Part 1: Introduction to Chocolate

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Chocolate and Other Ingredients

Chocolate has long been made from the cocoa bean, and now more than ever, there are a wide range of different varieties of chocolate available for the chocolatier. However, a number of other distinctive ingredients play an important role in working with chocolate as well.

The History of Chocolate

The history of chocolate has been written about many times, but for anyone who works with chocolate, it is essential to have an understanding of this all-important product's journey into prominence. Chocolate has a long and storied history, from aristocratic to bourgeois imbibers, from chocolate as a medicine to chocolate as an indulgence, and from bitter chocolate drinks to sweet chocolate drinks to bitter chocolate drinks again.

The Origins of Chocolate

Historians maintain that the origins of chocolate are rooted in the history of the Olmecs, who occupied a tropical area on the Gulf of Mexico, and not in the Aztec culture as is commonly believed. Conditions in this region of Mexico were ideal for the cacao tree; the earliest known cacao plantations were cultivated there in the years between 1500 and 400 BC. Initially cacao trees were grown for the white fruit of the cacao pod, but ultimately the Maya of Mesoamerica discovered that grinding and mixing the (cocoa) beans with water could produce a bitter drink, which they called *cacahuatl*.

In the years between AD 1000 and 1200, cocoa beans were so highly valued by the peoples of Central and South America that they were actually used as a form of currency. When the Aztecs moved southward into Mesoamerica from northern Mexico in the twelfth century, the beans were traded for goods. The ritual beverage made from the beans was reserved for the nobility, priests, and high officials, as it was believed to have restorative and aphrodisiac powers. The word "chocolate" comes from the Aztec word for this beverage, *xocolatl*, from *xocolli* (bitter) and *atl* (water).

Chocolate Travels to Europe

Although Christopher Columbus landed in Nicaragua as early as 1502, he was not interested in the cocoa beans and chocolate drinks he found in the New World. It was not until Hernán Cortéz reached South America in 1519 that the potential of the cocoa bean was recognized by Europeans. When Cortéz failed to unearth the Aztec gold for which he was searching, he turned to cocoa beans instead.

Cortez took the first cocoa beans to Europe in 1528, along with the tools to create chocolate. The Spanish welcomed these innovations and experimented with chocolate beverages, sweetening the chocolate with honey and cane sugar, adding orange blossom water, anise seeds, almonds, hazelnuts, cloves, and egg yolks, and using boiling water instead of cold water to create the first hot chocolate drinks.

Spain managed to keep the discovery of chocolate a secret for more than a century, but in 1606 the Italian merchant Antonio Carletti brought the drink to Italy, breaking the Spanish monopoly of the chocolate trade.

The Spanish princess Anne of Austria helped to spread chocolate's popularity further throughout Europe when she married Louis XIII and introduced the drink to the French court. In Paris, chocolate became a status symbol and was drunk only by the aristocracy and upper echelons of society.

London's first chocolate shop, which opened in 1657, made it possible for chocolate to be enjoyed by all levels of society, and in the late 1600s, Heinrich Escher, the mayor of Zürich, helped spread chocolate's popularity to Switzerland. By the turn of the eighteenth century, cocoa beans and the cocoa trade finally made their way to North America, and the chocolate trade continued to blossom. Venezuela became the world's leading producer of cocoa beans during this time period, producing half of the world's cacao.

The Industrial Chocolate Revolution

Chocolate factories began to appear in Europe as early as 1728, but they used age-old labor-intensive methods to grind and churn their products. It was not until 1819 that the first sophisticated chocolate factory was established in Corsier, Switzerland, by François-Louis Cailler. Cailler had learned the art of chocolate making in Italy, and his Swiss chocolate is the oldest brand still in existence today. Swiss chocolate factories continued to proliferate throughout the 1800s, and in 1875, Swiss chocolate maker Daniel Peter—who was married to Cailler's eldest daughter, Fanny Cailler—changed the world of chocolate forever when he added milk to chocolate and created the first milk chocolate.

The 1800s also saw the introduction of the first boxed individual chocolates from the Cadbury chocolate company, and in 1879, Rodolphe Lindt developed the process known as conching, which produced the first creamy, smooth-textured chocolate that melted on the tongue.

Milton S. Hershey, who sold his first Hershey Bar in Pennsylvania in 1900, used mass-production techniques to make chocolate less expensive, which provided new opportunities for mass consumption in the commercial market. A huge variety of chocolate products were developed during this time period, beginning with the first filled chocolates created by Séchaud Fils in Montreux, Switzerland, in 1913. The 1930s brought about the production of the first white chocolate by Henri Nestlé, and soon a huge range of chocolate products including truffles, bonbons with fillings, ganaches, chocolate bars, chocolate-covered fruits and coffee beans, and molded and sculpted chocolates were available throughout the world.

Chocolate—It's Good for You

Today, chocolate is more popular than ever, and serious studies have suggested that eating chocolate has positive health effects. Scientists claim that chocolate may be capable of alleviating depression, preventing heart attacks, lowering blood pressure, promoting happiness, and easing pain. Dark chocolate in particular has a high concentration of flavonoids, a type of antioxidant. However, as is always the case with food, let's not forget that "moderation is good in all things."

Harvesting and Manufacturing Chocolate

Over 3,000 different plants and trees have been identified as cacao. Of those varieties only one cocoa bean is commercially produced, the *Theobroma.* The four main varieties of *Theobroma* cacao are: Criollo, Forastero, Trinitario, and Arriba Nacional. Each variety has its own unique flavor that is influenced by the growing area and soil.

Growing and Harvesting the Cocoa Bean

The cacao tree is a delicate tree that thrives in tropical regions between 20 degrees south and 20 degrees north of the equator. West Africa, South America, and Southeast Asia are the largest producers of cocoa beans in the world. The tree requires high humidity, temperatures of 64° to 90°F/17.8° to 32.2°C, and 40 to 100 inches of rain a year. It grows to 40 to 50 feet/12.20 to 15.24 m in height. Most trees are planted among larger trees to protect them from wind and excessive sun. A neutral to slightly acidic soil is important to the quality of cacao.

