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National Homebrewers Conference

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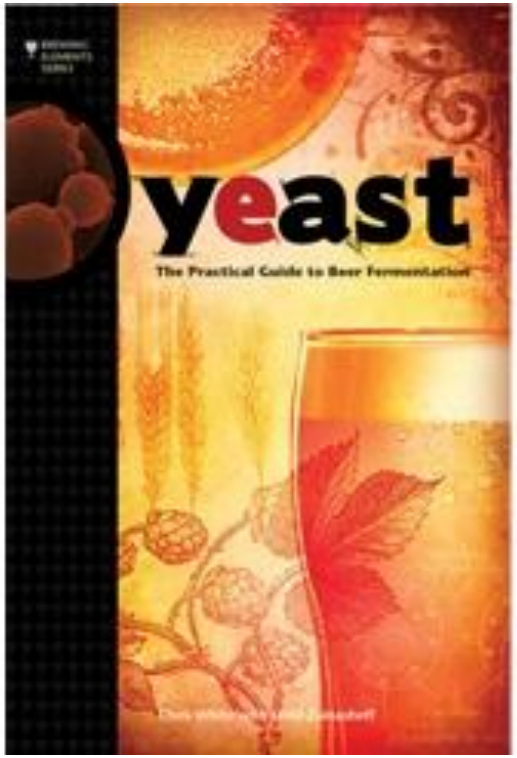
Choosing the Right Yeast

Chris White and Jamil Zainasheff

WHITE LABS
PURE YEAST AND FERMENTATION


yeast
The Practical Guide to Beer Fermentation

Yeast Chapters

Part One: The Importance of Yeast and Fermentation

Part Two: Biology, Enzymes, and Esters

Part Three: How to Choose the Right Yeast

- Selection Criteria
- Beer Styles and Yeast Selection
- Yeast Strains
- Multiple Strains
- *Brettanomyces*

