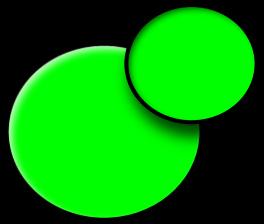

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Brewing Beer with Sourdough

October 2014
Jim Withee
GigaYeast Inc.

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Brewing Beer with Sourdough

The history of sourdough

The microbiology of sourdough

Brewing with sourdough

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Sour myth #1
"The lower the pH, the more sour it tastes"

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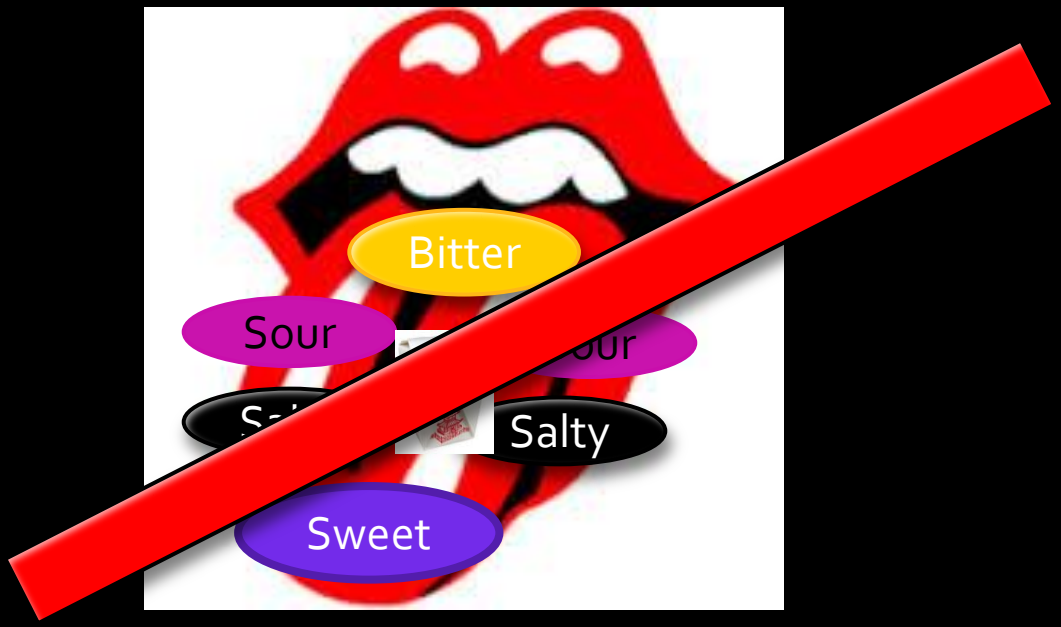
"...hydrogen ions and protonated organic acids are approximately equal in sour taste on a molar basis. "

Da Conceicao Neta ER et al. 2007

ACID-H + H^+ = SOURNESS!

Sour Myth #2
Sour taste is located in discreet locations of the tongue



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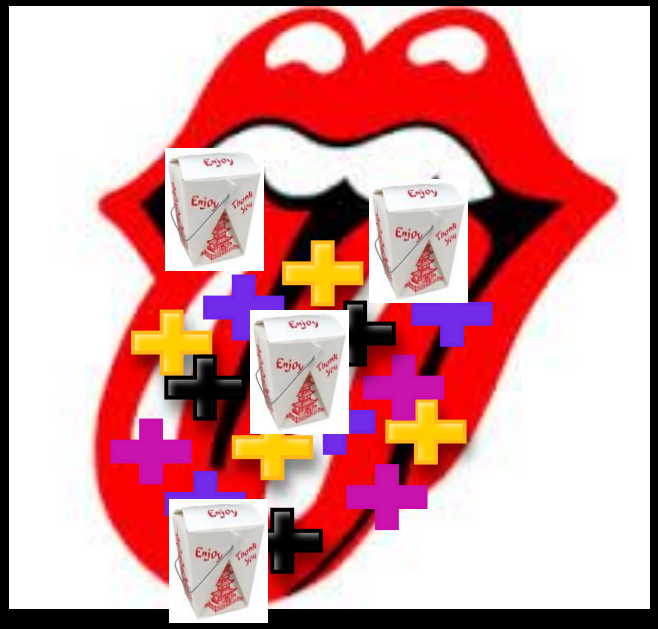
Receptors for various tastes, including sour, are distributed throughout the tongue!



