

Berliner and Beyond

Sour Mashing and Its Applications

Derek Springer
National Homebrewers Conference



Vegan Warning!

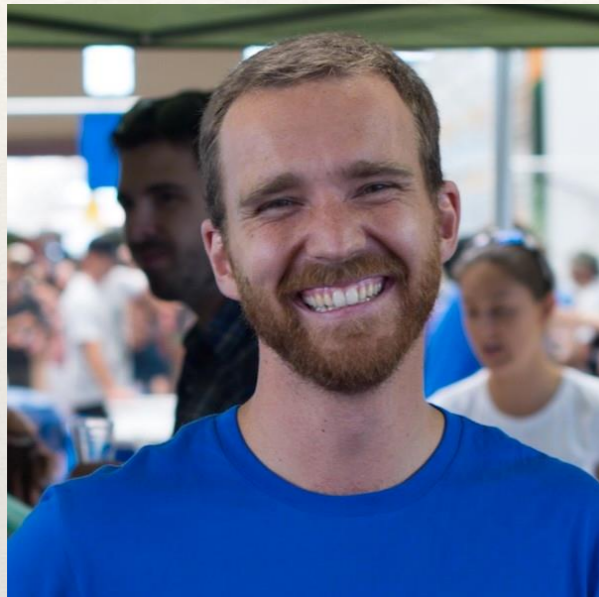


Sample #1: Extract Berliner

- ❖ 23A. Berliner Weisse
- ❖ 100% Bavarian Wheat DME
- ❖ Kettle soured w/ bacteria cultured from kefir yogurt (pH ~3.4)
- ❖ ~5 IBU Hallertauer
- ❖ WLP090 San Diego Super



Thanks for Coming!

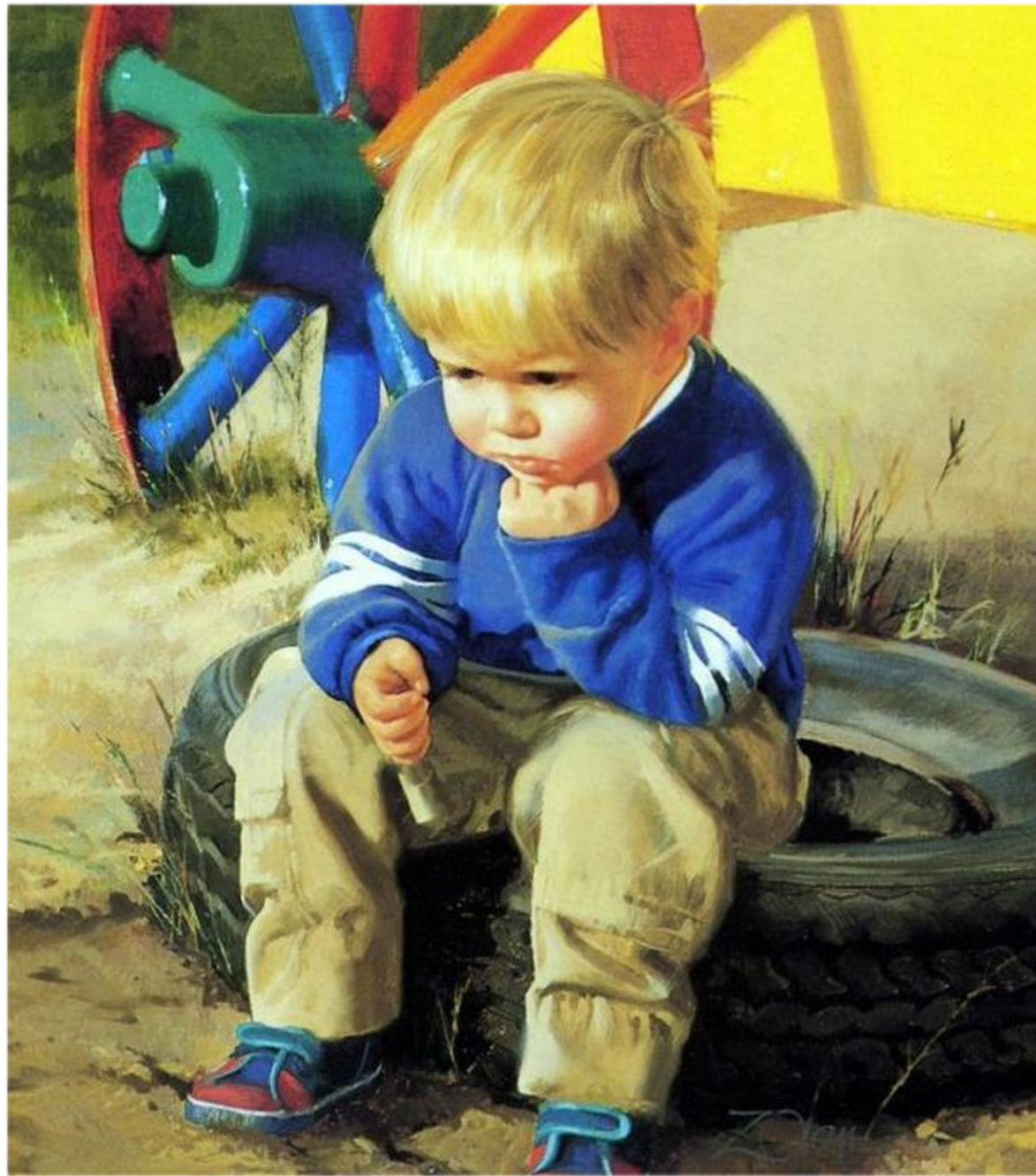


Who Is This Guy?

- ❖ Derek Springer
- ❖ San Diego native
- ❖ Society of Barley Engineers
- ❖ Brewing since 2005
(Earnestly since 2011)
- ❖ www.fivebladesbrewing.com
- ❖ @FiveBlades



Why Is He Here?



- ❖ To many, sour beer seems like an impossible dream.
- ❖ The time, equipment, and expertise required ensures that many view sour beer as a pastime for brewing elite.

My Mission

- ❖ Do not despair, sour beer is within your grasp!
- ❖ Sour mashing is a fast, easy method to making sours.
- ❖ This talk will discuss the tips and techniques to perform a successful sour mash and look at how any homebrewer, even extract brewers, can apply those techniques to a variety of styles.

I Tricked You!



