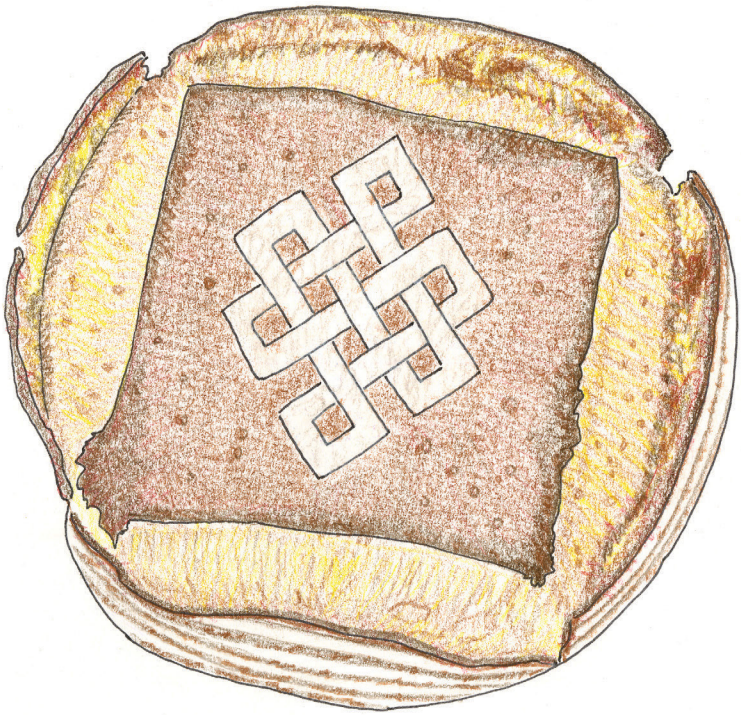
SOURDOUGH BREAD



By Joan Rasmussen

This booklet is a small collection of what I have learned during my personal journey through bread baking. The process has had both success and failure, all the while teaching me patience and permanence. As a result, my life has taken on a slower and more attentive rhythm. Learning about sourdough fermentation has truly been a blessing as both my body and soul are nourished! Even more, you get to share delicious bread with your loved ones.

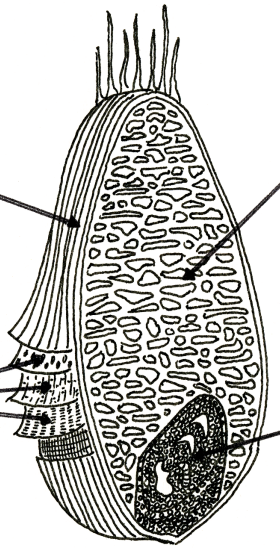
In the following pages, you'll find brief explanations of and some doodles on fermentation, sourdough cultures, bread formulas, scheduling, the hands-on process, and tips on troubleshooting unsatisfactory bread. With this, open your senses, take good notes, remember to be patient, and most of all, have fun! With love, Joan

"For all the many parts of baking that require your hands, dedicate yourself to focusing your attention when mixing, folding, dividing, shaping, and scoring. The hands have an astonishing capacity for memory; when your baking is no longer primarily a cerebral act but more of a tactile one, you have arrived at a place of experience and skill … then your experience can speak to your imagination, and you will develop new breads that suit your personal tastes. Experiment, play, realize that failure isn't really failure, it's an edible part of your evolution as a baker. No two bakes will ever be exactly identical, nor need they be; if they were the same time and time again, wouldn't the bread-baking process sooner or later become boring?

Hearing, touching, smelling, seeing, and tasting -- bread is about all of these. The bread is always talking to us, and only when we open ourselves fully -- mind and senses together -- do we slowly begin to learn the subtle, but quite articulate, language of bread."

