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CHEESE. Cheese, which has been described as "milk's leap toward immortality," can be more dispassionately defined as a product of milk fermentation. Yet part of our fascination with cheese may come from the sheer number and diversity of cheeses worldwide. They number into the thousands, although an exact count is difficult, as cheeses are notoriously difficult to classify. A classification of cheese only in terms of bacteriological processes neglects the symbolism of ancient mythologies, regional pride, and artistic ingenuity that are embedded in this, one of the simplest and most complicated of foods. The mythology of cheese is shared by disparate groups: the Greeks gods and mortals, the conquerors and conquered of the Roman Empire, a delighted Napoleon and the waitress who first served him Camembert. The legends are compelling, but not as much as the product itself.

History

The beginnings of cheesemaking are unknown, but it has been generally reasoned that the knowledge of how to turn milk into cheese closely followed upon the domestication of lactating animals. Some of the earliest archaeological evidence of cheesemaking comes from the Fertile Crescent, where animals were domesticated around 8000 B.C.E. A Sumerian relief (c. 3500–2800 B.C.E.) portrays cattle and dairying practice. Pots that had likely contained cheese were discovered in the tomb of Horus-aha, the second king of the Egyptian First Dynasty (c. 3000–2800 B.C.E.) And perforated bowls (c. 3000–1000 B.C.E.) made from pottery or rushes have been found in more than one European location. These bowls were designed to drain the liquid whey from the solid curds.

Cheesemaking was an efficient means of preserving an extremely perishable food (milk) from the spoiling effects of the Near East climate. The art and science of cheesemaking spread into Europe, and quickly became a regular part of the diet and a symbol of strength in ancient Greece, where Olympians trained on diets of cheese. Polyphemus, the brutal Cyclops of Homer's Odyssey, milks his animals amid the racks of cheese in his cave, while Odysseus watches quietly nearby. According to Greek mythology, the knowledge of cheesemaking was a gift to mortals by the gods of Mount Olympus. Roman soldiers carried cheese rations with them as the Roman Empire grew, though cheesemaking was highly developed in the Celtic parts of Europe. The Feast of Imbolc (2 February) was a celebration of the approach of spring: the new lambs and the milk of the ewes represented the changing seasons and were honored as a first sign of spring.

Artisanal cheesemaking might have been lost after the fall of the Roman Empire if not for the Christian monasteries. The monks not only preserved cultural traditions during the Dark Ages, but spent much time reworking and improving cheese recipes. Their creations, among them French Munster and Epoisses, are still referred to as "monastery" or "trappist cheeses."

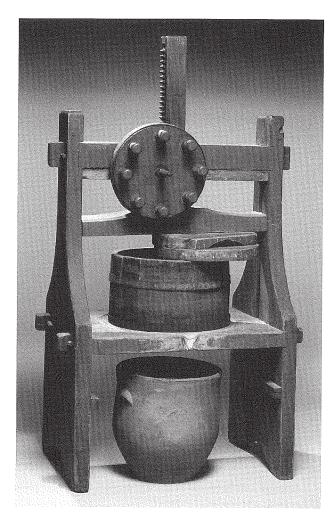
In the following centuries, cheesemaking grew as an art and industry. The first commercial cheese factory in the United States was established in Rome, New York, in 1851. Innovations like the kind of cream cheese popularly known as Philadelphia Cream Cheese and pasteurizing whole cheese (patented in the United States by James Kraft in 1916) followed. Almost a century of pasteurized process cheese sales in the United States and abroad have demonstrated their popularity, but a growing number of cheesemakers and cheeseeaters are committing to the preservation and production of artisanal (made by hand) and farmstead (made from the animals of a farm on that farm) cheeses. Several books about specialty cheeses have been published in the last few years, and wider selections of domestic and imported cheeses are available in supermarket, and restaurants.

Milk

When confronted by the vast number of cheeses, the different shapes, colors and aromas at a well-stocked cheese counter, it is astonishing to remember that all these endless varieties come from only one basic ingredient. Although a cheesemaker makes many decisions throughout the cheesemaking process that will affect the finished product, the first step is always to select the raw material, milk.

Cheese can be made from any animal that produces milk: cow, sheep, goat, camel, mare, buffalo, or yak. With the exception of Italy's mozzarella di bufala, made from the milk of herds of water-buffalo, cheeses in the Western world are typically made from the milk of cows, goats, and sheep. Of the three animals, sheep produce the lowest volume of milk, but because it is so much higher in fat and protein content than either goat's or cow's milk, less of it is needed to make cheese. On average, ten pounds of cow's or goat's milk or about half that amount of sheep's milk is required to make one pound of cheese. In contrast to the rich, concentrated flavor of sheep's milk, goat's milk is slightly sweet and fresh-tasting; cow's milk is the lightest of the three. The milk of individual breeds of the same species also has a unique flavor profile. Consequently, the laws governing many name-controlled cheeses specify the breed of animal from which the milk is to come. Cheesemakers have the further choice of how to use the milk they collect: full fat, partly skimmed, or with extra cream added.

