Gemüse

zutaten.

für den anfang:

Salz (2% d. Wassermenge)
Wasser
Gemüse, z.B Radieschen

(ggf. eine Messerspitze frischen Knoblauch / Pfeffer / Lorbeerblätter)

Brühe (%)	0.5 l
2	10 gr
3	14 gr
3-5	18 gr
5	26 gr
10	51 gr

Richtwerte / Salzanteil der Brühe

Lactobacillus plantarum

2%-Brühe: Kimchi, Sauerbraut, Blumenkohl, Karotten, Salsa, grüne Bohnen

3,5 bis 5%-Brühe: Paprika, Zwiebeln und Gurken

5% bis 10%-Brühe: Püree/Saucen

zubereitung.

Die Zutaten wie Radieschen, Karotten oder gemischtes Gemüse in ein Glas geben und dann die Salzlake und je nach Geschmack, verschiedene Gewürze hinzufügen.

Die auf den Zutaten vorhandenen Milchsäurebakterien beginnen mit der Zersetzung des Zuckers und machen die Salzlake sauer, was wiederum die Konservierung der Lebensmittel garantiert, da die schlechten Bakterien, die den Inhalt verderben würden, in dieser sauren Umgebung nicht überleben können.Um das Gemüse knackig zu halten, werden traditionell gerbstoffhaltige Blätter von Weintrauben, schwarzem Tee oder Meerrettich darauf gelegt, um die Zutaten in der Salzlake zu halten. Zudem muss der Inhalt mit einem Gewicht in der Lake gehalten werden. Das Hinzufügen eines gerbstoffhaltigen Elements im Glas ist kein Muss, aber es trägt zur Textur bei.

Bei Zimmertemperatur fermentieren lassen, bis die erste Fermentation abgeschlossen ist und keine Gase mehr vorhanden sind. Die Deckel von Schraubgefäßen nur leicht zudrehen, um das Entweichen von Gasen zu ermöglichen. Je nach Art des Gemüses kann die Fermentation 4-5 Tage (z.B. bei Radieschen) bis einige Wochen dauern. Optimal funktioniert eine Kombination aus Komponenten, die eine ähnliche Textur und Dichte haben.

Bon appétit

wild & radical

Experimentiere mit der Würzung - z.B. Nelken & Lorbeer für Rüben, Kräuter & grüner Pfeffer für Lauch; Lavendel für Karotten & Rettich für eine angenehme florale Note etc.

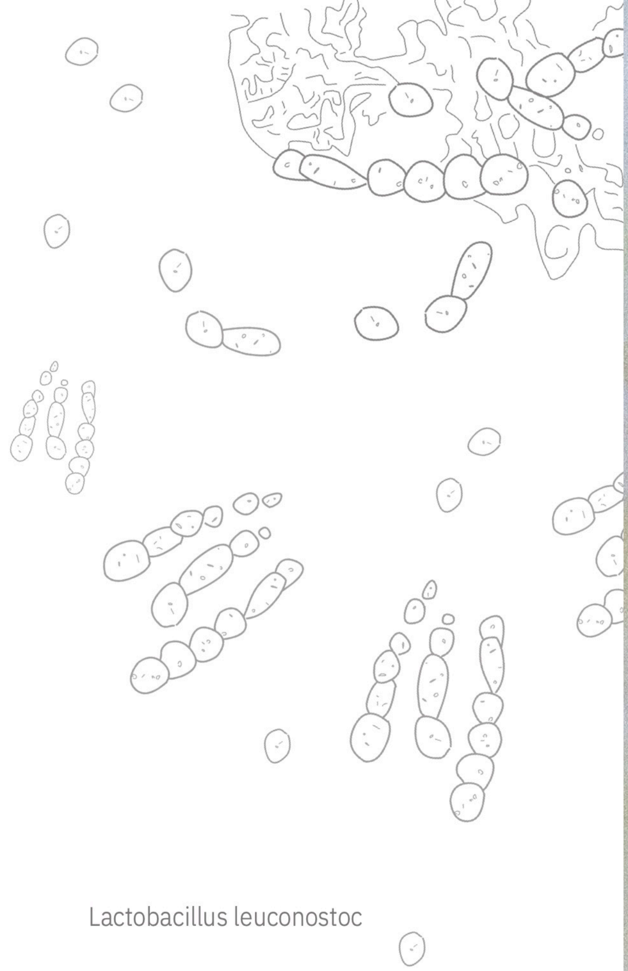
Verwende saisonale / gesammelte Zutaten; Obst kann hierbei bis zu 20% des Gemüses ersetzen. Erkunde das Terroir mit dem Sammeln & der Zugabe von Wildkräutern.

Radieschen mit einem Hauch Knoblauch. Fermentierte grüne Tomaten. Fermentierte gebackene Kartoffelecken. Fermentierte Wassermelonen-Rinde.

Formidable

Sauerkraut & Starterkulturen

zutaten.


Lactobacillus leuconostoc

für die basis:

17 gr Salz (2% der Masse)
800 gr Weißkohl

(auch möglich mit Zugabe von Karotten / Kürbis etc.)

für mehr würze:

Pfeffer
Fenchelsamen
Pfeffer
Kümmel
Kurkuma

zubereitung.

Zuerst den Weißkohl fein hobeln oder fein in Streifen schneiden und in eine Schüssel geben. Danach den Kohl salzen und für einige Minuten das Ganze einmassieren, damit das Salz dem Kohl Wasser entziehen kann und dieser in seiner Lake weiter fermentieren kann.

Nach einigen Minuten sollte eine anständige Menge Salzlake entstanden sein, nun kann mit dem Schichten begonnen werden. Dafür im Vorraus das Einmachglas sterilisiren, damit die Bakterienbildung verhindert wird. Zum Schichten immer eine Handvoll Kohl ins Glas geben und fest in den Boden drücken, diese Schritte so oft wiederholen bis alles ins Glas gepresst wurde. Dabei sollte der Kohl immer mehr an Wasser verlieren, sodass dieser am Ende bedeckt in Salzlake ruhen kann. Dabei sollte noch genügend Platz im Glas gelassen werden (4-5 cm) um dem Kohl genügend Raum zum arbeiten zu bieten und unter anderem Gewichte bzw. Kohlblätter unterzubringen.
Das Ganze mit Gewichten abdecken oder einem Kohlblatt, dabei ist zu beachten, das alles mit ausreichend Flüssigkeit bedeckt ist.

Das Sauerkraut nun 3 - 4 Tage bei Zimmertemperatur gären lassen. Gärgase nach Bedarf entweichen lassen / Deckel nur auflegen oder mit Klammern befestigen (Explosionsgefahr!). Das Glas anschließend in den in den Kühlschrank stellen und langsam weiterfermentierten lassen. Darauf achten das das Ferment immer mit Flüssigkeit bedeckt ist, damit keine Bakterien ins Ferment selbst gelangen können.

Bon appétit

wild & radical

Das Sauerkraut Ferment ist Basis für viele weitere Rezepte und wird oftmals als Starter Ansatzt weiterverwendet. Experimentiere dabei mit verschiedenen Gemüse Fermenten und der geimpften Geschmackskomponente des Sauerkrauts. Das Sauerkraut an sich kann ebenfalls gut recycelt werden - als Suppenzusatz für beispielsweise Bortsch, Gemüsesuppen etc. Doch auch in getrockneter Form gibt das Sauerkraut eine wunderbare Würze für jegliche Gerichte ab. Probier es doch mal im Cheez.

Formidable

Kimchi

zutaten.

für die basis:

17	gr	Salz (2% der Masse)
800	gr	Chinakohl

(auch möglich: Karotten / Rettich / Lauch(zwiebeln) etc.)

für die würzung/paste:

3 - 4		Knoblauchzehen
2 - 4	EL	milde Chiliflocken
1	TL	scharfe Chiliflocken
78	ml	Wasser /Gemüsebrühe
		ein Stück Ingwer
		(etwas Miso /Sojasoße)

mehr Knoblauch / Ingwer / Chili für Liebhaber

Lactobacillus leuconostoc

zubereitung.

Zuerst den Chinakohl in eine Schüssel geben, salzen und die Zutaten für 10 Minuten sanft massieren. Den Inhalt ruhen lassen.
10 Minuten ruhen lassen.

Den Vorgang zweimal wiederholen, bis der Kohl weich ist.
Nun sollte eine anständige Menge Salzlake entstanden sein. Zugaben wie Rettich, Karotte etc. in dünne Streifen schneiden (Chiffonade). Den Knoblauch und den Ingwer hacken und alle anderen Zutaten bereitstellen.

Alles in eine Schüssel geben, auch die Gewürze, das Wasser (die Gemüsebrühe) hinzugeben und mit(sauberen!) Händen den Inhalt noch einmal 3 - 4 Minuten lang massieren, bis er saftig ist.

Das Kimchi in ein Glas füllen und 3 - 4 Tage bei Zimmertemperatur gären lassen. Gärgase nach Bedarf entweichen lassen / Deckel nur auflegen oder mit Klammern befestigen (Explosionsgefahr!). Das Glas anschließend in den in den Kühlschrank stellen und langsam weiterfermentierten lassen.

Es ist monatelang haltbar.
Bon appétit

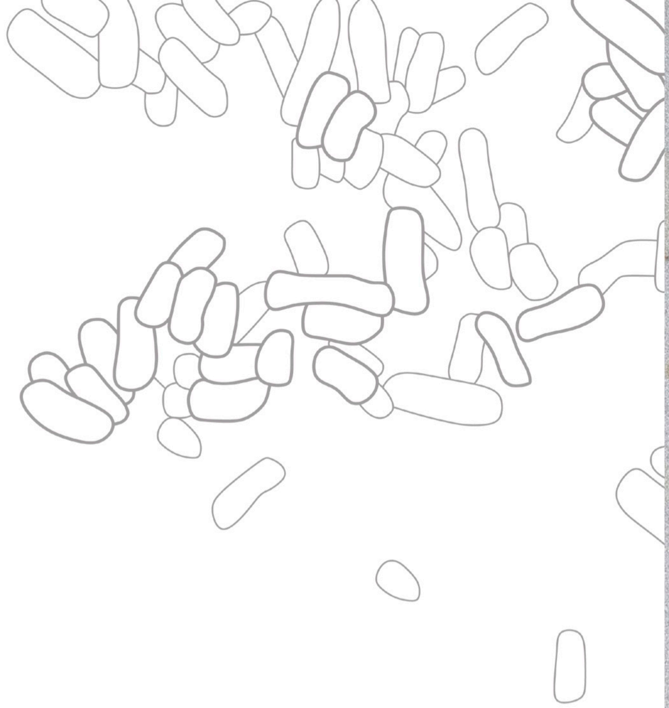
wild & radical

Ersetze (Teile der) Hauptkomponente (Chinakohl) mit Weisskohl / Lauch / Kohlrabi / Kürbis / Löwenzahn / Pilzen / Bärlauch / ...