Quotation from Bread by Jeffrey Hamelman

WHEAT KERNEL



PERICAP
protective layer, not milled

ENDOSPERM
82.5% - 83.5% of kernel, made of starch, proteins, and water

BRAN
14% of kernel, made of cellulose and minerals

GERM
2.5% - 3.5% of kernel, made of vitamins, minerals, and fats

SOFT vs HARD

lower vs higher protein

pastry vs bread

RED vs WHITE

white has recessive gene for bran, which also has a milder flavor

SPRING vs WINTER

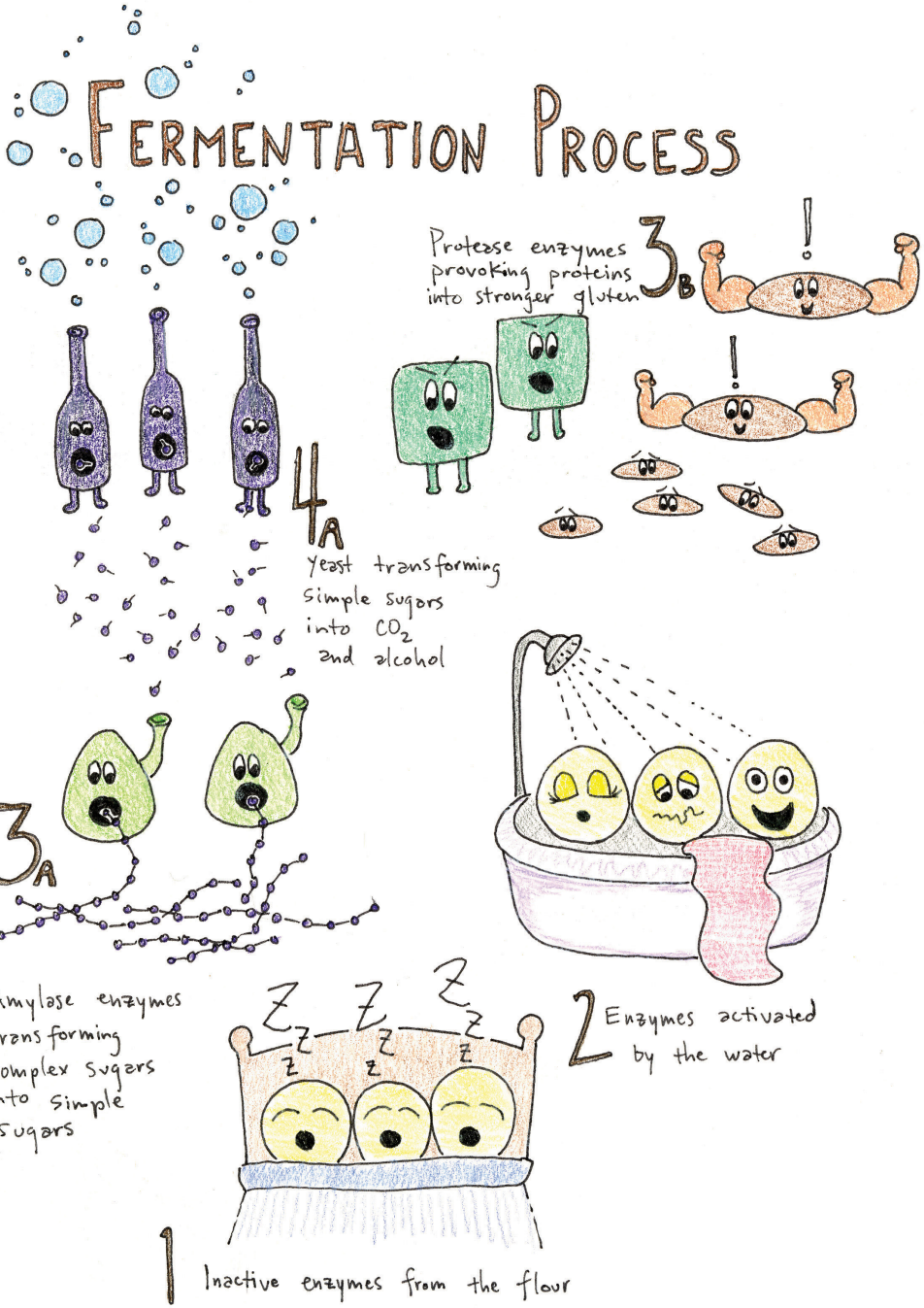
higher gluten (13% - 15%)
vs
lower gluten (11% - 12%)

FERMENTATION

Fermentation is the breakdown of compound molecules in organic substances under the effect of yeast and/or bacteria. For bread baking, alcoholic fermentation gives the following characteristics to bread: strength, flavor, aroma, color, volume, and shelf-life!