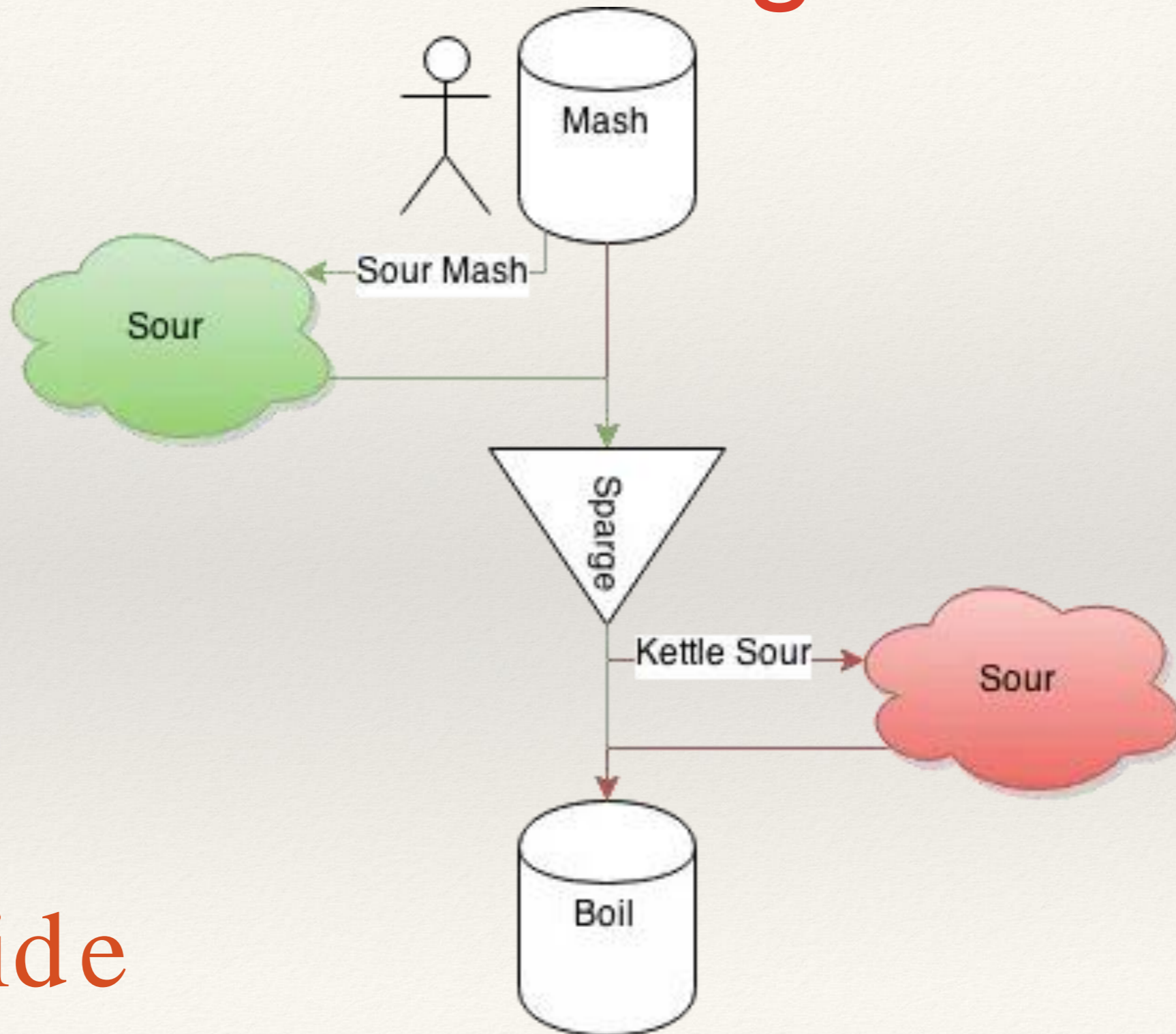
~~Sour Mashing~~

~~Sour Mashing~~



Fast Lactic Souring /
Hot Side Souring

Sour Mashing vs Kettle Souring



Hot Side

“Sour Mashing”

- ❖ I use sour mashing and kettle souring interchangeably.
- ❖ Mostly the same process with the same result.
(Fast lactic souring)
- ❖ Just choose the one that works best for you!
- ❖ It might be worthwhile to choose kettle souring if you are souring a higher gravity recipe.

Story Time



Story #1

- ❖ “I'm attempting my first sour mashed Berliner this week. I added a handful of grains, covered it with a lid, and stashed it in my basement.”
- ❖ “It smells like a parmesan cheese soiled a diaper... is this normal?”

Story #2

- ❖ “I’m making my first Barleywine this week. I pitched a single (old) vial of yeast and stashed it in my garage during the summer.”
- ❖ “It stalled out at 1.040 and tastes like rocket fuel... is this normal?”
- ❖ Bonus: “Does this look infected?”

See a Common Thread?



Don't Be Afraid!



So What Is Sour Mashing?

- ❖ The goal is simple: create an optimal environment for *Lactobacillus* bacteria and a sub-optimal environment for spoiling organisms.
- ❖ Harness *Lactobacillus*' innate ability to convert lactose and other sugars to lactic acid.



Why Sour Mash?

Pros

- ❖ Fastest way to naturally create sour beer (the Berliner Weisse is just over two weeks old).
- ❖ No extended period of ropy “sick” character (*Pediococcus*).
- ❖ Fine control over sourness.
- ❖ Hoppy sour beers.
- ❖ Final beer can be “clean.”
- ❖ No need for “dirty” equipment.

Cons

- ❖ Not impossible to create foul tasting and smelling wort.
- ❖ Wort pH < ~3.3 interferes with *Saccharomyces* fermentation.
- ❖ No chance for nuance from long-term sour process w/ diverse critters.
- ❖ Some folks don’t consider it a “real” sour.

The Gist of Sour Mashing

Sour mashing requires only a small deviation from your normal routine and has three goals:

1. Create an optimal environment for *Lactobacillus* bacteria.
2. Create sub-optimal environment for spoiling organisms such as *Clostridium* and Indole producing bacteria.
3. Allow *Lactobacillus* to drop pH to produce desired amount of acidity/ sourness.

How Do We Do That?

- ❖ Give the *Lactobacillus* a healthy head-start by pitching a large number of them. (Starter!)
- ❖ Keep the temperature $\sim 110^{\circ}\text{F}$, within the optimum temp of *Lactobacillus* and above the range of other organisms. (Optimum temp range is $95^{\circ}\text{F} - 120^{\circ}\text{F}$)
- ❖ Keep oxygen away, *Lactobacillus* is anaerobic and many competing organisms are aerobic.
- ❖ Get the pH < 4.5 ASAP, few organisms thrive in low pH.

How Much?

❖ Depends on how tart you want your beer to be.

❖ In terms of pH:

★ ≥ 4 - imperceptible

★ High 3's - light crispness

★ ~ 3.5 - refreshing tartness

★ ~ 3.3 - assertive sourness

★ ≤ 3 - peel the enamel off your teeth sour



As % Of Grist

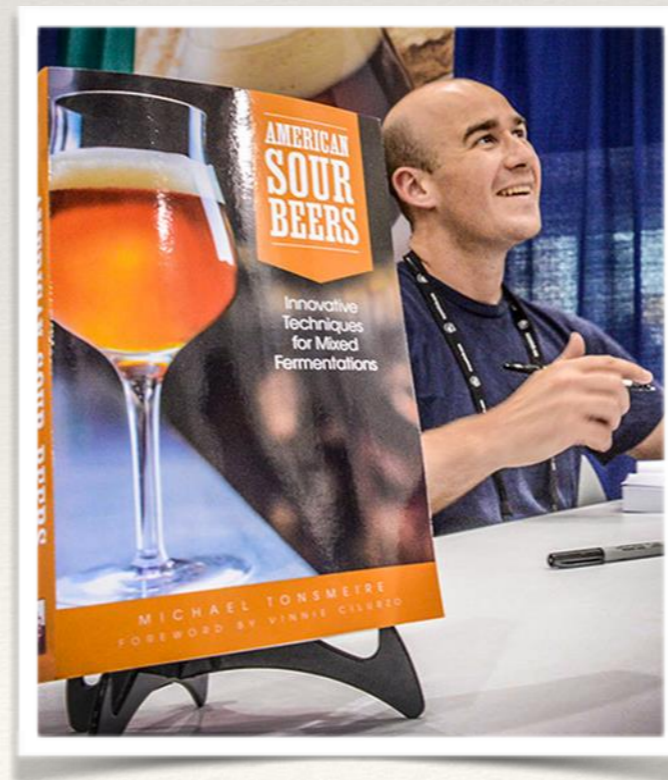
- ❖ *Lactobacillus* lowers pH fast so it can be hard to time it right. Experiment with souring only part of your grist and mixing it in post-mash / pre-sparge.
- ❖ For percentage of grist:
 - ★ 10% - adds crispness
 - ★ 25% - light tartness
 - ★ 50% - assertive tartness
 - ★ 100% - express train to Sourville

