# Our Beautiful Stinky Friend

Part 1. A Practical Guide to Fermentation and *Lactobacillus*

## Before proceeding, please read and answer the prompts in this interactive presentation

## How does one cook without heat?

After completing this section, you should be able to:

- Describe the basic science of fermentation
- Describe what ingredients are required
- Write a procedure to ferment a vegetable
- Know how to avoid unwanted microbes in your fermentation reaction

Below are two options for videos. The first one is a shorter YouTube video that goes over the basics of fermentation including ingredients, how to prevent mold, some of the science, and general tips. The second is longer and features an interview with a famous chef and fermenter. This video contains more information and a more in depth discussion of fermentation.

Your task is to watch one or both videos and collect information that will help you design your own fermentation experiment. Please note that I annotated the videos for you. As you watch and listen, there are certain key points that I want you to take away from these videos that will help you to answer these questions. While you should listen to the entire broadcast, I wrote in prompts that will help you gather this information and when it appears in the broadcast.

### 1. A 6.54 minute Youtube Video

**Annotated Guide With Prompts**

Below is an annotated guide to help you focus on key pieces of information as you listen. The left side of the table includes timestamps and quotes to listen for. The right side lists questions that I would like you to answer using information from the video. Each of the answers to these questions should be a couple sentences at most. Feel free to include pictures, diagrams, or any

other way of interpreting the material that helps you take it in. There will be times where there aren't questions to answer but you should still keep listening.

| Time Elapsed | Questions to answer during that period |
|---|---|
| 0.56 "Before you get started…" | 1. What is the "lacto" in lacto fermentation?<br>2. What is lactobacillus and why does it matter?<br>3. What is the chemical process by which lactobacillus works in fermentation?<br>4. What vegetables can you use?<br>5. What is meant by "Brine Percentage"? |
| Pause the video at 3.23 and note the formula on the screen | Answer this question based on that formula:<br>6. *A chef has 20 grams of carrots and 120 grams of water. How many grams of salt is needed for her ferment?* |
| 3.34. | 7. Write a procedure for how to ferment that focuses on how and when to add components. You can omit the calculations and just say when you are measuring and adding 2-3% brine. |
| 4.09 | 8. How can you keep your vegetables submerged? You may draw your set up as well<br>9. Why don't you want to tightly seal your fermentation jar? |

## 2. 27 minute podcast on fermentation

You are going to listen to a 27 minute podcast on fermentation. It was originally broadcast on NPR's Science Friday and features an interview between host Ira Flatow and chef/scientist David Zilber, who runs a fermentation lab at a prestigious restaurant in Denmark called Noma. In this interview, he discusses how he ferments foods and some of the science behind it.

**Annotated Guide With Prompts**
Below is an annotated guide to help you focus on key pieces of information as you listen. The left side of the table includes timestamps and quotes to listen for. The right side lists questions that I would like you to answer with information from the interview. Each of the answers to these questions should be a couple sentences at most. There will be times where there aren't questions to answer, but you should still keep listening.

| Time Remaining | Questions to answer during that period |
|---|---|
| -22.34 “Who gets into the club...” | 10. What is the chemical difference between fermentation and rot? Your description may include an analogy.<br>11. What are the different ingredients and control points that control fermentation?<br>12. How did bacteria aid the transformation of cabbage to sauerkraut?<br>13. How does salt aid the bacteria in changing cabbage to sauerkraut?<br>14. How does lactic acid bacteria do their thing?<br>15. How does fermentation make it harder for bad bacteria to grow? |
| 19.21 “What is the difference…” | 16. What is the difference between pickling and fermenting?<br>17. What are two types of fermentation that occurs during the pickling process?<br>18. What is the effect of pH on fermentation? |
| 16.33 “You can absolutely build…” | 19. Where in the house can you let something ferment?<br>20. What is the importance of location in the fermentation process?<br>21. Does fermentation always produce alcohol?<br>22. What is the textbook definition of fermentation? |
| 12.12 “For the novice…” | 23. What recommendations did the expert give for starting off in home fermenting? |
| 10.44 “In the same way that fermentation makes…” | 24. What is the expert excited about for the future of fermentation? |
| 8.44 “What exactly is kombucha...” | 25. What microbial reactions give kombucha its taste?<br>26. What are the two kinds of microbes?<br>27. What are the two microbial reactions?<br>28. Is it possible to “overcook” a fermentation? |
| 4.45 “What goes into a successful ferment…” | 29. What goes into making a successful ferment?<br>30. What did the expert say about “every little variable” in regards to the success of the ferment? |
| 3.43 “...mold…” | 31. What did the expert say to do if there were problems with mold? |

After you have listened to one or both podcasts and answered the questions, fill out this table.

| Prompt | Answer |
|---|---|
| What is fermentation? | |
| What is the microbe involved in a fermentation reaction? | |
| What chemicals do the microbes provide that give unique flavors to food? | |
| What can I ferment? | |
| How do I ferment? | |

# IV. Choosing a Dependent Variable and Planning an Experiment

Accomplished chefs are also scientists. They experiment with flavors and can iterate many times on the same recipe. As they cook, it is important for them to record their notes and observations as they change variables within the recipes.

To quote David Zilner of NOMA, when fermenting, “every variable matters” from the size of the vegetables you cut, the amount of salt you add, the length of the ferment, the size of the jar, etc.

You may wish to use This Digital Lab Notebook to plan your fermentation experiment.