So how does this happen? Well, when moisture, food, oxygen, and an appropriate temperature exist, the yeast's (whether commercial or natural) life cycle is activated! The 'moisture', which is generally water, allows yeast, which is naturally present in the flour, to absorb nutrients through the cell membrane, which then releases enzymes. The 'food' for these enzymes are the sugars that are also naturally present in the flour. There are both simple sugars—glucose and fructose—and complex sugars: saccharose, maltose, and starch. The enzymes that generate sugar degradation, which cause the production of alcohol and carbon dioxide, are called amylase enzymes. 'Oxygen' is incorporated during mixing. It allows for yeast reproduction and it chemically reacts with the molecules of protein, which are again naturally present in the flour. Two specific proteins, glutenin and gliadin, form gluten, which captures the carbon dioxide that is released during fermentation causing the crumb holes, called alveoles. The enzymes that provoke protein degradation are called protease enzymes. Finally, yeast activity is possible between 50F and 116F, while the thermal death point for yeast is 138-140F. 'Time' is the final necessary piece in the fermentation process. It can vary widely as there are infinitely many schedules for baking breads that can last between just a few hours and a couple of days.

Fermentation Process



"Adapted from Advanced Bread and Pastry by Michel Suas"))

LEVAIN

Levain is a sourdough culture that is matured enough to be used to ferment the final dough.

To start a culture, you need flour, water, oxygen, time, and microorganisms. Flour contains the food, water allows the yeast to start fermentation, oxygen is obtained through mixing, and we have time until we don't. Finally, microorganisms are everywhere: in the air, on the baker's hands, in the flour, etc. In fact, one gram of flour has about 13,000 cells of wild yeast and about 320 cells of lactic bacteria! Starting a culture will not be discussed here, but can be done with time and minimal effort. Once you have an established culture, which rises and falls predictably, you will be able to successfully bake sourdough bread. A healthy starter will generally rise two to three times its initial volume. As a starter matures, its flavor and aroma change from sweet and wheaty to tangy and sour. The starter needs to be fed when the surface starts to become concave, or collapsed, in the center. It's ready to be used as levain when it floats in water. To check this, remove some of the starter from its container and set it in a glass of water. Does it float?! If yes, bake bread!

How do you maintain a starter? See the next page for feeding schedules. Perhaps you want to do less frequent feedings? Well then, place the starter in the refrigerator and feed once every week or two. When taken from the refrigerator, feed the starter using Scenario Two and leave at room temperature. Four to eight hours later it should double in size. Put the starter back into the refrigerator, or if baking bread, do a second feeding before trying the float test.

When baking, remember to make enough levain for both the bread formula and some extra to refresh your starter. For both formulas, you can multiply each ingredient by a

factor of two to get 200g total or by three to get 300g total, etc. Next, fermentation times may vary depending on both room temperature and the health of the starter. Finally, you'll find that as seasons change, your starter, and subsequently your bread, will too. In warmer months, the starter will mature/ripen more quickly than in colder months. Feel free to make adjustments to these formulas as necessary. For example, warmer water, more water, and more starter will speed up fermentation, while cooler water, less water, and less starter will cause it to grow/ripen more slowly.

LEVAIN FEEDING -- for a starter sitting at room temp!

Scenario One -- slow growing stiff levain -- feed once daily

Ingredient	Percentage	Weight
White flour	50%	26g
Whole wheat flour	50%	26g
Starter	10%	6g
water	80%	42g
TOTAL	190%	100g

Scenario Two -- fast growing stiff levain -- feed twice daily

Ingredient	Percentage	Weight
White flour	50%	22g
Whole wheat flour	50%	22g
Starter	50%	21g
water	80%	35g
TOTAL	230%	100g

PAIN AU LEVAIN

ingredients

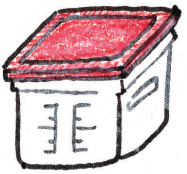
WATER

WHOLE WHEAT & WHITE FLOURS

SEA SALT

SOURDOUGH STARTER

tools



STORAGE CONTAINER

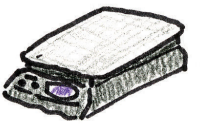
THERMOMETER

LAME & RAZOR

BENCH KNIFE

DATA & NOTES

BANNETON



SCALE

MIXING BOWL

TIME PIECE

DUTCH OVEN

plus a refrigerator & an oven!

BREAD BAKING PROCESS

The bread baking process is comprised of both fermentation steps, which are hands-off, and steps of working with the dough. The process begins with scaling appropriate weights of each ingredient. It's important to be accurate in scaling, as this leads to consistent and uniform loaves and allows for accurate troubleshooting. It is easiest to scale correctly if you first scale the water (remember to calculate the temperature - explanation in the following pages) and then the levain; afterwards agitate to evenly disperse the levain in the water. Next and in a separate bowl, scale the flours and salt.