Good Styles for Sour Mash

- ❖ Berliner Weisse
- ❖ Gose
- ❖ Kentucky Common
(BJCP 2015 sez: “not sour!”)
- ❖ Saison/ Farmhouse
- ❖ Dry Irish Stout
(Guinness allegedly sours
~3% of the grist to add bite)
- ❖ Lichtenhainer
- ❖ Crisp summer beers
- ❖ Bacteria-free sours
(Focus on *Brettanomyces* -
Brett is okay w/ low pH)
- ❖ Anything to which you
want to add an “edge,” but
remain clean.

“When paired with an aggressive pre-boil souring technique [e.g. sour mash...] a 100% Brett fermentation is a good solution for making a complex sour beer without waiting as long as you would for a traditional mixed fermentation... Given the popularity of sour beers today, it is surprising that this is not a more common method.”

–Michael Tonsmeire, *American Sour Beers*





HATERS GONNA HATE

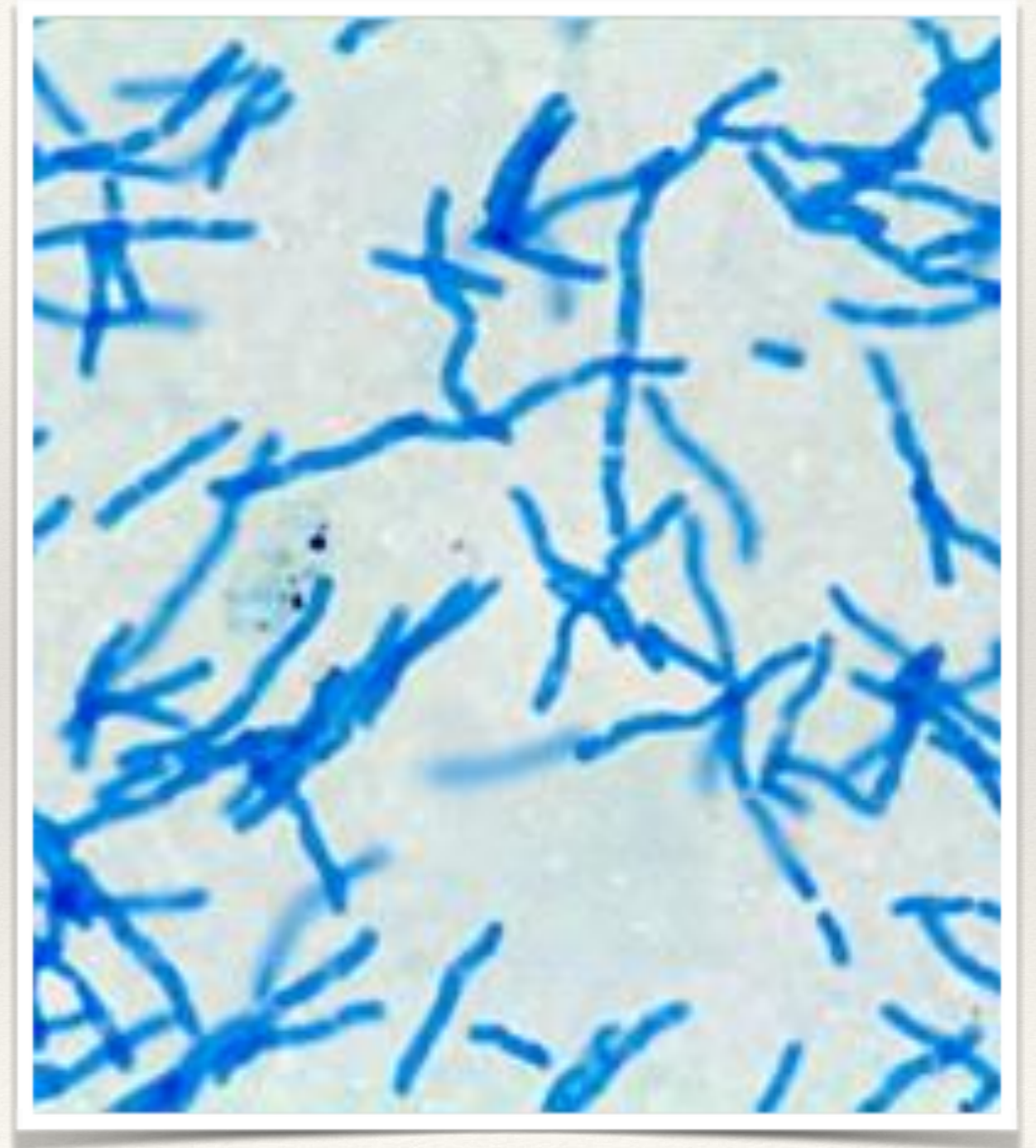
Sample #2: Death Rides A Pale Horse

- ❖ 28B. Mixed-Fermentation Sour
(Kettle-soured, all-Brett pale ale-y thing.)
- ❖ 65% 2-Row
25% Wheat
10% Flaked Rye
- ❖ Kettle-soured w/ lacto cultured from base malt (pH ~3.3).
- ❖ ~30 IBU Citra & Centennial in whirlpool and dry hop.
- ❖ Pitched The Yeast Bay Amalgamation Brett blend.



What Is Lactobacillus?

- ❖ Gram-positive facultative anaerobic (preferring no oxygen) rod-shaped bacteria.
- ❖ Member of the lactic acid bacteria (LAB) group, which converts lactose and other sugars to lactic acid.