Verwende Gemüsereste / Blumenkohlblätter / Wassermelonenschalen - der Hauptanteil sollte grünes (Blatt-)gemüse bleiben. Etwas Obst (z.B. Apfel) verfeinert die Würzpaste.

Kimchi als Snack oder als Beilage zu Reis-Bowls / Ramen / Gegrilltem.
Gebratener Kimchi-Reis.
Kimchi-Pancakes. Kimchi-Tofu.
Kimchi-Omelette. Kimchi-Dumplings.
Formidable

Veganer Cheez auf Nussbasis



Lactobacillus brevis

zutaten.

für die basis:

340 gr Nüsse (z.B. Cashews)
118 - 177 ml Starterkultur, z.B. Sauerkrautbrühe

(besser: die Flüssigkeit eines Ferments auf Lauchbasis)

für die würzung:

Salz
(wilde) Kräuter
(grüner) Pfeffer
Saaten
Chili
etc.

zubereitung.

Die Zutaten (Samen und Nüsse) einweichen und dann mit dem Mixer zu einer dicken Paste verarbeiten.

Achtung! Es muss von Beginn an etwas Flüssigkeit aus einer aktiven Starterkultur hinzugefügt werden. Gerade so viel Flüssigkeit, dass eine dicke, kompakte Paste entsteht und der Mixer arbeiten kann. Die Starterkultur leitet den Fermentationsprozess ein und intensiviert den Geschmack und die Würze des Käses durch die Reifung. Am besten ist es, ein junges Ferment (einige Tage alt) zu verwenden, solange es noch aktiv ist und voller lebender Bakterien sprudelt. Nach dem Mischen der Zutaten den Inhalt mit einem Spatel in eine Schüssel geben und etwas Käsearoma wie Miso, Knoblauchpulver etc. hinzufügen.

Die Paste probieren und ggf. Salz hinzufügen (der Salzgehalt nimmt während der Fermentation etwas ab). Um Weichkäse herzustellen, die Schüssel nun mit einem sauberen Baumwolltuch o.ä. abdecken und bei Raumtemperatur 24 bis 48 Stunden lang fermentieren lassen.

Anschließend im Kühlschrank einige Tage weiterfermentieren lassen und genießen.

Bon appétit

wild & radical

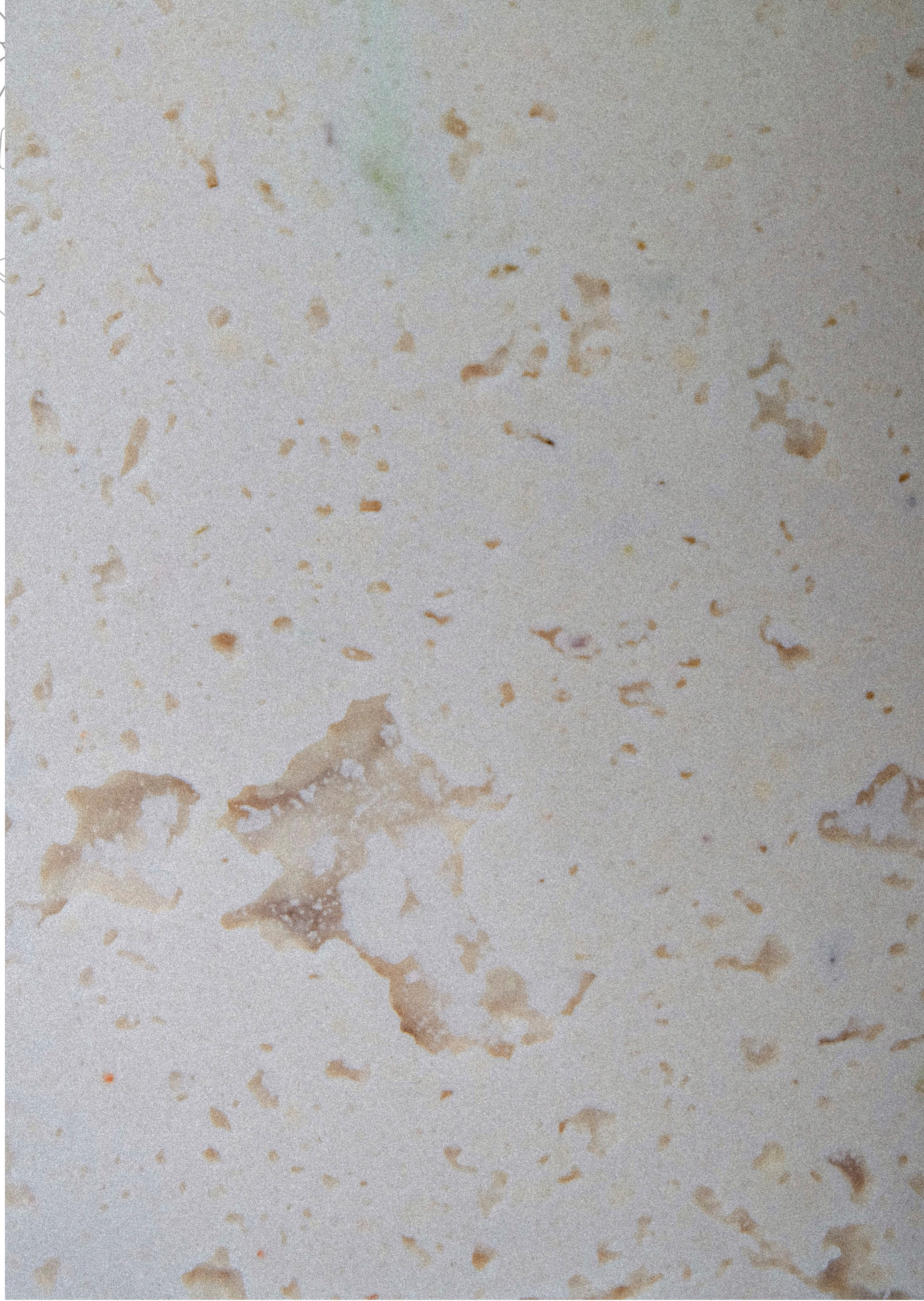
Ersetze (Teile) der Hauptkomponente (Cashews) mit gesammelten Walnüssen / Haselnüssen / Eicheln* / ...

*hier: vorbereitende Arbeitsschritte nötig

Verwende Reste und fertige Fermente, um Gewürze herzustellen. Getrocknetes Sauerkraut / pikant geröstete Knoblauch- und Zwiebelschalen / Kimchi-Brühe.

Cheez mit Sauerteig-Grissini. Curry-Cheez. Salsa Cheez.
Veganer Käse aus gesammelten Maronen. Veganer Hartkäse mit einer Kruste aus wilden Kräutern.

Formidable



Cracker

Saccharomyces exiguus

zutaten.

für den teig:

100 gr Sauerteig Starter
30 gr Mehl
(Dinkel / Roggen / Weizen)
30 gr Weizenvollkorn
1 TL Roggenmehl
1,5 EL Olivenöl
0,5 TL Salz

für das topping:

Sesam
Koriandersamen
Salz
Lavendel
Rosmarin
etc.

zubereitung.

Alle Zutaten vermengen und solange kneten bis ein glatter Teig entsteht. Den Teig abgedeckt ruhen lassen.
1 Stunde ruhen lassen

Nach der Ruhezeit den Teig auf einer bemehlten Arbeitsfläche sehr dünn ausrollen oder mit der Nudelmaschiene bearbeiten (Dicke: Stufe 4).

In der Zwischenzeit den Backofen auf circa 200°C, Ober und Unterhitze vorheizen.

Die Brote in die gewünschte Form bringen und auf einem Backpapier auslegen. Das Knäckebrot ein wenig anfeuchten und mit den gewünschten Toppings bestreuen.

Nun kann das Backblech in den Ofen geschoben werden für 10-15 min. Je nach Ofen variiert die Backzeit, dabei aufpassen, denn sobald das Knäckebrot Farbe angenommen hat, bräunt es sehr schnell und kann zu dunkel werden.

Auskühlen lassen und geniessen.
Bon appétit

Experimentiere mit der Würzung - z.B. Nelken & Lorbeer für Rüben, Kräuter & grüner Pfeffer für Lauch; Lavendel für Karotten & Rettich für eine angenehme florale Note etc.

Verwende saisonale / gesammelte Zutaten; Obst kann hierbei bis zu 20% des Gemüses ersetzen. Erkunde das Terroir mit dem Sammeln & der Zugabe von Wildkräutern.