The second step is called mixing. Add the dry into the wet then mix and squeeze until the dough is smooth. Be sure to scrape the sides down to incorporate everything. Always use a clean, wet hand to avoid stickiness! If you are doing an *autolyse*, first mix the water and flours then 15 - 60 minutes later add the levain, salt, and a little reserved water. French Professor Raymond Calvel discovered that this technique, of specifically holding the salt and sometimes the levain, better hydrates the flour's proteins, making for better gas retention. It also increases protease enzyme activity which makes the dough more extensible. A few more notes on mixing: hand mixing requires more folds than using a stand mixer; more whole wheat requires more mixing time; fats, like butter and oil, require a longer mixing time; things like seeds, fruits or nuts should be incorporated after mixing and during the first fold.

Once you have a smooth and somewhat shiny dough, move the dough from the mixing bowl into an oiled container with a lid. This waiting/resting period is called the bulk

or first fermentation and it is the third step. During this time, you will fold the dough to help strengthen the gluten network, to degas the dough, and to equalize the dough's temperature. Stretching the dough allows it to attain a balance of extensibility, tenacity, and elasticity. You'll often hear bakers refer to a dough's weakness or strength; a strong dough has a balance of the three.

The next step is dividing the dough mass into smaller predetermined weights. This ends the bulk fermentation. Flour your hands and the table surface to avoid sticking and ripping the dough. Try to cut the dough as close to the goal weight as possible as extra small pieces piled on top hinder the potential for a nice open crumb. Following the divide is the preshaping step. You should work the dough until the surface is taut and you have an even, round boule, but be careful to not overwork the dough which will tear the surface! Let the pre shaped dough rest on the shaping table, seam side down; this step is called the bench rest. Once the dough is again relaxed, you can shape the dough according to its desired loaf destiny: a boule/round, an oblong/batard, a baguette, a braid, rolls, etc. Whichever the case, remember to build good surface tension!

Move the shaped dough into a rice floured basket seam side up for its final resting period before baking. This is called the final fermentation. The baker should be able to determine if dough has proofed enough by applying gentle pressure with the fingers. A loaf that is READY to bake should spring back a little after being pressed, yet retain a light indentation. Under-proofed dough will spring back very quickly and feel firm to the touch, while over-proofed dough will keep the indentation and remain flat (or start to deflate) where the baker presses down.

Preheat the dutch oven as the oven is heating. Carefully, flip the proofed dough, which will now be seam side down, into the dutch oven. The next step is scoring; under-proofed dough can take a deeper cut, while over-proofed dough requires a more shallow cut. The angle of the blade determines the thickness and look of an ear. Finally, perpendicular cuts encourage vertical expansion, while parallel cuts encourage horizontal expansion. You can find common scoring patterns in the following pages. Once scored, replace the lid and load the dutch oven back into the oven.

The next to final step is baking, which needs high heat and steam. In this case, the bread will steam itself. Steam creates a thin layer of water on the surface of the dough, which allows for loaf expansion. It also slows surface evaporation and delays crust formation, which leads to a thinner, crispier crust with a glossy finish. Use more steam for under-proofed dough and less steam for over-proofed dough. This can be difficult to control with home baking - sorry!

The final step in the bread baking process is cooling. Sourdough breads do not come into their own until they are fully cooled! To prevent/prolong staling, make sure the cooling bread has an adequate air current. Do not store bread in the refrigerator and, if freezing, wrap the bread tightly first. Finally, if the bread is stale, reheat it to its core and eat it quickly!

THE IMPORTANCE OF TEMPERATURE

The dough's temperature is very important. Next to the health of your levain, it is perhaps the most important. The ideal temperature for most bread doughs is between 74F - 77F. This target temperature is called the Desired Dough Temperature (DDT). If a dough is too warm, fermentation will move too quickly and its tolerance will be reached before the proper strength or flavor can be developed. If a dough is too cold, then fermentation is dreadfully slow. So, how does the baker attain the dough's DDT?

