SOURDOUGH THEORY

by Greg Carpenter

Sourdough bread is the ultimate expression of the bread baker's art. The range of flavors and textures afforded by the sourdough process is unmatched by any other form of bread baking, leaving the creative baker unlimited possibilities. Yet sourdough baking is the simplest, most elemental form of baking. Essentially, all one needs to do is leave a mixture of flour and water out to ferment. It does not require commercial yeast. It requires 3 widely available ingredients: flour, water and salt. With proper adjustments it can be made with any flour, on any schedule and in any environment.

How does it work? ***The culture*** is the name we give to a collection of micro-organisms that has been cultivated in a medium of flour and water. There are many microorganisms in the mixture but only a few strains of bacteria and yeasts do most of the work. Fermentation of the natural sugars in the flour by these organisms leavens and flavors the dough. The leavening (or gassing) power of the starter primarily comes from the action of wild yeast organisms. The flavor development and acidity of sourdough primarily come from bacterial fermentation.

The initial source of these organisms can be just about anything: whole grains, fruit, vegetables. Whatever the source, the key is to encourage the growth of desirable organisms in the culture through controlled feedings, called **refreshments**, of fresh flour and water. By refreshing the culture with flour and water we can encourage the reproduction of the microorganisms that thrive on flour and water at the expense of those that don't. It's natural selection… Darwinism in a bowl.

Although some people like to start their cultures with apples, grapes, raisins or other yeasty fruits, none of these flavors will be present in the culture by the time you are ready to bake with it. I prefer to start sourdough cultures from the same grains that I will be baking with. I use organic whole rye or whole wheat flour to begin a new culture because it has plenty of natural flora and fauna and a lot of enzymes that help "jump start" fermentation. To begin a culture I simply mix the flour and water and wait for something to happen. After a day or two the mixture will become porous. Fermentation has begun.

Once fermentation begins, it is necessary to feed or refresh the culture with flour and water at regular intervals. If refreshment is neglected the acidity produced by the culture will inhibit fermentation and overwhelm the organisms, eventually killing them. Refreshment performs the dual functions of feeding the culture with fresh starches and diluting the acidity to a level that permits cultural growth.

After fermentation has begun, I switch to unbleached all-purpose flour or bread flour for the refreshments, preferably the same brand/type I'll be using when I make the bread. The enzymes in whole grain flours, while nice for "jump starting" a culture, will encourage a young culture to become too acidic too quickly. A wet (or liquid) culture

will also ferment very quickly so I choose to use a more controllable, firm culture for home baking.

It will be necessary to refresh your culture several times before the organisms come into equilibrium and your culture becomes stable. This is called **elaboration of the culture***.* In practice this can take one to two weeks. The initial refreshments will appear to progress quite slowly, but after five or six refreshments the starter should quadruple its volume in 8 hours. When it has achieved this level of activity it has reached equilibrium.

At this point the starter is stable. It is now called a "**starter**". You will use a portion of this every time you make a batch of sourdough bread and you will replace what you've used by refreshing what is left. In this way you will maintain a perpetual supply of *starter*. The *starter* can be kept indefinitely at room temperature if refreshed every 8 to 12 hours. I find that a 12 hour refreshment schedule works very well and can fit most people's schedule. An established *starter* can be stored for quite a while. Simply give it a refreshment and place it in the refrigerator. This will retard fermentation to a very low level. It will keep for 2 weeks or so without needing refreshment (some say longer). Just be sure to refresh it several times before the next time you want to bake with it. **When it is active enough to quadruple in 8 hours it's active enough to bake bread with.** After a few tries you will be able to fit sourdough into your schedule.

This is how I do it when I bake at home: If I plan on making final dough on Saturday morning I take my *starter* out of the refrigerator Wednesday evening and feed it at 8 p.m.. I feed it every 12 hours (at 8 a.m. and 8 p.m.). This uses about 3 minutes of my day. By Friday at 8 p.m. it's beautifully active and I can use it to make **levain** (the pre-ferment used when making sourdough bread). The *levain* ferments overnight and is ready to be used in the final dough on Saturday morning. Your results may vary, but you can adjust your refreshments to compensate. Starter is not active enough? Move it to a warmer place or refresh it with warmer water. Too active? Cool it off. Not active enough by Friday night? Take it out on Wednesday morning the next time so it gets one additional refreshment. It will respond to your input.