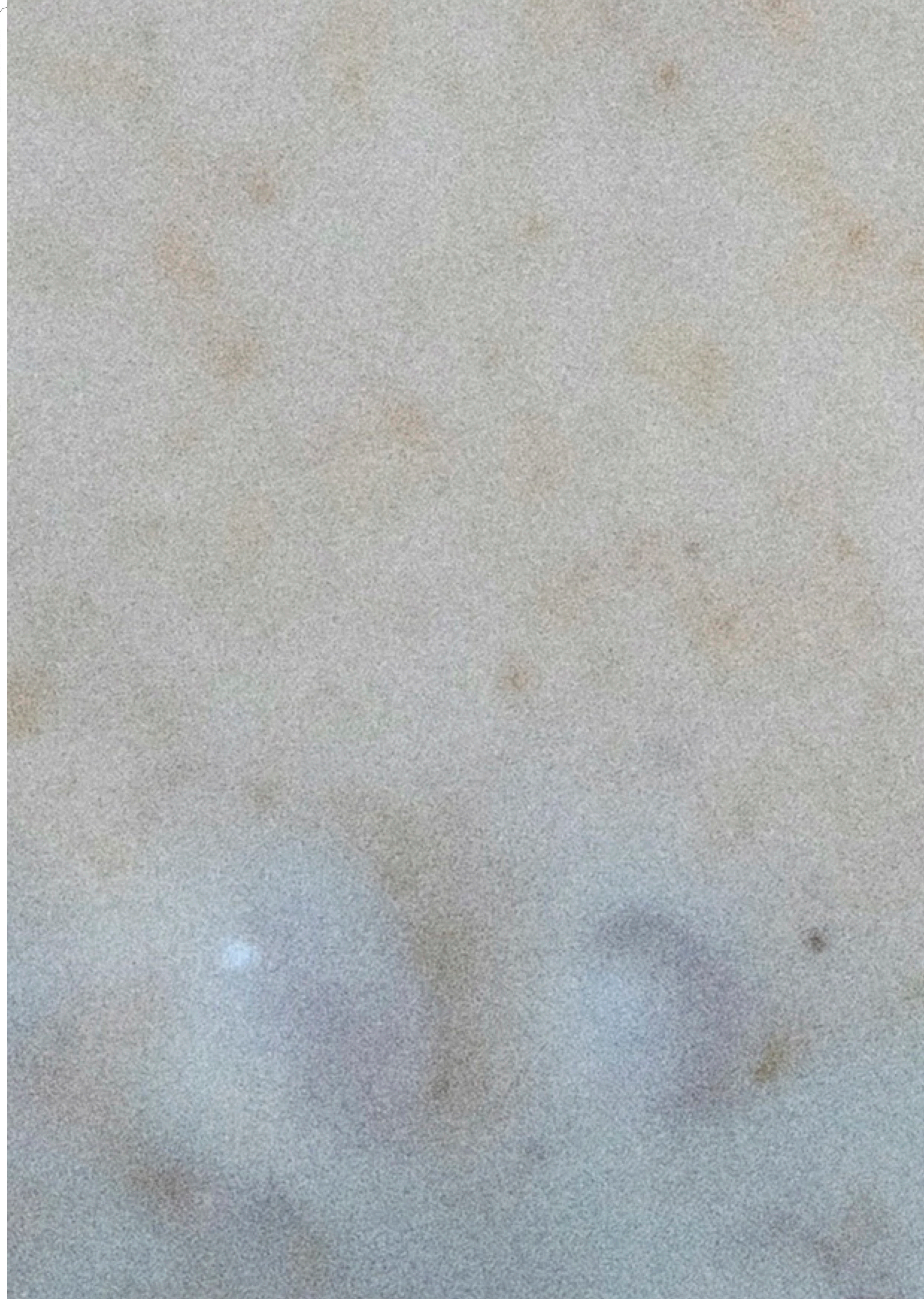
Radieschen mit einem Hauch Knoblauch. Fermentierte grüne Tomaten. Fermentierte gebackene Kartoffelecken. Fermentierte Wassermelonen-Rinde.

wild & radical

Mehlkomponenten können auch durch selbst gemahlene Mehle ersetzt werden (Eichelmehl, Maronenmehl) um ein besonderes Geschmackserlebnis zu kreiiren.

Für die Toppings / Würzung experimentiere mit selbst gesammelten Kräutern und Samen, je nach Saison können verschiedene Kombinationsvariationen gefunden werden.

Brenesselsamen und Salz.
getrocknetes Sauerkrautgewürz.
Lavendel und Aprikose.



Kombucha

zutaten.

Acetobacter xylinum

fürs erste:

1	x	SCOBY
(Symbiotic Culture Of Bacteria & Yeast)		
800	ml	Wasser
80	ml	Kombucha-Starter
4	TL	grüner / schwarzer Tee
80	gr	Zucker

fürs zweite:

Beeren
Ingwer und Zitrone
Aprikosen / Pfirsiche
etc.

zubereitung.

Wasser und Zucker mischen und in einem kleinen Kochtopf zum Kochen bringen. Die Hitze ausschalten, den Tee hinzufügen und zudecken.
15 Minuten ziehen lassen

Den Tee in ein Glasgefäß abseihen. Am besten ein breites Gefäß verwenden; Kombucha braucht eine ausreichende Oberfläche - am besten ist der Durchmesser des Gefäßes größer ist als die Füllhöhe. Den Tee auf Körpertemperatur abkühlen lassen, dann Starterflüssigkeit und Scoby hinzufügen. Mit einem Tuch abdecken und an einem warmen Ort aufbewahren (idealerweise 21° bis 29°C).
1 Woche beobachten, dann probieren

Nach ein paar Tagen bis zu einer Woche, je nach Temperatur, bildet sich eine Haut auf der Oberfläche des Kombuchas. Je länger er ruht, desto saurer wird er.

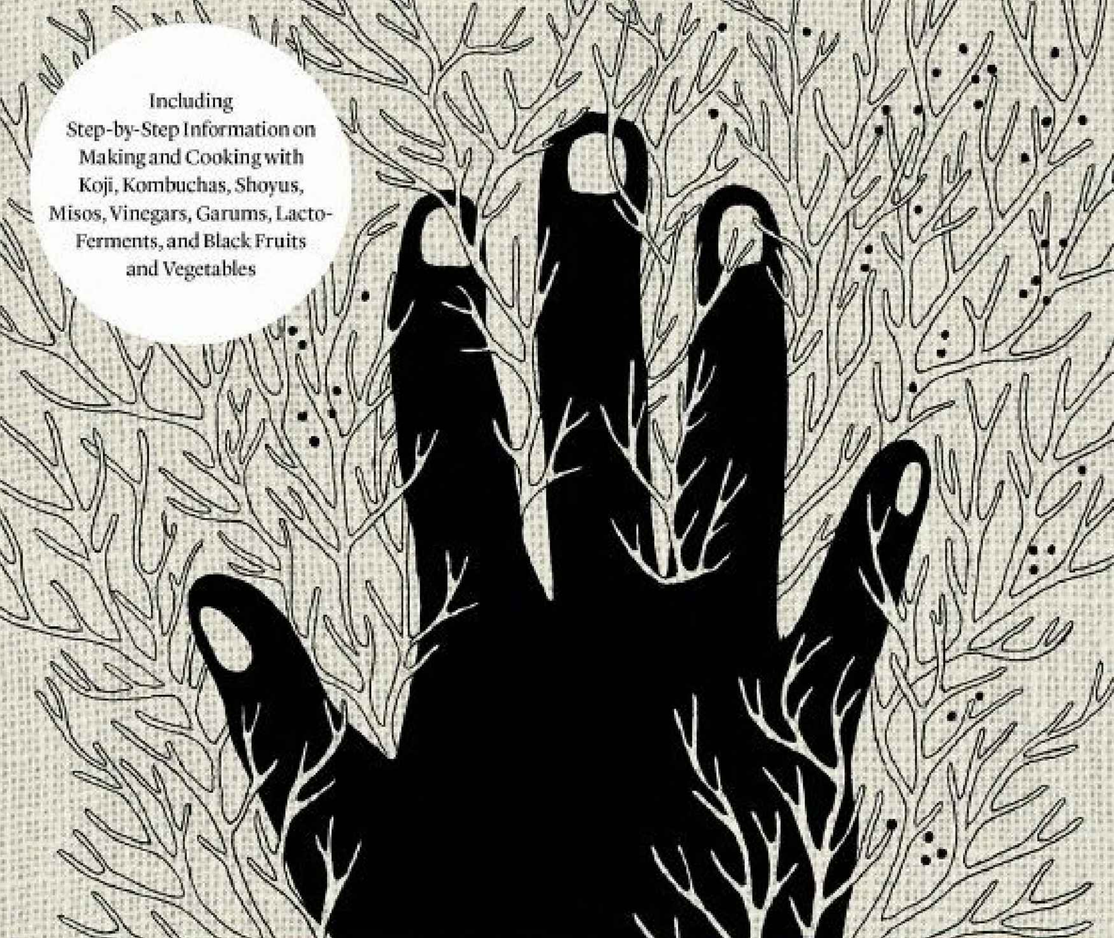
Bei gewünschtem Säuregrad: Flüssigkeit abgießen, bis auf Starter-Menge; ein neues Batch anfangen. Aus der anfänglichen Haut hat sich nun ein zweiter Scoby gebildet. Beide Scobys können für ein neues Batch verwendet werden oder im Kühlschrank als Reserve in etwas Starterflüssigkeit vorübergehend ruhen. Der entstandene Kombucha wird ggf. in einer Zweitfermentation (2-3 Tage) mit der Zugabe von etwas Obst veredelt.
Bon appétit

wild & radical

Ersetze (Teile der) Flüssigkeit (frischer Tee) mit zu Tee aufgebrühten (gesammelten) Kräutern. Frisch gepresster Saft substituiert Tee & Zucker (2kg Saft pro 200gr Starter).

Brühe Wasser und Zucker statt mit Tee mit 365 gr Kaffeesatz auf und lasse die Mischung über Nacht stehen. Filtere sie und gebe sie zu Scoby und Kombucha-Starter hinzu.

Kombucha Verbene. Kombucha aus Fruchtpüree. Jun-Kombucha. Hard Kombucha.
Kombucha-Sirup. Kombucha Vinaigrette. Kombucha Candy.
Formidable



Foundations of Flavor

The Noma Guide to Fermentation

René Redzepi & David Zilber

1.

Primer

—

What *Is* Fermentation?

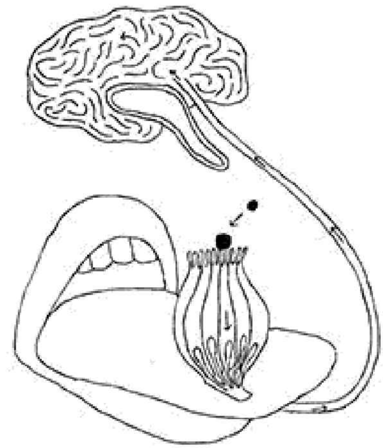
Before we dive into the practical ins and outs of fermentation, let's first clearly define what it is.

At the most basic level, fermentation is the transformation of food by microorganisms—whether bacteria, yeasts, or mold. To be slightly more specific, it is the transformation of food through enzymes produced by those microorganisms. And finally, in the strictest scientific definition, fermentation is the process by which a microorganism converts sugar into another substance in the absence of oxygen.