Free-grazing animals feast on a bounty of wild grasses, flowers, and other vegetation during the warmer months. This gives their milk a complexity of flavor that is easily distinguishable from the milk of grain-fed animals in winter. Some cheesemakers insist that they can



Red-painted cheese press, Connecticut, ca. 1835. Tulip poplar and oak. The press creates a wheel of cheese inside the tub, while excess whey drips from the drain into an earthenware pot. ROUGHWOOD COLLECTION. PHOTO CHEW & COMPANY.

perceive slight flavor adjustments daily—as the animals move from one pasture to another.

Pasteurization

Milk used for cheese may or may not be pasteurized. Pasteurization is a process of heating milk that destroys most of the naturally present bacteria (see Cheese Safety below). Current U.S. law requires that cheeses be pasteurized or, if made from unpasteurized milk, aged for at least sixty days at 35°F before sale for consumption. Milk may be pasteurized in one of two ways: by heating it to 161°F for fifteen seconds, or by heating it to 145°F for thirty minutes (the latter method is sometimes called "heat treatment"). These laws apply to both domestically produced and imported cheeses. When cheese is made from unpasteurized milk, it is frequently referred to as "raw milk" cheese, connoting that the milk has not been

"cooked." Most cheesemakers believe that the brilliant nuances of flavor found in raw milk, with its naturally present "good" bacteria, simply cannot be duplicated in a pasteurized milk cheese, though some well-respected cheeses, including British Stilton, are made only from pasteurized milk.

The Principles of Cheesemaking

An oft-repeated legend has it that the first cheesemaker fell into the role by accident. A nomadic tribesman prepared for a long desert journey, he carried a bag made from the dried stomach of a young sheep and filled with milk. As he walked steadily under the relentless sun, the milk began to curdle. Noting that this "fresh cheese" had a pleasant taste and did not spoil as easily as milk, the nomad later drained off the whey and salted the curds to enhance these qualities. The cheesemaking tradition had begun.

While modern cheesemaking techniques are more refined and recipes have become standardized, the basic principles remain the same now as when the (possibly apocryphal) nomad of cheese legend opened his sheep's stomach bag (which supplied the coagulating rennet), warmed by the sun and agitated by his rhythmic trek.

The Steps of Cheesemaking

There are as many recipes for cheese as there are cheeses, but all of them follow some combination of these steps.

Acidification: souring the milk. The milk is gently warmed to encourage the growth of lactic acid bacteria, Streptococci and Lactobacilli. These bacteria feed on the milk sugar lactose, changing it to lactic acid. As the acidity rises, the solids in the milk (casein protein, fat, some vitamins and minerals) clump together, forming curds in the watery whey (milk is approximately 85 percent water). This is the first step for making all cheeses; in ancient times, cheeses were most likely the result of leaving pots of milk to sour naturally in the sun, affected by bacteria in the air. Some cheesemakers still wait for these process to begin with free, airborne lactic acid bacteria, but most use a starter culture. Starters are widely available commercially, but cheesemakers can also use a bit of the previous day's milk (unless it is pasteurized)—the same principle as with a sourdough bread starter.

Renneting: coagulating the curd. Cheesemaking has been referred to as "controlled spoiling" because of the need to efficiently form curds before undesirable bacteria cause the milk to become rancid. The enzyme rennin, traditionally removed from the stomach lining of a young animal (usually the same species of animal that supplied the milk), hastens and completes the curdling process. The renneting property of some plants has been recognized nearly since the dawn of cheesemaking; these vegetable rennets are the traditional agents in several

cheeses. Other vegetarian rennets, made from a yeast or fungus, are also used today.

The curd is left to "set," forming a network of protein that traps the other milk solids inside. As the solids bind more tightly together, they begin to push out the liquid whey, a process the cheesemaker may continue by cutting, cooking, and pressing. The whey is sometimes used to make cheese as well (Italian ricotta and Cypriot hallumi are two examples), but usually it is discarded.

Treating the curds. After renneting, cheese recipes diverge. Some soft cheeses, like fresh goat's milk cheese, are gently transferred to molds. The curd's own weight will continue to press out whey. These cheeses might be labeled "hand ladled" to indicate that they were created using this time-consuming method. The Greeks called the molds that held the curds formos, which became the root for cheese in Italy (formaggio) and France (fromage). Our English word "cheese" has its root in the Latin caseus, which became Käse in German and queso in Spanish.

