

# Common Roots

## Fermenting Cabbage



## Introduction

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In this lesson you will learn that across the globe people have been eating and preserving cabbage for thousands of years. You will also learn about the food science of fermentation (a cooking process that does not require a stovetop) and why eating “soured cabbage” as kraut is a good winter wellness food choice. This lesson offers multiple cabbage recipes and dives into gut health and how it relates to the soil microbiome. Cabbage is not only rich in nutrients, including beneficial bacteria, but also is a useful natural plant dye and holds plenty of history, which makes this lesson exciting for curious learners!



# Sauerkraut

Makes a gallon of kraut, so share with some friends!

## Ingredients

- Green cabbage; 4 1/2 pounds.
- Red cabbage; 1/4 head
- 3 tablespoons sea salt
- 1/4th organic apple, grated.
- 1 thumb-size portion fresh ginger root, thinly grated.

## Supplies

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| <ul style="list-style-type: none"> <li><input type="checkbox"/> 5 gallon food grade bucket or large bowl to hold all the cabbage</li> <li><input type="checkbox"/> Pestles (options include kraut masher the size of a baseball bat, rolling pin without handles, or pint widemouthed mason jar filled with water and lid secured on tightly)</li> <li><input type="checkbox"/> 4 - 5 chopping boards</li> <li><input type="checkbox"/> 4 - 5 large sharp knives appropriate for age level and group size</li> <li><input type="checkbox"/> Food scale</li> <li><input type="checkbox"/> Measuring spoons</li> <li><input type="checkbox"/> Veggie peeler or potato grater microplane</li> </ul> | <ul style="list-style-type: none"> <li><input type="checkbox"/> Small mortar and pestle</li> <li><input type="checkbox"/> Stainless veggie grater</li> <li><input type="checkbox"/> 2 dish towels, sponge, hand soap, dish soap, nail brush, water in a wash basin</li> <li><input type="checkbox"/> Kraut crock or 2 - 3 widemouthed half gallon jars washed with lids</li> <li><input type="checkbox"/> Compost bucket</li> <li><input type="checkbox"/> Widemouthed funnel</li> <li><input type="checkbox"/> Large serving spoon that fits inside widemouthed jars</li> <li><input type="checkbox"/> Food-service gloves for mixing kraut and salt by hand</li> <li><input type="checkbox"/> 9x13 rectangular glass casserole or cookie pan with sides (for putting mason jars into as they ferment)</li> </ul> |
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## Directions

### Cut Up Ingredients

Slice the cabbage into 1/4" thin strips. Place in an oversized bowl or in a 5 gallon food-safe bucket. Add the salt—a good rule of thumb to go by is 10g of salt for every pound of cabbage or 3 Tbsp for 5 pounds cabbage.

### Massage or Mash (Part 1)

Massage the salt into cabbage with your hands for several minutes. Chapped and dry hands do not appreciate salt, so glove up. If you plan to use a wooden masher (see photo of wooden kraut mashers), it is best to place ingredients in the food-grade bucket.



## Directions

### Massage or Mash (Part 2)

Pass the bowl and bucket with masher around for all to try. Listen to the sounds that start out squeaky and crunchy. As you massage, the sound will change. As water releases from the cells of the cabbage it will start to sound sloppy... like walking through slushy snow!

Look in the bowl or bucket for watery brine. Observe any changes in color or texture.

### Mix

Once our cabbage is soft and a lot of water is released, we will add our thinly grated apple and microplaned ginger. Mix to combine.

# Sauerkraut

### Jar

Pack tightly in a jar, making sure there are no air bubbles. Place a cabbage leaf on top to keep the kraut submerged. You can also top with remaining juices to make sure the cabbage leaves are below the liquid in the jar. Lightly cover the jar with a plate or an unscrewed on lid to keep out dust and allow bubbly gasses to be released. Place on a pan to collect any oozing juices.

### Wait

Now we will leave this jar somewhere out of direct sunlight, at room temperature and do some magical cooking for 1-3 weeks. Check regularly to be sure massaged cabbage is below the surface of the brine water at all times. After a week taste for desired texture and flavor. Place in frig when you perfect your kraut.



# Coleslaw with Yogurt Dressing

## Ingredients

### Coleslaw

- 8-10 cups of shredded green cabbage (one large cabbage head).
- 2 cups of shredded carrots.
- Four scallions sliced very thin and chopped, optional.
- Celery leaves from three celery stalks minced, optional.

### Yogurt Dressing

- 1 1/3 cups yogurt.
- 3 Tbsp honey, warmed over low heat.
- 2 tsp Dijon mustard.
- 2 Tablespoons apple cider vinegar.
- Salt and pepper to taste, optional.
- Celery leaves from three celery stalks minced, optional.

## Directions

### Cut, Grate, and Combine!

Slice the cabbage into 1/4" thin strips. Cut cabbage into pencil-thin shreds. Grate whole carrots until you have two cups worth, making sure to include the nutritious outer peel. Combine cabbage, carrots, and celery leaves in a large bowl. Add yogurt dressing and toss well. Try this fermented yogurt dressing on salad, fish tacos, veggie burgers, and more. Explore!



# Crisp Cabbage, Apple and Carrot Salad

## Ingredients

- 2 1/2 Tbsp EVOO.
- 1 Tbsp orange juice.
- 2 tsp white wine vinegar.
- 1/3 tsp kosher salt.
- 1/4 Tbsp ground cinnamon.
- 1/4 Tbsp ground cumin.
- 3 cups shredded carrots (3–4 medium carrots; cook carrots for those with a raw carrot allergy or substitute green cabbage).
- 1 cup chopped red cabbage.
- 1 large crisp red apple chopped with nutrient-rich skin on.
- 1 cup sunflower sprouts.
- 1/2 cup fresh cilantro leaves.
- 3 tbsp lightly toasted sunflower seeds.
- Freshly ground pepper to taste.
- Lime wedge for serving, optional.