During its second or third year, the cacao tree will start to bear fruit. Blossoms appear on the trunk and thicker branches of the tree and are pollinated by insects. Once pollinated, each blossom develops into a cacao pod, which takes six months to fully develop and can weigh as much as 2½ pounds/1.13 kg. The tree will bear approximately twenty-five to fifty pods at a time and

THE BEANS	FLAVOR	POD AND TREE	ORIGIN	% OF WORLD'S CROP
CRIOLLO 	Rich and intense; has the widest range of flavors	Soft skinned, reddish color, smaller variety, delicate and highly prized beans	South America	1%
FORASTERO 	Soft; beans have a pungent aroma; is usually a "base" bean and not complex	Pod is thick-skinned with a red-yellow color; trees are hearty and produce a large number of beans	West Africa	80%
TRINITARIO 	Fine-flavored; exhibits Criollo and Forastero characteristics	Hearty and withstand infestation well; small yellow pods; a hybrid of the Criollo and Forastero beans	Trinidad	15%
ARRIBA/NACIONAL 	Full, smooth cocoa flavor with additional floral, nutty notes	Large, green, wrinkled pods; beans are large and purple	Ecuador	4%

ABOVE: From left to right: a cacao pod, cocoa beans, and finished couverture coins. *Courtesy of Albert Uster Imports*
BELOW: Cocoa Bean Varieties. *Courtesy of Albert Uster Imports*

can bear for twenty-five to thirty years. Pods are oblong and football shaped, and their colors and textures vary according to the variety of cacao. As pods ripen, they change from green to yellow or red.

The pods are harvested twice a year. It takes several months to harvest a tree, since pods ripen at different times. Every two to four weeks, the fruit is cut from the tree with a machete or sickle-shaped knife. The pods are carefully opened, and the cocoa beans (seeds) and pulp are removed to begin the fermentation process. Each pod contains an average of forty to eighty cocoa seeds. Each seed consists of two cotyledons (the nib), which contain the germ (center), and is surrounded by a protective outer shell.

Fermentation

Fermentation lasts for five to seven days and begins as soon as the pods have been opened. The fresh beans and pulp are placed in piles and covered to help regulate the temperature. Temperatures that are too high will allow the seeds to germinate, but in this case the goal is to have the bean die so that fermentation, which initiates the development of flavor, will begin. During fermentation, natural bacteria and yeast begin to multiply and break down the sugar in the pulp surrounding the beans. This breakdown results in the creation of alcohol that kills the bean. Lactic acid bacteria feed on the alcohol and other organic acids and convert them into lactic acid. At this point, acetic acid bacteria take over and convert the lactic acid into acetic acid. It is very important to monitor the beans so that the correct length of fermentation occurs. Too short a fermentation period will result in no flavor, while too long a period will destroy the bean. (The fermented pulp is not used in chocolate making.)

Drying and Shipping

It is important to dry cocoa beans and stop fermentation before the high water content of the beans causes them to rot. Exposing the beans to air and sunlight allows the water to evaporate and reduces the acetic acid content. This causes the bean to turn brown and reduces the humidity within the bean, which allows for better preservation by preventing mold growth during storage. Once the drying process is complete, the beans are bagged and shipped to manufacturers.

Cleaning and Roasting

Once the beans arrive at the manufacturer from the plantation, they are cleansed of impurities such as metal, sand, and plant matter. They are then roasted at 230° to 428°F/110.0° to 220.0°C (depending on the type of bean) to develop the chocolate flavor of the nib. During this time, the moisture content is reduced to about 2 percent, and the starch in the beans is transformed into dextrin.

Shelling and Winnowing

After the beans have been roasted, the thin, lightweight husks (or shells) must be removed, leaving the cocoa nibs to be further processed. Beans can be pretreated with infrared radiation to soften the husks, making them easier to remove. There are two ways to

remove the husks: drop the beans into a series of rotating blades, or pass the beans through a series of low-velocity impact crushers. The broken pieces are passed through a series of screens to sort them by size. As the similar-sized cocoa nibs and husks pass into the chamber, air is blown through the pieces. The nibs continue to fall to the next chamber and the husks are blown off into a separate chamber. The husks are recycled as mulch. The cocoa nibs pass to the next processing stage.

Blending, Grinding, and Mixing

Different varieties of cocoa beans are custom blended according to the recipes of the chocolate manufacturer. The blends then are sent to be ground. At this stage, the sugar, milk powder (for white and milk couverture; see Chocolate Products, page 11), and vanillin are added to the cocoa bean blend and ground into a chocolate mass. The chocolate mass is sent on to be rolled into finer particles in a process called refining.

Refining

The refining of the chocolate mass takes place between two steel rollers on repeated passes. The distance between the rollers decreases and the mass is sheared into smaller particles each time it passes through the rollers. Once the mass particles have reached 120 microns in size, it is sent through a series of five rollers to refine the mass to a particle size of 20 microns. It is important to maintain this size, as too large a grind results in a coarse mouthfeel and too fine a grind results in stickiness on the palate in the finished chocolate.

Conching

After grinding and refining, the chocolate mass will still have a high acidic flavor. The process of conching or milling produces chemical and physical changes that reduce the acidity and allow the other natural flavors to develop. A conching machine continuously kneads and churns the mass for 8 to 72 hours at a temperature of 122° to 212°F/50.0° to

Conching reduces the acidity of the chocolate mass. *Courtesy of Albert Uster Imports*

100.0°C to achieve the desired finish. The length of time and the temperature depend on the type of chocolate and the manufacturer specifications. There are three phases of conching:

DRY CONCHING: The moisture of the mass is reduced under slow-speed rotation.

PLASTICIZING: Cocoa butter is added and the temperature and speed increased. This is when the chocolate flavor begins to emerge.

LIQUID CONCHING: The direction of the blade is reversed, and the mass begins to cool. At this point the remaining cocoa butter, lecithin, and natural vanilla, if used, are added on high speed.

Tempering, Molding, and Packaging

The conched chocolate is cooled down and tempered to induce stability and to give the chocolate the proper snap, sheen, and mouthfeel. The tempered chocolate can then be molded into bars or coins or used in candies as desired. The chocolate must be cooled from 87°F down to 68°F/30.5° to 20.0°C to allow the stable crystals to form. Temperatures are then dropped to between 50° and 55°F/10.0° and 12.7°C to speed up the solidifying process. Finally the temperature must be brought back up to 68°F/20.0°C to prepare the chocolate for warmer storage temperatures. The chocolate is then packaged to protect it from light, heat, odors, and humidity.

Chocolate Products

There are a variety of products made from cocoa beans that result from the processing steps above. These include the products listed below, which are used during the production of confections.