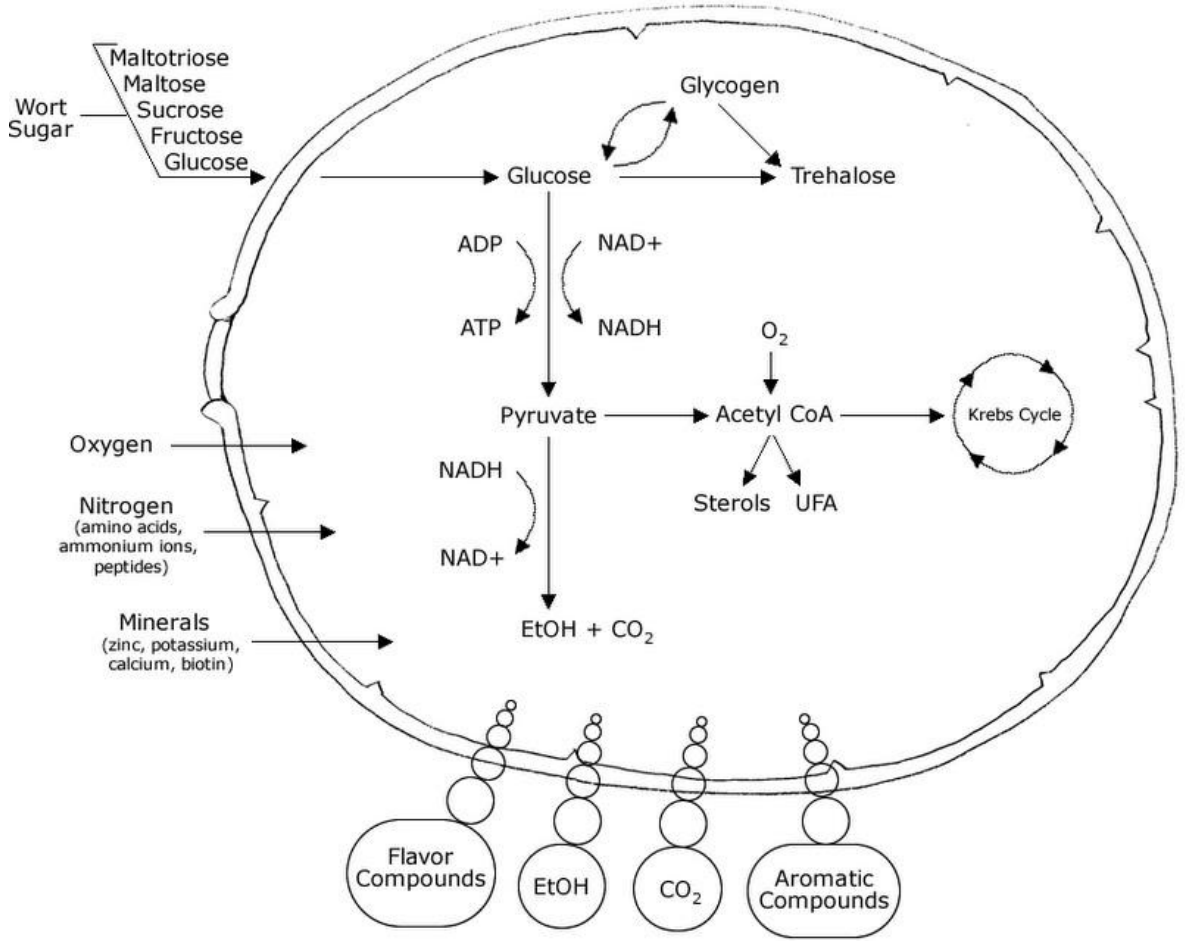
Part Four: Fermentation

Part Five: Yeast Growth, Handling, and

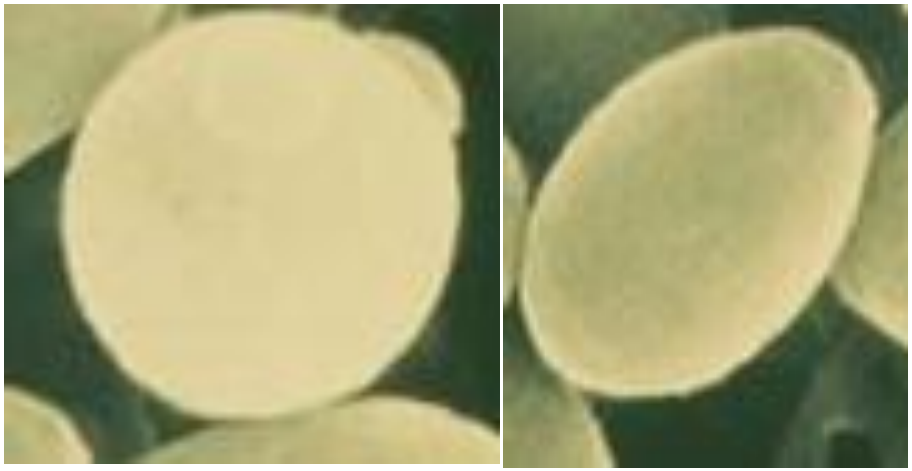
Part Six: Your Own Yeast Lab Part Seven: Troubleshooting