The word *fermentation* comes from the Latin word *fervere*, meaning "to boil." The ancient Romans, upon seeing vats of grapes spontaneously bubble and transform into wine, described the process using the closest analogue they could think of. And while those bubbling vats of grapes had nothing to do with boiling, they *were* true ferments in the scientific sense, as yeast-produced enzymes transformed the sugars in the grapes into alcohol.

However, not all the processes we consider to be fermentation fit neatly into tidy definitions of it. For instance, while koji is faithful to the definition, Noma's garums are not. In koji, the mold *Aspergillus oryzae* penetrates grains of rice or barley and produces enzymes that convert the grain's starches into simple sugars and other metabolites. This is what's known as a *primary* fermentation process. The garums in this book, on the other hand, are the product of a *secondary* fermentation process. To produce garum, we mix koji with animal proteins in order to take advantage of the enzymes produced during the primary fermentation process.

We don't differentiate between primary and secondary fermentation processes in this book, but you may find it helpful to have these definitions under your belt as you find your way with fermentation.



You taste as much with your brain as you do with your tongue.

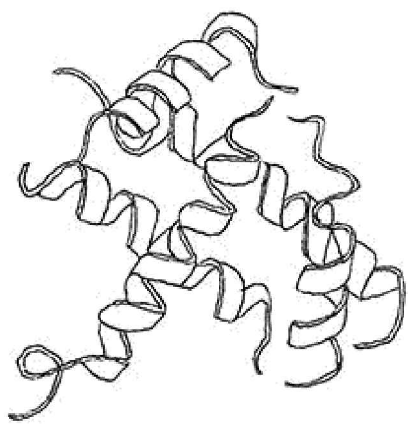
What Makes Fermentation Delicious?

Taste is a function of the human body, and to understand what tastes good to us, we have to understand its role in our evolutionary history. All our senses serve to aid in our survival. Our senses of taste and smell have been shaped over hundreds of millions of years to incentivize us to eat foods that are beneficial to our bodies. Our tongues and olfactory system are unbelievably complicated organs that take in chemical cues from the world around us and transmit that information to our brains. Taste lets us know that a ripe piece of fruit is sweet and thus full of calorie-rich sugar, or that a plant's stalk is bitter and potentially poisonous. We are born with aversions to certain flavors (a sense that becomes reinforced by experience), leading us to gag at the stench of rotting flesh decaying at the hands of pathogenic bacteria, while we register the scent of meat roasting over fire as mouthwateringly delicious, because it indicates to our brains that we're about to eat something rich in proteins.

There are numerous biological processes at work in any given fermentation, but the ones that matter most to us from a taste perspective are those that break down large chains of molecules into their constituent parts. The starches in foods like rice, barley, peas, and bread are actually long chains of linked molecules of glucose, a simple sugar. Proteins, which can be found in large supply in soybeans and meat, are constructed in a similar fashion from lengthy, winding chains of amino acids—small organic molecules essential to all aspects of life on earth. One of those amino acids, glutamic acid, registers on our taste receptors as umami—the elusive, crave-able quality that connects foods like mushrooms, tomatoes, cheese, meat, and soy sauce.

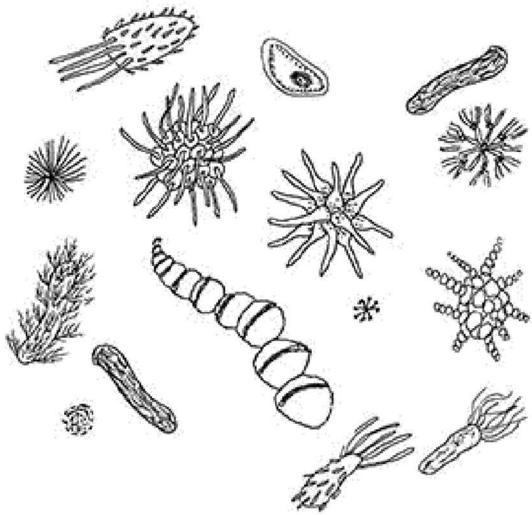
So what makes fermentation so good? On their own, starch and protein molecules are too large for our bodies to register as sweet or umami-rich. However, once broken down into simple sugars and free amino acids through fermentation, foods become more obviously delicious. Koji made from rice has an intense sweetness that plain cooked rice doesn't. Raw beef left to ferment into garum has a savoriness that speaks to us on a primitive level.

Simply put, the microbes responsible for fermentation transform more complicated foodstuffs into the raw material your body needs, rendering them more easily digestible, nutritious, and delicious. Our affection for the tastes those microbes produce has allowed them to evolve and stay in our company. Humans have been fermenting for so long that many of the microscopic agents responsible can be considered domesticated, just like household cats or dogs. But while pets can stare longingly at you if they're hungry or cold, microbes are a bit trickier to read. It's a mutually beneficial relationship, but one that needs a bit of work to keep everyone happy. That's the job of the fermenter.



Proteins are made of tangled chains of amino acids, life's building blocks.

Setting the Table for Microbes



The number of species of microbes on earth is greater than that of all plants and animals combined.

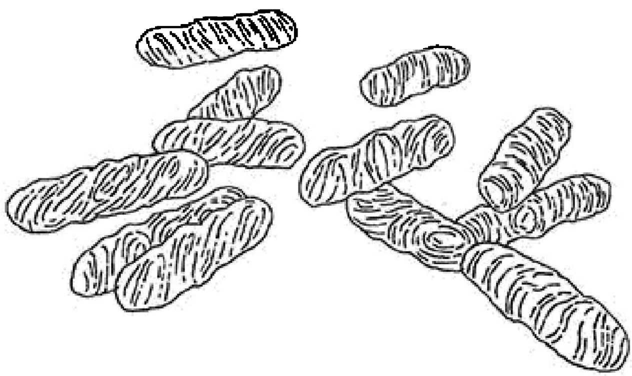
There's a thin line between rot and fermentation, and that line might best be understood as an actual line, like the kind you'd find outside a nightclub. Rot is a club where everyone gets in: bacteria and fungi, safe or unsafe, flavor enhancing or destructive. When you ferment something, you're taking on the role of a bouncer, keeping out unwanted microbes and letting in the ones that are going to make the party pop.

You have several tools at your disposal in trying to encourage certain microbes or deter others. Some organisms are more tolerant of acidity than others. Likewise with oxygen, heat, and salinity. If you're familiar with what your preferred microbe needs to function, you can wield these factors to your benefit. Each chapter in this book will go into great detail about the conditions you need to create successful fermentation, but for starters, here's an overview of the players that will be working for us.

Bacteria

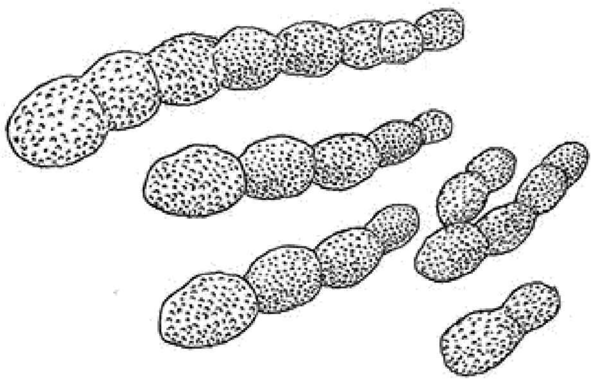
Among the earliest forms of life, bacteria are single-celled organisms that are present in uncountable quantities in nearly every corner of the globe. Only a fraction are known to science. There are malignant bacteria that can produce toxins capable of killing much larger organisms. At the same time, there are billions of beneficial bacteria living on and inside of us. At the end of the day, the majority of them are harmless to us.

Lactic acid bacteria (LAB)



LAB are rod- and sphere-shaped bacteria that are present in abundance on the skins of fruits, vegetables, and humans. We use them for their ability to convert sugar into lactic acid, giving pickles, kimchi, and other lacto-fermented products their characteristic sourness. Because they produce lactic acid, they are able to tolerate low-pH environments. They are also halo-tolerant (salt-tolerant) and anaerobic, meaning they thrive in the absence of oxygen.

Acetic acid bacteria (AAB)

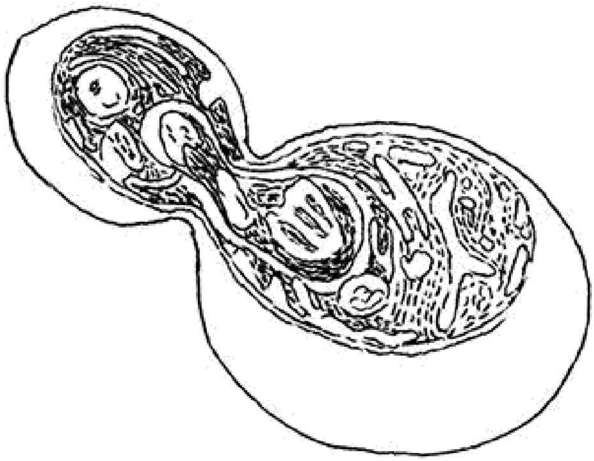


Like LAB, AAB are readily abundant rod-shaped bacteria, ever present on the surface of many foods. They generate the sharp sourness of vinegar and kombucha by converting alcohol to acetic acid. We often use them in conjunction with yeasts that first convert sugars into alcohol. They can tolerate the acidic environments they create, and require oxygen to create acetic acid, thus classifying them as aerobic bacteria.

Fungi

Fungi encompass a huge swath of life on earth, from single-celled yeasts to molds to gigantic puffball mushrooms. Multicellular, filamentous fungi like mushrooms and molds grow by gathering nutrients through tendril-like hyphae that together form a web-like system known as a mycelium, similar to the roots of a plant. They secrete enzymes through their mycelium, effectively digesting the food in their surroundings, then absorbing the nutrients from their environment.

Saccharomyces cerevisiae

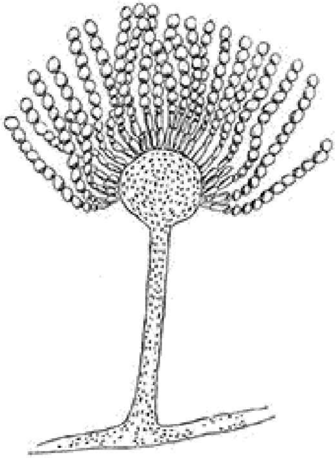


An extremely handy species of yeast, *Saccharomyces cerevisiae* is responsible for three of humanity's most important culinary pillars: bread, beer, and wine. Bountiful in the natural world, as demonstrated by producers of spontaneously fermented bread and wine, *S. cerevisiae* makes a living converting sugars into alcohol. It breaks down glucose to harness the chemical energy needed for its life processes, while producing carbon dioxide and ethanol as by-products. Different strains or subspecies are harnessed for their particular qualities, which can lead to wide variations in flavor. For instance, the strain of *S. cerevisiae* that is used in bread baking isn't desirable for producing beer or wine. Yeast can survive and multiply in the presence of oxygen, but alcohol fermentation takes place anaerobically. *Saccharomyces* dies at temperatures in excess of 60°C/140°F.

