Making Home Made Cheese, by Phyllis Hobson, 1973
(This recipe is for 3 gallons of milk which makes about 3 lbs of cheese)

About the Milk
You can use cow milk, goat milk, or sheep milk. Whole milk is best for hard cheese. Use fresh whole milk from healthy grass-fed cows (from nearby farm, no hormones in feed). Some cheese makers pasteurize even fresh, raw milk, because the native bacteria may compete with the specific molds and bacteria you want to proliferate. If you want to pasteurize raw milk, heat it to 145 degrees F in a stainless steel pot or double boiler. Hold the temperature for 30 minutes, then chill the pot until the milk dips below 40 degrees. Store bought milk is OK, but do NOT get "ultra-pasteurized" milk.

About Starters
Acids: Citric Acid, Lemon Juice, Vinegar
Bacteria: Rennet, Yeast, Buttermilk, Yogurt

You can make a tart starter by leaving 2 cups fresh milk at room temperature for 12-24 hours, or until it clabbers.

To make mellow homemade culture, put 1/8 cake ueast in 1 cup warm milk and let stand 24 hours. Pour out half the milk and add 1 cup warm milk and let stand another 24 hours. Repeat this for one week. At eh end of the week add the mixture to 2 cups warm milk and let stand another 24 hours.

About the Water
Its best to use filtered water or distilled water when making cheese as some water supplies contain compounds that compromise milk's ability to be made into cheese.

Adding Color
If you desire to add coloring do it now before ripening the milk.

Ripening the Milk
Warm the milk slowly to 86 degrees (double boiler style). Stir occasionally so it does not skim over and it heats evenly. Then add two cups **starter**, stirring thoroughly for two minutes. Cover and let stand in a warm place (perhaps overnight). In the morning taste the milk. If it has a slightly acid taste it is ready for the next step.

> ***Using Starter Only:*** If you are not using rennet, skip the next step and let stand for 18 to 24 hours more, or until the curd has formed and the whey is separating.
>
> ***Using Rennet (accelerator):***
> With the milk at room temperature add ½ teaspoon rennet liquid or 1 rennet tablet dissolved in ½ cup cool water. Stir for two minutes to mix in thoroughly. Cover the container and let it remained undisturbed until the milk has coagulated, for about 30-45 minutes.

Cutting the Curd

When the curd is firm and a small amount of whey appears on the surface the curd is ready to be cut. With a clean knife slice the surface curd into half-inch cubes. Stir the curd carefully with a wooden spoon or paddle and cut any cubes which do not conform to size. Stir carefully to prevent breaking the pieces of curd.

Saving the Starter

If you wish to save some starter, carefully pour off two cups of whey at this time to be used as a starter.

Heating the Curd

Place the container in a larger one of warm water, double boiler style, and heat the curds and whey slowly at the rate of two degrees every five minutes. Slowly heat to a temperature of 100 degrees (in 30-40 minutes), then hold at this temperature until the curd has developed the desired firmness. Keep stirring gently to keep the cubes of curd from sticking together and forming lumps. As it becomes firmer the cured will need less stirring to keep it from lumping.

Test the curd for firmness by squeezing a small hand full gently, then releasing it quickly. If it breaks apart easily and shows very little tendency to stick together it is ready. The curd should reach this stage 1.5-2.5 hours after you add the rennet to the milk.

It is very important that the curd be firm enough when you remove the whey. If it is not the cheese may have a weak pasty body and develop a sour flavor. If it is too firm the cheese will be dry and weak flavored. When it is ready remove the container from the warm water.

Removing the Whey

Pour the curd and whey into a large container which have lined with cheesecloth. Then lift the cheesecloth with the curds inside and let it drain in a colander or large strainer.

When most of the whey has drained off take out of the cheesecloth, put the curd in a container and tilt it several times to remove any whey that drains from the curd. Stir occasionally to keep the curd as free from lumps as possible.

Stir the curd or work it with your hands to keep the curds separated. When it has cooled to 90 degrees and has a rubbery texture that squeaks when you chew a small piece it is ready to be salted.

Salting the Curd

Sprinkle 1-2 tablespoons flake salt (non-iodized, iodine kills bacteria) evenly throughout the curd and mix it in well. As soon as the salt has dissolved and you are sure the curd has cooled to 85 degrees, spoon the curd into the cheese form which has been lined, sides and bottom, with cheesecloth. Be sure the curd has cooled to 85 degrees.

Initial Pressing of the Curd

After you have filled the cheese form with the curd, place a circle of cheesecloth on the top. Then insert the wooden follower and put the cheese form in the cheese press.

Start with weights of 3-4 bricks for 10 minutes, remove the follower and drain off any whey that has collected inside the can. Then replace the follower and add one brick at a time until you have 6-8 brick pressing the cheese. When it has been under this much pressure for an hour, the cheese should be ready to dress. Pressing is extremely important, and if you want a hard, dry cheese you'll need 30 or more pounds pressure for a 2-3 pounds cheese.