COCOA MASS: Made of cleaned, roasted, broken, and ground cocoa beans.

BLOCK COCOA: Unsweetened, finely ground, conched cocoa mass. Has a cocoa butter content of at least 50%.

COCOA BUTTER: A natural fat that is present in cocoa beans, yielded by the pressing of the cocoa mass.

COCOA POWDER: The finely ground pressed cake that appears as the cocoa butter is pressed out of the cocoa mass. A good quality cocoa powder should have a fat content of 20 to 22% and be dark brown, possibly with reddish tones, depending on the processing used.

SWEETENED COCOA POWDER: A mixture of cocoa powder and sugar. Has a maximum sugar content of 68%.

DARK CHOCOLATE: A homogenous mixture of cocoa mass and sugar. Has a minimum cocoa butter content of 18%.

CHOCOLATE POWDER: Pulverized chocolate. Has a minimum cocoa butter content of 16%.

MILK CHOCOLATE: Normally contains about 35% total fat and is made of 20% milk solids, 30% cocoa beans (15% cocoa mass and 15% cocoa butter), 40% sugar, and 10% additional cocoa butter.

WHITE CHOCOLATE: Consists of at least 20% cocoa butter and 14% milk solids, with 3.5% milk fat and a maximum of 55% sugar.

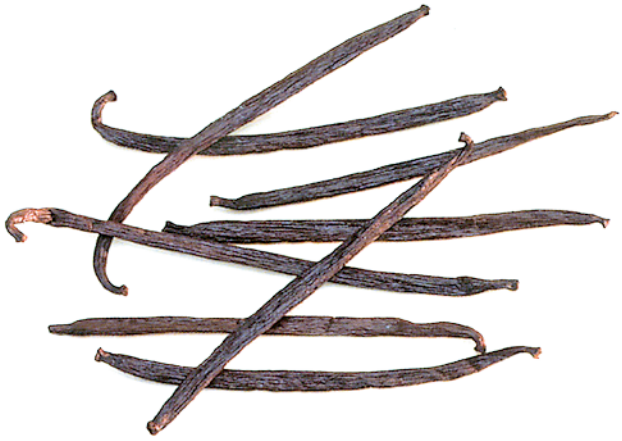
COUVERTURE: A very high quality chocolate with 32 to 39% cocoa butter. The fat content can vary according to the desired use for the couverture. The total percentage of combined cocoa butter plus cocoa solids must be at least 54%.

CHOCOLATE GLACE: A mass similar to couverture, but with the cocoa butter replaced by another type of fat. This allows for a simpler method of work, as it does not have to be tempered, but it will result in a lower quality product. In countries like Switzerland, chocolate glace cannot be used for truffles, fillings, or covering and molding chocolates.

Premium Couverture

For the recipes and techniques in this book, it is recommended to always use premium couverture. There are many chocolates available worldwide, but only a small number of them are considered premium couvertures. The term "couverture" is protected by Swiss law and good Swiss manufacturing practices and is defined in Switzerland as "chocolate for the pastry shop." Couverture is always of higher quality than chocolate, as it is made under stringent guidelines.

To create a true premium couverture, a manufacturer must control the complete supply chain, carefully selecting the country and the cacao plantation of origin for the beans. Premium couverture is made from only the finest Criollo, Arriba Nacional, Trinitario, and Forastero beans and the best-quality milk products, natural vanilla, and other ingredients. The whole beans must be roasted under the direction of a roast master, and the chocolate mass must be conched for up to 72 hours. A Master Chocolatier may use up to seven different beans per recipe to assemble complex and harmonic flavor profiles for a premium couverture, and the origin and type of cocoa beans, roasting parameters, and recipes must be adjusted constantly to achieve a consistent premium flavor profile in spite of variances in harvests.

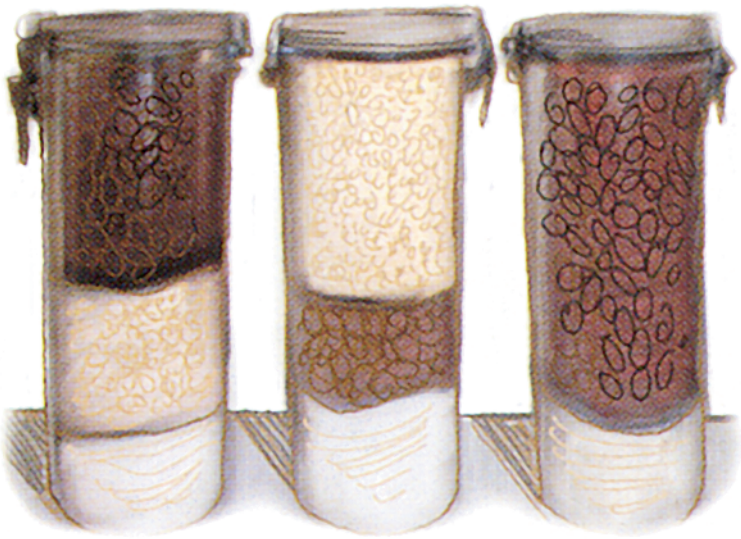


Premium couverture includes the highest-quality natural vanilla. *Courtesy of Albert Uster Imports*

Understanding Couverture Percentages

The percentage assigned to a couverture represents the amount of bean in the couverture. The bean is made up of 45% nonfat cocoa solids (the flavor) and 55% cocoa butter (the flavor carrier). Since dark couverture is largely made up of the bean component (fat and nonfat solids) and sugar, the higher the percentage of cocoa, the lower the sugar content.

Even if couvertures from different manufacturers have the same percentage, the quality of the couvertures may vary depending on the origin of the beans, the quality of the ingredients, and the manufacturing process, as well as the split between cocoa butter and nonfat cocoa solids. The same percentage in two different brands of couvertures does not equal the same taste. For example, one 73% couverture may consist of 31% cocoa solids and 42% cocoa butter, while another may consist of 27% cocoa solids and 46% cocoa butter. Even though they have the same total percentage, they are not identical. The first couverture, which consists of 15% more cocoa solids, will have a stronger chocolate flavor and a greater viscosity than the second. As a result, the application possibilities and results will vary greatly. Some manufacturers indicate the percentage of cocoa solids and cocoa butter separately on their packaging, which is helpful in selecting a premium couverture for a particular use. When developing new recipes, the chocolatier should carefully record the type and brand of chocolate or couverture used to ensure production consistency.

