

YEAST 101

BUTLER COUNTY BREWING SOCIETY

YEAST: IS THIS THE MOST IMPORTANT INGREDIENT?

- 2017 HomebrewCon – Homebrewer of the Year Competitors Derrick Flippin and Dexter Garner.

“What are your top pieces of advice for brewing beer that will place or win in competition?”

1. Pitch a LOT of HEALTHY yeast.
2. Controlling your fermentation temperature for the style you are brewing.



WEIRD SCIENCE



A LITTLE BIOLOGY REFRESHER...

Kingdom: **Fungi** (*that's right – you're favorite fermented beverage came from a fungus*)

Phylum: Ascomycota → **Subphylum:** Saccharomycotina → **Order:** Saccharomycetales

Family: Saccharomycetaceae → **Genus:** Saccharomyces

- Brewer's yeast (and Baker's yeast) are specifically a **Species** of yeast called:
 - *Saccharomyces cerevisiae* for ales
 - *Saccharomyces pastorianus* for lagers
 - Wild or sour fermentations are using completely different types of yeasts

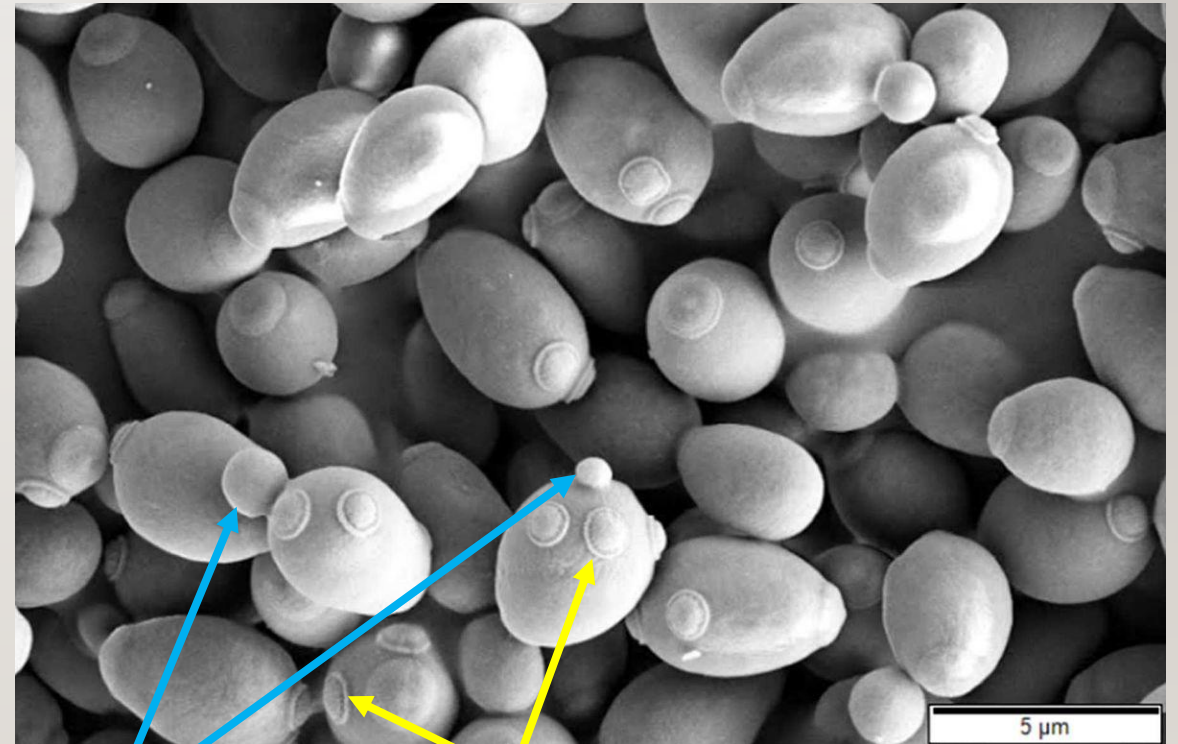
TO BREATHE OR NOT TO BREATHE

- Yeast can survive in environments that are either **aerobic** (oxygen is present) or **anaerobic** (no oxygen present).
- When you pitch yeast slurry into a starter or a freshly brewed and chilled batch, the yeast are starting out in an oxygen-rich environment so their aerobic process goes to work first.
- Oxygen and other nutrients are consumed and drive reproduction. You won't see much going on in the flask or fermenter. This is sometimes called the 'lag phase'.



YEAST GROWTH – THE LAG PHASE

- Yeast cells reproduce through a process called “budding”.
- The bud grows out from the main cell and when ready, the cell nucleus will split and transfer to the bud, then break away from the original cell.
- The exercise leaves a “bud scar” on the original yeast cell.

