TRANSFORMING A FEW BASIC INGREDIENTS INTO A VARIETY OF PASTRIES AS DIVERSE AS TENDER LADYFINGERS, LIGHT-YET-RICH CHOCOLATE MOUSSE, SOPHISTICATED TORTES, FRUIT TARTS, CREAMY ÉCLAIRS, AND CRISP BISCOTTI SEEMS MYSTERIOUS AND MAGICAL TO THE UNINITIATED. INDEED, PASTRY MAKING IS FREQUENTLY THE LAST FRONTIER FOR MANY HOME BAKERS AND ASPIRING PROFESSIONALS.

CHAPTER 1: THE INGREDIENTS

Almost every pastry combines flour, butter, sugar, eggs, and salt. Frequently, other ingredients, including chocolate, nuts, spices, fruit, extracts, and especially vanilla, are added to enhance the basic flavors. An easy way to elevate your pastries is to use the most appropriate and the highest quality ingredients available for any particular process.

Familiarity with the properties and characteristics of ingredients used in pastry making allows pastry chefs to create classic pastries using traditional ingredients and techniques to achieve consistent results. An understanding of the ingredients affords pastry chefs the ability to create interpretations of the same traditional pastries. Reinterpreting and personalizing traditional pastries is one of the markers distinguishing pastry chefs from pastry cooks.

Speaking with the august group of pastry chefs featured in this book, I heard four recurring themes:

- Use the best ingredients.
- Respect the fundamentals.
- Document your results.
- Practice, practice, practice.

Of course, practice is the most fun part of this equation—more so when you are able to troubleshoot and solve problems. (However, it is even more fun to avoid them in the first place!) Ingredient selection and sourcing will become easier as you learn the manner in which they influence results. Then you'll be able to fix problems when they arise and manipulate recipes without compromising the integrity of the formulation. So let's start talking about the ingredients you'll use most often.

Protein numbers can be misleading. The quality of the protein is more important than the quantity.

FLOUR

Flour is the logical choice to begin the study of pastry ingredients, since it is found in all baked pastries. It is milled from wheat kernels to provide a variety of strengths, particle sizes, and other characteristics.

Pastries that include flour are typically leavened by physical, chemical, or biological means (more on this on page 15). Only wheat flour possesses the quality gluten-forming proteins necessary to trap these leavening agents. Flours from other grains—such as rice, corn, oats, rye, and buckwheat—contribute to the characteristics associated with regional and ethnic pastries; however, they are typically combined with wheat flour so that the pastries will have the gluten they need to be light, tender, and uniform.

Wheat kernels are seeds necessary for the perpetuation of the plant species. They contain the vital nutrients for the nascent stages of the next plant and are made up of three parts: the bran, the germ, and the endosperm. Bran is the protective outer coating, rich in minerals, cellulose, and fiber. The germ has an abundant supply of enzymes used to convert starches into simple sugars (useful for fermentation), fats, and vitamins. It is the embryo of the next plant. The endosperm is the largest part of the kernel and is made of starches, proteins, and carbohydrates.