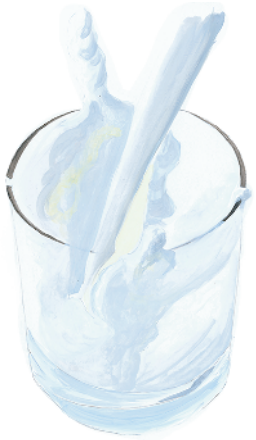


Three different couverture recipes labeled 73% may all contain very different percentages of cacao solids, cocoa butter, and sugar. *Courtesy of Albert Uster Imports*

Storing Chocolate and Couverture

Chocolate is sensitive to odors, light, and warmth. It is important that the storage place is dry, free from foreign odors, and at a stable temperature. The ideal temperature for storage of all chocolate products is 60° to 65°F/15.6° to 18.3°C with 50 to 60 percent humidity. When stored properly, dark chocolate has a shelf life of approximately twelve months, and milk and white chocolate have a shelf life of about eight months. Block cocoa has a minimum shelf life of fourteen months. Cocoa mass, cocoa powder, sweetened cocoa powder, and chocolate powder can all be stored for up to twenty-four months, and cocoa butter can have a shelf life of more than three years if stored properly.

Other Distinctive Ingredients



There are certain ingredients that are essential for quality chocolate production. Dairy, if not the most distinctive ingredient, is of course the most important in making chocolate.

Dairy Products

Dairy products such as milk, cream, buttermilk, and yogurt are often used in baked products and candy. Dairy products contribute to texture, flavor, crust color, shelf life, nutritional value, and moisture.

Most dairy products go through a pasteurization process in which they are heated to 161°F/71.7°C for 15 seconds to destroy pathogenic bacteria. Pasteurization destroys enzymes that cause spoilage.

Milk

Milk can be found in many different forms, including fresh whole, low-fat, and skim, and dried.

FRESH WHOLE MILK comes straight from the cow and has 3.5% milk fat.

LOW-FAT MILK is produced by removing part or all of the milk fat from whole milk. Low-fat milk contains between 1 and 2% milk fat.

SKIM MILK is also called fat- free milk and contains up to 0.5% milk fat.

MILK POWDER is made from whole milk by removing all the moisture. It is also made from skim milk (nonfat milk powder).

Milk is primarily used in baking applications and seldom in confectionery work.

Cream

Cream is a rich milk product containing at least 18% milk fat that is pasteurized and homogenized. The milk doesn't separate, and the fat is broken down into small particles that are evenly and permanently distributed in the milk.

HALF-AND-HALF consists of whole milk and cream with a fat content between 10 and 16%.

LIGHT CREAM contains between 16 and 32% milk fat.

HEAVY CREAM must contain at least 36% milk fat. It can be whipped easily, and it holds its texture for a long time. Heavy cream is never homogenized.

Heavy cream is the type of cream most frequently used in confectionery work. It is used for making ganache because of its fat content, which carries flavor and gives the ganache its smooth texture.

Evaporated and Sweetened Condensed Milk

EVAPORATED MILK is whole milk from which 60 percent of the water has been removed, resulting in a slightly darker color than fresh and a cooked flavor. Evaporated milk is canned and may last years without refrigeration.

SWEETENED CONDENSED MILK is evaporated milk with sugar added. It has a distinctive caramel flavor and is ivory in color. It also comes canned and should not be substituted for evaporated milk because of its sugar content.

Evaporated and sweetened condensed milks are rarely used in chocolate confections.

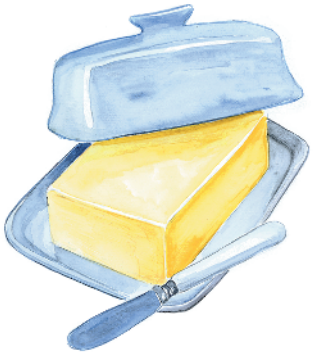
Other Dairy Products

BUTTERMILK originally was the by-product of churning cream into butter. Today buttermilk is a fresh nonfat milk to which bacteria are added, resulting in a sour taste, thick texture, and a very small amount of butterfat (0.5 to 3% fat).

SOUR CREAM is cream that has been cultured by adding lactic acid and bacteria, which give it a thicker consistency and tangy flavor. It should have at least 18% fat.

YOGURT is milk cultured with *Lactobacillus bulgaricus*, resulting in a thick, tart product. The fat content depends on how much fat the milk contains.

BUTTER is a great emulsifier and can form a stable emulsion on its own. American butter contains about 80 to 81% fat, and European butter is generally closer to 85% fat. Good quality butter has pale yellow color and a sweet flavor. Salt acts as a preservative to the butter, and if added, should not exceed 2 percent of total weight.



Butter is used frequently in chocolate confections, especially in ganache. Yogurt is also sometimes used in the making of ganache.

Sugar

Sugar plays an important role in many aspects of creating ganache. As sugar comes in many different forms, it is necessary to have a clear understanding of each variety. The table below outlines how each type of sugar is manufactured, its power of sweetness, and its many different traits and uses.

TYPE OF SUGAR	WHAT IT IS/HOW IT IS MANUFACTURED	SWEETENING POWER VERSUS SUCROSE	TRAITS AND USES
Brown Sugar	A type of sucrose; refined cane sugar containing molasses. The darker the sugar, the higher the percentage of molasses and the more intense the molasses flavor.	97%	Hygroscopic (readily absorbs moisture). Used in sweet and savory foods; used mostly for flavor in confectionery work.
Confectioners' Sugar – Powdered sugar (alternate name)	A type of sucrose; granulated sugar ground to a powder with cornstarch added (3%) to prevent lumping. Available in different grades; the higher the number (10X), the finer the grind.	100%	Dissolves quickly in liquids; produces light and tender cakes. Used in icings and glazes and for decorating baked products. Good for making gianduja or fruit ganache.
Fructose	Simple sugar found in honey, fruits, and vegetables	130%	Hygroscopic; inhibits crystallization without adding sweetness; very temperature sensitive. Products sweetened with fructose tend to be moist because fructose attracts more water.
Glucose (Dextrose) – Corn syrup (most common form)	Syrup extracted from the starches in corn, potatoes, rice, or wheat in a process called acid hydrolysis	50–60%	Hygroscopic; helps prevent moisture loss and increases the shelf life of various products; slows down crystallization. Used in icings, caramel, nougat, marshmallows, and other candies.
Honey	Natural invert sugar (fructose) produced by bees from flower nectar. The lighter the color, the milder the flavor; the darker the color, the stronger the flavor.	125–150% Honey has a high fructose content, 25–50% sweeter than sugar (sucrose)	Hygroscopic. Baked products made with honey are moist and dense. It is also used to add flavor to ganache.