What is sourdough?

A delicious tangy bread with a hard crust and soft chewy middle!

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Sourdough is the first bread

The first leavened breads ever made were likely sourdough

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Sourdough is a microbial ecosystem of wild yeast and bacteria called a starter

A sourdough starter is formed when yeast and bacteria from the flour, water, air and the baker inoculate a mixture of flour and water

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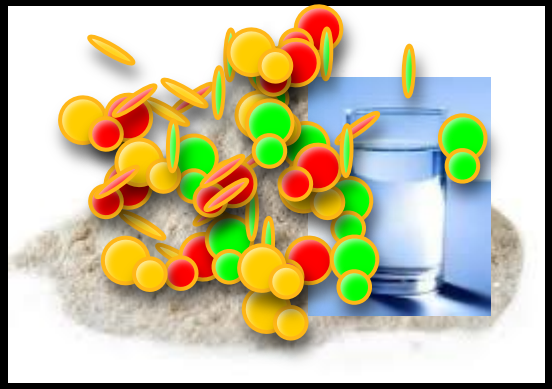
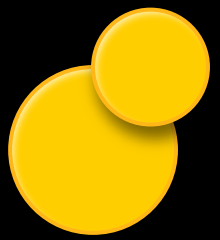
Sourdough starters can become stable over time

Repeated re-use of the starter creates a stable ecosystem dominated by a small number of different species of yeast and bacteria that grow well together but keep intruding microbes at bay



The sourdough microbiome

The lactic acid bacteria create acetic and lactic acids to sour the bread and the yeast create CO_2 and esters to leaven the bread and add character



Yeast– one or more species including. Species found including S.cerevisiae,Candida milleri, C. humilis and S. exiguous

Pulvirenti A et al 2004

Bacteria– one or more species especially a Lactic acid bacteria *L. sanfranciscensis*

T. F. Sugihara et al. 1971

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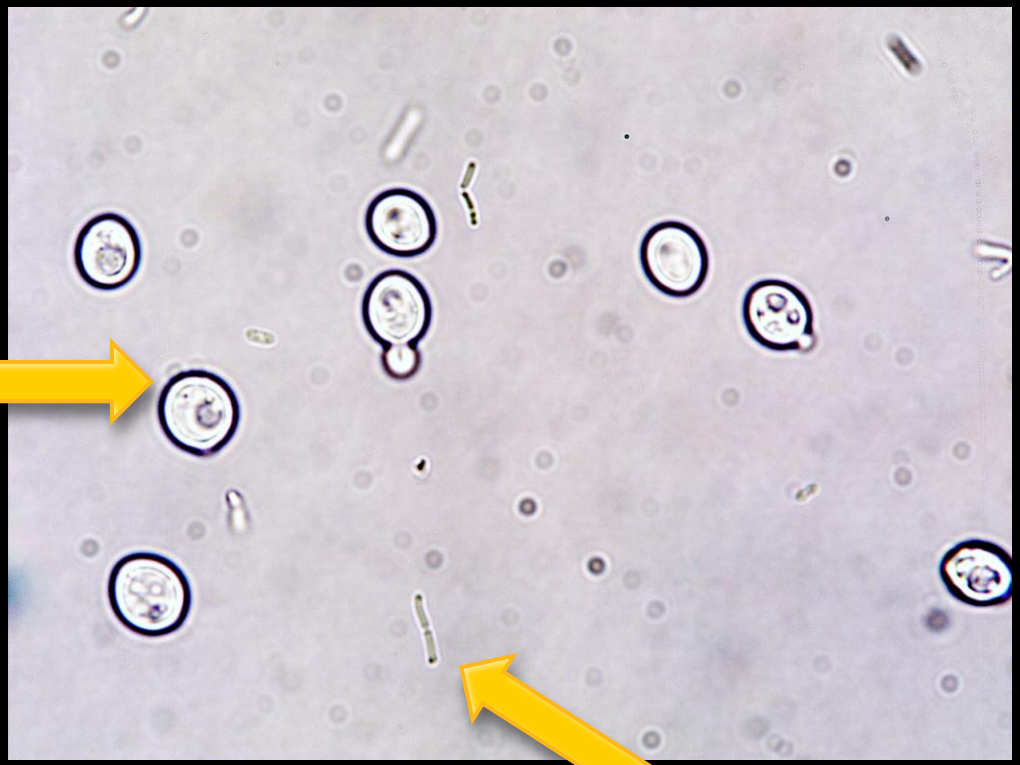
The Sourdough Microbiome