## Directions

### Whisk

Whisk oil, orange juice, vinegar, salt, cinnamon, and cumin in a large bowl. Add carrots, cabbage, apple, sunflower sprouts, cilantro, and sunflower seeds.

### Toss

Toss to combine with dressing. Serve with lime wedges if desired.

# Health and Wellness

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## *Ages 4-7*

Cabbage is a very important vegetable. Does anybody know what cabbage is? Have you eaten it at home? Cabbages are basically big balls of leaves like the ones on trees. They just taste much better! Can you name any other foods with leaves? Long ago, people did not have refrigerators so cabbage was stored in cold root cellars underground. Cabbages can be stored for many months during winter when other fresh garden foods cannot be grown. People noticed that eating cabbage during their long workdays gave them the energy they needed to keep going. Cabbage also helped them to stay healthy because it has lots of vitamin C—more than an orange. If you choose to eat cabbage, you are helping your body build energy and perhaps even prevent winter sniffles.



## *Ages 8-12*

Cabbage is a very important vegetable packed with many nutrients. People have been eating cabbage for thousands of years. It provided the energy needed for communities to do the heavy work of building roads and houses long before we had inventions and machinery to make the tasks easier. Cabbage was valued so much that it was preserved by a cooking process that used no heat from a fire or stove. It's called fermentation. Fermentation isn't the only way to preserve food. Food can also be preserved using sugar. However, preserving with sugar is not desirable because it lacks the benefits found in fermented foods. Instead it uses sugar, a food that does not build strong bodies. A diet that includes fermented foods can improve how well we digest our food and make available much more of the vitality in the food we chew.

When we eat cabbage, we are fueling our body with important nutrients that will help us to learn and think as well as do hard physical tasks such as sports and chores like stacking wood or shoveling snow.

Our gut and a forest have a similar role to play in breaking down plant and animal matter. In the case of a forest, its nourishment consists of fallen leaves as well as many other forms of decaying plant and animal matter. Yet you and the forest benefit from thousands of invisible, cooperative miniature life-forms in the soil that help us both thrive. The word for this wonderful natural habitat found in soil and our bodies is called a microbiome.

## ***How Sauerkraut Saved the Sailors***



On long voyages at sea, it was hard to feed the sailors, and what food they were able to keep edible was not very tasty. After a while, some sailors came down with a disease called scurvy. Have you heard of scurvy? Scurvy is caused by a severe lack of vitamin C in the diet. What vitamin C-rich food do you eat on a regular basis? Well, one of the amazing things about sauerkraut is that it not only remains edible for long periods of time (or on long voyages!) but it contains lots of vitamin C!

But even more amazing is that sauerkraut and all its good bacteria kept these sailors strong by keeping their gut microbiomes strong! On long voyages, sailors were separated from foods grown in the soil microbiome and thus their own gut

microbiomes weakened. By eating sauerkraut full of gut microbiome-boosting beneficial bacteria, these sailors were protected while at sea.

Because of these incredible properties, sauerkraut served as medicine and was able to save the sailors!

## *Ages Teen to Adult*



There are many ways we can prepare cabbage, including through fermentation. Fermentation is a natural preservation process that is done through the work of the many microorganisms living in food and soil. Fermenting doesn't only preserve food, it also plays an essential role in our gut microbiome health.

Bacteria and fungal microorganisms invisible to the naked eye work together in our gut and soil microbiomes. As we chew, we don't always masticate our food enough to release all the available vitality. Fermented food bacteria breaks down our chewed food to more readily release available nutrient particles. This bacteria helps us fully digest our food and possibly prevent indigestion and other related intestinal ailments. It also supports healthy bowel elimination. In the past few years, there has been research showing that a healthy gut microbiome can support healthy brains. You can support your whole body by eating fermented foods like sauerkraut, yogurt, miso, kimchi, and sourdough breads. Fiber in grains and whole foods are also beneficial for gut health and elimination.





## ***Prenatal Benefits of Sauerkraut***

Sauerkraut is a probiotic. This means that it contains bacteria that is beneficial to your gut microbiome. Your gut biome can be very important when you are pregnant. Both before, in preparation, and during pregnancy, a woman's body needs to be well nourished with vitamins, minerals, and energy to support the growth of the fetus. A healthy gut biome can help with this by aiding in the health and immune function of the mother and thus the child. A woman's gut microbiome is transferred over to her child upon delivery. This means that the healthier her gut biome, the healthier the child's. When a child is birthed naturally and passes through the birth canal, a small sampling from the mother's gut biome is transferred over from the birth canal to the infant. When a cesarean section is necessitated, you might want to ask your doctor about manually giving a swab of bacteria to the newborn child.

The gut microbiome can also impart positive effects on a person's mental health and mood. Stress during pregnancy might be mitigated by maintaining a healthy gut microbiome, which would support the well-being of both mother and child.



## ***Elders***

### ***Sauerkraut, memory retention, and the gut microbiome***

We often refer to cabbage as a head of cabbage. And who knew? A healthy gut microbiome has the power to influence and even alter a person's brain chemistry. It has been shown to have positive effects on mood and even memory. A tablespoon or two of sauerkraut a day can help keep your gut biome happy with a diversity of bacteria. As we age, thoughts can slip our mind, but one way to fight back against this is to take care of the bacteria that live in our gut. One of the ways to do this is by eating fermented foods such as sauerkraut.

# No Waste!

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## *Create Color with Cabbage*

Cabbage is not only nutritionally dense and incredibly tasty, it also can be used for a natural dye! Red cabbage contains beautiful pigments that can be transferred onto fibers such as paper, cotton, and wool. We can obtain the beautiful magenta color of sauerkraut but also change the color by altering the dye's pH with household ingredients. This natural and simple dyeing method is the perfect craft to do with cabbage that would otherwise go straight to the compost!