TYPE OF SUGAR	WHAT IT IS/HOW IT IS MANUFACTURED	SWEETENING POWER VERSUS SUCROSE	TRAITS AND USES
Invert Sugar – Trimoline	Produced by heating a combination of sugar syrup and a small amount of acid (cream of tartar or lemon juice). This process inverts the sucrose into glucose and fructose.	125%	Hygroscopic; inhibits crystallization in creams. Provides aroma and color when heated. Because it has a fine crystal structure, it produces a smoother product and is used in making candies, fondant, etc. It is best used in items with high water content that must be kept soft.
Maple Syrup	Made from the sap of maple trees, which is about 80% sugar and 20% water. The sap is boiled to evaporate the water content, leaving the sweet, brown syrup.	60–67% Grading differs among US states and between US and Canada; grades include: Extra Light AA; Light A; Medium B; Amber C; Dark D	Provides distinct flavor to baked goods, frostings, pancakes, and waffles. Amber C is normally used for flavoring and baking because of its strong flavor and thickness and is often used for making ganache, especially for holiday time.
Molasses	A liquid by-product of sugar cane refining. It contains sucrose, invert sugar, acid, moisture, and other substances.	Three grades: First Stage (Unsulfured): light and very sweet, 65% Second Stage (Sulfured): darker and not as sweet, 60% Final Stage (Blackstrap): the least sweet of the three, 50–55%	Provides strong flavor and dark color but is not as sweet as sugar. It has a slightly bitter, robust taste. Molasses is not generally used in chocolate.
Sorbitol	Sugar alcohol produced by reduction of glucose. It also comes in powdered form. Sorbitol can be found in ripe fruits: apples, pears, and berries.	50–75%	Moisture stabilizer; can be used to partially replace sugar. Also an emulsifier.
Sucrose – Cane sugar – Beet sugar – 50% sucrose and 50% glucose	The sugar derived from either sugar cane or sugar beets is 99.5% pure sucrose. Granulated sugar is refined sucrose that has been crystallized. It is composed of equal amounts of glucose and fructose.	100%	Hygroscopic; crystallizes when oversaturated; provides aroma and color when caramelized. It is the most common type of sugar used.

Nuts

Nuts have been an essential ingredient in the kitchen for more than 2,000 years. Nuts go hand in hand with chocolate and confections, and one would not think to create either without thinking about nuts. Nuts provide the distinctive flavor and fat content that gives richness to many chocolates and confections, as well as added crunch.

Almonds – *Fat content 45 to 55%*

Almonds are the young developing fruit of the deciduous *Prunus* genus tree. The fruit, called a drupe, takes approximately seven to eight months to develop and matures in the autumn. It has an outer fleshy membrane or hull that surrounds a hard shell that contains the seed, which is the almond kernel. Almonds can be eaten raw or toasted, ground, and made into flour. Almond flour is popular because the almond contains practically no carbohydrates, making it an excellent choice for those on low-carbohydrate diets, diabetics, and those who require gluten-free flour due to allergies.

Coconut – *Fat content 60 to 70%*

A coconut is the dried nut of the coconut palm tree. Coconut palms are grown in tropical climates. Nearly every part of the tree is usable by humans. The coconut palm has been called the "tree of life" because, in theory, if a person were stranded, the tree could supply everything he or she would need to survive. Coconut palm trees have both male and female flowers that continuously produce seeds. The seed (endosperm) is hollow and contains coconut water. The seed, known as the "meat" of the coconut, is white and fleshy and is protected by a thin brown skin known as the endocarp. The encapsulated seed nestles inside a green shell that is thick, fibrous, and hairy. When the seed is mature, the outer shell turns brown and falls from the tree. Each tree produces up to seventy-five nuts per year. Coconut meat is high in saturated fat and minerals and contains sugar and protein. The meat of the coconut can be eaten fresh or dried.

Hazelnuts – *Fat content 55 to 65%*

Hazelnuts grow on shrubs that can reach up to 45 feet/13.71 m tall. The flowers, which are both male and female catkins, hang from the bush. They are produced in spring and are wind pollinated. The fertilized catkins produce clusters of one to five nuts held in place by a husk. After seven to eight months, in mid autumn, the ripened hazelnuts fall from the husk. The nuts can be used raw, roasted, or ground into paste. Hazelnut butter is fast becoming as popular as peanut butter. Hazelnuts are rich in protein and unsaturated fat and contain significant amounts of vitamins. Hazelnuts are widely used for oils, coffee flavorings, liqueurs, and the ever-popular Nutella spread.

Macadamia – *Fat content 72 to 76%*

Macadamia nuts are highly nutritious. They contain the highest amount of monounsaturated fats of any nut and are rich in protein, carbohydrates, fiber, and multiple vitamins. Macadamia nuts grow on an evergreen tree that can mature up to 40 feet/12.20 m tall. It takes seven to ten years before a tree can produce commercial quantities of nuts, but the tree continues to produce for 100 years. The first commercial orchard of macadamia trees

was planted in 1880 in New South Wales, Australia; currently Hawaii, Australia, California, South Africa, and Costa Rica continue to commercially produce the nuts.

Peanuts – *Fat content 45 to 50%*

As the peanut plant matures, the pea-like flowers self-pollinate in clusters. The flowers wither and the stalk bends toward the ground and forces the fertilized fruit into it. The seeds continue to develop and the seed pods turn from white to a reddish brown when mature. The pods are wrinkled and contain seeds, usually two in each pod, that have a paper thin "skin." It takes four to five months and plenty of water for peanuts to ripen. When ready for harvest, the plant is cut just below the soil level and pulled from the ground. The plants are then placed root side up and left to dry for two to three weeks before the peanuts are removed from the plant. Peanuts are a rich source of protein and antioxidants.