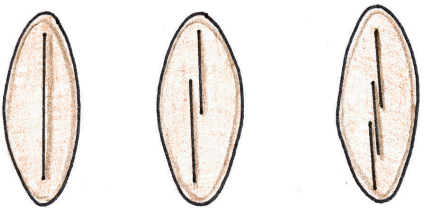
Most commonly, the factors that contribute to DDT are: flour temperature, water temperature, room temperature, and the friction factor, which is the heat added by mixing. For hand mixing, 5F is generally appropriate for the friction factor. The only controllable factor for the baker is the water temperature! Hence, the baker calculates the water temperature to be used based on the actual temperatures of the room and flour. Again, the goal of doing this math is to achieve the desired dough temperature with a desired fermentation schedule.

How do you calculate the temperature for the water? By using a math equation based on averages, of course!

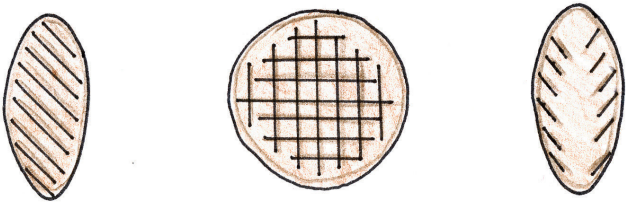
(DDT x 3) - room temp - flour temp - friction factor = water temp

For an example, let's say that the room temp is 72F, the flour temp is 65F, and you are hand mixing. Your DDT is 78F. First multiply, 78F x 3 = 234F. Then subtract, 234F - 72F - 65F - 5F = 92F, which is the water temperature to be used! Woo, done!

SCORING



classic cuts



sausage cut

criss-cross or polka cut

chevron cut

square cut

straight-line cut

cross cut

diamond cut

BREAD BAKING AT HOME

Schedule One: bread in one day

- ❑ 7am: Mix levain using Feeding Scenario Two and a DDT of 80F. It should be ready for use in 3-6 hours -- remember, it will float in water when properly fermented. Mix twice the levain amount to have enough for the bread and to feed your starter.

- ❑ About 11am: Calculate water temperature and mix dough until well incorporated with a DDT of 80-84F. (This warmer temp is good for colder weather! In warmer weather, return to 74 - 77F.)

INGREDIENT	PERCENTAGE	WEIGHT
White flour	80%	280g
Whole wheat flour	20%	70g
Water	72%	253g
Levain	40%	140g
Salt	2%	7g
Malted barley	0.1%	0.35g
TOTAL	214.1%	750.35g

- ❑ Move the dough from the mixing bowl to an oiled container for bulk fermentation. Record your dough temperature and set a repeating timer for folds every 20 minutes.

Four to six folds over the next two hours should be good. Let the dough rest for a third hour. (If the dough is weak give it another fold or two.)

- ❑ About 2pm: Preshape the dough into a round and let rest seam side down and covered for half an hour. Once rested, shape the dough into a round and place seam side up in a floured banneton (a mixture of whole wheat and rice flours works great!). Cover with a towel and let rest in the warmest room, assuming it is between 70-80F.

- ❑ The final fermentation takes another 2-4 hours. The dough is ready when you poke it and the indention springs back slowly but remains slightly on the surface of the dough.

- ❑ 4-8pm: Preheat oven to 500F with the empty dutch oven. Remove the dutch oven carefully! Flip the dough seam side down into the pan and score the top surface (deeper if underproofed, shallower if overproofed). Replace the lid and bake for 20 min. Remove the lid and bake another 12-25 minutes. The bread is done once the crumb reaches a temperature of 197F -- you can check the temperature by poking a thermometer into the center of the loaf. Take care not to let the thermometer touch the pan or crust - they will be hotter!

** Fermentation times may vary depending on room temperature and dough temperature! **

BREAD BAKING AT HOME

Schedule Two: bread over two days

- ❑ 7am: Mix levain using Feeding Scenario One and a DDT of 80F. It should be ready for use in 10-11 hours -- remember, it will float in water when properly fermented. Mix twice the levain amount to have enough for the bread and to feed your starter. *Note that you could also mix levain about 2pm using Feeding Scenario Two and a DDT of 80F. It should be ready for use in 3-6 hours.
- ❑ About 6pm: Calculate the water temperature and mix dough until well incorporated with a DDT of 80-84F. (This warmer temp is good for colder weather! In warmer weather, return to 74 - 77F.)

INGREDIENT	PERCENTAGE	WEIGHT
White flour	80%	322g
Whole wheat flour	20%	82g
Water	72%	290g
Levain	12%	48g
Salt	2%	8g
Malted Barley	0.1%	0.4g
TOTAL	186.1%	750.4g

- ❑ Move the dough from the mixing bowl to an oiled container for bulk fermentation. Record your dough temperature and set a repeating timer for folds every 20 minutes.