Step 1: Gather materials.

- Red cabbage
- Salt
- pH adjuster (white vinegar or baking soda)

Other materials:

- White natural fiber items to dye (paper, white napkin, an old T-shirt, yarn, light tapestry, shoelaces, etc.)
- Large non-aluminum pot
- Rubber bands
- Sieve
- Non-aluminum container large enough to hold the liquid from strained cabbage
- Non-aluminum container shaped to hold dye bath and items you want to dye
- Hot plate, stove, or slow cooker

Step 2: Chop red cabbage into 1-inch pieces.

Step 3: Cook cabbage.

- Transfer chopped-up cabbage into a large pot on top of either a hot plate or stove or place in a slow cooker.

- Cover with a few cups of water and sprinkle with a thin layer of salt (about 3 tablespoons for a full head's worth of cabbage).
- Boil water over high heat for 4–8 hours, or until mix has been reduced by nearly half. If using slow cooker, set on high for 4–8 hours until cabbage has released as much moisture as possible.

Step 4: Transfer dye.

- The liquid should now be pigmented as a rich magenta color.
- Using a sieve, strain liquid from cool cabbage into a container and press down on the cabbage to squeeze out as much liquid as possible.
- Move dye to a container that is large enough to soak your items in.
- Save the dye, and compost the leftover cabbage to help replenish the soil.

Step 5: Change dye color by adjusting pH.

- This is an optional yet fun way to change the dye color.
  - The dye is currently a pretty magenta color.
  - Adding an acid, such as vinegar, will turn the dye a pretty pink.
  - Adding an alkaline substance, such as baking soda, will turn the dye a beautiful blue.
  - Adding a lot of baking soda will turn the dye a nice shade of green when dry!

### ***Optional Activity:***

Split class into three groups. Separate strained dye into three equal-sized bowls. The first class will dye their items with the original magenta color. The second group will add about two tablespoons of white vinegar to their dye to turn it green. The third group will add a tablespoon of baking powder to their dye to turn it pink!

Step 6: Prepare and dye the paper or cloth.

- You can fold and tie paper and cloth with rubber bands and create a tie-dye pattern, or just let the item soak without creating a pattern.
- Let items soak for at least 24 hours.

Step 7:

- After 24 hours, rinse items in cold water until the water runs clear and let dry.
- It may look dull at first, but after rinsing, unfolding, and pressing with an iron, the color will be more colorfast, beautiful, and vibrant!
- Students can compare the different colors each group created with the different methods.

# Cultural and Historical Background

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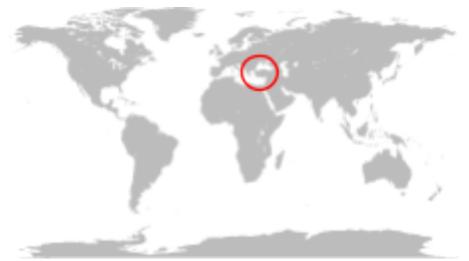


## *Ages 4-7*

The word cabbage comes from the French word *caboche*, which means “head.” Can anyone think of why cabbage might come from a word that means head? Probably because it looks a lot like the head you have on your body! In fact, when we talk about a cabbage plant, we use the word “head” to describe the big ball of leaves that we eat. Cabbage is a very old plant that has been used by people around the world for thousands of years. Over the years, people would carry cabbage plants and their seeds with them on their travels so they could grow it wherever they lived. When does your family eat cabbage? In the winter? In the summer months?

## ***Food Origins: Ancestral Wisdom, Flavors, and Wellness***

Does your family eat cabbage in the winter? How do they eat it? Do your grandparents enjoy any favorite cabbage recipes? You might ask them. For more years than you have lived, some families all over the world have been eating cabbage every day. Eating cabbage once was as important as drinking water. Why? It was considered to be preventative medicine. Preventative medicine is thought to help you avoid getting sick. Today there are still many different ways that families eat cabbage—or not.



Once cabbage was harvested in the fall just at the time when everyone went back to school, it was properly stored in a cool place like a cold cellar or a refrigerator. It lasted between three weeks to two or more months if properly stored. This hearty vegetable

was perfect for winter meals. After most food stopped growing due to cold temperatures, stored cabbages provided a boost of nutrients when there was little fresh food full of vitality to harvest. In many lands, cabbage was eaten like we eat an orange—not for the flavor but for the high levels of vitamin C found in cabbage.

Cabbage was also fermented by making it into sauerkraut or kimchi. Why ferment cabbage? Fermented cabbage could be stored longer, and it added beneficial bacteria called probiotics that aid in digestion, reduce bellyaches, and support a strong immune system to help fight off viruses. Cabbage has many names in many cultures. For example, in Poland, cabbage is prepared in a very similar way to German sauerkraut and is called “kapusta” [kah-POOS-tah], which just means cabbage!

Many cultures (including European countries such as Poland and Germany and even colder countries such as Russia) begin fermenting cabbage once it is harvested in the late fall. Then they wait until the new year to eat it. The sauerkraut is meant to symbolize prosperity and good health. It is eaten just as the new year begins with the hope that it brings on good luck for the next year—probably because it’s so good for everyone!

Would you like to plan a Sauerkraut New Year Celebration? Follow our recipe to turn cabbage into sauerkraut. Teach others how to ferment sauerkraut. Hold a contest challenging friends to come up with unique ways to eat sauerkraut—salty, spicy, funky, wild. Be sure to have taste tests available.