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Elegant symbiosis

T. F. Sugihara et al performed the first real scientific explorations of sourdough in the early 1970's

They found that most sourdough cultures contained just one dominant species of wild yeast and one of lactic acid bacteria

Remarkably, they found that in most cases, the yeast were unable to metabolize maltose while the bacteria relied almost solely on the maltose to create glucose and lactic acid

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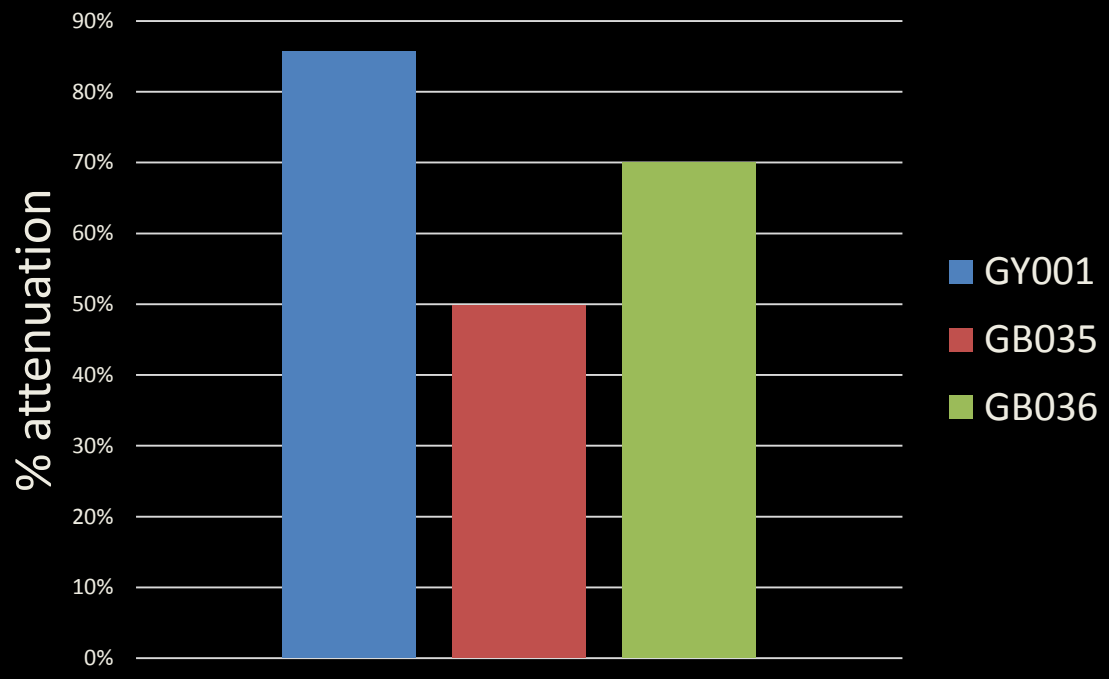
Uhhh. That's interesting. What about beer?