In contrast to the light touch required for soft cheeses, which derive their creamy texture from a higher water content, the curds for other cheeses are sliced and chopped, by hand or machine, to release more whey. The smaller the curds are cut, the firmer the resulting cheese. Cheddar and some other cheeses undergo a unique process called "cheddaring," which results in its firm, flaky texture. Blocks of curd are stacked, turned, and restacked to press out as much whey as possible. Then the dry curds are milled, ground into tiny pieces, and packed into molds.

Some hard cheeses are "cooked," that is, the curds are reheated during processing. This causes the curds to release even more whey and alters the texture of the cheese. Examples of cooked cheeses include Emmentaler, Appenzeller, and Gruyère.

Preparation for aging: salting, molding, and pressing. Cheeses can be salted in four different ways. For some cheeses, the salt is stirred directly into the curd. A second method involves rubbing or sprinkling dry salt onto the rind of a cheese. This helps to form the rind, protecting the inside of the cheese from ripening too quickly. Some large cheeses are soaked in a pool of brine. The fourth option is to wash the surface of the cheese with a brine solution. In the case of washed-rind cheeses, the salt does not protect the cheese from bacteria—it invites them. The cheeses must be regularly rubbed with water, brine, or alcohol to encourage the growth of the bacteria that give them their sticky orange rinds and distinctive aroma.

Cheese is then transferred, if it has not been already, to a mold where the final cheese will take shape. The whey of soft cheeses drips through the holes in their molds, pressed out by the cheese's weight. Other, firmer cheeses are pressed by hand or machine to extract the last bits of whey.

Ripening. During the ripening or aging stage, the cheesemaker cares for the cheese at a precise temperature and humidity level until it is ready to eat; this can range anywhere from a few weeks for a soft-ripened cheese to a few years for a wheel of Parmigiano-Reggiano. Depending on the variety, ripening cheeses need to be turned to equally distribute the butterfat and brushed to maintain the rind quality.

Name-controlled Cheeses

Before the 1951 Stresa Convention in Stresa, Italy, it was impossible for traditional, regional cheesemakers to protect their products from inauthentic forgeries. The delegates to this international conference accomplished two goals: they created a uniform definition of "cheese" to facilitate international trade, and protected by law the names and origins of a select group of treasured traditional cheeses. Protected cheeses fall into two categories. A few cheeses, including France's Roquefort and Switzerland's Sbrinz, are given absolute protection—the cheese cannot be made outside of its designated region. A second group of cheeses may be produced in nontraditional areas, but must be clearly labeled with its region of origin. Camembert produced in the United States is a good example of this second group.

"Name-controlled" cheeses must meet stringent laws that go beyond the international standards for processing and safety. The departments and associations that supervise these cheeses differ from country to country (and from cheese to cheese), but generally emphasize the unique, regional quality of the cheese. In Switzerland, for example, cheeses must be native to the area in which they are made. France has the most specific cheese production laws of any country. The Appellation d'Origine Contrôllée (AOC) designation indicates that a cheesemaker has complied with regulations that include the type and breed of animal from which the milk comes, location of production of both milk and cheese, production techniques (including pasteurization), the final composition of the cheese (its fat and moisture content, for example), and the physical and sensory attributes of the cheese, which include its shape, size, and of course, flavor. Spain, Portugal, Italy, and Great Britain are also home to namecontrolled cheeses.

The effort to control cheese quality through government standards of identity can be related to similar efforts with wine. Purchasing a French cheese with the AOC designation on the label does not necessarily guarantee quality, however. Subtle differences between individual producers, milk quality, or aging time and conditions can make the difference between a great cheese and a not-so-great one.

Classifying Cheese

As Pierre Androuët asserts in his fundamental text *Guide du Fromage* (Guide to Cheese), a cheese should simply be what it is—its appearance, aroma, texture, and flavor



Traditional baskets for straining cheese curds. Cyprus, 20th century. Myrtle twigs. The use of myrtle for cheese strainers dates to classical antiquity. ROUGHWOOD COLLECTION. PHOTO CHEW & COMPANY.

should be characteristic of the variety to which it belongs. But how does one determinate a cheese's "type"? There are innumerable cheeses, and no single, standardized method for grouping them; rather, authorities employ different classification systems.