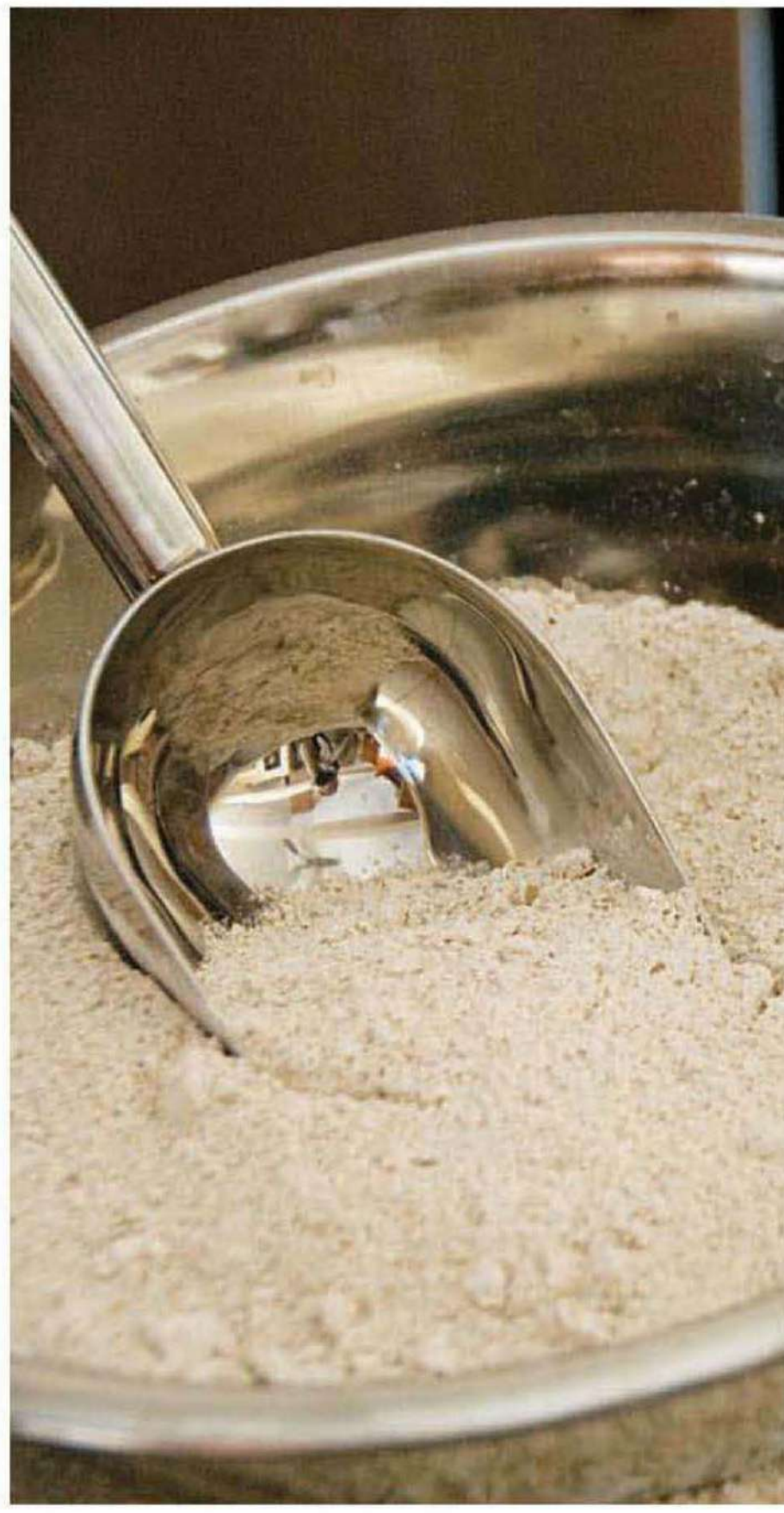
There are other components in flour, such as fats and moisture; however, in pastry making, the main considerations are the quality and amount of starches and proteins. Starches absorb liquids and provide structure to baked goods. There are two gluten-forming proteins in wheat flour: glutenin and gliadin. Glutenin provides strength, elasticity, and gas-trapping properties to dough. Gliadin provides extensibility (the ability to stretch). Technically, there is no gluten in flour, only the gluten-forming proteins. When you add water to wheat flour and agitate or mix them, gluten is formed. When dough is properly developed, a web of gluten permits the dough to be shaped and expand during rising and/or baking (extensibility), yet controls the expansion and maintains the desired shape (elasticity).

CLASSES OF WHEAT

There are six classes of wheat among tens of thousands of varieties: *hard red winter, hard white winter, hard red spring, soft red winter, soft white*, and *durum*. These classes denote which part of the year the wheat is planted, the color of the grain, and the hardness of the grain. Soil conditions and climate affect the quality of the gluten-forming proteins.

Hard wheat left in the ground during winter absorbs abundant amounts of nitrogen, resulting in flour with high-quality proteins required for bread production. Too much moisture in the form of rain or snow dilutes the nitrogen content, and too little moisture creates a nitrogen deficit, adversely affecting the proteins.