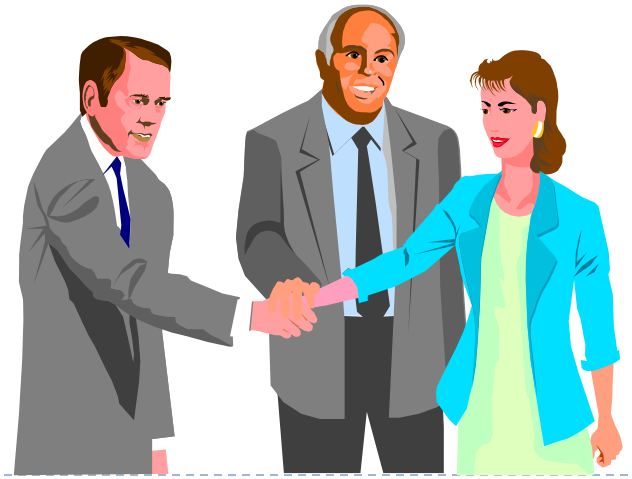
Yeast Fermentation

- Figure 2.3



Species vs. Strain



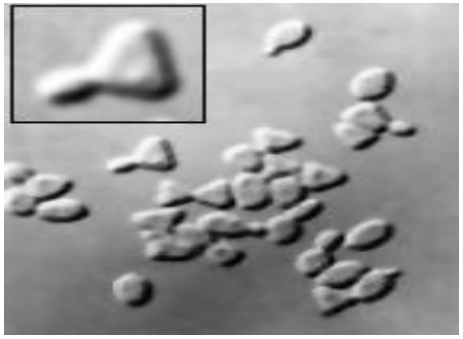


Kingdom
Phylum
Class
Order
Family
Genus
Species

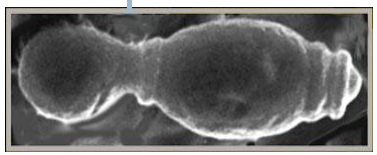
Strain

Diversity of yeast cell morphology

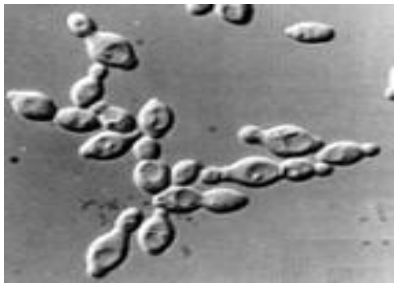
triangular



bipolar



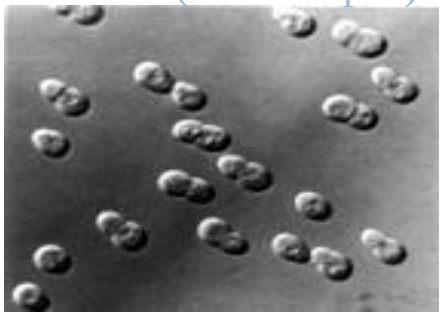
apiculate



curved

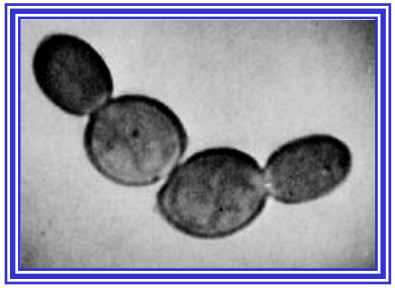
cylindrical

bottle (flask-shaped)



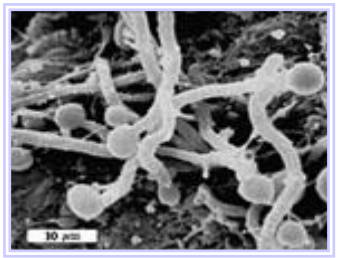
spherical

oval



elongated

dimorphic



Graeme Walker, 2009

Ale Yeast

‘Warm’ fermentation temperatures

Ferments clean to fruity

Variable flocculation

Usually good top cropper

Produces a great variety of beers

Storage is good.

Ale Yeast, Specialty

- Hefeweizen Yeast

Ferments with wild character.

Low flocculation

Low diacetyl

Can produce sulfur.

Ferments very rapidly, but not greater cell #.

top cropping is best way to collect slurry.

Produce a small variety of beers.

Ale Yeast, Specialty

- Belgian Yeast

Ferments with very unusual character-wild like

Low flocculation

Bottling with it?

Low diacetyl

Can produce sulfur.

Ferments very rapidly

Can be very fruity

Produce a good variety of beers.

Lager Yeast Types

‘Cold’ fermentation temperatures

Ferments with clean character

Not drop out quickly.

Will produce diacetyl.

Will produce sulfur.

Ferments slowly, and not grow very well.

Usually not top crop.

Produce a medium variety of beers.

Wild Yeast Types

Brettanomyces is the main wild yeast used

identified in *strong* English stock beer:

Claussen 1904 showed a brett inoculation of a 1.055 specific gravity beer would achieve the “English” character.

Shimwell 1947 confirmed the conditions: a 1.060 OG beer was essential to achieve a “vinous” wine like flavor, a beer under 1.050 would produce an unpalatable and turbid beer with insipid flavor and aroma. Shimwell said Brett can behave “as a desirable organism in one beer and an undesirable one at one and the same brewery”.

Usually used in secondary and bottle condition

Classification of Brett

Brettanomyces category grew as many new strains added. Many different synonyms.

Dekkera and Brettanomyces: same thing, but Dekkera is the sexual form, it forms spores. Brettanomyces is non spore forming, just as brewing yeast.

Multilateral budding

SO_2 sensitive

Maltose and dextrin utilization variable

Classification of Brett

5 species, based on ribosomal DNA sequence homology:

B. bruxellensis
includes *B. intermedia*
B. lambicus
B. custersii

B. anomalus
includes *B. claussenii*

B. custersianus

B. naardenesis

B. nanus
newest classification, added to the other 4 in 1990's

Flavor Characteristics of Brett

Brettanomyces have the enzyme B-glucosidase.