Attenuation

Souring

Beer Profile

Attenuation of sourdough cultures



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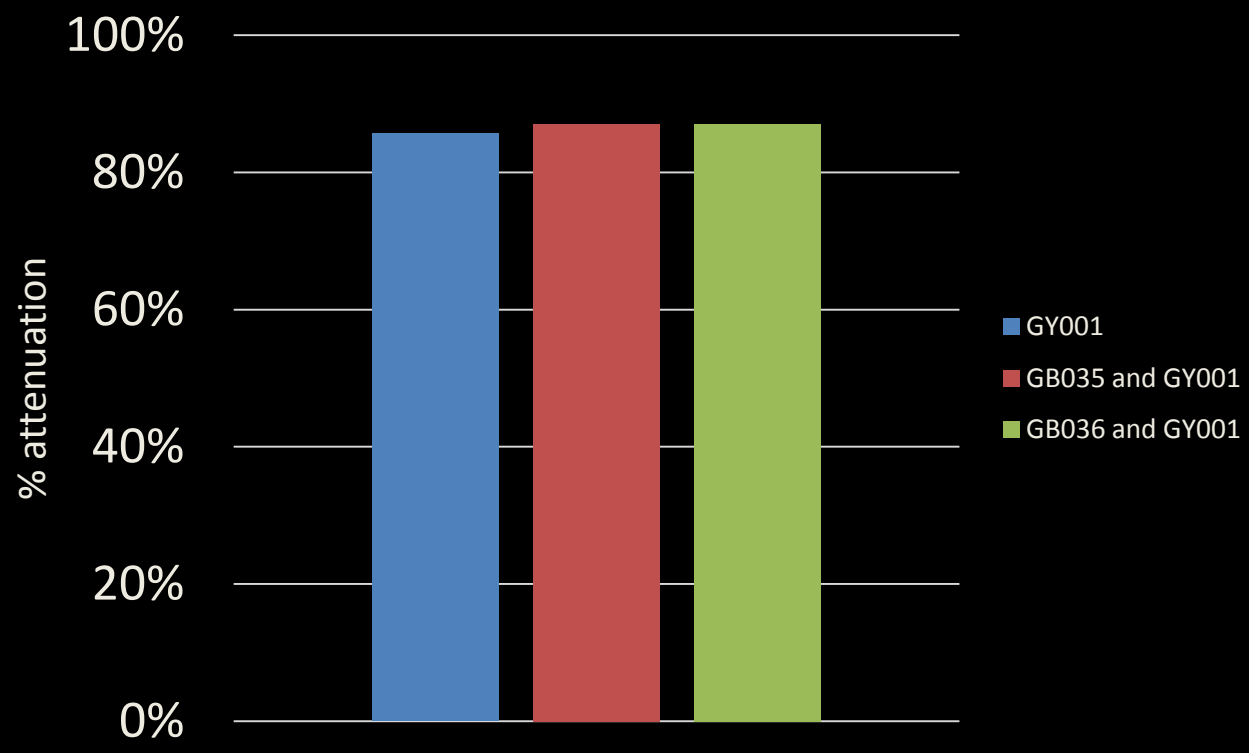
Add an ale yeast and sourdoughs attenuate well!