Dressing and Final Pressing of the Cheese

Remove the follower and turn the cheese form upside down so the cheese will drop. You may nave to tug at the cheesecloth to get it started. Remove the cheesecloth from the cheese and dip the cheese in warm water to remove any fat from the surface. With your fingers, smooth over any small holes or tears to make a smooth surface. Wipe dry.

Now cut a piece of cheesecloth two inches wider than the cheese is thick, and long enough to wrap around it with a slight overlap. Roll the cheese tihtly, using two round circles of cheese cloth to cover the ends.

Replace the cheese in the cheese form, insert the follower and press with 6-8 brick another 18-24 hours. (follow specific directions for pressing time in each recipe)

Drying the Cheese

At the end of the pressing time, remove the cheese, take off the bandage, wipe the cheese with a clean, dry cloth and check for any openings or cracks. Wash the cheese in hot water or whey for a firm rind. Seal the holes by dipping the cheese in warm water and smoothing with your fingers or a table knife.

Then put the cheese on a shelf in a cool, dry place. Turn and wipe it daily until the surface feels dry and the rind has stared to form. This takes from 3-5 days.

Waxing the Surface

Heat ½ pound paraffin to 210 degrees in a pie pan or disposable aluminum pan deep enough to immerse half the cheese at one time. Be sure to heat the paraffin over hot water (double boiler) not direct heat.

Hold the cheese in the hot wax for about 10 seconds. Remove and let harden a minute or two, then immerse the other half. Check to be sure the surface is covered completely.

Curing the Cheese (Ripening)

Now put eh cheese back on the self to cure. Turn it daily. Wash the sun the shelf once a week. After about six weeks of curing at a temperature of 40-60 degrees the cheese will have a firm body and mild flavor. Cheese with a sharp flavor requires 3-5 months or longer. The lower the temperature the longer the time required. It's a good idea to test your first cheese for flavor from time to time during the curing period.

Rennet (pronounced /ˈrɛnɪt/) is a natural complex of enzymes produced in any mammalian stomach to digest the mother's milk, and often used in the production of

cheese. Rennet contains a proteolytic enzyme (protease) that coagulates the milk, causing it to separate into solids (curds) and liquid (whey). The active enzyme in rennet is called *chymosin* or *rennin* (EC 3.4.23.4) but there are also other important enzymes in it, e.g., pepsin or lipase. There are non-animal sources for rennet substitutes.

The chief use of rennet is in the making of cheese, curd, and junket. *Chymosin* reacts specifically with κ-casein, cleaving the protein between the amino acids phenylalanine(105) and methionine (106), producing two fragments. The soluble fragment (residues 106-169), which becomes part of the whey, is known as glyco macro peptide and contains the glycosylation sites for κ-casein. The other component (residues 1-105) is insoluble, and in the presence of calcium ions causes the coagulation of the casein micelles to form a curd.

Natural calf rennet is extracted from the inner mucosa of the fourth stomach chamber (the abomasum) of young calves. These stomachs are a by-product of veal production. If rennet is extracted from older calves (grass-fed or grain-fed) the rennet contains less or no chymosin but a high level of pepsin and can only be used for special types of milk and cheeses. As each ruminant produces a special kind of rennet to digest the milk of its own mother, there are milk-specific rennets available, such as kid goat rennet especially for goat's milk and lamb rennet for sheep milk. Rennet or digestion enzymes from other animals, like swine-pepsin, are not used in cheese production.

Dried and cleaned stomachs of young calves are sliced into small pieces and then put into saltwater or whey, together with some vinegar or wine to lower the pH of the solution. After some time (overnight or several days), the solution is filtered. The crude rennet that remains in the filtered solution can then be used to coagulate milk. About 1 gram of this solution can normally coagulate 2000 to 4000 grams of milk.

Today this method is used only by traditional cheese-makers in central Europe: Switzerland, Jura, France, Romania, and Alp-Sennereien in Austria.

Modern method

Deep-frozen stomachs are milled and put into an enzyme-extracting solution. The crude rennet extract is then activated by adding acid; the enzymes in the stomach are produced in an inactive preform and are activated by the stomach acid. After neutralization of the acid, the rennet extract is filtered in several stages and concentrated until reaching the required potency: about 1:15000 (1 kg of rennet would have the ability to coagulate 15000 litres of milk).

In 1 kg of rennet extract there are about 0.7 grams of active enzymes – the rest is water and salt and sometimes sodium benzoate, E211, 0.5% - 1% for preservation. Typically, 1 kg of cheese contains about 0.0003 grams of rennet enzymes.

Because of the limited availability of proper stomachs for rennet production, cheesemakers have always looked for other ways to coagulate the milk. Artificial coagulants are a useful alternative, especially for cheap or lower-quality cheeses.