Sources of *Lactobacillus*

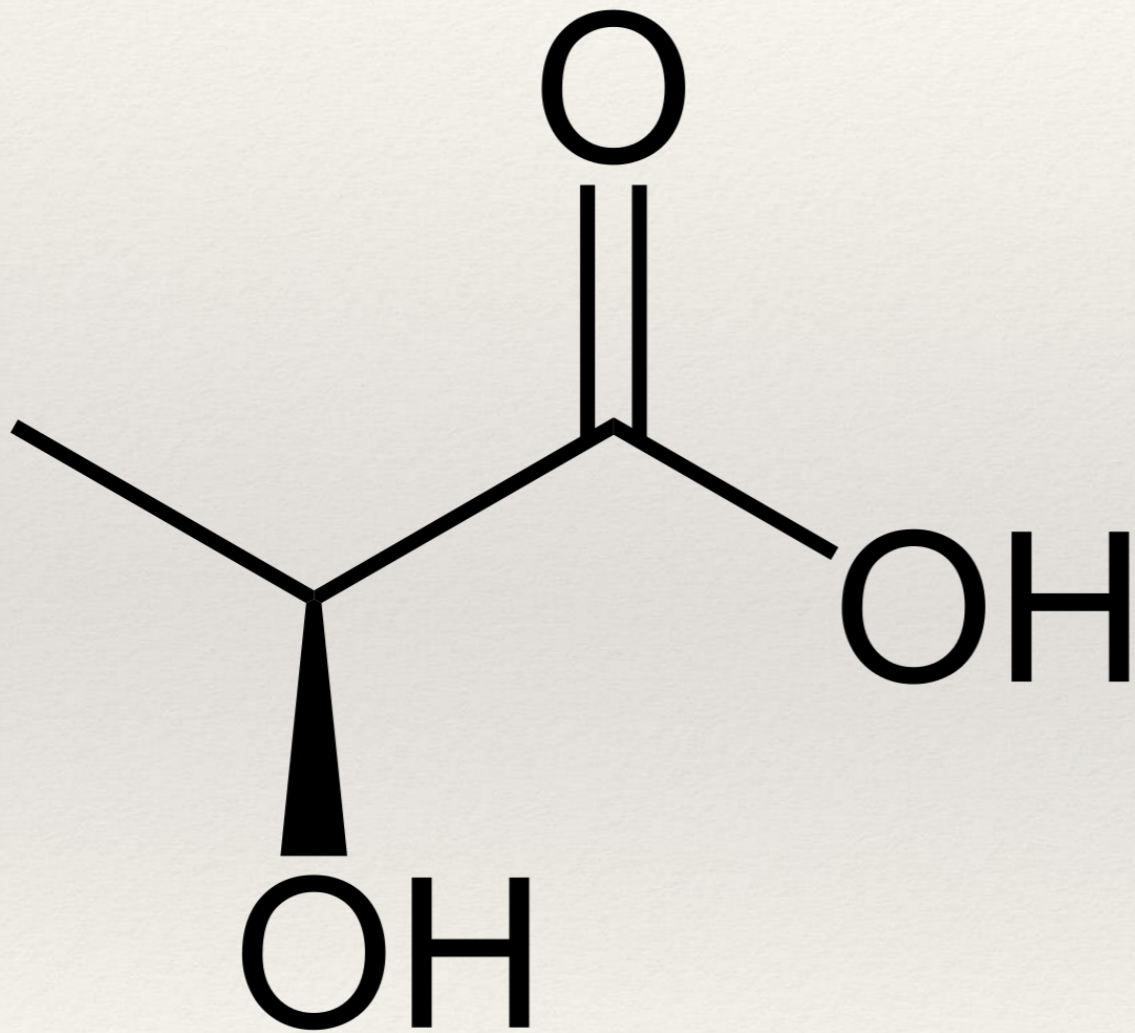
- ❖ Two main sources of *Lactobacillus* we are concerned with:
 1. Wild *Lactobacillus* from base malt.
 2. Pure cultures from sources like White Labs, Wyeast, The Yeast Bay, Omega Yeast Labs, etc.
- ❖ For the adventuresome out there, you can also culture *Lactobacillus* from yogurt and probiotics!
- ❖ IMO, “rolling the dice” w/ wild lacto is more fun!



Types of Lactobacillus

1. Homofermentative - produces only lactic acid
(e.g. *Lactobacillus delbrueckii*)
 2. Heterofermentative - both alcohol and lactic acid.
(e.g. *Lactobacillus brevis*)
- ❖ Hottenroth from The Bruery is fermented almost completely with heterofermentative *Lactobacillus*!

Lactic Acid



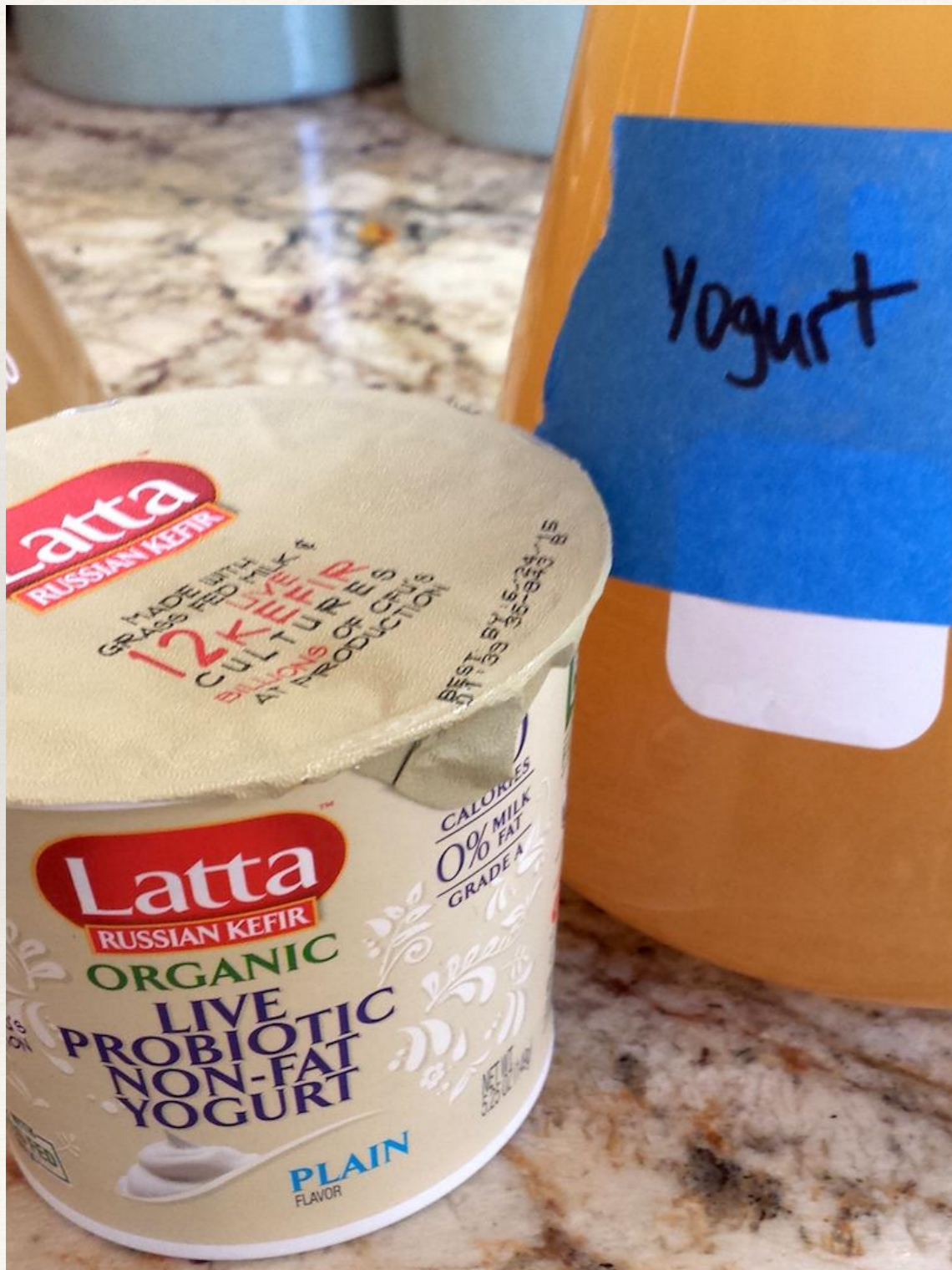
- ❖ A chemical compound with a clean, bright acidity that is both smooth and refreshing in beer.
- ❖ Lactic Acid Bacteria (LAB) such as *Lactobacillus* are responsible for favorites such as kimchi, sauerkraut, yogurt, and sourdough bread.
- ❖ Sour!