General characteristics, such as the type of milk (or whey) used or the country of origin, provide a starting point for discussing broad topics; for example, the relative unpopularity of sheep's milk cheese in the United States compared to European countries, or the social implications of cheese consumption in England as opposed to France. More specific classifications—the moisture content of the cheese (hard, semi-hard, soft, or fresh), whether it was made from pasteurized or unpasteurized milk, or the length of aging—may serve scientific inquiries concerned with bacterial development rates in different cheeses.

When cheese is classified by "type," it is grouped by similar characteristics like taste, smell, and appearance. The rind type and the method of production are often used as determining factors. Steven Jenkins describes eight different cheese "families" (including processed cheese) (*Cheese Primer*, pp. 11–13). These very common categories may help when choosing a cheese at the cheese counter, but a particular cheese may fit into more than one category, or not seem to fit in any.

Fresh cheese. After the formation of curds, the cheese (and also, sometimes, the whey) is usually transferred to plastic tubs and covered. The cheeses are eaten fresh, not ripened, and do not have a rind. Cottage cheese, cream cheese, and feta—a pickled cheese—are some common examples of fresh cheeses. Sometimes fresh Mozzarella is also included in this category because it does not form a rind, but this is problematic because Mozzarella curds are heated and stretched.

Bloomy rind cheeses. Also called simply "soft ripened cheese," this category includes cheeses like French Camembert and Brie, which are covered with velvety white molds that ripen the cheese from the outside in.

Washed-rind cheese. These orange, sticky, stinky cheeses are rubbed with a water, brine, or alcohol solution to invite the growth of ripening bacteria and molds on their rinds. Examples include the French Livarot (nicknamed "The Colonel" because it is ringed with raffia stripes) and Alsatian Munster.

Natural rind cheese. These cheeses are self-sufficient, naturally forming their rinds from air contact. Surface-molded goat cheeses and British Stilton are good examples. British farmhouse cheeses are sometimes included in the natural rind category because their permeable cheesecloth wrapping allows them to develop a thick pro-

tective rind. Likewise, Parmigiano-Reggiano and other cheeses are helped to form a rind that still develops largely from air contact.

Blue-veined cheese. To allow the growth of their distinctive bluish or greenish interior molds, these cheeses are never pressed. They are typically injected with a mold strain, and then pierced to expose the insides to air. They may be wrapped in foil like Italian Gorgonzola or form natural rinds like British Stilton.

Uncooked, *pressed cheese*. This is a category defined by processing type. These cheeses are pressed to remove whey, but are not cooked (see Treating the Curds).

Cooked, pressed cheese. Cheeses such as Swiss Emmental (sometimes Emmentaler) and Gruyère are cooked and pressed in the processes described above.

Processed cheese. There is another type of cheese that, because of its overwhelming presence in supermarket refrigerator cases, should not be overlooked. Pasteurized processed cheese is created by heating and mixing a blend of natural cheeses and emulsifiers. These cheeses—American cheese certainly being the best-known in the United States—can retain their flavor and texture qualities in a much broader range of temperature and moisture conditions than can natural cheeses, and for a longer period of time. They are also easy to use in a variety of dishes, and are typically less expensive than natural cheeses. Because the entire product, not just the milk, is pasteurized, and because processed cheeses are often vacuum-packaged, they are uniformly and consistently safe. The nutrient content of processed cheese remains very close to that of natural cheese, although the sodium content may be higher. All of these characteristics make them popular choices not only in the United States but in other countries as well.

Processed cheese food and cheese spread both contain natural cheese and emulsifying agents, but add other ingredients like whey, skim milk, milk powders, or water that raise the moisture content of the product. This causes them to melt or spread more easily. There are also imitation cheese products that contain little or no milk protein. Soy cheese is one example of an imitation cheese product.

Nutritional Value

The fat content of cheese is noted on its package as a certain percent butterfat. This can be misleading, however, because the fat content is evaluated as a percentage of the solids in the cheese (fat-in-dry-matter), not the overall weight of the cheese. Even a very hard, aged cheese like Parmigiano-Reggiano contains a significant amount of water, about 30 percent. As a cheese ages, it loses moisture, and the fat percentage relative to weight increases, though the fat-in-dry-matter remains the same. Soft cheeses typically have a high fat-in-dry-matter percentage, but they also contain more water than hard cheeses;

their overall fat percentage is much lower, as much as half, the fat-in-dry-matter percentage.

Cheese's greatest nutritional advantage is its high protein content and the digestibility of that protein. In addition, cheese is a valuable source of vitamin A, vitamin B2, and vitamin B12, and the minerals calcium and phosphorus.