Brettanomyces

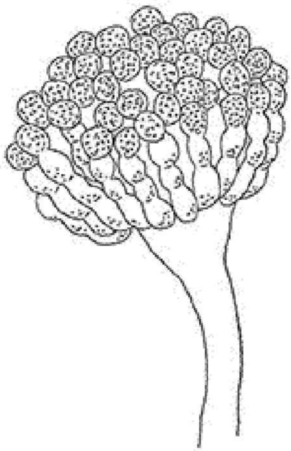
A genus of long, cylindrical yeast, *Brettanomyces* is used in the production of beers with sour qualities because of its ability to produce acetic acid as a metabolite. *Brettanomyces* also occurs naturally on the skins of fruits, and can be purchased readily as "saison yeast." It can survive in oxygen, but produces ethanol anaerobically. Like other yeasts, it cannot survive temperatures above 60°C/140°F.

Aspergillus oryzae



Perhaps the most important microbe in this book, *A. oryzae* (pronounced oh-RAI-zee) is the sporulating mold also known as koji. It's been bred for hundreds of years to grow extremely quickly in hot and humid environments when given access to the plentiful starches in products like cooked rice or barley. (Generally speaking, 30°C/86°F and 70% to 80% humidity are ideal for *Aspergillus*; temperatures above 42°C/108°F will kill it.) Koji secretes the enzymes protease, amylase, and a small amount of lipase, which break down proteins, starches, and fats, respectively. We harness these enzymes in the production of our misos, shoyus, and garums.

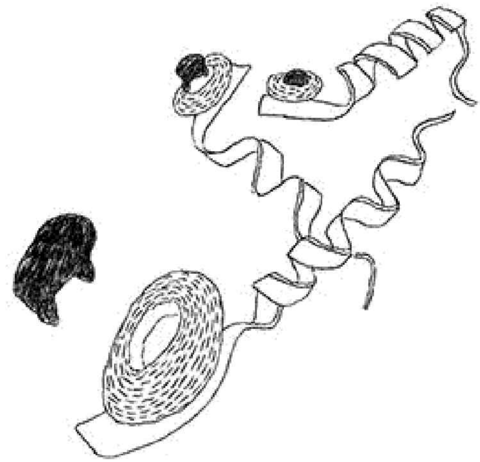
Aspergillus luchuensis



A relative of *Aspergillus oryzae*, *Aspergillus luchuensis* (pronounced loo-CHOO-en-sis) metabolizes starches and proteins and produces citric acid as a by-product. It's traditionally used to brew the bases of Asian spirits like Korean *shochu* and Japanese *awamori*, as the distillation of the alcohol leaves the citric acid behind. Though it's a lesser-known species, it's extremely delicious.

Enzymes

Enzymes are not microbes—they aren't even alive—but rather biological catalysts that facilitate chemical transformations within organisms or organic matter. You can generally identify them by the suffix *-ase*, as in protease (an enzyme that breaks down proteins) and amylase (from the Latin word *amylum*, meaning "starch," which breaks down exactly that). They are a class of proteins built through evolution to serve specific but different functions. Exactly how they work is rather complicated, but you can think of the ones featured in this book as a cross between keys and scissors. They're keys in the sense that they are tailored to fit specific locks, acting on one organic molecule while leaving others alone; and they're scissors in that they can cut ribbons into shorter lengths. Generally speaking, enzymes work most efficiently in warm, fluid environments, but if heated too high, they can be “cooked” to a point where they no longer function.



Beta-amylase is an enzyme capable of breaking down starches into their constituent sugar molecules.

Wild Fermentation

The ferments we undertake at Noma all depend to varying degrees on wild fermentation. That is to say, we create environ-ments that are conducive to the growth of naturally occurring beneficial microbes, and detrimental to malevolent ones. With our lacto-ferments, for instance, we depend entirely on a wide set of lactic acid bacteria in the environment—on the fruit or vegetables we're fermenting, on our hands, floating in the air—to turn sugar into lactic acid and other flavorful metabolites. By allowing nature to do its thing, we get layers of nuance and complexity in our ferments that wouldn't be possible if we dictated exactly which microbes were allowed to work. Wild fermentation is a non-inoculated and often very diverse fermentation. Simply put, it's how fermentation was first performed, and it's still tried and true.

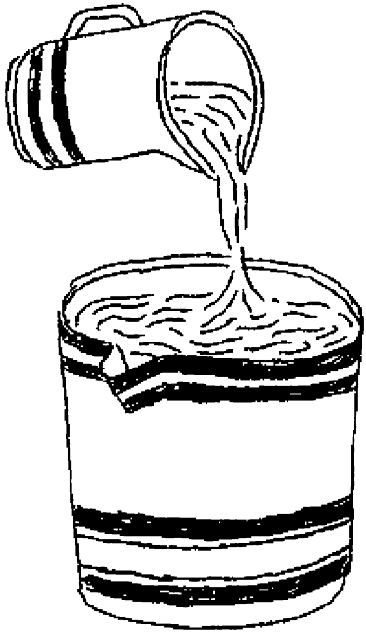
For our kombuchas, vinegars, and koji, we do introduce bacteria, yeast, or fungus into the equation in order to get the results we're looking for, but we still allow and encourage wild fermentation. The same goes for especially large batches of lacto-fermented products. For instance, when we're fermenting hundreds of kilos of asparagus at a time, we add powdered lactic acid bacteria (LAB) to the brine. If for some reason the naturally occurring LAB had trouble getting started, we'd be exposed to the risk of some other malignant microbe taking hold. A boost in the LAB population is a nice bit of insurance against losing all that product when you're working on a large scale.

Backslopping

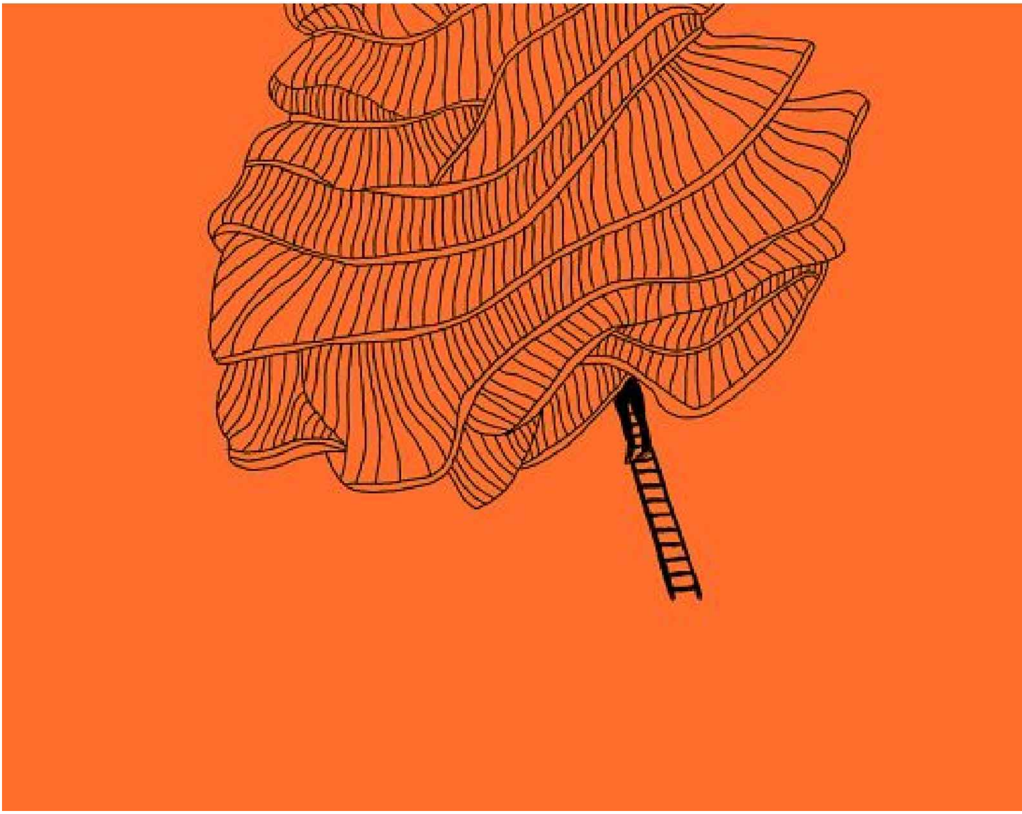
Backslopping is a vital technique in prepping microbial environments for fermentation and will come up numerous times in this book, especially in the production of kombucha and vinegar. The idea is basically to give the substance you intend to ferment a boost of beneficial microbes by adding a dose from a previous batch of that same ferment.

By pouring a healthy amount of, say, perry vinegar into a jar of fresh perry, we both lower the pH of the solution and add a healthy shot of acetic acid bacteria (AAB). Lowering the pH (acidifying) has the effect of slowing or stopping any unwanted microbes that aren't acid-tolerant from acting on the perry, and ensures that there's a healthy population of AAB to ferment the perry into perry vinegar. Backslopping stacks the deck in favor of the microbes we want to succeed.

Of course, if this is your first time making one of the ferments in the book, you won't necessarily have a previous batch to use for backslop. In that case, you'll have to find a similar substitute. For our vinegars, we suggest unpasteurized apple cider vinegar as a replacement. For our kombuchas, you can use a similarly flavored unpasteurized kombucha or the liquid that your SCOBY (the "mother" culture of yeast and bacteria that produces kombucha; see cooperative frementation) comes packaged in. The downside is that you're going to dilute the pure flavor of the vinegar or kombucha you're making. That's fine, though, as it gives you a perfect reason to make the same vinegar or kombucha again—this time using a portion of your first batch as backslop.