Making a Wild Starter

- ❖ Three days before sour mash.
- ❖ Create a “standard” starter.
(I use 1L per 5 gal.)
- ❖ Add 1/4 tsp 88% lactic acid per 1L.
- ❖ Cool below 120°F, add 1 cup base malt per 1L.
- ❖ Flush w/ CO₂, cap with airlock.
- ❖ (Top off w/ carbonated water!)
- ❖ Keep between 104°F-111°F.
- ❖ Strain, add to cooled mash/ wort.



Making a Cultured Starter



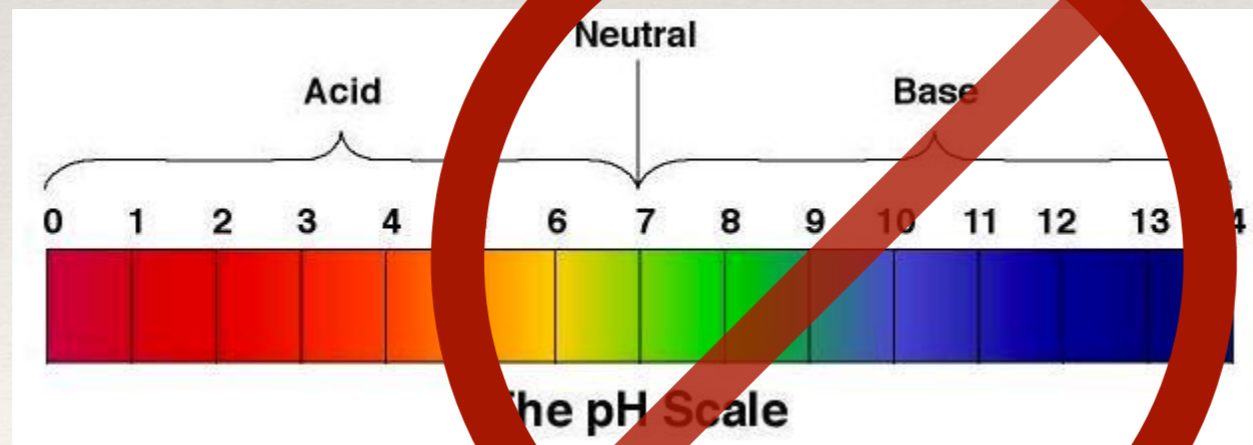
- ❖ A day or two before sour mash.
- ❖ Create a “standard” starter.
(No need to drop pH!)
- ❖ Chill starter to temperature listed in the Milk the Funk wiki.
(<http://www.milkthefunk.com/wiki/Lactobacillus>)
- ❖ Pitch vial/ yogurt/ probiotic & cap with airlock.
* If culturing *L. brevis*, cover with aluminum foil and stir it up.
- ❖ Pitch into to cooled mash/ wort.
(Refer to Milk the Funk wiki)

Omega Lactobacillus Blend

- ❖ Popular choice for cultured *Lactobacillus*.
- ❖ Blend of *L. brevis* and *L. plantarum* for wide active temperature range.
- ❖ Sours well between 75°F-95°F.
- ❖ Heterofermentative strains.



Our Enemies



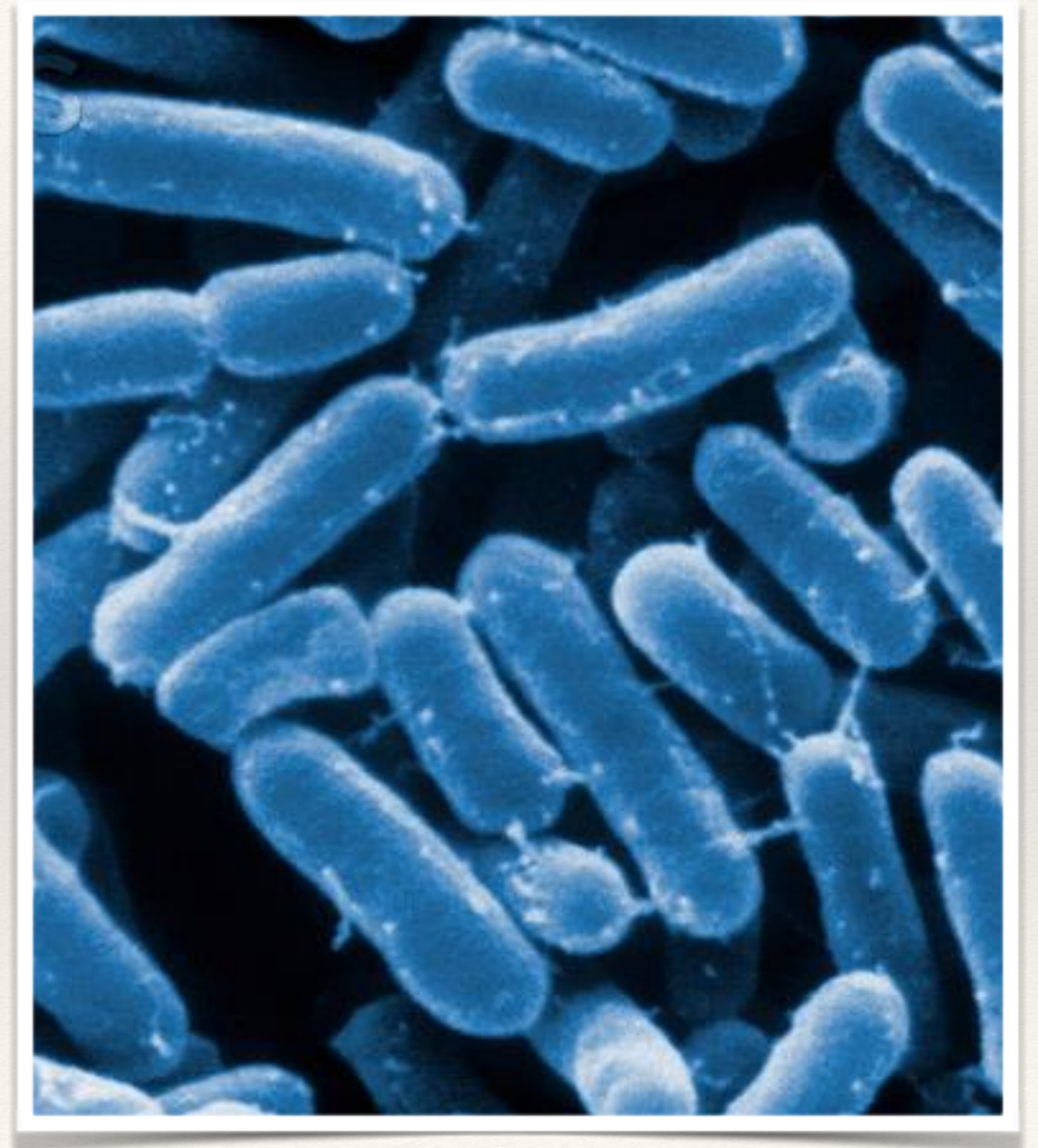
Clostridium

- ❖ Active < $\sim 100^{\circ}\text{F}$ and $\text{pH} > \sim 4.7$ in anaerobic environments.
- ❖ Produces butyric acid, which tastes like rancid butter, vomit, and sweaty socks.
- ❖ Small amounts of butyric acid can be boiled out, but a bad infection is worth dumping.
- ❖ Do everything you can to avoid Clostridium.