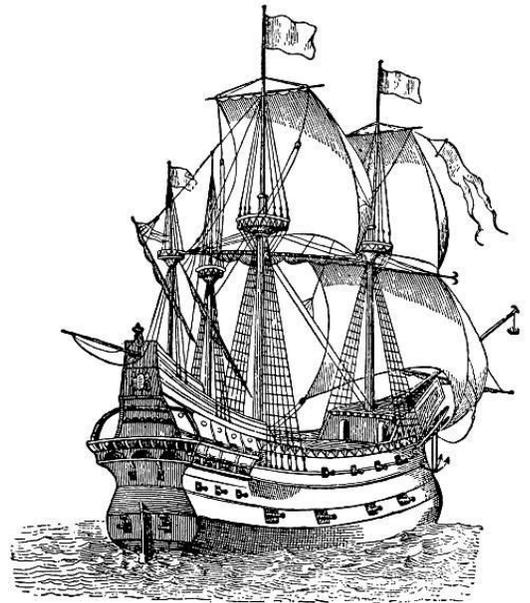
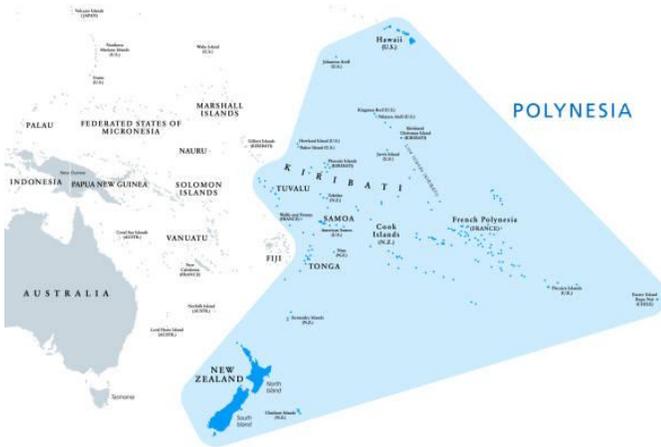
### ***Ages 8–12***

The word cabbage comes from the French word *caboche*, which means “head.” Why might cabbage come from a word that means head? In fact, when we talk about a cabbage plant, we use the word “head” to describe the big ball of leaves that we eat. Cabbage has been eaten around the world for thousands of years. Scientists believe that the plant originated in Asia Minor, far from the United States. Do you wonder how cabbage came to American soils? Cabbage was spread far and wide by travelers and

explorers who valued this food. Cabbage seeds eventually came to North America by an explorer named Jacques Cartier, who planted cabbage in Canada. After that, Native Americans and European colonists began growing the plant for their communities. Today, cabbage is enjoyed by many different cultures.

## ***Sauerkraut Saved the Sailors!***

Did you know that sailors in the 18th century relied on cabbage to stay healthy on their long voyages? Explorers traveled without access to land for months at a time. Think about it: if you're on a boat for months at a time with no refrigeration, what foods will last? Would you be able to keep strawberries or apples fresh for that long? Sailors didn't have access to all the vitality in fresh food. Can you think of ways to keep food from rotting? Fermenting and pickling became popular at the end of the 18th century.

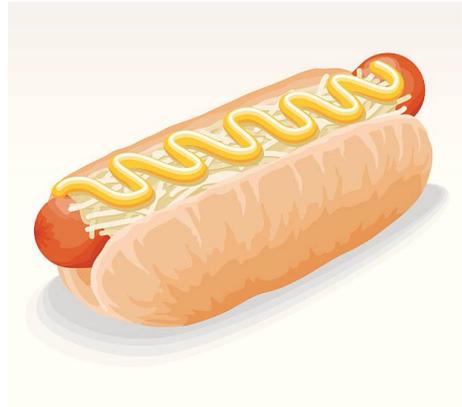


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Hearty and nutritious vegetables like—you guessed it—cabbage were preserved by a process called fermentation. Fermented cabbage provided sailors on long voyages with what they needed to reduce sickness! Famous sailors like Captain Cook fed the entire crew plenty of fermented (also called soured) cabbage. Without sauerkraut, explorers might never have discovered the lands we call home today!

Cabbage is a celebrated and staple dish in many cultures. Humans in various regions have been cultivating it for over 4,000 years! Between Western Europe, the Mediterranean, Asia Minor, and Russia, cabbage has become a staple food for everyday life as well as cultural celebrations. When we think of cabbage, oftentimes images of sauerkraut on a German bratwurst, as a bowl of Korean kimchi, on a hot dog, or as a side of coleslaw come to mind. These recipes all originate from cold northern climates. Did you know that Russia's national vegetable is the cabbage? Compared to the average North American, Russians eat seven times more cabbage! It is the perfect cold-climate crop because it is full of nutrients to help people living in frigid areas stay healthy and resilient to illnesses that thrive in cold weather, like colds and the flu.



<https://www.istockphoto.com/illustrations/sauerkraut-hot-dog>



### ***Ages Teen–Adult***

Cabbage has been a part of human diets for thousands of years. It originated in Asia Minor in countries like Turkey, Lebanon, Syria, Israel, and Palestine. The original cabbages were spread all over Europe by travelers and explorers. Thousands of years ago, during the Roman Empire a new type of cabbage was developed that was more tolerant to warmer climates. These newer cabbages were softer compared to the harder cabbages that were developed in Northern Europe. Cabbage was then brought to North America in the 1500s by Jacques Cartier, and eventually seeds found

their way into Canadian soils and later were planted in other North American soils by Native tribes.

# Growing Gardens

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Every huge head of cabbage begins as a tiny seed. Did you know cabbage means “head”? Depending on the climate where you live, cabbage can be planted in the early or late spring just before school is out. When planted in late spring, it can be harvested in the cooler days of autumn when you return to school. You can make lots of coleslaw and sauerkraut if you plant red and green cabbages.

Cabbage can tolerate temperatures as low as 20 degrees Fahrenheit and will prematurely bolt if it is exposed to temperatures surpassing 80 degrees! Cabbage is built for the cold. For this reason, we plant cabbage three or four weeks before the spring frost or wait until it is cool enough in the late spring for the seed to thrive.