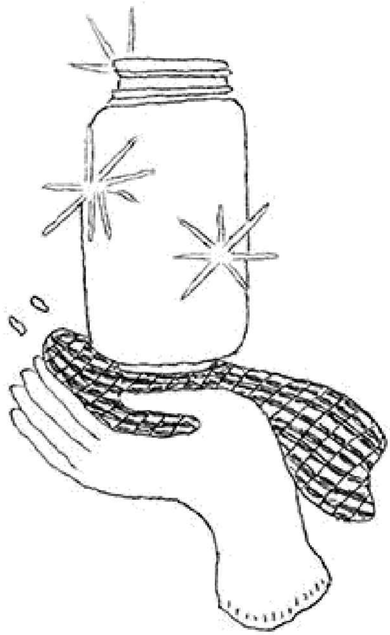
Backslopping gives a boost from one generation of a ferment to the next.



Cleanliness, Pathogens, and Safety

Cleanliness is something we take very seriously in the kitchen, out of both pride for our workplace and respect for our colleagues. However, a clean and sanitary workplace is doubly important in the fermentation lab, in order to prevent unwanted pathogens from invading a ferment and causing it to taste off or, worse, become dangerous to eat. At Noma, we always err on the side of caution. If something you've made smells *wrong*—not just funky like fish sauce, but nose-stingingly rotten—trust your nose. If you taste a small sample and it turns your stomach, remember that your body is designed to reject things that may be harmful to you. When in doubt, throw it out. If you're ever unsure of a fermented product, toss it. The weeks or months of your invested time are not worth risking your health.

Potentially harmful microbes are ever present in the environment. Bacteria can multiply speedily, with or without oxygen, at temperatures ranging from 4.5° to 50°C/40° to 122°F, especially in moist, nutrient-rich environments. Of course, that describes the exact circumstances in which many fermented goods are produced. Both the World Health Organization and the United States Department of Agriculture recommend cooking foods sensitive to pathogenic contamination above 70°C/158°F before consumption. Now, that's a fairly severe safeguard, and obviously not possible for many ferments. That being said, you should be cautious, but not worried. Fermentation is meant to be a rewarding and exhilarating practice, but remember that you're playing with live ammo.



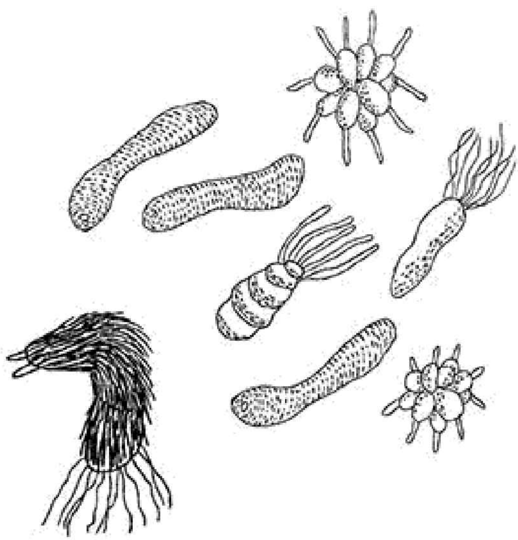
Cleanliness is next to godliness (and also crucial to a safe and successful ferment).

Throughout this book, we do our best to provide clear instructions that will produce safe and delicious products if followed closely. Don't eyeball measurements or take shortcuts. When a recipe calls for a specific salt content (above 10 percent by weight) or pH (below 4.5), it's to ensure that you're fermenting safely. But of course, the first step in preventing unwanted microorganisms from taking hold in a ferment is to make sure your equipment and hands are clean before they come into contact with food. While this is less important in certain cases, it's critical in other instances. When making koji, for example, you'll need to be sure the incubation chamber is properly sanitized before introducing the inoculated grains. And when working with your hands, wear nitrile or latex gloves to prevent contamination (except in places where a little bacteria from your skin can help things along, as with lactic-acid fermentation).

Now, what do we mean by "clean"? There is a difference between the level of cleanliness you would expect to find in a university biology lab and that in a home or restaurant kitchen. Let's define some terms. *Cleaning* means that you've removed visible dirt from the surface of objects. Soap and water will clean a surface but do very little to reduce the surface's population of microorganisms, good or bad. *Sterilized* implies that you've eradicated *all* life-forms—viruses, bacteria, fungi—on your equipment and your work surfaces (and sometimes even in the product you're looking to ferment). This is a level of certainty required in hospitals and microbiology labs. You'll never need something as serious as an industrial-strength autoclave for a recipe in this book. What we're looking to do for the recipes here is *sanitize*. To sanitize a piece of equipment or work surface implies that you've removed *most* microbiological life. That will be sufficient for our purposes. Running your equipment through a hot cycle in a dishwasher or steaming or boiling it for a few minutes is more than enough to ensure that you're working clean and sanitarily. If your equipment is heatproof, dry-heat sterilization is another option. Ceramic, glass, and metal containers and utensils can be baked in the oven for 2 hours at 160°C/320°F to ensure that they're free of contaminants.

For equipment or work surfaces that you can't pop into the dishwasher, there are common sanitizers intended for food production and fermentation like StarSan (available at many home-brew shops), distilled white vinegar (a sanitizing agent favored by grandmas the world over), and even household bleach diluted with water to 20 milliliters per liter (as long as you rinse with fresh water afterward). At Noma, for large items like crocks and buckets, we disinfect using ethanol diluted with filtered water to 60 percent alcohol by volume (ABV)—40 milliliters water for every 60 milliliters ethanol. (We dilute it because if the percentage of ethanol is too high, it can actually coagulate the proteins that make up the cell walls of many microbes and prevent them from dying.) We put the solution in a spray bottle and spray whatever needs to be sanitized, let it sit for 10 to 15 minutes, then wipe it off with a paper towel.

Finally, while a great deal of time is spent in this book introducing the amazing microorganisms responsible for fermentation, it's equally important to acquaint ourselves with the microbes that can make things go sideways. With a thorough grasp of pathogenic bacteria and molds, and what conditions they can tolerate, you'll be better equipped to keep them out of your products.



While many microbes are beneficial and the majority are harmless, there are still a few bad microbes that can cause illness.

Clostridium botulinum

C. botulinum is the sporulating bacteria responsible for botulism. It is an anaerobic bacteria that thrives in nutrient-rich, warm environments. Its spores are commonly found dormant in soil and water, waiting for favorable conditions to propagate and release potent neurotoxins. Ingesting just a microgram of botulism toxin is enough to cause serious illness. You cannot taste or smell botulism toxin, and thus the only way to guarantee safety is through careful attention to best practices.

Though cases of botulism poisoning are rare, it's usually found in improperly refrigerated animal products or improperly canned vegetable products (where canning temperatures were not hot enough and/or the canning liquid was not sufficiently acidic). Given that the spores of the bacteria are often found in the soil, special attention should be paid when fermenting roots, bulbs, and tubers. When making black garlic, for example, you're keeping a root vegetable in an anaerobic environment at a warm temperature. However, *C. botulinum* cannot survive at a sustained temperature of 60°C/140°F. Your responsibility is to ensure that your heating chamber doesn't dip below that threshold.

C. botulinum also has great difficulty growing in fluid mediums with a water activity below 0.97 (achieved by salt concentrations of 5 percent or higher) and in acidic environments with a pH below 4.6. Many ferments in this book begin with salt concentrations lower than 5 percent and a pH above 4.6. However, the combined effect of moderate salt content and a gradually decreasing pH is usually enough to safeguard against malevolent bacteria. For instance, a vegetable brined at 2 percent salt will have a high enough salt content to inhibit *C. botulinum* while beneficial lactic acid bacteria lower the pH. If a ferment reaches a pH below 5 within the first two days and ends up below 4.6 by the time of completion, it is generally recognized as safe.

Escherichia coli

Many strains of *E. coli* are actually harmless and part of a normal gut flora, but some varieties can cause severe food poisoning. These bacteria are usually transmitted through poor hygiene or contaminated meat products.

Cross-contamination of work surfaces and utensils is one of the more common causes of *E. coli*–related illness. Proper and thorough washing of vegetables in cold water will greatly reduce populations of the pathogen, should they be present. For products like beef garum, salt concentrations of 10 percent or higher will kill off the microbes. On top of that, the high temperatures at which garum ferments offer an added layer of protection.

Salmonella

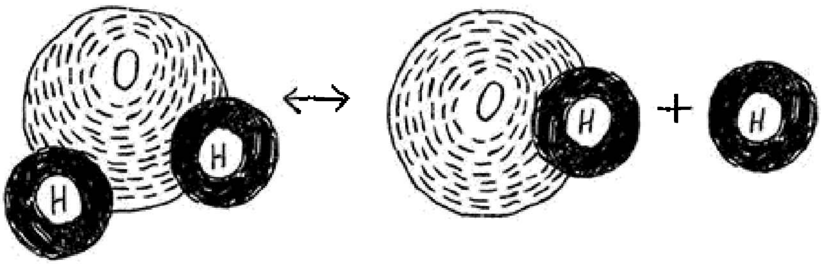
Salmonella is a genus of rod-shaped bacteria often found in raw poultry products and unpasteurized milk and on unwashed fruits and vegetables. Doing everything you can to avoid cross-contamination from raw poultry is paramount in avoiding *Salmonella* food poisoning. For example, if you're cooking chicken wings for chicken wing garum, be sure to clean and sanitize any utensils before putting them back into action with the final, prepared ingredients. Like *E. coli, Salmonella* has a minimum water activity level of 0.95, meaning that salt levels above 10 percent will kill it off.

Pathogenic molds

There are thousands of wild and invasive molds that would jump at the opportunity to eat your fermentation project before you get the chance. Many microscopic mold spores are airborne, while others travel in water or on the backs of insects. Not all of them will necessarily be harmful, but if you didn't put the mold there yourself, it's best not to take the chance.

There are many instances in this book where we are trying to create the ideal environment for beneficial mold growth, so the best preventative measures you can take against pathogenic molds are cleaning and sanitizing. By eliminating any unwanted guests at the outset, you ensure that they won't spoil the party later. Another method is to overwhelm competing molds. With koji, we inoculate steamed barley heavily with *A. oryzae* spores in order to elbow out the competition. With ferments like garums and shoyus, the salt content retards mold growth. Frequent stirring and cleaning of the container walls will bring any spores on the surface out of contact with the air and drown them in a salty sea. For kombucha, keeping the surface of your SCOBY moist by basting it with liquid is often enough to keep it acidified and mold-free. Last, molds are easier to spot than other pathogens. When making something like miso, you can simply scrape away any mold that forms on the surface.