People who suffer from lactose intolerance often believe that they must forego cheese altogether. In fact, many cheeses (especially aged, hard cheeses like Parmigiano-Reggiano) contain very little or no lactose, as the lactose is expelled along with the whey. The small amounts of remaining lactose are mostly converted into lactic acid during the aging process.

Cheese Safety

Cheese has been cited as the vehicle for several bacterial outbreaks-defined as an illness from a common source that affects two or more people. Organisms communicated to humans through cheese have included Salmonella, Listeria monocytogenes, Brucella melitensis, and Escherichia coli (including E. coli O157). Nearly all of these bacteria are destroyed during the pasteurization process. Raw milk cheeses seem to have been the cause of reported outbreaks more often than pasteurized cheeses. In the interest of public safety, the United States requires that milk for cheesemaking be pasteurized or that the cheese be aged for sixty days. However, recent concerns about the effectiveness of pasteurization, coupled with alarm and confusion over animal disease outbreaks like mad cow disease and hoof-and-mouth disease (which do not affect milk safety) have prompted scientists and government officials to reevaluate the current policy.

A close review of the reported outbreaks reveals that current laws are probably adequate to prevent cheeseborne illnesses, provided that they are strictly enforced and the starting quality of the milk is high. Reports and studies of cheese-borne outbreaks often include "unpasteurized" and "improperly pasteurized" cheese in the same category, implying that milk that has not completed the pasteurization process is of the same quality as raw milk. Traditional cheesemakers would argue that this is not the case. When milk is intended for pasteurization, its initial bacterial quality need not be as high as that of raw milk, as all bacteria will be destroyed in the pasteurization process. However, if the pasteurization process were ever to fail, or if, as some researchers have hypothesized, pasteurization is not effective against all bacteria, milk of low initial bacterial quality increases the risk of cheese-borne illness. Cheesemakers who use raw milk, on the other hand, must take special care to keep it free of dangerous bacteria.

Few outbreaks have been caused by unpasteurized dairy products in which there was not at least one flaw in the production process. Curds from unpasteurized milk have been mislabeled as pasteurized, raw milk

cheeses have been sold before the minimum required aging time, and fresh, unpasteurized Mexican soft cheese has been illegally imported and sold. All of the above cases involved raw milk cheeses, demonstrating the danger that can be associated with that product. Yet, they also show that the existing standards governing raw milk cheese could have prevented the outbreaks, if they had been carefully followed.

Bacterial levels in raw milk will always be higher than in properly pasteurized milk, even when the greatest of care is taken. Aging a cheese for at least sixty days has long been thought to neutralize harmful bacteria, but this may not be true for all types of cheeses and all types of bacteria. Certain groups of people, those with weakened immune systems or special concerns, should not consume raw milk products, particularly soft and semi-soft cheeses. A consumer choosing a raw milk cheese needs to do so fully aware of the possible risks. New labeling requirements could help make sure that people are informed of the risks and the pleasures when they purchase cheese.

See also Dairy Products; France; Italy; Wine.

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CHEF, THE. This entry focuses on the emergence of the *chef de cuisine* with the rise of restaurants in the public sphere. Until recently, well-known chefs working in restaurants in Britain and the United States were French or French-trained (for example, Alexis Soyer at the Reform Club in London and Charle Elme Francatelli at Delmonico's in New York City). Japan and China did not have fine dining-style restaurants or the western-style kitchen organization until more recently. African Americans were usually cooks, primarily in domestic settings or as caterers.

The role of "chef" emerged initially from the homes of European nobility, beginning as early as the medieval period. In these grand estates, kitchens were large and populated with numerous workers whose jobs were to help the nobility execute the large, complex banquets important to the maintenance of social position and power during this period. These banquets were about excess, elaborately decorated fish, fowl, and game on platters, dramatic interludes, and massive goblets of wine. As Europe entered the early modern period (1500s and 1600s), the link between social power and social display began to revolve more around exhibits of refinement. Civility and elegance took precedence over excess. The table increasingly became a site for such assertions, hence the kitchen also became more important.

The position of "chef," which comes from chef de cuisine, or chief of the kitchen, signifies the highest-ranking worker in a grand hierarchy. Initially he was in charge of running the kitchen, and, like the butler, reported in turn to the head of the household. In twentieth-century parlance, the "chef" traditionally has been a department head. Chefs de cuisine were part of the guild system, which regulated artisan practices in France until the French Revolution. Guilds controlled apprentices, the only means available for acquiring training in artisanal crafts and becoming an established craftsperson. Guilds also supervised aspects of production. In France up until the nineteenth century, maître queux, or master cooks in noble houses, were treated under a separate set of guild statutes. Cuisiniers and traiteurs, who worked alongside the urban streets, were considered another corporate