B- glucosidase breaks down the wood sugar cellobiose, to produce glucose.

Cellobiose in barrels occurs as a result of the firing process used to toast the barrels.

B-glucosidase is inhibitied by ethanol, and pH optimum is 5-6, temperature optimum 40-50C.

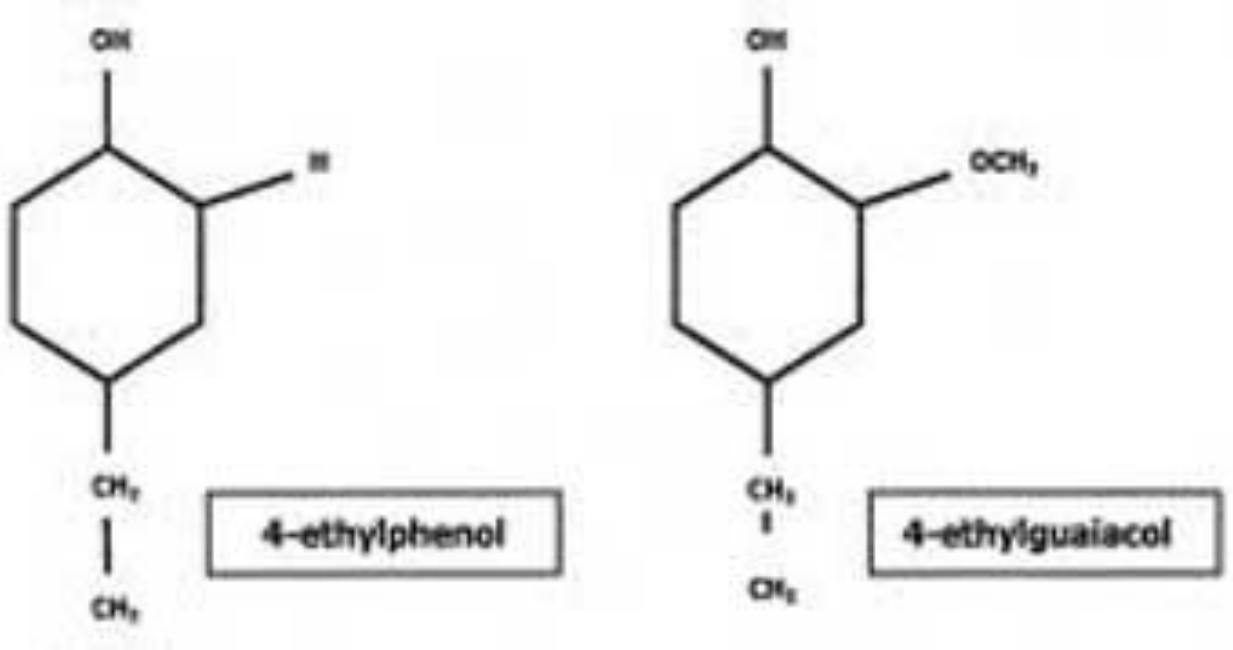
New barrels contain higher amounts of cellobiose than used barrels, and therefore have the potential to support higher *Brettanomyces* populations.
Wineries are encouraged to destroy barrels if Brett develops.
Fruity-like flavors from glucosidase activity?

Flavor Characteristics of Brett

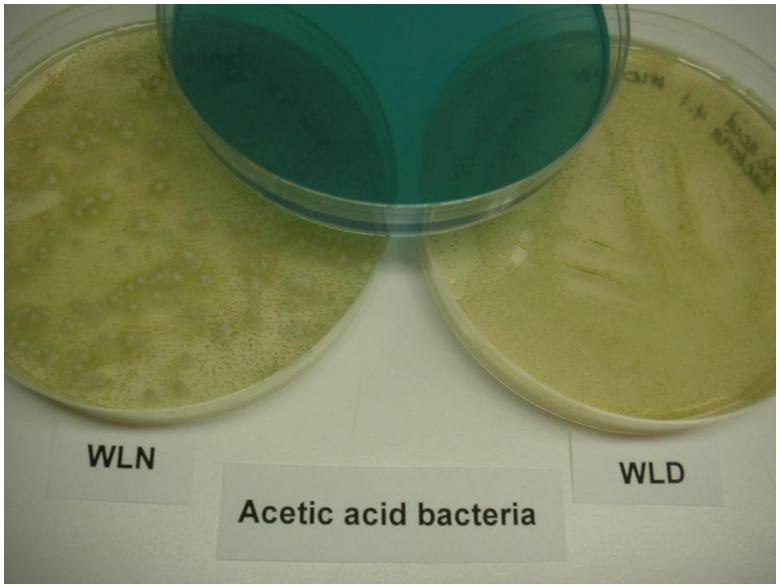
Isovaleric acid, guaiacol, plastic like compounds; 4-ethyl guaiacol (4EG) and 4-ethyl phenol (4EP)

produced by the decarboxylation of the hydroxycinnamic acids p-coumaric and ferulic acid 4EP