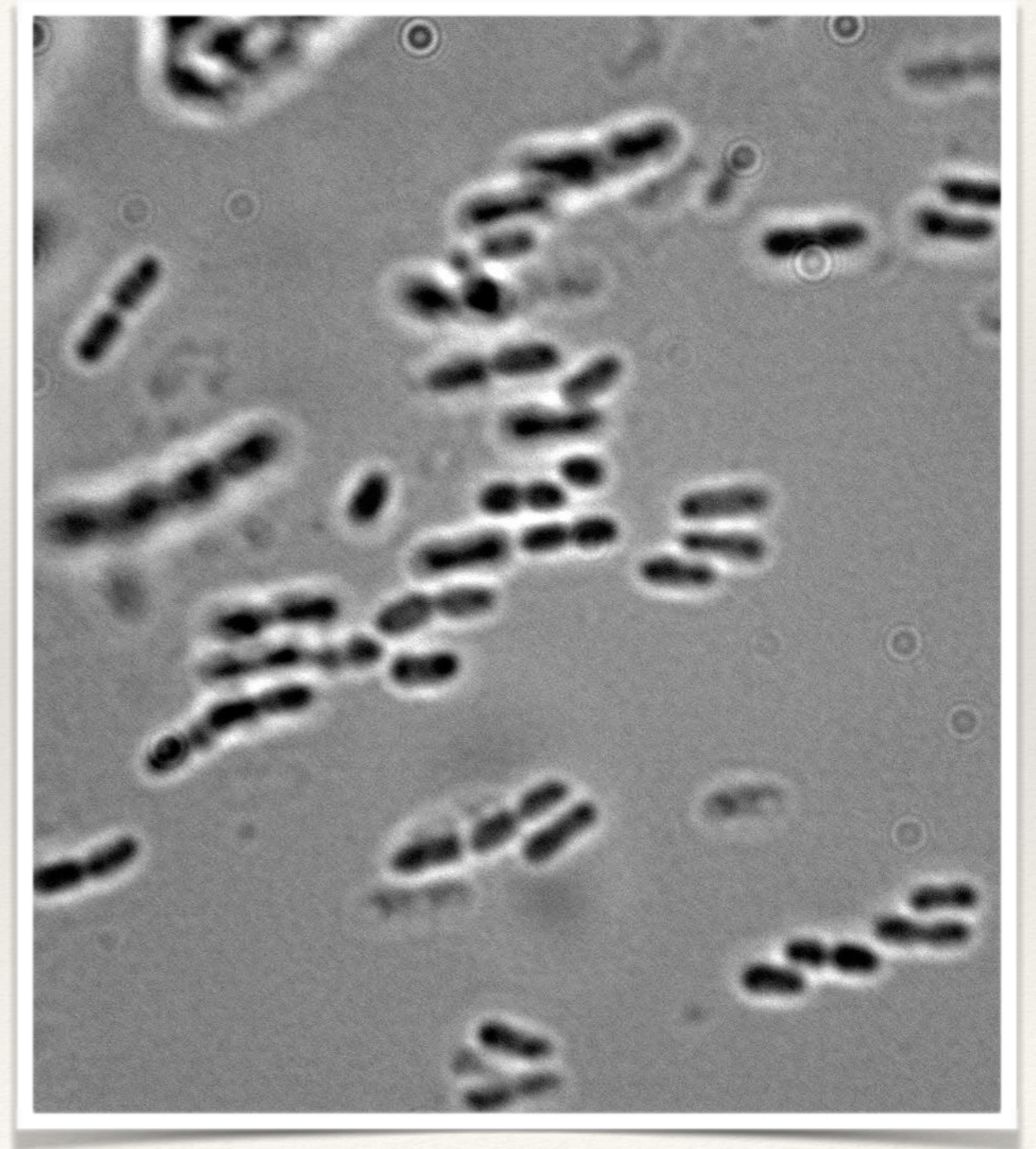
Indole Producing Bacteria

- ❖ These bacteria include families such as *Citrobacter*, *Klebsiella*, *Enterobacter*, and *Escherichia*.
- ❖ Active pH > ~4.4 and are facultative anaerobes (oxygen neutral).
- ❖ Produce the chemical indole, a chemical which smells of feces.
- ❖ Do everything you can to avoid indole producing bacteria.



Acetobacter

- ❖ Active < 86°F and pH > ~4.5 in aerobic environments.
- ❖ Produces acetic acid, aka vinegar, from alcohol and O₂.
- ❖ All things considered, a small worry.



Mold

- ❖ Aerobic surface fungus.
- ❖ Black and brightly colored molds are bad news, but other forms are can be harmless.
- ❖ You can just skim light mold colonies off the top, try not to think about it.



Three Tips To Success

1. Drop the pH < 4.5 ASAP.
 2. Pitch lacto starter.
 3. Cover surface with plastic wrap (blocking O₂).
- ❖ Once I started doing these three things I've never had even a hint of funk in my sour mashes.

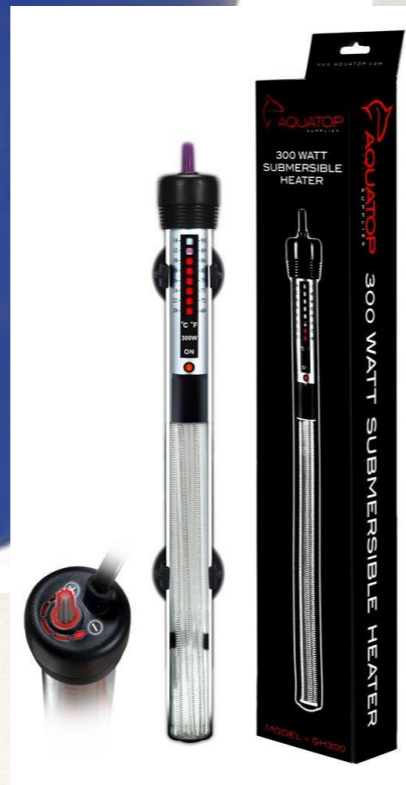
Equipment Needed

- ❖ Vessel for mash/ wort that is insulated or can be heated.
- ❖ Plastic wrap.
- ❖ Heat source.
 - ❖ Reptile heater pad.
 - ❖ Light bulb.
 - ❖ Brew belt.
 - ❖ Sous vide circulator.
 - ❖ Hot water infusion (last resort, good for insulated coolers).