## **Phase One: Growing under lights indoors**

A seed is the beginning of a plant’s life. The beginning part of the cabbage’s life is very important. Just like we need to be taken care of as babies, a seed needs extra attention when it is young. One way to protect the seed as it grows is to plant the seed under grow lights indoors. This protects it from things out of our control like harsh weather. The best time to plant indoors is 8 weeks before the final spring frost or 12–14 weeks before the first frost of the winter. Give each seed just enough space in the potting soil so it isn’t crowded and bury them just deep enough to be covered with soil. With water, indoor grow lighting, and nutrients from the soil, a seedling will begin to sprout!

Seen on the next page is a picture of a red cabbage seedling. You can’t see the roots that emerged first, and they should not be disturbed by looking at them now. When you transplant your seedlings into the garden you should see a well-formed root system. Notice how the first signs of life in a cabbage are the leaves. Does anyone have an idea why? It’s because leaves collect the light for the plant to grow.

Growing plants indoors under lights is not a simple process. For a more comprehensive guide on how to do so, click [here](#) for more information!

## **Phase Two: Hardening off before transplanting to the garden**

Indoors, the seedling grew in a sheltered environment. When it's 4–6 inches tall and has 2–4 leaves, we must prepare seedlings for life in the garden! Moving outdoors can be a shock to a baby plant, so it needs to adjust to the strength of the sun and wind and acclimate to temperature changes. This process is called hardening off and gives the plant time to adapt to elements such as wind, sun, and rain and changing conditions.



<https://www.alamy.com/stock-photo-young-red-cabbage-brassica-oleracea-seedlings-being-protected-from-104228659.html>

Move your seedlings outdoors into partial sun for half a day. Do this for several days, then move them into stronger sunshine for a few more days before planting. It is important to shelter transplants from strong winds and intense heat—remember, cabbage is made for the cold. Observe water needs every day and check for sun-damaged leaf edges. Move into a more sheltered area if you see sun damage on the leaves. It is especially important to pay attention to the weather and observe how your seedlings are reacting to it.

### **Phase Three: Transplanting into the garden**

Now you are ready to plant! The third or last week of April is usually a safe time, but check your planting zone to determine the best transplanting dates for your location. The seedling wants to be in soil that is nutrient dense and moist and gets at least 6–8 hours of sunshine! Does anyone remember one way we can make sure the soil has lots of vitamins and minerals? That's right—compost! Be sure to add at least a half inch to an inch of compost to the soil. Put the compost directly in the area where you will be planting.

### **Phase Four: Cabbage forms a head**

As the plant grows, it gets bigger above and below the soil. Below, the cabbage roots might look like underground branches. Roots collect the water and nutrients from the

soil. While the roots are gathering up what the plant needs, the upper parts of the plant grow larger. On top of the soil, we can actually see what's happening!

What does cabbage look like when we see it at the store? It's not a bunch of sprawling leaves, right? Cabbage, when fully grown, is the shape of a head. Has anyone heard the term a "head of cabbage"? So how does it change from the leaves we see in the



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seedling into a head? Cabbage grows in an amazing way. Egg-shaped leaves wrap around the stem. They wrap around it so tightly that many outer leafy layers form and create a round shape.

Can you see the round shape forming? The leaves start at the bottom of the stem and then fold inward. They fold over the leaves that are closer to the center, protecting each egg-shaped layer that grew before.

Let's take a peek inside a beautiful head of cabbage. Can you guess where the stem is? That's right—the leaves wrap around the stem so the stem must be the stalk in the center! We call this the core. Around the core, we can see many layers of leaves. The ones on the inside were the first to wrap around the core and as the cabbage grew bigger and bigger, the leaves kept wrapping around the outside! The outside of the cabbage is what is exposed to the environment. One of the coolest things on the outside of the cabbage are all these tiny things called bacteria. Who has heard that term before? Usually, when we hear "bacteria," we think about getting sick. We wash our hands and