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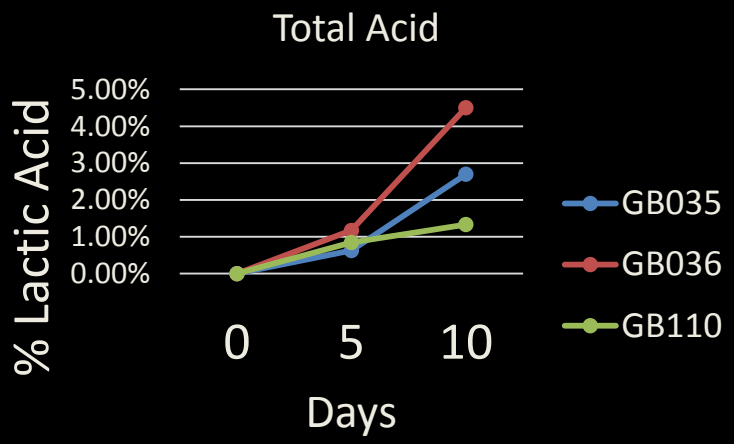
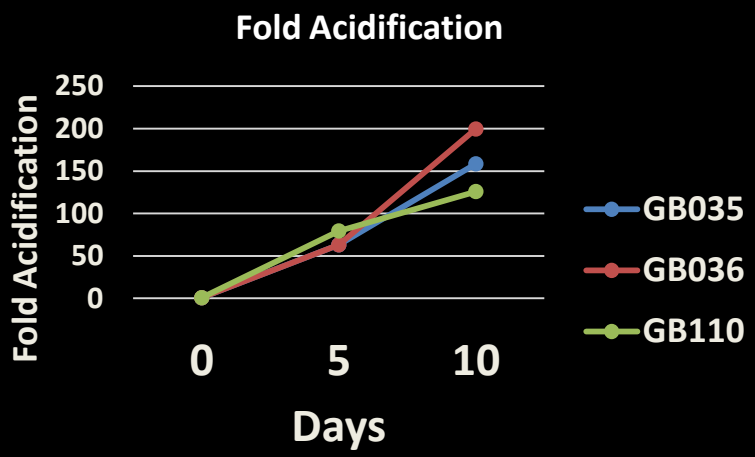
Souring of sourdoughs

The two most familiar lactobacillus sp. to brewers are *L. delbrückii* and *L. brevis*. *L. Sanfranciscensis* is a whole different animal… in fact the first time it was discovered was by Sugihara in 1971!

How does *L. Sanfranciscensis* compare to typical brewers lactobacillus?





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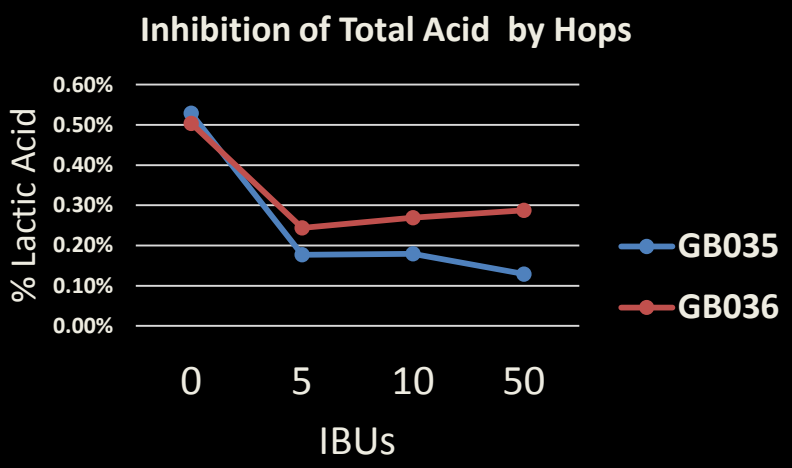
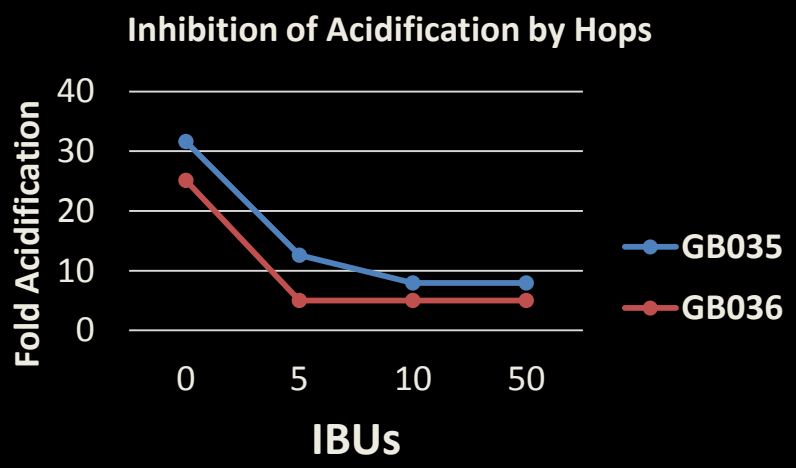
Hop sensitivity?