Potential of Hydrogen (pH)



The ratio of hydroxide ions (negatively charged) to hydrogen ions (positively charged) in an aqueous solution determines its pH.

Potential of hydrogen, or pH, is a hugely important measurement in chemistry, and a key factor to consider in fermentation. Simply put, it helps you measure acidity. The pH scale was first conceived in the Carlsberg Labs in Copenhagen near the turn of the twentieth century. It measures the difference in concentration in an aqueous solution between hydrogen ions (H+) and hydroxide ions (OH–), with every increase in numerical value from 0 to 14 indicating a tenfold change in ionic concentration.

In distilled water (pure H2O), hydrogen and hydroxide ions sit in exact balance with each other. It has a pH of 7, right in the middle of the scale, and is neither alkaline nor acidic, but neutral. When hydroxide ions outnumber hydrogen ions, the substance is said to be basic or alkaline, and has a pH above 7. When hydrogen ions outnumber hydroxide ions, the substance is acidic, and has a pH below 7. The most acidic substances you can find, like hydrochloric acid (a component of stomach acid) and sulphuric acid (found in car batteries), have a pH near 0. The most basic substances, like sodium hydroxide (found in lye or drain cleaner) have a pH close to 14.

At times in this book, we seek to control or change the pH of a ferment, which affects everything from microbes' ability to thrive and propagate to an enzyme's ability to function properly to the taste of the final ferment. Sometimes, we're seeking to lower the pH in a ferment—thus making it taste more sour—through the creation by microbes of lactic, acetic, or citric acid. We use alkaline solutions too, as in the case of our miso made from masa, where we boil corn in a calcium hydroxide solution to coax out floral and fruity notes from the kernels.

You can track pH using a few tools, including test strips or digital meters. More exacting fermenters may find these tools helpful, but taste is your best guide. Ultimately, what you find palatable should dictate what you think the "right" pH is.

Salt and Baker’s Percentages

Salt is one of the most important factors in a safe and successful fermentation. For starters, it has the remarkable ability to inhibit biological processes of both microbes and humans. (There’s a reason why drinking salt water will kill you if you’re stranded at sea.) Salt is an ionic compound of sodium and chloride, which breaks apart into a sea of ions when it dissolves in water. Nature abhors imbalance, so anywhere they can, water and the salt ions dissolved in it will try to spread out into an even distribution. Put a piece of meat or a bacterial cell in a solution of salt, and water from inside will flow outward while salt ions flow inward, until eventually equilibrium is reached. It’s how brining works, and it’s also the mechanism by which pathogens like *Salmonella* can be killed with salt. Salt draws water out of the bacteria’s cells until they shrivel up and die. (For a more detailed explanation of this, see “Salt/Water”.) Knowing the salt tolerance of different microbes can make a world of difference in a ferment.

For that reason, we stress precise salt measurements, usually expressed in percentage by weight. Note that in the fermen-tation lab at Noma, we use baker’s percentages—when we tell you to add 2% salt to a kilogram of plums, we mean 2% of the weight of the plums (which comes out to 20 grams), not the total weight of the plums *and* the salt (which would be 20.4 grams). The difference is not always very significant, but using baker’s percentages streamlines the math.

Last, the type of salt makes a difference. We call for non-iodized salt, because iodine is mildly antimicrobial. While using standard table salt won’t stop a ferment cold, it can impede helpful microbes from gaining a strong foothold. Kosher salt will work well, and should be available in your local grocery store. Mineral-rich sea salts like fleur de sel are great, too, and can actually improve the texture of lacto-ferments.

SANDOR ELLIX KATZ

Foreword by Michael Pollan

The ART *of* FERMENTATION

AN IN-DEPTH EXPLORATION OF ESSENTIAL CONCEPTS AND PROCESSES FROM AROUND THE WORLD

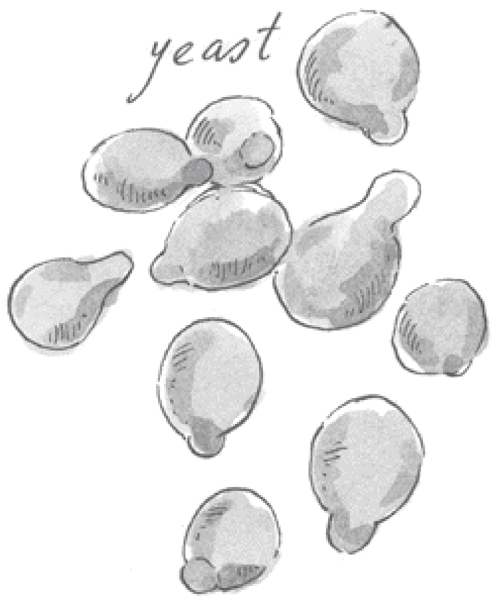
With Practical Information on Fermenting Vegetables, Fruits, Grains, Milk, Beans, Meats, and More

Fermentation and Coevolution

What is fascinating about the concept of coevolution is the recognition that the processes of becoming are infinitely interconnected. As a dynamic between two species, coevolution has been described as "an evolutionary change in a trait in the individuals of one population in response to a trait of the individuals of a second population, followed by an evolutionary response by the second population to the change in the first."[48] Life, however, is never so simple as to be limited to just two interrelated species; coevolution is a complex and multivariable process through which all life is linked.

All the plants our hunter-gatherer ancestors ate, like those our primate ancestors ate, consisted of unique chemical compounds, along with enzymes, bacteria, and other associated microbial forms, to which our ancestors and their microbiota adapted (or not, but they are not here to tell the tale). The plants' coevolutionary histories do not revolve exclusively around us. For instance, could certain large fruits have evolved to attract the attention and seed-spreading potential of extinct megafauna, to our enduring benefit?[49] Some plants we eventually coevolved with in ways we came to describe as domesticated. "We automatically think of domestication as something we do to other species," writes Michael Pollan in *The Botany of Desire*. "But it makes just as much sense to think of it as something certain plants and animals have done to us, a clever evolutionary strategy for advancing their own interests. The species that have spent the last ten thousand or so years figuring out how best to feed, heal, clothe, intoxicate, and otherwise delight us have made themselves some of nature's greatest success stories."[50]

The influence of coevolution changes all involved. To say that one species is the creation or the master of another is a self-serving oversimplification. What we call "domestication" is a process that exists along a continuum, which ethnobotanist Charles R. Clement describes as running from wild, to "incidentally coevolved," to "incipiently domesticated," to "semi-domesticated," to "landraces" and "modern cultivars," representing "a continuum of human investment in selection and environmental manipulation."[51] Like any coevolutionary process, domestication has repercussions for all parties. Coevolutionary success can lead to very specialized relationships. Treeshrews eating the fermenting nectar while pollinating the bertram palms, discussed already, is one vivid example. With the major human food crops, our great investment in selection and environmental manipulation makes us "obligate agents," meaning "sufficiently dependent upon certain plants so that [our] survival, at new densities, is dependent on the survival of the plants."[52]



In that dependence, in all our cultural particulars, we are manifestations of coevolutionary processes with the plants as much as they are manifestations of coevolutionary processes with us. Humans are not the only actors in these relationships. Nor are plants the only other life-forms to benefit from their close association with us. How about *Saccharomyces cerevisiae*, the primary yeast used to produce alcoholic beverages and bread? Yeasts are widespread in nature, but this particular one developed—through its long association with humans and our willingness to grow and process plants, in huge quantities, to its preferred specifications, to feed it generously and cultivate it continuously over the course of the millennia—into the coevolutionary partner we now know as *S. cerevisiae*. "Microorganisms are [our] most numerous servants," wrote Carl S. Pederson in a 1979 microbiology textbook, epitomizing a worldview of humans as the supreme creation of evolution, with all other life-forms ours to freely exploit.[53] To view ourselves as masters and microorganisms as our servants denies our mutual interdependence. Rather than *Saccharomyces cerevisiae* being the servant of humanity, it could be said that we are its doting fan and servant, much as we are to *Vitis vinifera* (grapes) or *Hordeum vulgare* (barley).

Although we rarely pay much attention to them, we have also consorted with many varied lactic acid bacteria (LAB). By 2007, geneticists could state emphatically: “Every person in the world has contact with lactic acid bacteria. From birth, we are exposed to these species through our food and environment.”[54] The LAB’s genetic diversity “allows them to inhabit a variety of ecological niches ranging from food matrices such as dairy products, meats, vegetables, sourdough bread, and wine to human mucosal surfaces such as the oral cavity, vagina, and gastrointestinal tract.”[55] Comparative genome analysis suggests that in nutrient-rich niches, the LAB specialize efficiency by shedding genes for metabolic pathways they are not using. “The specialized adaptation to milk is particularly interesting,” notes the analysis, “because this fermentation environment would not exist without human intervention. The selective pressure came not only from the natural environment, but also from anthropogenic environments created by humans.”

Who exactly is the servant of whom? Are the acidifying bacteria in milk or the yeasts in grape juice *our* servants, or are we doing their bidding by creating the specialized environments in which they can proliferate so wildly? We must stop thinking in such hierarchical terms and recognize that we, like all creation, are participants in infinite interrelated biological feedback loops, simultaneously unfolding a vast multiplicity of interdependent evolutionary narratives.

Fermentation as a Natural Phenomenon

Fermented foods were not exactly human inventions; they are natural phenomena that people observed and then learned how to cultivate. Depending on the place, varying natural phenomena were observed, because different foods were being produced in surplus, processed in distinctive ways, and stored under specific conditions in each environment. The distinctness of cultures arises out of the specificity of place: Different plants (and animals) grow abundantly and produce surpluses, and different microbial communities develop on them. In China, rice and millet were developed, and their complex carbohydrates came to be digested by molds into simple sugars for alcohol fermentation. “The discovery of the *mould ferment* in the Neolithic period is the result of the happy conjunction of three factors,” writes H. T. Huang. “Firstly, the nature of the ancient cereals cultivated by the Chinese, that is, rice and millets, secondly, the development of steaming as a preferred method for cooking such cereals, and thirdly, the kinds of fungal spores that were present in the environment. . . . As far as we know, the convergence of these distinctive factors occurred only in China.”[56] In the “Fertile Crescent” of the Middle East, it was barley and wheat instead that developed, and a very different method, germination (malting), that came to be used to digest them into sugars for fermentation.

