Sourdough

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North Carolina State University
Whole grains, holistic health.
Overview

- HOW to grow a starter
- WHY sourdough is so popular
- WHAT is happening in that jar
1 – How to make a starter

1. Mix flour and water.
2. Measure height.
3. Measure pH.
4. Sample for sequencing.
5. Backslop.
6. Add fresh flour and water. Mix.
7. Repeat steps 2-6 daily for two weeks.
Smelling your starter

photo credit: Lauren Nichols

http://robdunlab.com/projects/wildsourdough/
2 – Why is sourdough so popular?

photo credit: Lauren Nichols
Science of Sourdough

BACTERIA
from the environment

YEAST
from the environment (only the acid-tolerant yeasts survive)

FLOUR
Sugar & starch is food for the microbes

Acid
produced by bacteria
also produces sour flavor
produced by bacteria keeps other microbes from growing

Aromas
produced by yeast
contribute to complex flavors and smells

CO₂
produced by yeast
makes bread rise
and affects texture
Sourdough is a PRE-biotic.
When I bake bread, I give thousands of yeast organisms false hope by feeding them sugar, before ruthlessly baking them to death in an oven and eating their corpses.
Health benefits of sourdough

- vitamins B and K
- reduced glycemic index
- reduced gluten sensitivity
3 – What is happening in that jar??

NOTE: The following slides contain unpublished results. Please do not share any of the images or figures.
Lactic Acid Bacteria (LAB) increase over time.

Abundance of lactic acid bacteria (LAB)
Lactic Acid Bacteria (LAB) produce acid.
Acidity limits bacterial diversity.

Abundance of lactic acid bacteria (LAB)

pH of the starter after mixing

Bacterial diversity
...although Rye is an outlier.
sorghum

bacteria

yeast

all-purpose

whole wheat

rye

teff

BACTERIA

YEAST

sorghum

X

buckwheat

amaranth

photo credit: Erin McKenney
BACTERIA
YEAST

sorghum
buckwheat
teff
amaranth

all-purpose whole wheat rye

X

photo credit: Erin McKenney
Beta amylase unlocks sugars, fueling diversity.
I digress.

Back to the colonization story!
rotten, bodily odors
|   | Acinetobacter | Enterobacter | Enterococcus | Erwinia | Gluconobacter | Klebsiella | Lactobacillus | Lactococcus | Leuconostoc | Panoea | Pediococcus | Pseudomonas | Salmonella | Weissella | Other | NA |
|---|---------------|--------------|--------------|---------|---------------|------------|---------------|-------------|-------------|--------|-------------|------------|------------|-----------|-------|---|---|
| d6 | 0.2           | 1.9          | 0.6          | 0.2     | 5.2           | 6.8        | 27.8          | 6.4         | 8.3         | 2.3    | 5.5         | 10.4       | 0.2        | 14.4      | 1     | 9 |   |
| d3 | 0.3           | 3.1          | 1.3          | 1.1     | 2.9           | 11         | 9.5           | 8.6         | 4.3         | 3.5    | 16.9        | 0.3        | 16.8       | 0.5      | 16 |  |
| d2 | 0.4           | 3.3          | 1.8          | 2.6     | 0.2           | 11.1       | 8.1           | 4.8         | 5.5         | 5.3    | 18.4        | 0.3        | 16.9       | 0.6      | 19.1|  |
| d1 | 0.4           | 3.2          | 0            | 10.3    | 0             | 12.7       | 3.4           | 0.4         | 2           | 19.9   | 0.3         | 15.5       | 0.3        | 1.5      | 0.8 | 29.4 |

sour

rotten, bodily odors
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<th>Erwinia</th>
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<th>Klebsiella</th>
<th>Lactobacillus</th>
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<th>Leuconostoc</th>
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**Sour, bread**

**Sour**

**Rotten, bodily odors**

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*Image courtesy of Oldways Whole Grains Council.*
### Day 14

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*Photo credit: Erin McKenney*
Sourdough recipes!

- **bread** (whole wheat, rye, millet)
- **crackers** (whole wheat, amaranth, buckwheat)
- **pancakes** (whole wheat, buckwheat, oats)
- **waffles** (whole wheat, rye)
- **pizza dough** (whole wheat)