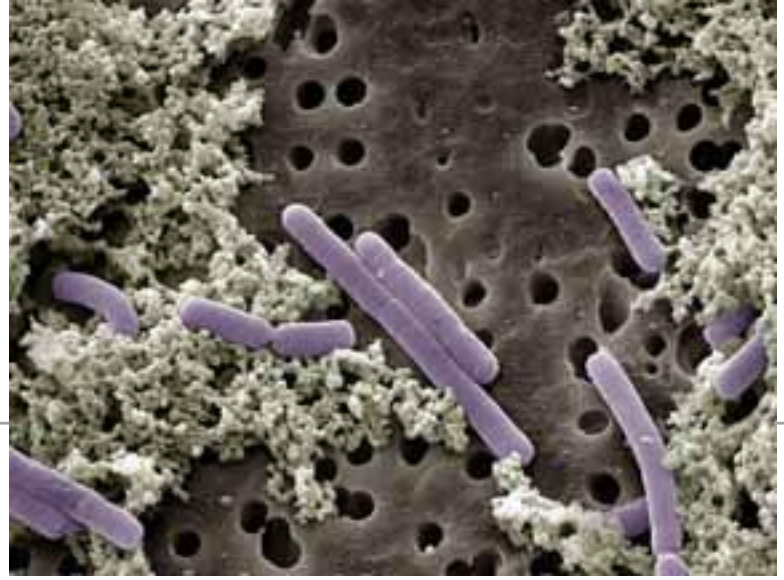
used to confirm Brett presence.



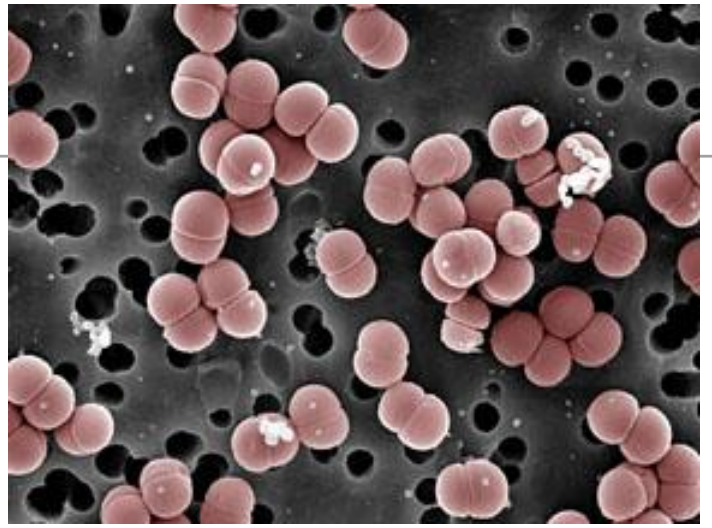
Bacteria Types



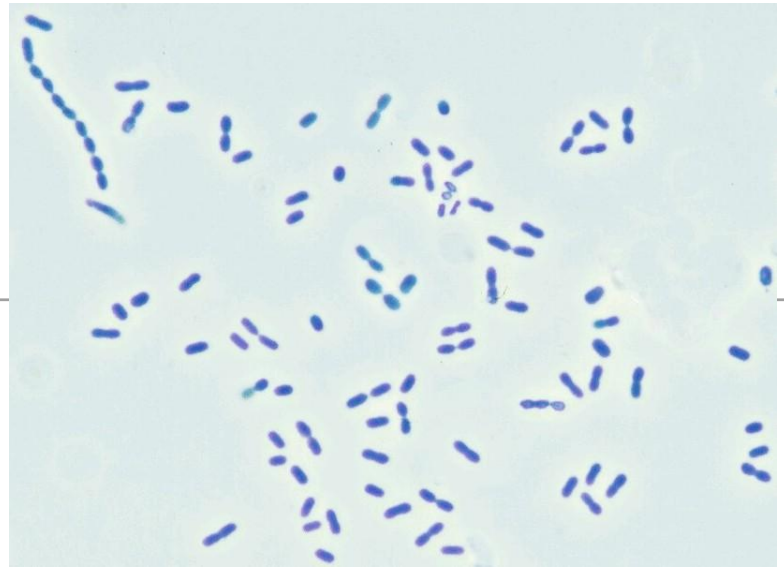
Usually beer spoilage organisms
10% of the size of yeast
Much simpler organism