Pecans – *Fat content 65 to 70%*

Pecans grow on a deciduous tree from the hickory genus. The flowers are wind pollinated, with male and female catkins on the same tree. Once pollinated, the flowers produce fruit from the endocarp, an oblong nut enveloped in a hard shell formed from the exocarp. The exocarp opens at maturity to release the nut. Pecan trees can continue to thrive and produce nuts for more than 300 years. The United States started commercially producing pecans in the 1880s and now produces 80 to 95 percent or more of the world's pecans. The nuts are rich and buttery and used in cooking and candy making. They are a good source of protein, antioxidants, and unsaturated fat.

Pistachios – *Fat content 50 to 55%*

The trees of pistachios are unisexual, with separate male and female trees. The trees are planted in orchards and bloom biennially, meaning they bear fruit yearly but only produce a good crop every other year. It takes around ten years for a pistachio tree to reach production size, and the trees bear well until around twenty years of age. The fruit has a hard exterior shell that changes from green to yellow when ripe. The shell then splits partially open to expose the green nut with a papery mauve skin. Iran is the main exporter of pistachios, with the United State's production a close second. Pistachios are high in monounsaturated fat; in fact, bulk shipping containers of pistachios can be prone to spontaneous combustion due to their low water and high fat content. Pistachios can be eaten and used in cooking and confections either fresh or roasted.

Walnuts – *Fat content 50 to 55%*

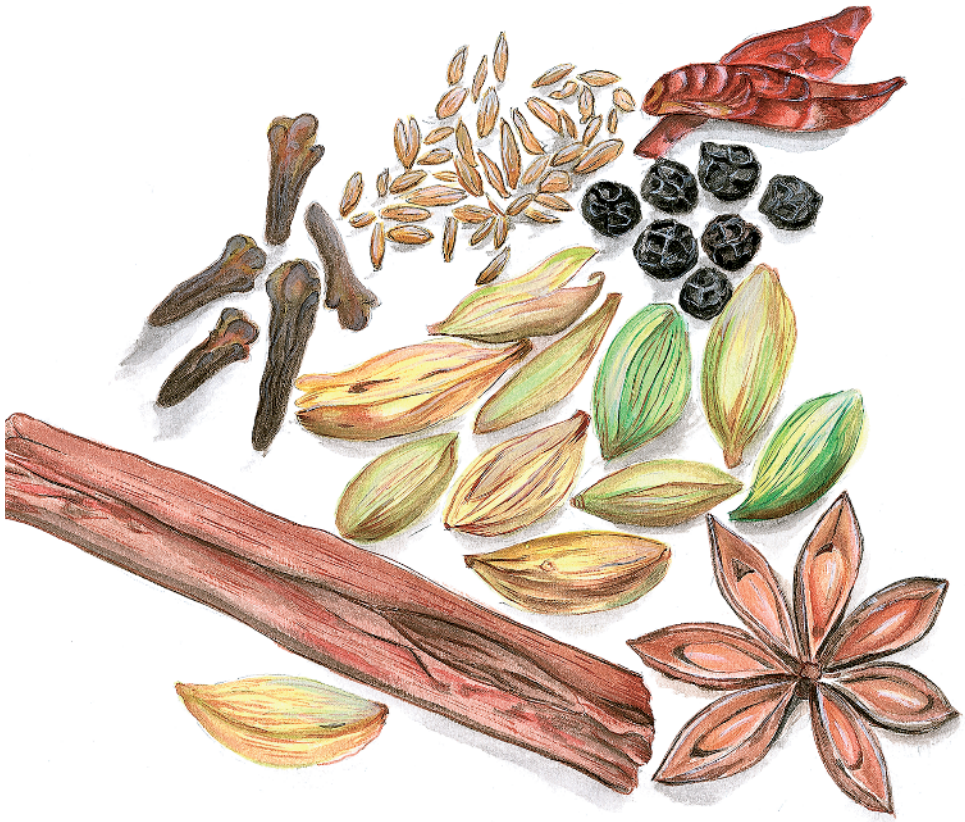
Walnuts are grown from deciduous trees of the Juglandaceae family. There are many varieties of walnuts, but the most popular is the Peruvian walnut, which has a large nut and a thin shell. The pollinated fruit develops an outer husk that hardens and protects the nut. Walnuts are rich in oil, which can be used for cooking. Walnuts have been made into syrup, flour, and dye and even pickled in vinegar. Ninety-nine percent of the United States' walnut production comes from a small region in California, where over thirty varieties are grown.

Spices

Spices are derived from the seeds, berries, bark, fruit, branches, and roots of plants and used to add flavor to foods. They are usually dried and ground or grated into powder and sold by weight. Spices provide the characteristic flavors and unique aromas found in many different foods and desserts. In chocolates, spices are used primarily to flavor ganaches through infusion. This is done by bringing the cream and spice to a boil and letting the mixture infuse for ten minutes, then straining and using the spice-infused cream to create the ganache.

Be careful when using spices. Spices should be used to enhance the flavor of a confection, and adding too much of any one spice or too many different spices in combination can ruin the product. Chocolate and spices are expensive, so it is best to test new products in small batches. The flavor and aroma of seed spices, such as poppy and sesame, can be accentuated by toasting in a heavy skillet until lightly browned.

The shelf lives of spices vary according to the spice and even its form. Whole spices such as nutmeg or cloves will last longer than ground spices, as their protective coatings prevent exposure to oxygen and light. Oil-rich seeds can be refrigerated or frozen to prevent them from becoming rancid. Storing spices in an airtight container and avoiding exposure to light, heat, oxygen, and moisture are the keys to maintaining freshness. Date all spice containers, check spices yearly, and discard any that do not give off an aroma when pressed in the palm or that have lost their fresh color.



CLOCKWISE FROM BOTTOM LEFT: Cinnamon, cloves, cumin, red chile, black pepper, cardamom, and star anise can all be used to enhance the flavor of confections.

Vanilla

Vanilla is the most important flavoring used by bakers because of its strong flavor and aroma. It comes in three forms: whole beans (vanilla pods), vanilla extract, and vanilla powder. Vanilla beans are the dried fruits of the tropical vanilla orchid. They are mainly grown in Mexico, Tahiti, China, India, and Madagascar, and they need to be hand pollinated, which makes them one of the most expensive spices. Vanilla beans have different flavors depending on where they are grown. The most popular varieties of vanilla are Tahitian and Madagascar Bourbon. It is generally recommended to use whole beans in the confectionery kitchen.