As the proper coagulation is done by enzymatic activity, the task was to find enzymes for cleaving the casein that would result in a taste and texture similar to animal-based rennet.

Vegetable rennet

Many plants have coagulating properties. Some examples include fig tree bark, nettles, thistles, mallow, and Creeping Charlie. Enzymes from thistle or *cynara* are used in some traditional cheese production in the Mediterranean.

These real vegetable rennets are also suitable for vegetarians. Vegetable rennet might be used in the production of kosher cheeses but nearly all kosher cheeses are produced with either microbial rennet or GM rennet. Worldwide, there is no industrial production for vegetable rennet. Commercial so-called vegetable rennets usually contain rennet from the mold *Mucor miehei* - see microbial rennet below.

Microbial rennet

Some molds such as *Rhizomucor miehei* are able to produce proteolytic enzymes. These molds are produced in a fermenter and then specially concentrated and purified to avoid contamination with unpleasant side products of the mold growth. At the present state of scientific research, governmental food safety organizations such as the EFSA deny QPS (Qualified Presumption of Safety) status to enzymes produced especially by these molds.

The flavor and taste of cheeses produced with microbial rennets tend towards some bitterness, especially after longer maturation periods.[1] These so-called "microbial rennets" are suitable for vegetarians, provided no animal-based alimentation was used during the production.

Genetically engineered rennet

Because of the above imperfections of microbial rennets, some producers sought further replacements of natural rennet. With the development of genetic engineering, it suddenly became possible to use calf genes to modify some bacteria, fungi or yeasts to make them produce chymosin. Chymosin produced by genetically modified organisms was the first artificially produced enzyme to be registered and allowed by the FDA in the USA. In 1999, about 60% of U.S. hard cheese was made with genetically engineered chymosin[2]. One example of a commercially available genetically engineered rennet is Chymax, created by Pfizer.

Today the most widely used genetically engineered rennet is produced by the fungus Aspergillus niger. The problems of destroying the aflatoxins or the antibiotic-resistant marker genes seem to be solved.[*citation needed*]

Cheese production with genetically engineered rennet is similar to production with natural calf rennet. Genetic rennet contains only one of the known main chymosin types, either type A or type B. Other chymosin types found in natural rennet do not exist in genetic rennet. This is also the reason why special analysis can determine what kind of coagulant has been used by analyzing what bonds have and haven't been cleaved.

Often a mixture of genetically engineered chymosin and natural pepsin is used to imitate the complexity of natural rennet and to get the same results in coagulation and in development of flavour and taste.

The so-called "GM rennets" are suitable for vegetarians if there was no animal based alimentation used during the production in the fermenter—but only for vegetarians who are not opposed to GM-derived foods.

Acid coagulation

Milk can also be coagulated by adding an acid, such as citric acid.

Cream cheese, paneer, and rubing are traditionally made this way (see Category:Acid-set cheeses for others), and this form of coagulation is sometimes used in cheap mozzarella production without maturation of the cheese[*citation needed*].

The acidification can also come from bacterial fermentation such as in cultured milk.

The Encyclopedia of country Living by Carla Emery

Pg 775 (see 770-781)
http://cheese.about.com/od/howcheeseismade/f/rennet_faq.htm
You can make rennet from plants. It never acts as fast as regular rennet. At best it will curdle milk overnight. You can make veggie rennet from Nettle and Thistle. The best is the giant thorny kind of thistles.
To harvest thistle for rennet, gather the thistle flowers when they have turned brown. If you see thistledown, the plant is over-mature. Get it right after the end of bloom and before the stage where down blows away. Air dry the flowers. You can store them in jars to wait until needed for cheese-making.
To use your veggie rennet, a quick way is just to tie a bundle of flowers together with string and leave it in the milk until it clabbers. But the more professional way is to pound and extract. You take out enough – 5 heaping T. of pounded dry herb will be needed per 1 gallon milk to be curdled. Pound is a mortar with your pestle until quite crushed. Then pour just a little warm water or whey over, just enough to cover. Let soak 5 minutes. Pound 5 minutes more. Repeat the soaking and repeat the pounding until you've pounded at least 4 times total. You be seeing a dark (brown) fluid. Strain. Add the fluid to your milk. Be careful not to add too much of any veggie rennet herb because excess can, at best, be unpleasant tasting in the cheese at the end of the line or cause indigestion. These are real vegetable rennet, though they often also have undesirable effects on cheese flavor (bitterness) and are a little more unpredictable when used in some cheese.

Clotting Study

A 2% thistle flower extract was obtained using 2g of frozen fresh thistle flower and a NaCl 5% solution. The mixture was first homogenized with an ultra-turrax and then filtered in a Whatman n040 filter paper and the volume was taken to 100 ml with NaCL solution. Tests were done with 11% reconstituted powdered milk at 89 degrees F and pH 6.5
Clotting trials: To 10 ml of milk was added 1 ml of clotting agent solution