Sourdough also offers a greater level of tolerance for retarding a fully shaped loaf. Wild yeasts work more slowly than commercial baker's yeast, leaving many windows of opportunity for retarding. At Crooked Tree Breadworks we retard many of our fully shaped sourdoughs for 18 hours after they have already proofed for at least an hour. When done properly improves the flavor of the finished bread.

Another important thing to remember is to always maintain enough chef (another name for starter) for your bread recipe *plus* a refreshment so you don't run out.

Basic Starter Startup

Perform all of the following steps at room temperature with lukewarm water 85°F). After 1 week to 10 days you will end up with about 1/3 cup of ripe starter. This is enough to make a *levain* for your sourdough bread.

Step 1 Mix **120 grams Whole Wheat or Whole Rye flour** with **120 grams lukewarm water.** Put this mixture in a sealed container, preferably transparent. Place it in a warm place in your house and wait for it to bubble. After it has risen to its peak volume, is quite porous and begins to recede it is ready for step 2. This may take 2 to 3 days. Don't be put off by the smell… it will get better. Do not advance to step 2 until you see obvious fermentation.

Step 2 Take all of the smelly mess you created in step one and knead an additional **120 grams of unbleached (white) bread flour** into it until the lumps are gone, making a very firm dough. Clean your container and put the starter back into it. When the starter is very porous and sticky, advance to step 3. This may take a couple of days. Do not advance to step 3 until you see obvious fermentation.

Step 3 Measure out 60 grams of fermented starter and discard the rest or use it for another purpose (crackers, pancakes, etc). Mix the **50 grams starter together with 100 grams of organic bread flour and 55 grams of water**. Wash out your charismatic sourdough jar and put the starter back into it. Leave it to ferment for 24 hours. After 24 hours it should be gooey, full of holes and quite fragrant. If it is not, **let it sit until it is**. Do not advance to step 4 until you see this activity.

Step 4 From this point on you will be refreshing the starter as it is needed until it has reached equilibrium (meaning, until it quadruples its volume in an 8 hour period). This may take 4 or 5 more refreshments. Follow the same refreshment method you used at the beginning of step 3 (**50 grams fermented starter, 100 rgams All Purpose Flour and 55 grams water. Discard or find a use for the remaining starter**). Watch the sides of your sourdough jar and see how high the starter rises; it will leave tracks. When it has reached its peak and begins to fall it is ready for another refreshment. You will notice that it doesn't rise very high at first, but with each successive refreshment the starter becomes more active and rises a little higher. The time between feedings will decrease as the starter becomes more and more active. When the starter rises to quadruple its volume in an 8 hour period it has reached equilibrium. At this point it has become active enough to use as a to create the "levain" for your sourdough bread. It can be maintained indefinitely.

Step 5 **Maintaining the starter**. You now have a "ripe" starter. You can put it on the schedule that works for you. To maintain it, refresh with **25 grams ripe starter, 28 grams water, and 50 grams All Purpose Flour.** Knead this mixture into a firm dough and refresh it every 12 hours, either discarding the extra starter or using it to bake.

If you won't be using the starter for a while it can be tightly covered (immediately after refreshment) and placed in the refrigerator for up 2 weeks.

SOURDOUGH BREAD

This bread uses a pre-ferment called *levain*. It is the source of leavening and flavor for the final dough. The levain, however, uses a small portion of sourdough *starter* as its leavening agent instead of commercial yeast. The levain is also quite a bit firmer, starting out with the consistency of a firm dough. It is very forgiving of schedules. A levain mixed at 8 p.m. will usually be ready to use by 6 a.m. and can be used for up to 16 hours.

Levain (mix the night before)

45 grams active, firm sourdough *starter*

95 grams cup water at room temperature

125 grams All Purpose Flour

Knead all ingredients together until well combined in a firm ball. The levain will seem very stiff. If you absolutely cannot get all of the flour absorbed, sprinkle with additional water until you can. Let sit at room temperature overnight. A perfectly ripe levain will have risen to 2 to 3 times its original volume. It will hold its shape but will deflate slightly when pressed with a finger. If your levain has not risen, do not proceed until it has.