Saffron

Saffron is the most expensive spice by weight in the world. It comes from the dried inner threads, known as the stigmas, of the purple saffron crocus plant. Each plant produces three stigmas, and it takes 150 flowers to yield 1 g of saffron threads. Since the saffron crocus is sterile, it cannot reproduce except by corms. Corms, which are short vertical underground plant stems that serve as food storage for the plant for survival in cold weather, are hand separated and planted in order to grow more flowers. Saffron threads are golden yellow and used to color and flavor foods in different cuisines such as Spanish and Middle Eastern. It is important to store them in an airtight container to minimize exposure to air, which breaks down the saffron.

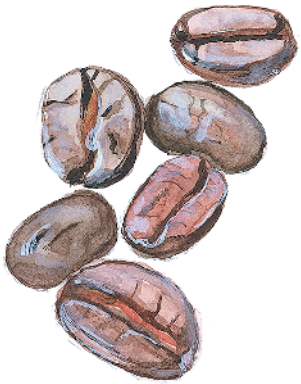
Nutmeg

Nutmeg is the seed inside the fruit of the tropical evergreen nutmeg tree. The seed is dried and ground or freshly grated into soups, sauces, cheeses, vegetables, sweet desserts, and other products. The flavor and aroma of nutmeg are strong and sweet. The lacy reddish outer covering of the nutmeg seed is known as mace when it is dried and ground.

Ginger

Ginger is obtained from the rhizome of the tropical ginger plant, which produces fragrant yellow flowers. Ginger has a peppery flavor, is slightly sweet, and has a spicy aroma. It can be pickled, made into syrups, dried, or candied, and it is used in many sweet and savory dishes.

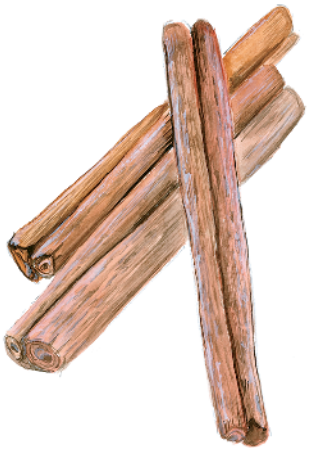
Coffee



The coffee bean is the seed of the coffee bush (sometimes grown as a small tree), which is picked, dried, and roasted. Coffee is grown in tropical and subtropical regions throughout the world, and its flavor differs according to where it is grown. Coffee is one of the most popular beverages worldwide, and it is brewed from ground coffee beans. There are two main types of beans grown, Arabica and Robusta. Arabica is the most popular because it is smooth tasting and the most suitable for drinking purposes. Robusta has a more bitter flavor and contains 40 to 50 percent more caffeine than other beans. Because of this, it is either blended with other coffees or used for espresso. For use in cooking, baking, and candy making, roasted beans or ground coffee may be steeped in milk or cream and then strained out. Brewed coffee may be reduced to a thicker consistency for use as a flavoring, and commercial coffee extracts are also available. The smoky, rich taste of coffee goes well with chocolate.

Clove

This spice originates from the dried unopened flower buds of a tropical evergreen tree called the clove tree. Eighty percent of the world's cloves are produced in Indonesia. The spice's aroma is soothing, and as a result the fragrance is often used for candles and perfumes. Cloves can be used in whole or ground form. Cloves have a very strong flavor, so a small amount goes a long way. Cloves are usually blended with other spices.



Cinnamon

Cinnamon is one of the most popular spices. It comes from the inner bark of an evergreen tree in the same family as laurels. It can be purchased ground or in sticks, which are used in dishes where the cooking time is long enough to extract the flavors from the stick. Cinnamon is grown in tropical regions throughout the world. It is suitable for use in sweets such as cakes, puddings, desserts, and drinks as well as savory dishes, and it is often used in chocolates, especially for holiday ganaches.

Allspice

Allspice, sometimes known as the Jamaican pepper, is derived from a plant grown in tropical regions, with white flowers and reddish round berries. The berries are available whole or ground and have a peppery aroma. Although allspice tastes like a mixture of cinnamon, cloves, and nutmeg, it is not a blend of these three. It is used in pickling spices as well as cakes, jams, and fruit pies, and it can also be used in ganaches.

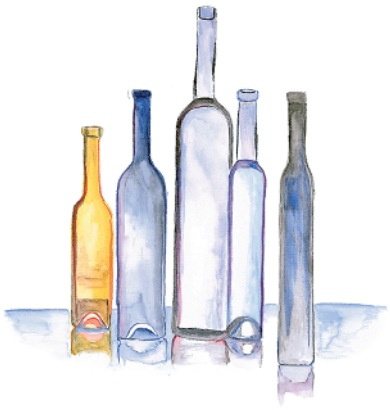
Anise

Anise is one of the oldest spices grown in India, North Africa, and Southern Europe. It has a white umbrella-shaped flower that blooms and releases seeds. The seeds are small, gray-green oblongs. They have a strong, sweet flavor similar to licorice. Anise is used all over the world to flavor a variety of food and drinks, as well as in liqueurs, aromatherapy scents, and digestive aids.

Cardamom

Cardamom seeds are encased in ¼-inch-long/6-mm-long, light green or brown pods. Cardamom is highly aromatic with a unique cool, fragrant flavor, and it is used in both sweet and savory dishes as well as in beverages and medicines. This is the spice that gives spiced tea *(chai)* its unique taste. Cardamom is widely used in India, the Middle East, and Europe to flavor drinks, pastries, and breads. The second most expensive spice behind saffron, ground cardamom loses its flavor and aroma rapidly, so it is best to store the pods and grind the seeds as needed or keep only small amounts on hand.

Liquors



Liquor has always been an important ingredient in making chocolate, although it is less popular today than in years past. Liquor is used to bring out the flavor as well as increase the shelf life of ganache. The list below includes those liquors that are most commonly used in confections.

Rum

Rum is one of the oldest liquors in the Americas, dating to the seventeenth century. Rum is an alcohol that is distilled from sugarcane. Plantation slaves found that a by-product of sugarcane, molasses, could be fermented and distilled into liquor. The types of rum available for use in confections include:

LIGHT RUM: Very little flavor, slightly sweet. Light rums are sometimes filtered to remove any color. Used for cocktails.

GOLD RUM: Amber-colored, medium-bodied rum that is aged. Aging in wooden barrels contributes to the dark color.

DARK RUM: Aged longer, dark rum has a stronger flavor than light or gold rums. There are strong molasses and caramel overtones to this rum, as well as a slightly spicy bite. It is the most commonly used rum in cooking.