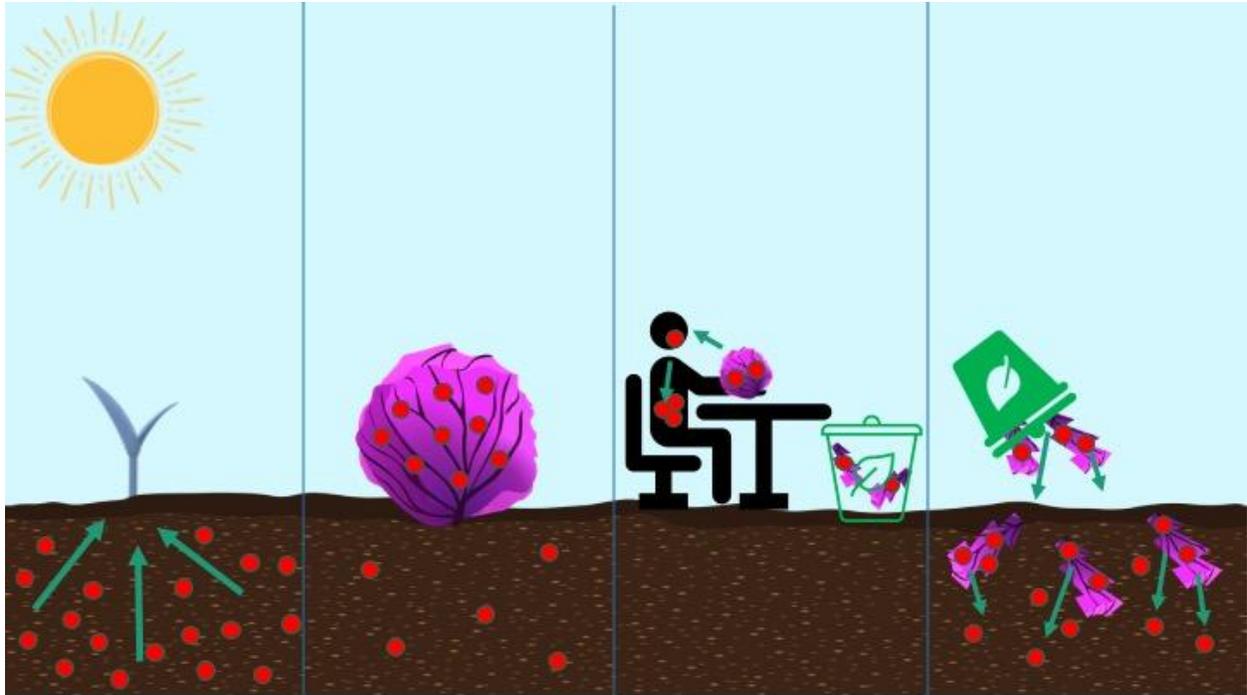
Photo credit: JoAnna Dene

use hand sanitizer to get rid of the bad bacteria that can make us sick. However, there are many other types of bacteria that actually help us stay healthy! These are called probiotic bacteria. We can call them our invisible helpers because when we eat them, they stay in our bodies and help us digest food and fend off sickness. On the outside leaves of the cabbage head, there are tons of invisible helpers! This means that by eating the cabbage, we are giving our bodies more invisible helpers!

While the cabbage head begins to form, the farmer is doing their best to make sure it has everything it needs. She is making sure the soil is moist, that the cabbage is getting plenty of sunlight, and that pests are staying away.

### **Phase Five: Harvest**

Eventually, the plant will be ready for harvest! How long do you think it takes for the cabbage to be fully grown? 10 days? 50 days? 100? It takes, on average, 70 days for red cabbage to be fully ready. Once it is ready to harvest, the farmer will chop the cabbage head off the stem and we're almost done. The last step of the life cycle of any vegetable is making sure someone gets to enjoy it. The farmer may eat the cabbage themselves, give it to a friend, or sell it at the grocery store or at a farmer's market. All of the parts of the cabbage that don't get eaten, like the stem and roots, go back into the soil after being composted. In order to grow, the cabbage collects many nutrients from the soil, so the soil needs some nutrients returned to feed the next crop. The parts that aren't being enjoyed can be made into compost and then go back to rebuild the soil where the cabbage came from and help grow a future plant!



Anna Brown

Pictured is a graphic showing us how nutrients move from the soil to the plant, into our body, and back to the soil when plant waste is composted.

**Phase One:**

The cabbage sprout begins to grow. As the sprout is growing, it takes nutrients it needs right from the soil microbiome.

**Phase Two:**

As the cabbage plant gets bigger and bigger, it continues to take nutrients from the soil. As you can see, because the cabbage absorbed the soil's life-giving nutrients, the soil has less now.

**Phase Three:**

Now the cabbage is fully grown and is full of nutrients that will nourish us. When you eat the outer leaves of cabbage, you absorb the benefits of nutrients that were once in the soil. Remember how we used the leaves when capping off our cabbage so it could ferment into sauerkraut while preventing unwanted bacteria from growing in the jar? Sound like a cycle of goodness that never ends? Nature works in collaborative ways.

We eat as much of the cabbage as we can, but scraps like the core that don't end up in our bodies can be discarded as compost.

***Phase Four:***

This is when you can play a role in the cycle of goodness by using food scraps to make compost. Compost returns nutrients to the soil so that it becomes strong again to grow more plants!

# Digging Deeper:

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## *Fermentation, Gut and Soil Microbiome Relationships*

### **Note to Educators:**

#### **Why is our gut bacteria so important?**

The bacteria that live in our digestive system, most living and working in our large intestines, are responsible for breaking down food into its most absorbable form. As some of us know, earthworms move along and eat soil, then poop out BETTER soil. It's better because the nutrients in that soil were digested and made into their simplest form. The plant can absorb the digested soil without using any energy to break it down. Our gut bacteria are our earthworms. They eat (ferment) our partially digested food, using it for their energy. Their waste product is a smaller, more bioavailable substance that can move across our intestinal membranes and into our bloodstream. From there, vitamins, minerals, sugars, fats, proteins, etc., are able to be absorbed as needed. Without healthy gut bacteria, a portion of the available nutrients are not absorbed even if you're eating food raised in the healthiest of soils.

Because of our loss of contact with both the natural world and diversity in the soil of that world, the gut biome that our bodies depend on has weakened. Humans have adapted to the microbiome of the soil where we live, and if those soils are full of vitality we can build up a healthy gut biome. But as outside activities and exposure to soil decreases, so too does the strength and diversity of our gut biome. When we embrace the dirt under our fingernails by going outside, playing, and planting, we invite the natural world to boost our natural strength.



### ***Ages 4-7***

Have you heard “wash your hands, sanitize the table, cough into your elbow”? Those are reminders that certain bacteria can make us sick. But did you know that good bacteria are invisible helpers

and are very important for building up our strong body? The good news is that today we are turning cabbage into sauerkraut, and kraut is full of invisible helpers. Cabbage has lots of naturally good invisible helpers right on its leaves! And dirt, yes soil, is also full of these invisible helpers. Playing in dirt, growing a garden, and building stick forts in the forest help us gather up all these invisible helpers—right under our fingernails.

These invisible helpers are also in fermented foods. These are foods such as sourdough, pickles, kombucha, and sauerkraut. Even yogurt is a fermented food, and it is full of invisible helpers. It can be a great and easy addition to any meal, including coleslaw— just like in Grandma Slaw’s secret coleslaw recipe!

This is the story of Grandma Slaw and her amazing coleslaw recipe and the little girl who finally convinced her to share.

Throughout the town Grandma Slaw, so named because of her fantastic coleslaw recipe of course, was renowned. She made the best coleslaw in the whole town and as such was constantly asked by her friends and neighbors, “How do you do it?” At the store they asked. At parties they asked. And even when Grandma Slaw was taking her daily walks they asked!