Final Dough

700 grams All Purpose Flour

530 grams water at 80°F (warmer if your kitchen is drafty). Reserve some to make adjustments.

20 grams salt

All of the levain from above

Mix all ingredients together. Adjust the dough texture to achieve a medium soft dough by adding as much of the reserved water as necessary. Knead the dough until smooth and elastic. The final dough should be extensible yet manageable. Place the dough in a lightly oiled bowl and cover tightly with plastic. Allow the dough to rise in a medium-warm environment (dough temperature should be **75-79**°F**) for 2 hours.** The dough should be elastic at this point but may not rise much. Gently deflate the dough by turning it over in the bowl. **Let rise two more hours**. Be sure the temperature stays in the 75-79°F range.

At this point there should be some gas bubbles in the dough and it should feel lively and elastic. Gently remove it from the bowl, divide into two pieces and lightly round them. Let rest, covered, for 20 minutes and then gently shape the dough however you wish. If you are going to retard the breads before baking, now is the time (see below)

Proof loaves in a couche, a proofing basket or a bowl lined with a well-floured tea towel for 2 to 4 hours or until loaves are significantly larger and present little resistance when gently poked. Score the loaves and bake at 475°F with heavy steam (or in a preheated Dutch oven) until dark brown, 30 to 45 minutes. If you are having trouble generating enough steam in your oven, mist the loaves with water just before scoring and loading them.

To retard these breads it is best to wait until the loaves are shaped. Due to the high acidity of the dough (which will continue to increase in the refrigerator), retarding the final dough before shaping does not work as well. After shaping, wrap the proofing board or basket in a plastic bag and let the breads proof until you see visible signs of growth (1 to 2 hours at room temp). Place them in the refrigerator for up to 18 hours. Remove from the refrigerator, let warm up for 1 to 2 hours and bake normally.

Trouble shooting: After every bake, take a minute to review the process you just went through. How long did the dough take to rise? Were the loaves easy to shape? Did they stand up proud on their way into the oven or did they droop? Did you get good "Oven Spring"? Did you change anything since the last time you made it (different flours, extra ingredients, different ambient temperature or humidity)? How did your changes affect the dough? Doing this over and over is the best way to improve your baking.

The most important thing to remember with sourdough is that faults in the bread are easiest to correct when discovered **early in the process**. Is the starter sluggish? Refresh it again before making levain. Is the levain sluggish? **WAIT** until it is ripe before making the final dough or move it to a warmer spot. Is the final dough sluggish after 4 hours of fermentation? If so, fold the dough once more (to give the culture a little shot of oxygen) and **WAIT** for signs of life. Be sure it is in a warm enough place. **Don't proceed until you see activity**. One more hour of rising time in a warmer environment should be all that is needed. Have patience. If you rush to shape the dough while it's sluggish you will increase the proofing time by several hours and may still get an under-risen loaf. Errors multiply exponentially, so it makes sense to take corrective action early.

COMMON SOURDOUGH PROBLEMS & POSSIBLE REMEDIES

PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
Levain doesn't rise	Weak starter	Be sure starter has been refreshed & is active
	Cold environment	Move levain to warmer place
Slow fermentation of final dough	Under fermented levain	Leave levain in a warmer place & be sure starter is active
	Cold dough temp	Move levain to warmer environment. Use warmer water next time.
	Dough too dry	Add more water to final dough next time
Slow rising of shaped loaves	Under fermented dough	Check all possible causes listed above
	Cold environment	Try a warmer area for proofing (rising) the dough
	Bad music	Try Zydeco!
Loaf deflates in oven or while loading into oven	Shaped loaves proofed too long before baking	Reduce proof time or ambient temperature
	Dough too weak	Increase kneading, increase bulk fermentation time before shaping, and/or punch and fold the dough one more time.
Finished loaf is flat and wouldn't hold its shape, but dough was active	Dough too wet	Reduce water in final dough next time
	Poor gluten development	See "dough too weak" above recommendations & try next time
Finished loaf is small & dough was inactive	Under-fermented final dough	Increase primary fermentation time
	Dough too dry	Increase water in final dough next time
Finished loaf "explodes" where scored	Under-proofed loaves	Let proof longer next time
	Insufficient steam	Mist loaf with water before loading into oven next time