Four to six folds over the next two hours should be good. The dough should be more billowy and can be placed in the refrigerator. You can leave the dough out another hour if the fermentation seems slow.

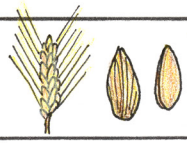
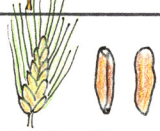
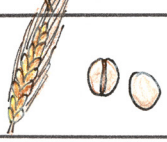
- ❑ On the next day, take the dough from the fridge (it should be about double in size). Preshape the dough into a round and let rest seam side down and covered for half an hour. Shape the dough into a round and place seam side up in the floured banneton (a mixture of whole wheat and rice flours works great!). Cover with a towel and let rest in the warmest room, assuming it is between 70-80F.

- ❑ The final fermentation takes another 2-4 hours. The dough is ready when you poke it and the indention springs back slowly but remains slightly on the surface of the dough.

- ❑ Preheat oven to 500F with the empty dutch oven. Remove the dutch oven carefully! Flip the dough seam side down into the pan and score the top surface (deeper if underproofed, shallower if overproofed). Replace the lid and bake for 20 min. Remove the lid and bake another 12-25 minutes. The bread is done once the crumb reaches a temperature of 197F -- you can check the temperature by poking a thermometer into the center of the loaf. Take care not to let the thermometer touch the pan or crust - they will be hotter!

** Fermentation times may vary depending on room temperature and dough temperature! **

grains w/ GLUTEN

Einkorn		the oldest cultivated wheat, flavor is grassy & nutty, has delicate glutem
Spelt		aka Dinkel, heirloom wheat variety, gluten is more extensible & less elastic, softer wheat with less tolerance for high hydration and long rising times, higher in protein & vitamins
Emmer		aka Farro, ancient hard durum wheat, more delicate glutem and higher in protein than common wheat
Kamut		aka Khorasan, large, hard durum wheat, 20-40% higher in protein than modern wheats, can be used well in bread and pastry
Semolina		flour made from durum wheat, sweet flavor
Rye		traditionally Eastern & Northern European as it thrives in adverse conditions, not wheat, sour/tangy flavor, low in gluten and high in pentosans,, higher bran & fiber so absorbs more water
Barley		believed to be the oldest cultivated grain in the world,, not wheat,, high in fiber and low in gluten,, earthy flavor,, good for pastry too

grains w/ NO GLUTEN

Buckwheat		pseudocereal from plant closely related to rhubarb, no gluten, strong earthy flavor
Corn		sweet flavor, no gluten, adds glistening viscosity to bread if added as a polenta porridge
Oats		high in protein, fat, and fiber, no gluten, adds wholesome richness and tender body, good for porridge in bread and for pastry too
Brown Rice		white rice with the bran, germ, and oils left intact, no gluten, great flavor and good for porridge in bread
Millet		small cereal from seeded grass, no gluten, common in Africa & Asia
Amaranth & Quinoa	 	high in nutrients (about 60% more than wheat & barley), amaranth is particularly high in Lysine (an essential amino acid),no gluten, both are closely related to spinach & chard with a nutty chardlike flavor

MAIN DEFECTS OF SOURDOUGH BREAD

Baking unsatisfactory bread can be frustrating and confusing. To help with the latter, use the following to help troubleshoot your bread's defects.

1. The bread lacks acidity and has a flat flavor:
    a. Increase the fermentation time.
    b. Find a warmer and more humid place for the bulk fermentation.
    c. Increase the amount of levain.
    d. The levain was too young – let it go longer.
2. The bread has an excess of acidity and a sharp flavor:
    a. The sourdough culture is old – perhaps start a new one.
    b. Be more consistent in feeding the culture and do the feedings more often.
    c. The levain amount is too much in the final dough – reduce it.
3. There is little development in the bread:
    a. Not enough fermentation activity / low gas production – use warmer water temp.
    b. The sourdough culture is not active enough – do not keep it in fridge, revive it for longer, and use warmer water temperature.
4. There is little strength in the bread:
    a. The dough lacks acidity – give it a longer first fermentation.
    b. Do more folds.
    c. Not enough levain – increase the amount of levain.
    d. Final dough temperature is too cold – use warmer water temperature.