But Grandma Slaw never told. Oh no, even more famous than her recipe was the secretive smile she gave when she told her admirers, “It’s a secret, my dears, and I shall never reveal it!”

Even Grandma Slaw’s family was left wondering!

“Grandma, Grandma!” they cried when she came by. “Oh, tell us, tell us your secret, Grandma, so we can eat your coleslaw at home and at work, at school and parties, and never run out!” But even still, faced with the pouting and pleading of her children and grandchildren alike, Grandma Slaw just smiled her secretive smile and lifted a finger to her lips.

“It’s a secret, my dears, and I shall never reveal it!”

And so it went. Time after time she was asked and asked again. And time and time again she smiled a smile full of secrets and magic and coleslaw mystery.

Then one day, little granddaughter Sindy Slaw blinked her big brown eyes at her grandmother and asked about the secret recipe. For Grandma Slaw, this brought on a memory of days long past. A memory of her own brown eyes, sweet and pleading, asking her mother much the same.

“Oh Mama, Mama, won't you teach me to make your yogurt? It is oh so delicious, and I do so wish to learn.” That day Great-Grandma Slaw taught her daughter the secret. It was not just any yogurt, oh no. It was yogurt made from cows that grazed on the green grass of lush pastures. The cows were happy and loved and cared for, making their milk so fresh and scrumptious it could make even the grumpiest of grinch's smile. Grandma Slaw's yogurt was made with just two farm-fresh ingredients: milk fresh from the udder and wonderful living bacteria. This tradition was as old as the Slaw name, passed from father to daughter and mother to son—all who savored its deliciousness on their tongues.

Great-Grandma Slaw showed Grandma Slaw how to make yogurt. She placed a pot of milk on her woodstove. They carefully watched for little bubbles to circle around the milk at the edges of the pot. When they saw the bubbles, they put their pinky fingers in the milk. If they could barely keep their fingers in the hot milk while counting one, two, three, four seconds before pulling out, it was just the right temperature and time to take the pot off the heat. If their pinky fingers were comfortable, they waited to test the four-second rule again until it was just right.

“Like Goldilocks,” Great-Grandma Slaw would say. “Not too cold, not too hot, but just right.” The milk rested off the heat for a while. When the milk cooled down and was just barely warm against Great-Grandma's pinky, she spooned out a heaping dollop of yogurt and mixed it into the milk. If she had

some dry milk powder she would add a tablespoon or two to the mix. That little dollop of yogurt would sour and thicken the milk. Great-Grandma Slaw wrapped the jar of warm milk and yogurt mixture in a towel. She left it sitting overnight near the warm woodstove. In the morning she unwrapped the warm jar and tipped it on its side. The milk did not splash in the jar. It was firm like pudding, all due to that little dollop of yogurt. The yogurt soured (fermented) the milk, creating the perfect secret ingredient that made Grandma Slaw's coleslaw famous.

Grandma Slaw loved that her mother taught her to make yogurt. She vowed to teach little Sindy Slaw as soon as she was old enough. And so the next time Sindy asked Grandma, she answered with a secretive smile and a wink. "It's a secret my dear...for now. But soon, soon."



## ***Ages 8-12***

### ***What is fermentation?***

The invisible bacteria in our fermentation jar break down food and release chemicals to make the water in the jar deadly to any unwanted bacteria. The beneficial bacteria eat and break down the fermenting vegetables slowly so that they do not rot. You should be able to observe the bubbly fermentation process during the first few days to a week.

### ***How is fermentation similar to the actual growth of the plants and vegetables we eat?***

What do plants need to grow? They need water, energy (in the form of sunlight), and food (in the form of sugar). And what do you know, that's basically what human beings need to ferment food.

**Water:** The vegetables you are fermenting need to be fully submerged under liquid. This allows the beneficial bacteria to flourish and prevents the growth of the harmful bacteria.

**Energy:** Plants need the energy of the sun to grow, and the bacteria needs energy to ferment the vegetables. The fermenting bacteria need warmth, or heat, not sun! Heat is a different form of energy. If the jar you are fermenting your vegetables in is too cold (not enough energy), the bacteria take a long time to sour or ferment. This is why the jar is best kept at around 68°F to 72°F. Of course, it can become too hot, and if this happens the bacteria will either work too fast and burn out or simply perish.

**Food:** Lastly, plant leaves photosynthesize sunlight into sugars to support their growth. To ferment vegetables, you need food (sugar and carbohydrates) to feed the bacteria. Just like you might not be able to work on an empty stomach, the bacteria that ferment our food can't either. The sugar and carbohydrates in the fermenting foods themselves act as the food for the bacteria fermenting them. We want to encourage the growth of these bacteria so they can support our gut microbiome, which then supports our digestive health and our brain.

## Teens to Adults.



**From Sweet to Sour: Fermenting other veggies such as carrots, radish, fennel**

Fermentation is the process in which anaerobic (oxygen denied) bacteria slowly decay the food that we are fermenting. This bacteria uses the sugars and carbohydrates in fermenting food to feed themselves and then release substances into the water that make it inhospitable to aerobic (oxygen thriving) bacteria that would disturb the fermentation process and make the final product inedible.

- First we sanitize our jar 16-oz. jar. The best material to use for the lid is plastic, but plastic wrap under the metal lid (if tight enough) will also work.
- Then we fill it with salty water or vinegar and delicious herbs and spices. In this case use  $\frac{1}{2}$  tablespoon equal parts water and vinegar.
  - Slice carrots, beets (should be cooked first), fennel, and watermelon radish into pickle-size widths or into thin rounds. String beans can be used whole.
- In a pan, mix together water, vinegar, and salt, bring it to a boil, then add to the jar. Add other spices and herbs into the jar such as a peeled clove of garlic or some dill flower heads or dill seeds.
- Make sure the vegetables are fully submerged in the water and there is a  $\frac{1}{4}$ -inch space between the water and the top of the jar.
- Screw on the lid. Test the seal by pressing into the lid; it should not move. Wait 2–3 weeks before eating and storing in the fridge.