My Setup



Inexpensive Solutions

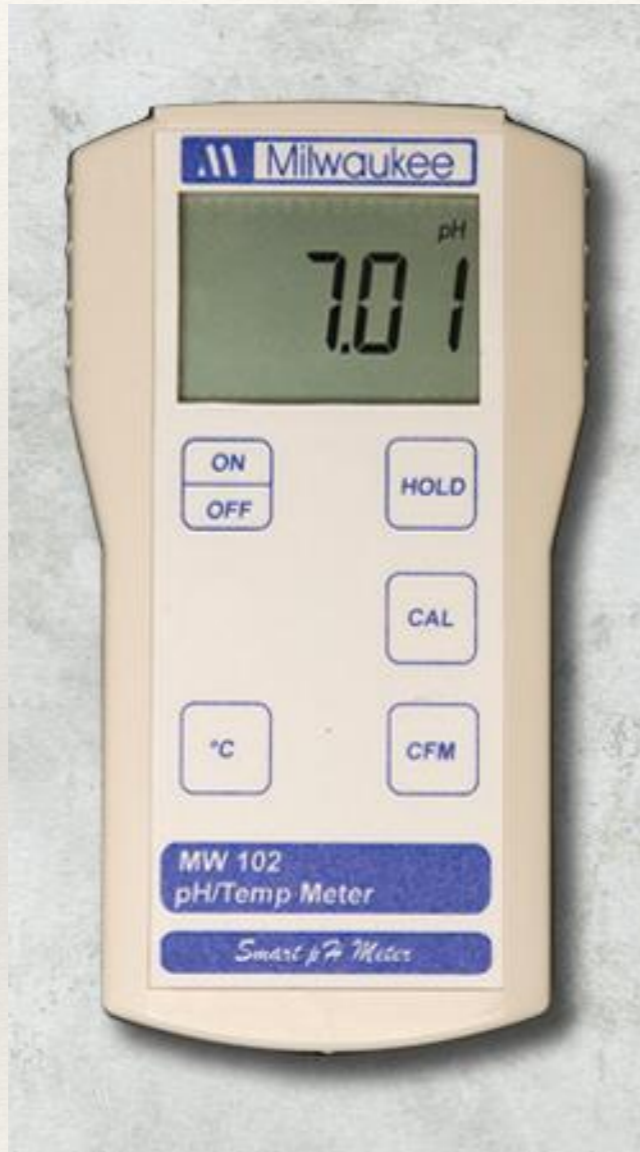


Fancy-Pants Solution

- ❖ I've had good luck using a sous vide circulator to keep lacto starters and sour mashes at optimum temp.
- ❖ You can use it to cook food!
- ❖ Full disclosure:
Anova gave me one to test.



Recommended pH Meters



Milwaukee MW 102
pH/ Temp Meter



Hach Pocket Pro+ pH Tester
w/ Replaceable Sensor



Step *34* Step

Step 1) Mash As Usual

- ❖ This is exactly the same as every other mash you've done.
- ❖ Mash high or low as your recipe requires.
- ❖ I've heard folks say they've had better success w/ thinner mash. (Anecdotal)



Step 2) Lower pH < 4.5

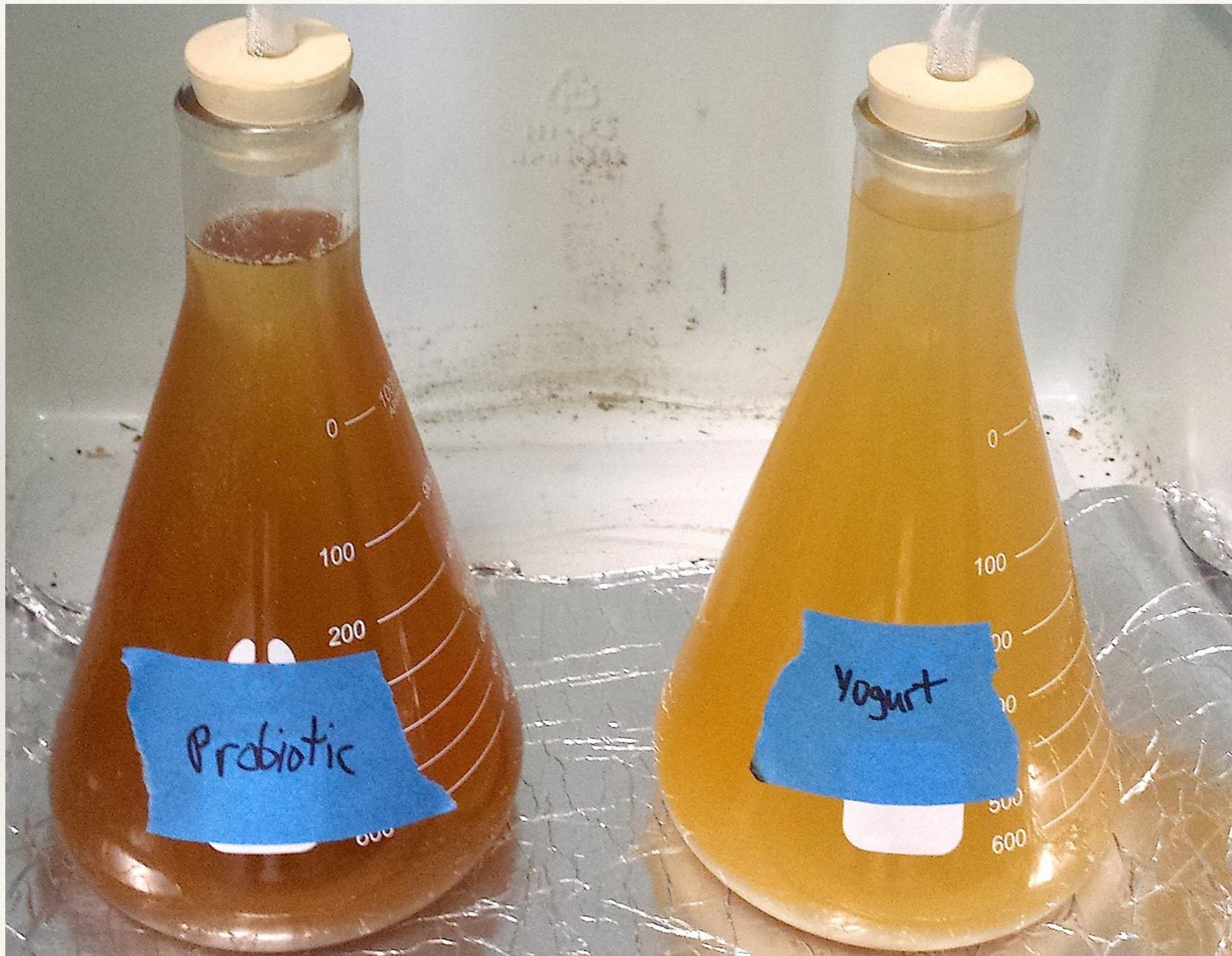


I use 1 TBSP 88% Lactic per 5 gal of mash or wort.

Step 3) Cool to $\sim 110^{\circ}\text{F}$



Step 4) Pitch Lactobacillus starter



Step 5) Cover w/ Plastic Wrap + CO₂



Step 6) Place in Warm/Insulated Place



Step 7) Check Progress

- ❖ Temp between 100°F - 110°F.
- ❖ Once a day or so taste a sample or check pH.
- ❖ Don't let O₂ in!
- ❖ Looking for pH ~3.3.
- ❖ 1-3 days.