Lactobacillus



Pediococcus



Acetic Acid Bacteria

Bacterial differences

- Aerobic vs. anaerobic
- Gram positive vs. Gram negative

  - Gram staining- req. special stains and microscope with oil immersion capability

  - Easy test→3% KOH solution

    - Increased viscosity→Gram negative
    - No viscosity→ Gram positive

Bacterial I.D.

Microorganism	Growth	Gram	KOH result	Cell morphology	Catalase
Acetobacter	Strictly aerobic	Negative	viscous	short rods	positive
Gluconobacter	Strictly aerobic	Negative	viscous	short rods	positive
Obesumbacterium	facul. Anaerobic	Negative	viscous	Rods	positive
Rahnella	facul. Anaerobic	Negative	viscous	Rods	positive
Lactobacillus	Anaerobic	Positive/variable	non-viscous	Rods	negative
Pediococcus	Anaerobic	Positive	non-viscous	Cocci	negative

Bacterial Flavors/Contribution

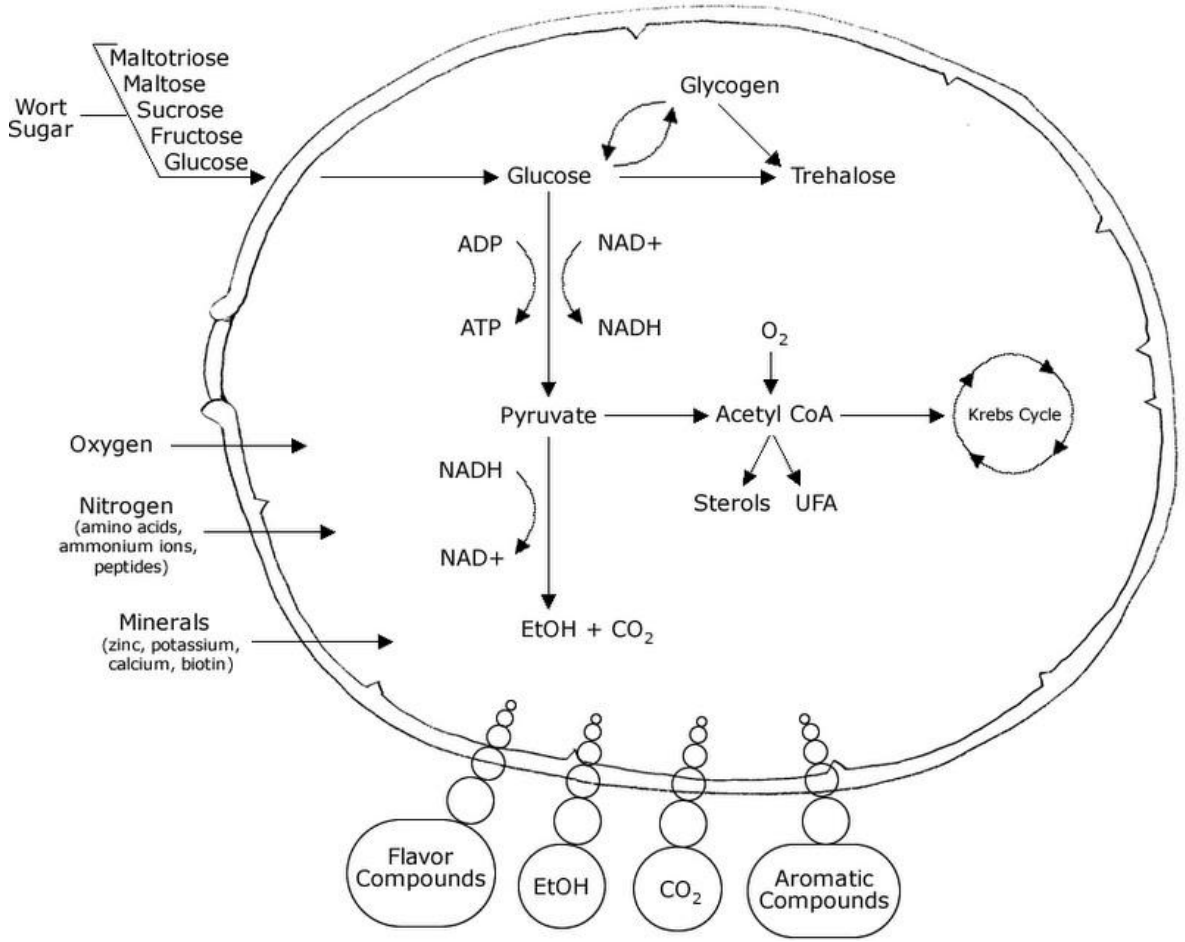
Lactobacillus delbrueckii

acidity, sourness

Pediococcus damnosus

acidity, sourness and diacetyl

Why Choose the Right Yeast?



- Does it matter?
- Creativity, the desire to produce the best beer possible

Easily Proven

- Ferment the same wort with multiple yeast strains

- Different resulting beers even with high gravity, high hops, etc.

Yeast Behavior

- Different strains can show differences in:
  - Oxygen requirements
  - Fermentation time line
  - Cell counts in tank
  - Aroma
  - Viability
  - Nutrient requirements
  - Diacetyl rest
  - Yeast collection
  - Yeast storage
  - To name a few…
- Does not need to be completely mapped out in beginning.

Strain Selection Process

- Jamil method
  - Simple, straightforward
  - There is no magic
- Set goals for the beer
  - Parameters (ABV, IBU, SRM)
  - Flavor concept (malty, hoppy, other?)
  - Determine at least one or two key requirements
- Select likely yeast candidates
  - You can try them all
  - Or use goals and key requirements to narrow choices
- Test batches
  - Keep tests consistent, adjust later

Determining Key Requirements

