



# Our Beautiful Stinky Friends

**A Practical Guide  
to Fermentation**



# Fermentation is “Cooking” These Substances!

science  
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*Fermentation is a means of cooking food without heat. It is done by microbes but can be controlled by humans to produce foods with unique tastes. Humans have used fermentations to present food for millenia!*

# What is Fermentation?

- Describes one way that organisms make energy when oxygen levels are low in cells
- Occurs in all biological organisms
- Makes energy to sustain but happens at a cost
  - Produces by-products that make the organism has to remove or break down
- This process can be manipulated in microbes to make many different types of food








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# What Can We Make by Fermentation?

The table to the right shows five microbes and the types of food products that make when they are fermented.

**Which is your favorite?**

*Note: You must be at least 21 years of age to select the center picture.*

| Organisms             | <i>Propionibacteria</i>   | <i>Aspergillus<br/>Lactobacillus<br/>Streptococcus</i>  | <i>Saccaromyces</i>  | <i>Escherichia<br/>Acetobacter</i>  | <i>Clostridium</i>  |
|-----------------------|---|---|--|---|---|
|                       | ↓   | ↓   | ↓  | ↓   | ↓   |
| Fermentation products | Carbon dioxide<br>Propionic acid<br><br>Swiss cheese | Lactic acid<br><br>Cheddar cheese<br>Yogurt<br>Soy sauce | Carbon dioxide<br>Ethanol<br><br>Wine<br>Beer | Acetic acid<br><br>Vinegar | Acetone<br>Isopropanol<br><br>Nail polish remover<br>Rubbing alcohol |

# What Materials Do I Need to Ferment?

Required:

1. A sterile jar with lid
2. A firm vegetable
3. Kosher or sea salt
4. A way to sterilize the jars
5. Knife and cutting board

Optional:

1. Dried spices such as thyme, sage, rosemary, dill, or caraway seeds
2. Garlic and/or onions



Illustration by Sandy Roberts for Science Friday. Graphics from [Canva](#).