SPICED RUM: Dark in color, the flavor is derived from the addition of spices and sometimes caramel. Some of the cheaper brands use white rum with artificial color added.

FLAVORED RUM: One of the newest variations on the market, these rums are infused with different fruit flavors and have fruity fragrances. Common flavors include lime, mango, pineapple, coconut, and orange. Rums with flavoring can be used to create interesting variations in candy making.

OVERPROOF RUM: Highly concentrated rum with an alcohol content of 60 to 84.5 percent (120 to 169 proof). Standard rum is usually in the 40 percent (80 proof) range, so overproof rum is very potent by comparison.

PREMIUM RUM: Normally reserved for sipping like a fine Cognac, this rum is aged and carefully cared for in order to reach this quality. This is not rum that you would use in mixed drinks, cooking, or candy making, as these uses would detract from its superb character.

Baileys Irish Cream

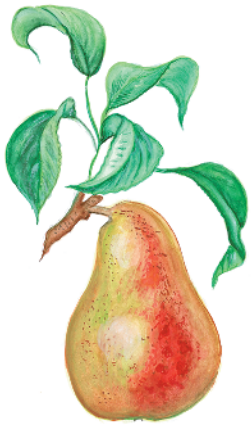
This is an Irish whiskey-and-cream-based liqueur that was first introduced in 1974. Its alcohol content is 17 percent. According to the manufacturer, Baileys was the first liqueur to combine alcohol and cream in a manner that was stabilized enough for commercial distribution. In order to prevent separation during storage, the whiskey, cream, emulsifier, and flavors are homogenized. The manufacturer also states that no preservative is necessary due to the alcohol acting as a preserver for the cream. When properly stored, the shelf life can be as long as twenty-four months. This liqueur is normally enjoyed by itself, over ice, or mixed with other beverages such as coffee. Baileys has several flavors on the market, including mint chocolate, caramel, and coffee. These different versions can be used to enhance the flavors of pralines. Caution must be used when working with Baileys in recipes using acid, as it is sensitive to curdling when it comes in contact with acidic ingredients.

Fruit Brandies

Quality fruit is important in the making of fruit brandies. The flavor and aroma depend on the distiller's expertise in the selection of fruit and careful eye over the fermentation process. To make brandy, fruits are placed in tanks to allow the natural sugar to ferment. The majority of the sugar transforms into alcohol in the first ten days, then the fermentation slows down and takes around six weeks to complete. Because of their low sugar content, some berries will not produce much alcohol from fermentation, so they are paired with alcohol to macerate. After fermentation, the liquor is distilled. The alcohol content of brandies should be 40 to 50 percent. There are many types of brandy available, but Kirschwasser and Williams pear brandy are two of the most commonly used in confections.

Kirschwasser

Commonly known as Kirsch, Kirschwasser is German for "cherry water." This brandy is clear and colorless, and it is double distilled from cherries. There are over 350 varieties of Kirsch. Any variety of cherries can be used, but the type traditionally used in Kirsch are Morellos, which are fermented with their stones. This brandy is not sweet but has a hint of cherry flavor with a slightly bitter almond taste from the stones. Around 22 pounds/9.98 kg of cherries are needed to produce one 750 ml bottle of Kirsch with an alcohol content of 40 to 50 percent. This brandy is generally sipped as an after-dinner drink, but it is also very popular to use in chocolates and a vast array of desserts.



Williams Pear

A popular and interesting pear brandy that is widely used in chocolates is *eau-de-vie de poire Williams.* It is made by fermenting the crushed, ripened fruit of the Williams pear for up to six weeks, then distilling the brandy and allowing it to age. It has a rich pear flavor that is soft to the palate. Many bottles of Williams pear brandy are sold with a pear inside. To achieve this, growers hang empty bottles on their trees and insert the young fruit buds, which are trained to grow inside the bottles until the fruit becomes fully matured and ripened. The bottle and pear are removed from the tree and carefully cleaned. The brandy is then added and the bottle sealed.

Acids

Acids are both flavor enhancers and preservers of food. Common acids used in cooking and confectionery work include tartaric acid, citric acid, and vinegar.

Tartaric and citric acid are both commonly used in kitchens. The choice between these two acids comes down to individual preferences and availability; citric acid is easier to find. Tartaric acid is 30 percent stronger than citric acid, so care must be taken with its use.

Tartaric Acid

Tartaric acid is a white crystalline organic acid. It occurs naturally in many plants, particularly in bananas and grapes. Tartaric acid is one of the main acids found in wine. It is used as a flavoring agent in foods to create a sour taste.

The potassium salt of tartaric acid is a weak acid and is known as cream of tartar. Tartaric acid is mostly used in jelly to activate the gelling process, and it can also be used to enhance the flavor of fruit used in ganaches.

Citric Acid

Citric acid is a weak colorless organic acid naturally found in citrus fruits such as lemons, limes, oranges, and tangerines. It is a natural preservative with a strong tart taste. It is used as a preservative in food and soft drinks and as a flavoring to give a tart taste to foods and candy. Citric acid comes in a white crystalline powder that easily mixes into liquids. Many sour candies have a fine, white powder coating of a citric acid mix on the exterior to give them an extra punch of sour taste when eaten.

Lemon juice contains about 5 percent citric acid. It can be used to enhance the flavor in fruit ganaches such as raspberry, strawberry, peach, and mango—but if too much is used in ganache, it can develop a bitter taste.

Vinegar

Vinegar can be produced from a range of products, including fruits, berries, potatoes, beets, malt, grains, and even coconuts. Vinegar is created when the natural sugars of the product ferment to form alcohol then continue on to a secondary fermentation that changes them into an acid. Vinegar has been around for more than 10,000 years. It was originally discovered when a cask of wine had gone past its prime, turning into *vin aigre* ("sour wine" in French). Vinegars range in strength from table vinegar (around 5 percent acid) to pickling vinegar (18 percent acid). Balsamic, distilled white, cider, and rice vinegars are common varieties found in most stores that are used for flavoring, cleaning, and preserving. Balsamic vinegar is a good choice for imparting flavor to recipes—even though it has a high acid level, it lends a somewhat mellow flavor because its sweetness balances the tartness. Balsamic vinegar is ideal to use with strawberries or mango. New spice-infused vinegars such as cinnamon, clove, and nutmeg can also lend an interesting flavor to recipes.