# Episode 3

# Kitchen Chemistry

Any questions?
Reach out
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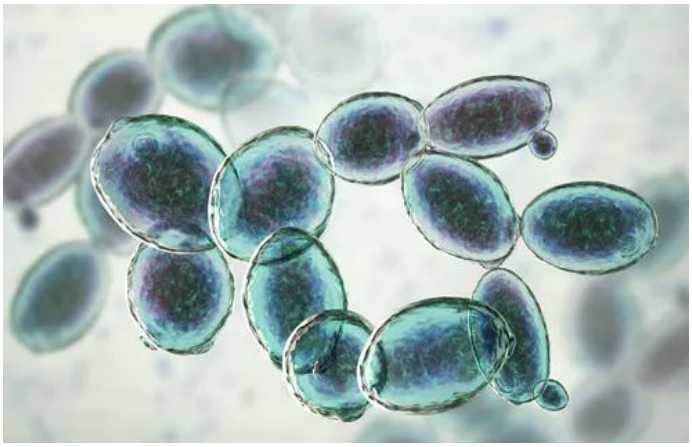
# Yeast & Sourdough Starter

**Yeasts** are single celled microorganisms that live in a wide variety of environments, from the ocean to the stomachs of bees to the skins of fruits to human digestive tracts. Yeasts are **eukaryotes**, and belong to the same kingdom as fungus and mushrooms. One of the most commonly used yeasts is *Saccharomyces cerevisiae* (microscopic image below), and it is arguably the most well studied because it is used as a model organism in cell biology to study eukaryotic cells. Different strains of *S. cerevisiae* are used for baking and brewing, but natural yeasts strains (those present on the whatever was initially fermented) are also used.



Yeast is useful for brewing and baking because of its biological properties. Yeasts use water and sugar to produce energy, and excrete carbon dioxide and ethanol as by products of the process of fermentation. Yeasts are added to baking (along with sugar and water) to give bread rise. As the yeasts produce carbon dioxide, it forms bubbles in the dough. Once baked, the dough solidifies, which traps the $CO_2$ bubbles within the bread. For brewing the yeast is fed so that it produces $CO_2$ (carbonation) and ethanol.

Bread has existed for thousands of years, so how was it made before people were able to obtain yeast? Or before microbes were discovered? This is where sourdough bread comes in. Yeast grows on wheat plants, and remains after the wheat it ground into flour. The yeast present in flour is mostly inert (think of it like sleeping), but when water is added to flour the yeast is able to ferment sugar and begin to replicate. Other bacteria also exist in the flour and are able to grow, specifically **lactic acid bacteria** ( LAB, genus *Bacillus*), and to ferment the sugars present in flour along with yeasts. When left at room temperature, the yeast and LAB ferment the sugars present in flour to form what is called a **levain** or sourdough "**starter**" -- this is what is used to "start" the rise in sourdough bread, without actually adding yeast to the mixture.

# Yeast & Sourdough Starter

## Materials:

For the starter:

- Flour
  - Can use all purpose, whole wheat, or pumpernickel (rye flour) for the starter
    - I used whole wheat flour to start it, then fed with all purpose flour
    - If you decided to use rye flour, I recommend using it mixed with another flour (otherwise it may affect the texture
- A large container with lid -- big enough to add your starter mixture with space for it to “breath” as the yeast ferments and rises
  - I used a large glass mason jar with a cloth for the “lid” to let it breath, but you could also use a proper lid, tin foil, or plastic wrap
- Measuring cups
- Mixing spoon
  - You want it to be long enough that it can reach the bottom of the container to fully stir the starter/fully mix in the added flour


## Safety Considerations:

- When storing your starter, be mindful to loosely cover the container to prevent compressed gas build up

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**Making the starter:**

## Steps

1. Mix 1 cup of flour with ½ cup (125 mL) of water in your starter container, making sure that no dry bits of flour remain
2. Loosely cover the starter container, leaving some way for air to get in and out
3. Let your starter sit in a warm place (not direct sunlight) for 24-36 hours
    a. After 24-36 hours, your starter should have risen in its container, and it should look bubbly and maybe a bit jiggly
    b. If it does not, don't panic! Your starter may just need more time to rise. Check on it every 6-8 hours until it looks right
4. Feed your starter with 1 cup (250 mL) of flour and ½ cup (125 mL) of water, then give it a good stir
5. Let your starter sit out for 24 hours again
6. After 24 hours, toss out half of your starter then replace it with 1 cup (250 mL) flour and ½ cup (125 mL) water and stir
7. Let your starter sit out for 24 hours like before
8. Repeat steps 6 and 7 every day until your starter is able to rise to the top of your container several hours after fooding
    a. At this point, your starter should smell acidic (but in a nice natural way, not a funky "I wouldn't want to eat this" way) and be super bubbly
    b. It took my starter five days to reach this point, but my house is quite warm. It may take your starter a little longer, which is totally okay -- keep tossing half then feeding it until it reaches its happy point.
9. Your starter is ready to use!
    a. If you baking right away, remove however much starter you need then store as stated below
    b. If you aren't using your starter right away, or you are storing the remaining starter, move it into its permanent home (or keep it in the fridge container) for however you want to store it in the fridge. Feed it one last time (same as before, 1 cup (250 mL) flour and ½ cup (125 mL) water, then stir), then let the starter sit out for a few hours. Store your starter in your fridge, loosely covered (you do not want a sealed jar of compressed gas in your fridge).
10. Starter maintenance -- feed your starter 1 cup (250 mL) of flour and ½ cup (125 mL)of water once per week.