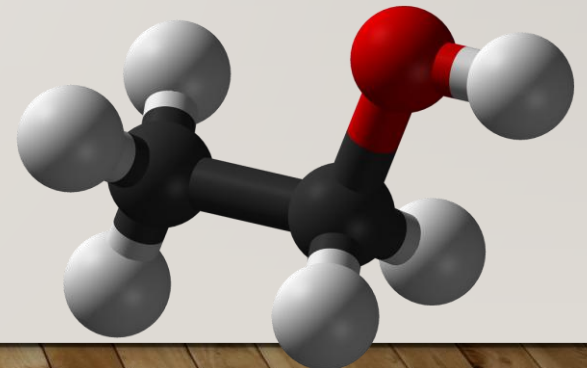
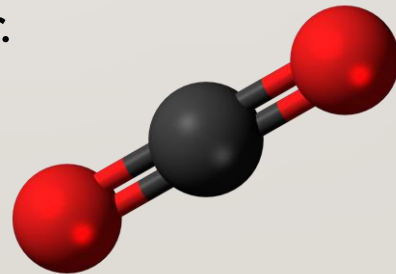


“bud”

“bud scar”

YEASTY BEASTIES ATTACK! FERMENTATION

- When yeast run out of the necessary materials to reproduce (usually oxygen), the cells turn their attention to metabolizing the sugars in the wort to sustain themselves.
- The yeast have plentiful food to work with, so the initial fermentation is vigorous and generates krausen at the top of the wort level.
- The remnants of the sugars are primarily carbon dioxide (CO_2) and ethanol ($\text{C}_2\text{H}_5\text{OH}$), but there are other fractured pieces of the sugars – esters, phenols and other compounds which can play a role in flavor.



PHASE 3 – CLEAN UP IN AISLE 12

- When sugar becomes scarce, the yeast turn their attention to leftover fragments generated during the first two phases.
- Depending on timing, temperature, etc., the yeast may not completely eradicate some of these items. That may be a good or a bad thing:
 - Belgian beers or German wheat beers are noteworthy for esters and phenols that remain in the beer.
 - Your IPA or dry Irish stout, not so much.
- Diacetyl is one of the components you want the yeast to clean up in a lager at the tail end of fermentation.

IT'S THE END OF THE WORLD AS WE KNOW IT

- Without sugar, the yeast can't be very active and many of the cells will either die or they will go dormant and settle out (known as 'flocculate').
- Some portion of the yeast can stay active and suspended in the beer. That's not a bad thing if you want to bottle condition or move the beer to a secondary fermenter for some aging (recommended for porters and stouts).
- The yeast will form noticeable layers on the bottom of the fermenter. The darker beige layer are dead yeast cells and the white layer is **dormant but viable yeast**.



BREWING PRACTICES



YEAST PACK INFORMATION

- Brand (White Labs), Number (830), Name (German Lager)
- Number of cells (reported in billions)
- ABV Tolerance = Maximum % ethanol that the yeast can achieve
- Floc or Flocculation = Degree to which the yeast will clump together after fermentation
- Apparent Attenuation = $(\text{OG} - \text{FG}) / (\text{OG} - 1)$ $(1.050 - 1.010) / (1.050 - 1) = 80\%$
- Fermentation Temperature = Recommended temperature range for the yeast to ferment
- Sometimes the pack provides styles the yeast works well for (if not, Google)

SO MANY CHOICES!

- There are common strains offered by each Yeast company, but they are branded differently.
 - Safale US-05 (dry) is the same strain as Wyeast 1056 American Ale and White Labs 001 California Ale. It is sometimes referred to as the 'Chico' yeast strain.
- Some yeast strains are highly attributed to a brewery. Sierra Nevada uses 'Chico' a lot.
- Homework:
 - Find out more about your favorite yeast. Google – [“yeast comparison chart”](#)



YEAST STARTERS

[White Labs Video for making a starter](#)

- 5 gallons of 1.048 gravity wort mathematically needs about 170 billion cells (for an ale).
- Most packages of liquid yeasts (Wyeast, White Labs) start with 100 billion cells, but some newer brands start with 150 (Omega) or 200 billion (Imperial). Dry = 230B
- If the beer gravity is higher OR the yeast is close to expiration OR you are making a lager, you will need more yeast. A starter is a cheap way of growing the additional cells yourself and has the bonus of getting the yeast raring to go at the time of pitch.
- What you are basically doing is making a small batch of beer, but you are doing it for the cell growth – the lag phase.

CALCULATING RECOMMENDED CELL NEEDS

- (Millions of Yeast cells per mL of Wort) x (mL of Wort) x (Original Gravity in Plato) =
➤ **The Recommended Number of Yeast Cells to Pitch**
- (**0.75** for an ale) x (5 gal is about **19000mL**) x (1.048 is **12 Plato**) = **171,000 million** =
➤ **171 billion cells**
- **There are lots of online calculators that you can use for figuring out how much starter to make...**

CALCULATING STARTER CELL GROWTH

- [Captain Brew's Calculator for Yeast Starters](#)
- The recommended gravity of a starter is always around 1.035-1.040 because it's the most conducive environment for cell growth.
- Then it's a matter of how much yeast you have to start with and how many cells you need to grow to determine the volume of your starter(s).
- *(Walk through example in the Captain Brew Yeast Calculator)*

TRICKS TO SPEED THINGS UP

- Instead of making wort with DME, save some extra runnings from your brew day. Boil it down to a gravity of ~ 1.037 , chill and save in sanitized jars in the fridge. On starter day, pull the jar out to warm up to room temp, pitch and you're done!
- Use a yeast cake from a previous brew for your next brew, especially high gravity beers.
 - **Example:** Brew an English Ordinary Bitter (3.5%) and ferment with a single pack of yeast. Rack off the Bitter when complete and pitch new wort for a Wee Heavy (7.5%) right onto the old yeast cake. When the Wee Heavy is done in primary, rack it to secondary and rack an English Barleywine (10%) on the yeast cake.
 - **3 Batches, 1 Yeast pack, 0 Starters !!!**