- Flavor, often the most important
  - Bitterness, hop character
  - Malt sweetness, malt character
  - Alcohols, esters, and others
- Alcohol tolerance
  - Extreme beer?
  - Most yeasts handle considerable ABV
- Attenuation
  - ABV target, residual sweetness
- Fermentation temperature
  - Some Belgian strains require temp push
- Other considerations
  - Speed of fermentation, storage, flocculation

Example: Smoked Belgian

- Goal in mind
  - 7-8% ABV
  - Slight but evident smoke character
  - Dark, rich malty character
  - Some malty sweetness
  - Balancing bitterness, no hop character
- Recipe
  - Pils, Munich, Rauch, Special B, Carafa Special, Sugar
  - Hallertau
  - 17 °P, 23 IBU, 19 SRM

Example: Key Flavor Considerations

- Smoke phenol from grist
  - Plus fermentation, could be overwhelming
  - Low phenol, complimentary phenol yeast
- Need some additional complexity
  - Fruity esters, "Belgian" character
- Malt character
  - Enhanced malt character, with subtle smoke character
  - Some yeasts enhance, others subdue
- Malt sweetness
  - Avoiding too heavy and sweet or too dry
- Attenuation
  - 75 – 86% to result in 7 – 8% ABV

Example: Test Batches

- Pitch rate 0.75 M/°P/ml, 68 °F to 74 °F, 8-10 ppm O2

- Antwerp (WLP515)
  - 75% Apparent, 4.3 °P, 7.0 %ABV
  - Malty, rich, full, more rauch character
- Abbey (WLP530)
  - 77% Apparent, 3.8 °P, 7.3 %ABV
  - Slightly full, drier than 515, fruity
- Belgian Strong (WLP545)
  - 92% Apparent, 1.3 °P, 8.6 %ABV
  - Dry, spicy, alcohol evident, lowest malt character

Example: Adjustments

- Antwerp (WLP515)
  - Increase attenuation without losing malt character
  - Second yeast? Mash adjustment? Grist?
- Abbey (WLP530)
  - Reduce fruity character, let rauch be more evident
  - Pitching rate? O2? Nutrient? Temp? More rauch?
- Belgian Strong (WLP545)
  - Refine alcohol character, less dry
  - O2? Pitch rate? Temp? Mash?
- Blending?
- Worthwhile?

Thank you!

- Questions?

- Contact Info:
  - cwhite@whitelabs.com