent | 19 | 22.79 | 0.18 |
| Parent | 20 | 22.74 | 0.18 |
| Parent | 32 | 22.75 | 0.21 |
| Evolved | 0 | 22.54 | 0.01 |
| Evolved | 14 | 19.75 | 1.06 |
| Evolved | 19 | 17.85 | 1.77 |
| Evolved | 20 | 17.05 | 2.19 |
| Evolved | 32 | 7.95 | 6.41 |

Name: _____ Date: _____ Section: _____

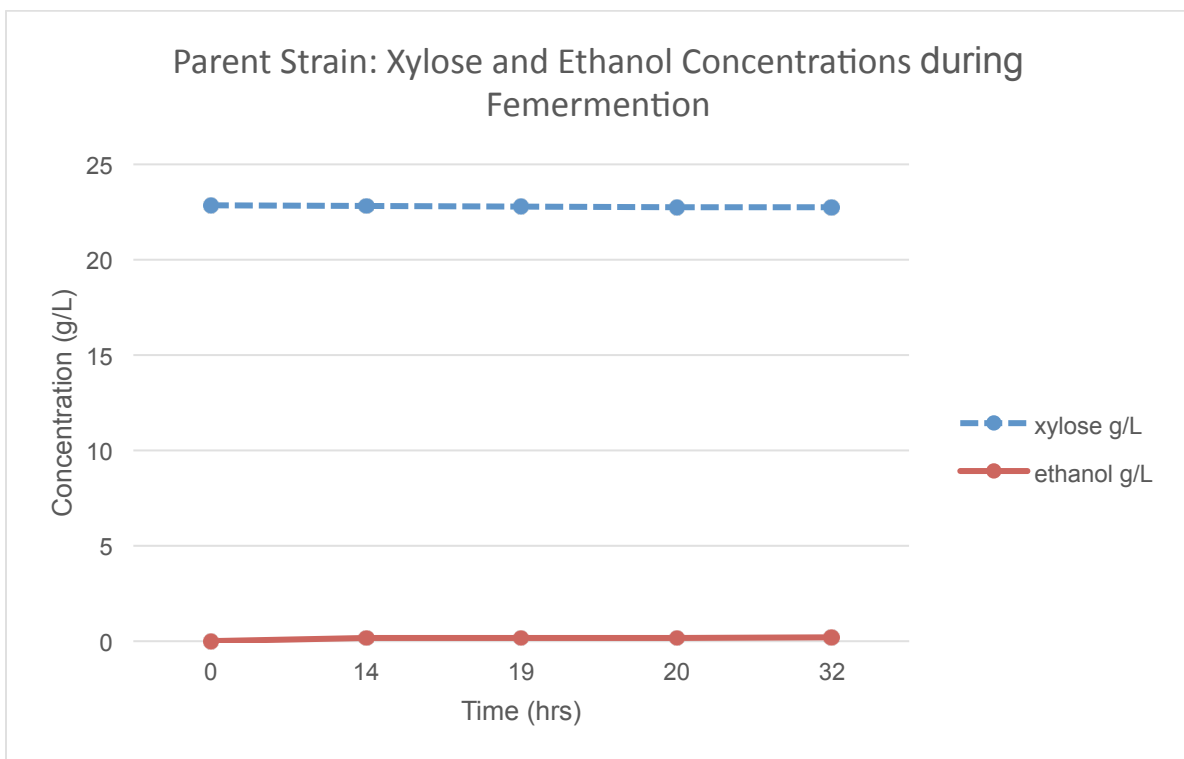
3. What data will you graph to answer your question?

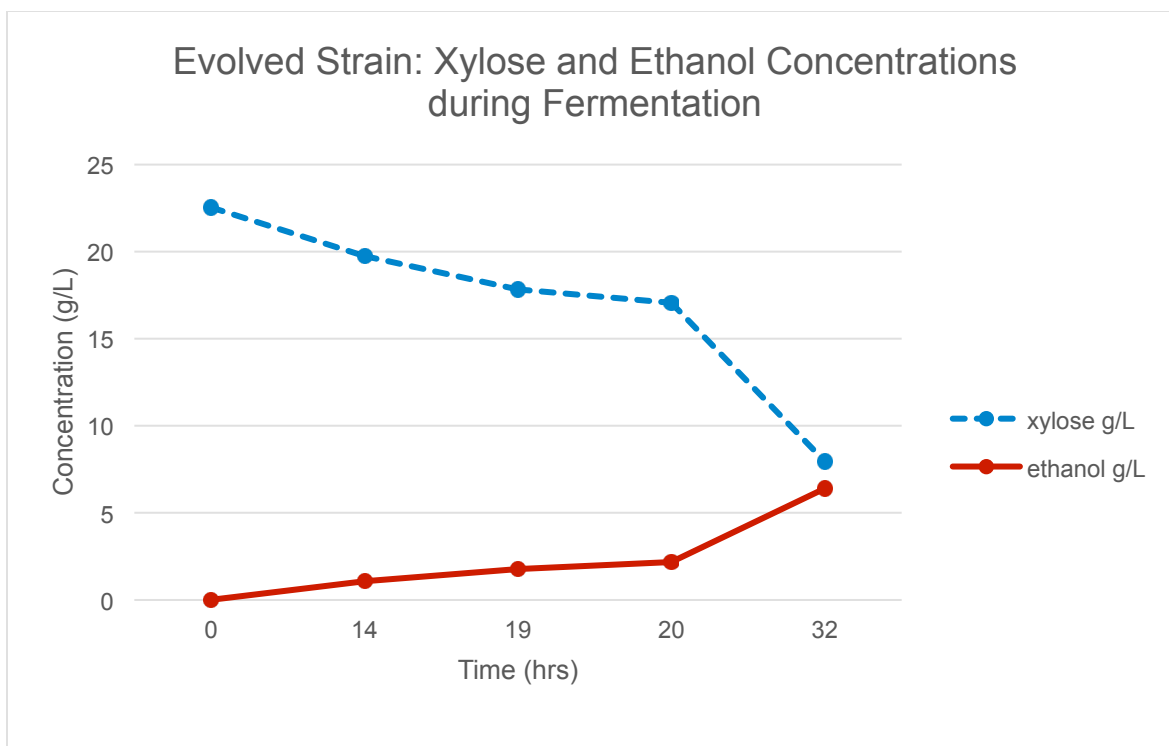
Independent variable: (a) Strain of yeast

Dependent variables: (a) Xylose concentration (g/L)

(b) Ethanol concentration (g/L)

Graphing and interpreting data: Below are two graphs of the data.





4. Based upon this evidence, write a statement that helps answer the scientific question. Justify your reasoning using data.

The evolved strain is more efficient than the parent strain at converting xylose to ethanol. The evidence for this is that with the parent strain there was no observable change in xylose or ethanol concentrations over time. The evolved strain increased the ethanol concentration by 14.59 g/L while the xylose concentration decreased by 6.4 g/L as the yeast converted the xylose into ethanol.

5. **Your next step as a scientist:** Science is an ongoing process. Did this study fully answer your original question? What new questions do you think should be investigated? What future data should be collected to answer them?

Answers will vary. Here are some examples of new questions that could be answered with further research:

- What specific genes mutated in the evolved strain? Extracting DNA and generating DNA sequences could produce data to answer this.*
- How did the genetic mutations alter protein expression and metabolic pathways? In other words, what mechanism enables the mutant yeast to ferment xylose more efficiently? Generating amino acid sequences and comparing to know protein functions would help answer this question.*
- Are there other yeast strains that could ferment xylose even more efficiently? One could repeat this experiment with other strains.*