Should You Continue?

- ❖ May look and smell a little gross/ funky, this is fine.
(My first sour mash smelled like tomato soup)
- ❖ A good sour mesh smells “cleanly” sour.
- ❖ But! If it smells *a lot* like vomit or makes you want to vomit, you may not want to continue.
- ❖ *Some* butyric acid will boil out or be scrubbed by fermentation.



When to Stop

- ❖ If you have a pH meter, many folks agree that a pH of 3.3 or so is a good combo of tartness without preventing *Saccharomyces* from doing its job.
- ❖ Otherwise, just taste it: is it sour enough? Then stop!
(Keep in mind it will seem more sour when fermented)

Warning!

- ❖ A starting pH < 4.5 will typically eliminate risk of food poisoning, use caution when tasting the sour mash.
- ❖ Only a low pH and the presence of alcohol can guarantee your fermented product is safe to drink.



Step 8) Finish Mash/Sparge

- ❖ Pellicle or mold may have formed, just skim it off.
- ❖ If only souring part of mash, add sour part back to regular mash (at end).
- ❖ Sparge as usual.



Step 9) Boil Wort

- ❖ This will sterilize wort, making your ferment “clean” if you desire.
- ❖ Everything from here on requires your standard cold-side process.



Ways to Cheat

- ❖ Add food-grade lactic acid to taste after fermentation.
- ❖ Add a significant portion (20%?) of acid malt.
This could pose significant challenges to your mash, so add it at the end.
- ❖ These methods are very 1-dimensional and are better used to juice brews that aren't quite sour enough.

Recipe: Berliner Weisse

- ❖ Wheat - 50% / Pilsner - 50%
(100 % Wheat DME)
- ❖ OG 1.032 / FG 1.004
- ❖ Mash low $\leq 150^{\circ}\text{F}$
- ❖ Sour mash to pH $\sim 3.5 - 3.3$
- ❖ “Clean” yeast (WLP001, WLP011, WLP090 are good)
- ❖ After sour mashing, boil 20 minutes to sterilize wort
- ❖ ~ 5 IBU (I like Warrior)



Two Mods

- ❖ Start with the Berliner Weisse recipe.
- ❖ Gose
 - In the boil add (per 5 finished gallons):
 - 10 g salt
 - 15 g coriander
- ❖ Lichtenhainer
 - Replace pilsner malt with rauchmalt.

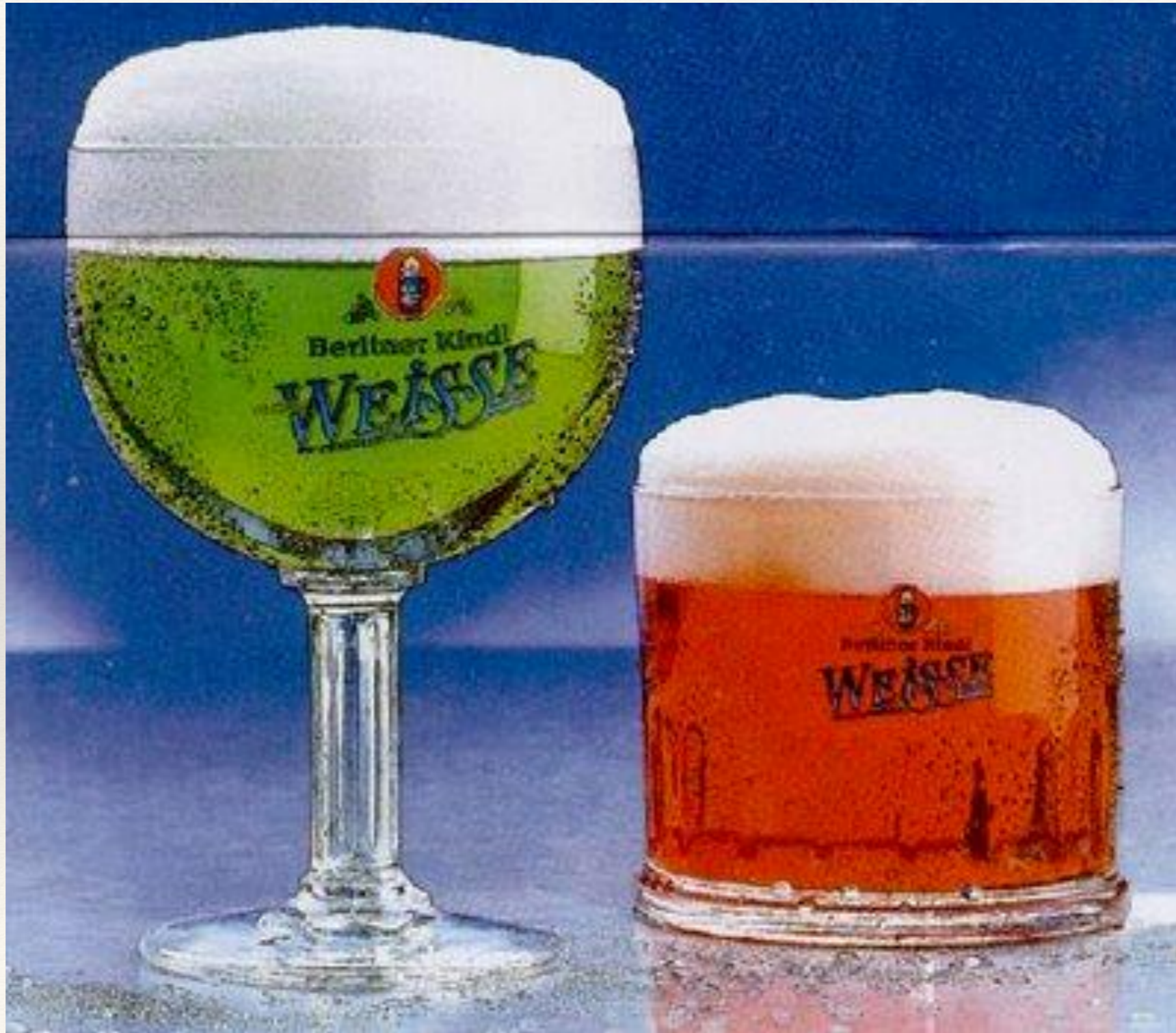
Recipe: Farmhouse

- ❖ 85 % Pilsner / 10% Flaked Wheat / 5% Aromatic
- ❖ OG 1.050 / FG 1.006 / 25 IBU
- ❖ Mash 146°F
- ❖ Sour mash 50% of grist, add to main mash after conversion
- ❖ 20 IBU Hallertauer @ 60 min / 5 IBU Hallertauer @ 10 min
- ❖ WLP565 Belgian Saison I or Yeast Bay Wallonian Farmhouse
- ❖ Try aging on fruit!

Recipe: Summer Ale

- ❖ 70 % 2-Row / 25 % Wheat / 5% Victory
- ❖ OG 1.050 / FG 1.010 / 30 IBU
- ❖ Mash 153°F
- ❖ Sour mash 25% of grist, add to main mash after conversion
- ❖ 20 IBU Centennial @ 60 min / 10 IBU Centennial @ 10 min
- ❖ WLP090 San Diego Super

Questions?



Thanks!