## ***Prenatal***

### **From sweet to sour: Fermenting veggies**

Fermentation is the process in which anaerobic (oxygen deprived) bacteria slowly decay the food that we are fermenting. The bacteria use the sugars and carbohydrates to ferment food to feed themselves, then release substances such as alcohol into the water that make it inhospitable to aerobic (oxygen thriving) bacteria, which would disturb the fermentation process and make the final product inedible.

See recipe in Teens to Adult section above.



## ***Ages 8-12***

### **Experiment: Yeasty Beasty Bacteria**

1. Repurpose: Get a clean plastic jar or bottle with a screw-on lid.
2. Add a spoonful or two of sugar.
3. Fill  $\frac{1}{6}$  to  $\frac{1}{4}$  of the way with water.
4. Add  $\frac{1}{2}$  teaspoon of yeast.
5. Mix well by shaking the bottle, but do so gently.
6. Cover the mouth of the bottle with a deflated balloon and wait.
7. The balloon will inflate, and this is fermentation. The gasses that are inflating the balloon are by-products of the anaerobic bacteria (yeast) fermenting the sugar!

8. What else do you observe? Perhaps the slight foaming of the fluid in the bottle?

- Link to video:

<https://www.youtube.com/watch?v=LmfV8m5SqWY>

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# References

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Aggie Horticulture. (n.d.). Of cabbages and celts. Retrieved from Aggie Horticulture Texas A&M Agrilife Extension website:  
<https://aggie-horticulture.tamu.edu/archives/parsons/publications/vegetabletravelers/cabbage.html>

Albert, S. (2020). How to grow cabbage in easy steps. Retrieved February 15, 2021, from [https://harvesttable.com/how\\_to\\_grow\\_cabbage/](https://harvesttable.com/how_to_grow_cabbage/)

All-natural cabbage dye. (2018, July 05). Retrieved February 18, 2021, from <https://www.instructables.com/All-Natural-Cabbage-Dye/>

Anderson, M. (n.d.). Of cabbages and celts. Retrieved February 15, 2021, from <https://aggie-horticulture.tamu.edu/archives/parsons/publications/vegetabletravelers/cabbage.html>

Bir, S. (2020, January 03). The true story of traditional new year's lucky foods. Retrieved February 15, 2021, from <https://www.serious-eats.com/2014/12/good-luck-food-new-year-pork-sauerkraut-lentil-herring-collards-hoppin-john.html>

Blum WEH, Zechmeister-Boltenstern S, Keiblinger KM. Does Soil Contribute to the Human Gut Microbiome? *Microorganisms*. 2019; 7(9):287.  
<https://doi.org/10.3390/microorganisms7090287>

Cabbage facts. (n.d.). Retrieved February 15, 2021, from [https://www.softschools.com/facts/plants/cabbage\\_facts/662/](https://www.softschools.com/facts/plants/cabbage_facts/662/)

Cabbage: Using & storing. (n.d.). Retrieved February 15, 2021, from <https://cedarcirclefarm.org/tips/entry/cabbage-using-storing>

Davies, E. A., Woodward, J. B., Vance, J. E., & Stilwell, J. J. (2020, November 10). 17th-Century developments. Retrieved February 15, 2021, from <https://www.britannica.com/technology/ship/17th-century-developments>

GermanFoods.org. (n.d.). Sauerkraut, germany's superfood. Retrieved from German Food website:  
<https://germanfoods.org/german-food-facts/sauerkraut-superfood/>

Holzapfel, W., Schillinger, U., & Buckenhüskes, H. (2008). Sauerkraut. In *Handbook of fermented function foods* (pp. 395-409). Boca Raton: CRC Press Taylor And Francis Group.

Howe, H. (2018, August 16). 51 fascinating facts about SAUERKRAUT & CABBAGE. Retrieved February 15, 2021, from <https://www.makesauerkraut.com/sauerkraut-facts/>

Kubala, J., MS, RD. (2017, November 4). 9 Impressive health benefits of cabbage. Retrieved February 15, 2021, from <https://www.healthline.com/nutrition/benefits-of-cabbage>

LeBlanc, T. (2014, April 23). Magical sour cabbage: How sauerkraut helped save the age of sail. website:  
<https://modernfarmer.com/2014/04/magical-sour-cabbage-sauerkraut-helped-save-age-sail/>

“Light & Temperature.” *The Probiotic Jar*,  
[www.probioticjar.com/light--temperature.html#:~:text=Cover%20the%20Jar%20with%20a,dark%2C%20and%20light%20kills%20them.](http://www.probioticjar.com/light--temperature.html#:~:text=Cover%20the%20Jar%20with%20a,dark%2C%20and%20light%20kills%20them.)

Link:

<http://www.probioticjar.com/light--temperature.html#:~:text=Cover%20the%20Jar%20with%20a,dark%2C%20and%20light%20kills%20them.>

Owen, M. (n.d.). Why captain cook owes his career to cabbage! Retrieved February 15, 2021, from <http://www.plantea.com/cabbage-cook.htm>

Rolek, B. (2019, October 2). Sauerkraut packs a punch in many Eastern European Recipes. Retrieved March 01, 2021, from <https://www.thespruceeats.com/sauerkraut-the-quintessential-eastern-european-vegetable-1137498>

Sandborn, D. (2020, December 7). Plant science at the dinner table: Cabbage. Retrieved February 15, 2021, from [https://www.canr.msu.edu/news/cabbage\\_and\\_the\\_science\\_behind\\_them](https://www.canr.msu.edu/news/cabbage_and_the_science_behind_them)

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