Both available foods and spontaneous fermentation phenomena vary dramatically between the extremes of tropical heat and arctic cold. In cold climates, fermentation is absolutely essential for survival. In summer, when waterways are accessible, people catch fish, as well as birds, and bury them in pits, where they ferment for months, until winter food scarcity requires their use. People in tropical climates are not driven by such stark seasonal imperatives, yet fermentation is no less important there. Hamid Dirar documented more than 80 distinct ferments in the Sudan alone. In tropical heat, rapid microbial transformations of food are inevitable. Fermentation is a strategy used to guide that transformation to create delicacies rather than decomposition. “Sudan’s foods are almost all fermented,” notes Dirar.[57] Clifford W. Hesseltine and Hwa L. Wang, of the US Department of Agriculture Fermentation Laboratory,[58] state: “Fermented foods are essential parts of diets in all parts of the world.”[59]

KRAUT PRAYER

Eli Brown, Oakland, California

Myriad beings beneath my sight, thank you for your transformations. May you nourish me as I nourish you. May you thrive in me as I thrive on the earth. In all the worlds may nourishment follow hunger as the echo follows the call.


musings
food
feminism
fermentation
2021 Edition

K is for Kneading

Emily Hoven

I feed my sourdough starter every day; even before the virus came, this was my routine.

Discard. Splash of water. Rye and bread flour until it thickens.

Mix dough. Knead til it holds. Let it rest, but always come back.

I keep a notebook next to my sourdough starter. In the early days of the pandemic, between rounds of kneading dough, I jotted a sentence down in the notebook I keep next to my sourdough starter: "*warm dough, yeasts respiring—closest thing to a body I've held in weeks.*" Then I let it rest.

See H is for Hands

On other pages, I wrote poems about how I'd given up writing for making with my hands—starters, doughs, loaves—and, in doing so, forgot the ways that writing is handiwork too. Forgot the way that words have texture and body and give, the way they make worlds possible somewhere between the hand and the page.

I'm coming back to it now, this fragment. I'm trying to experiment with how I might knead a sentence, stretching words, folding them, kneading them together until they hold.

What would it look like to practice bready writing, a writing that is attuned to the ways words stretch, the ways they ferment, the ways they sour? I'm trying to find it here. I'm practicing now.

See K is for Kitchen

I'm in my kitchen. The rye dough I'm folding coats my nostrils in the summer heat, all nutty and malt. I'm dancing the dough across the countertop—nudging it forwards with the heels of my hands, feeling it catch, using the friction between the laminate and the dough to pull its elastic surface taut. Somewhere in this circling rhythm, I learn that these tender movements are what gives the dough strength. Somewhere in this circling rhythm, words enter the fold—

yeasts respiring   *closest thing to a body I've held in weeks*

yeasts
          conspiring
                    closest I've been to a body in weeks

                    closest I've been to my body

                    close   *bodies*

How do I tell you about all the lively teachings sourdough has given me about embodiment and interdependency? About the ways it's attuned me to the *us* of me, to all the yeasts and bacteria that fill

See R is for Reciprocity

my gut, my hands, my words, my world

our gut, our hands, our words, our world

guts,   *hands,*   *words,*   *worlds?*

This twinned practice of kneading doughs and words—playing, plying, prodding—is where I turn to experiment with what language can hold, with who it can hold.

Resources

Anne Boyer (2015) "Sewing" from Garments Against Women.

K is for Kitchen

Stephanie Maroney and Sean Nash

As cooks, fermenters, teachers, and experiential learners, we like to play in the spaces of daily life and practice as they relate to food, fermentation, and feminism. As interdisciplinary writers and artists, we create ways to connect with entangled relations and systems of interdependence within the human and more-than-human world.

In this entry, we attune to the temporal states—of microbe, material, mood, memory—from within the kitchen. To do so, we invoke our ongoing collaborative project ArtKitchenFerment (AKF); an interactive art environment and conceptual space engaging with the processes, creative results, and byproducts of food fermentation. Our opportunity to play together in shared and public space with the sensory experiments of AKF has been delayed through the pandemic, so we take this time to build AKF through research, writing, and art-making.

As a conceptual framework, the acronym AKF can be further elucidated in this way: Art is our attention to the aesthetic and procedural nature of transformation in the space of the Kitchen, where Fermentation is the catalyst for that transformative activity. "K is for Kitchen" is our means to explore the field of the kitchen, with special attention to describing the kitchen as a historically complex creative and generative universe, where all sorts of things can ferment literally and metaphorically. In this short text we want to dissolve, degrade, and (especially) ferment the kitchen as a site for material encounters and possibilities within an art/fermentation context.

See V is for Vessel

There are so many ways to think and feel the kitchen as a space, as a place. Through the AKF framework, we are allowing many layered realities of kitchens to emerge and exist simultaneously, like overlaid transparency drawings. Visual representations of kitchens are dominated by bodies, foodstuffs, tools, architecture, and the miscellany of human culture. However, the negative physical space of a kitchen holds as much sensory presence as what might be seen: aroma compounds, steam and smoke, sounds of cleaving, banging, persistent pounding, careful excising, and the energy of rising hunger as stomachs prepare for a meal. The kitchen is teeming with the liveliness of microorganisms and a menagerie of organic matter; the air is transformed by heat, water, electricity — vibrating with the force of human and more-than-human desires.

See E is for Erotic

The kitchen is the terminus of the global food chain where memory haunts everything seen and still invisible. Blood, bone, seed, spice, grain, leaf, plastic, iron. Everything came from some other place and carries within it the remnants of soil, microbes, and nutrients, or the sensations of hands, tools, and transportation equipment. Layers of time and meaning coat each object that sits on a shelf, languishes in a refrigerator, ferments in a crock, decomposes

in a plastic-lined bin, off-gasses on countertops and tile floors, or bakes in a sunny window.

What kitchens have you known?
Who and what populates that space?
We invite you, reader, to pause for a moment and recall these kitchens with their animacy and sensory collection of materials and happenings.

Cutting Through the Kitchen of Tomorrow, colored pencil on paper and cut paper digital composite by Sean Nash, 2021.

The kitchen is a site of complex and contradictory raced, classed, and gendered meanings. It is a place of endless cyclical labor—enslaved, indentured, reproductive—required to maintain the vitality of the home and those lives within it. It is a space of feminine power and oppression; a space of coercion, control, and creativity; a space mired in symbolic imagery. Racist depictions from brands Aunt Jemima, Uncle Ben's, and Land O'Lakes or advertising featuring women and children subservient to men through kitchen labor have filled pantry shelves and the popular imagination. Although those caricatured faces have been disappeared on products, the legacy of harm is not undone. They are dormant but tender, blanketed by the passing of time, like countless kitchen cuts and burns still raw under new skin.

The modern, western kitchen has been treated culturally and academically as a physical space rich in social meaning and speculation. Twentieth-century architects and designers used functional design concepts to alter consumer connotations of the kitchen as a messy, hot, smelly place where service work was performed out of sight. No longer an appendage of the dining space, the kitchen was transformed into the heart of the home and expressed the personality of the home owners. Post-war industrial manufacturers promised kitchens of the future, where technology could automate cooking, eating, and service. Neoliberal obsession with individual accumulation birthed the contemporary kitchens that reflect fantasies of social status and belonging. Set in gleaming stone, marble, and steel, these kitchens have become entertaining spaces for the conspicuous display of class, wealth, and trendy desires.

Today the fetishization of the kitchen as a clean and highly controlled space has exploded into the consumer realm of kitchen tools and accessories. The kitchen is a lab, where the home cook can aim for the heights of a professional chef trained in molecular gastronomy (or the newest haute cuisine trend). The home consumer can potentially own thousands of functional and fashionable tools for kitchen use, such as a "magic air maker kit" for culinary foams, a "modernist pantry magic wand," or a "spherificator." The world of food fermentation products and gadgets is similarly overflowing with options. As food fermentation practitioners, we appreciate the possibility of magic and alchemy explored through these gadgets, but we want to de-emphasize the apparent *need* for fancy things to get to the magic and alchemy that is readily available in food sources.

See C is for Capital(ism)

Rather than perpetuating the kitchen as a vortex of global capitalist accumulation or a display case for class fantasies, we center the microbial, the material, the moody, the memorialized. We stay with the trouble of the entangled kitchen pasts, presents, and futures that have baked into one another. When you stand in the kitchen, you are inside and outside, private and communal, industrial and handmade, clean and dirty, here and there, now and then, one and many. Our playing with ArtKitchenFerment does not reconcile these binaries and troubles, though we bring them to the surface as a practice of awareness that heeds lived realities and combinatory possibilities.

See G is for Gerunds

The kitchen of AKF is a place of wild dreaming and speculative fictions, but also a place of doing, transforming, decomposing, and reworking our entangled chrono-spatial-relations with the human and more-than-human. We treat the kitchen like the transitional crossroads that it is; always a place of movement, transformation, and becoming. We remember the things we can reuse and recycle in or from the kitchen to honor labor, time, creation, and reciprocity with (but not limited to) food and microbes.

See R is for Reciprocity

To practice AKF, use kombucha SCOBYS (symbiotic communities of bacteria and yeast) as art installation material and adornment—build a SCOBY-leather shrine to honor an elder or make jewelry for your symbiotic kin. Watch as it dries, degrades, and then repairs with moisture. Make a cabbage or beet ferment to eat and then pour the vibrant liquid on cotton, wool, or silk to microbially-zhuzh up your wardrobe. Wear the aromas and flavors that your tongue craves. Dehydrate spicy kraut-chis and sprinkle on your rice, popcorn, or ice cream—eat your probiotics while consuming prophetic feminist science fiction. Transform your pile of spent coffee grounds into an oyster mushroom feeding/breeding grounds—sautee their reproductive bodies in butter and then turn the mycelium into paper for a letter to a friend. Watch microscopy samples of kraut juice dry up in real time and ponder the mysteries of embodiment, breath, and matter in the space of the kitchen.

We invite you, reader, to join us in this hot, messy, smelly place of AKF to create a way to understand transformation and time as a sensory site of knowing—a place from which to make relations and feel the rhythms of our shared aliveness in the world.