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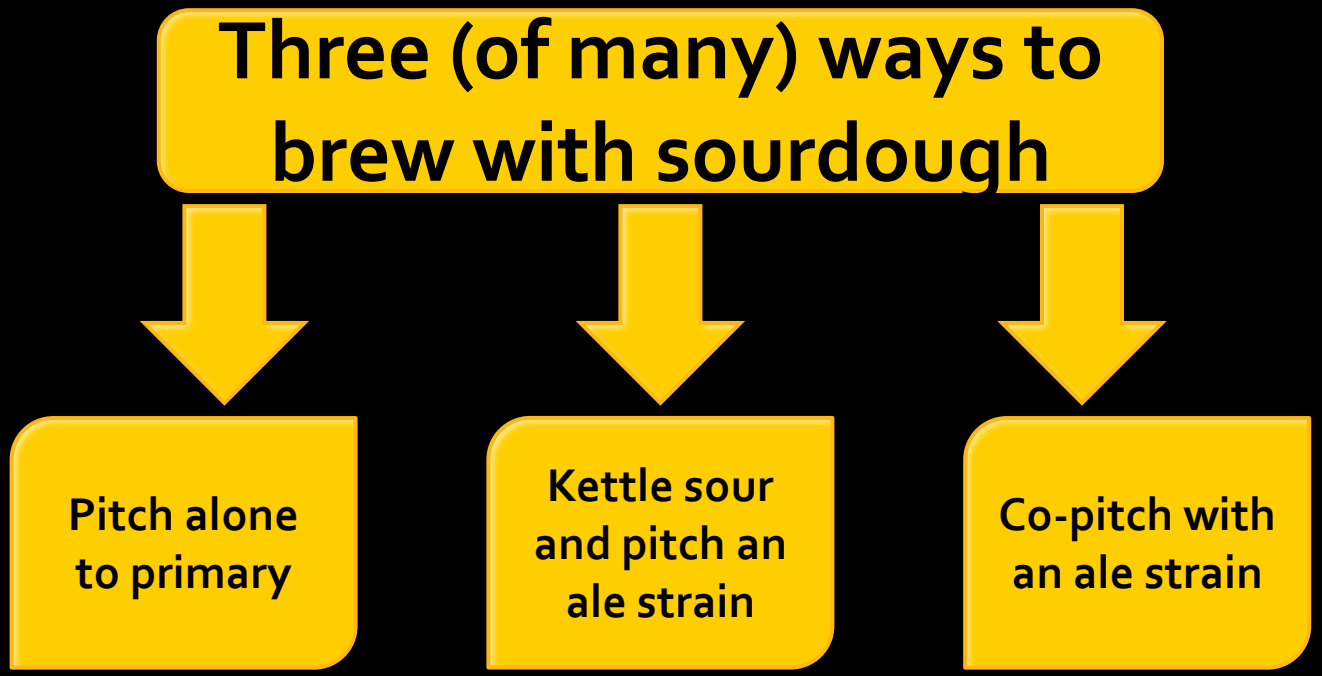
Flavor profile

Very interesting! Floral, sweet esters. Sour. Different than most ale yeasts and tasty

Final Notes



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