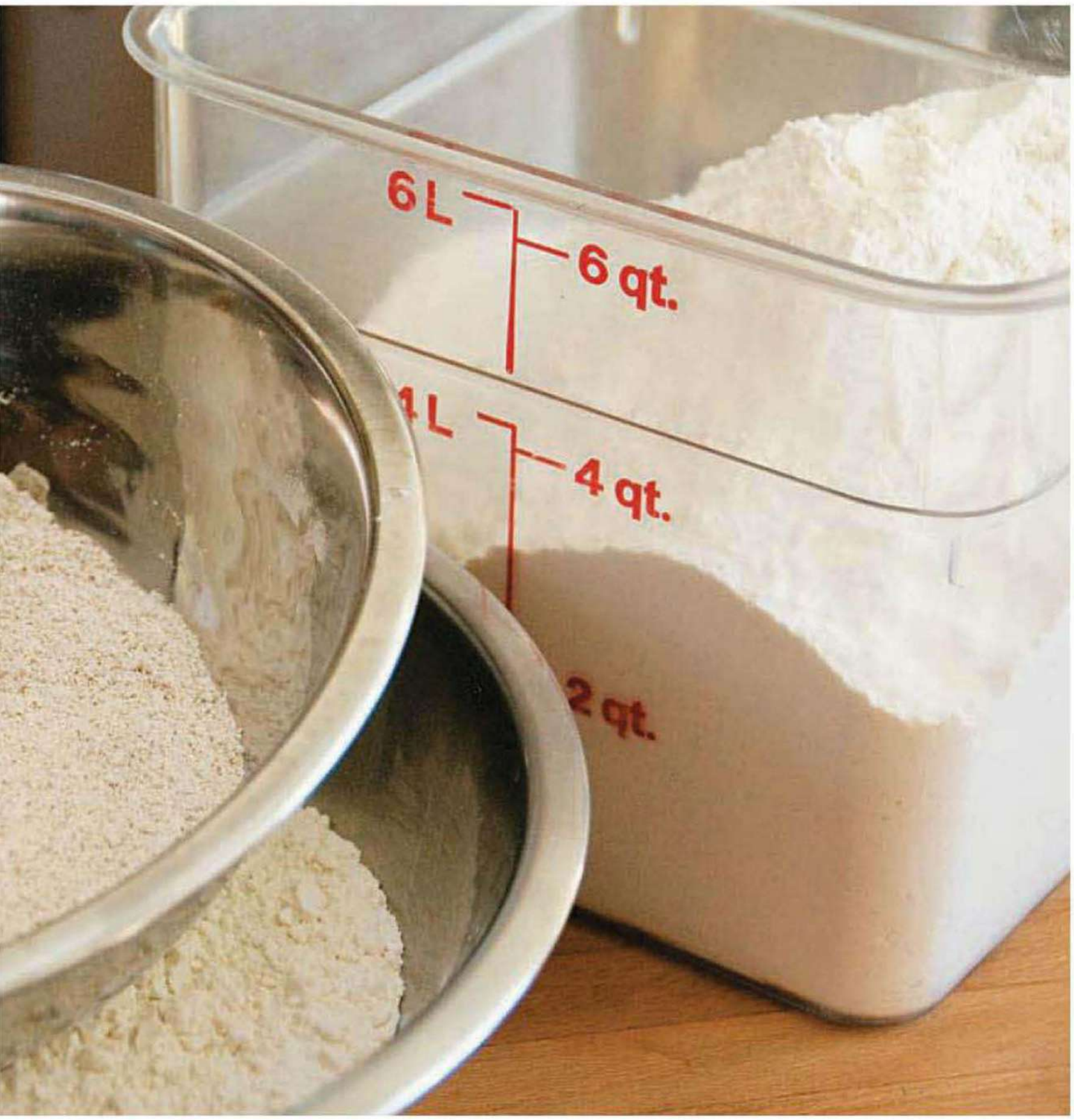
Because of its pale color and shorter, more easily broken gluten, **soft white flour** works well for making cakes and pastries. Pastry flour is milled from **soft red winter** and/or soft white flour, and it is ideal for tart crust, cookies, pie dough and the like. Cake flour, milled from soft red wheat, is bleached white and is ground and sifted to a finer consistency than bread and pastry flours, which allows it to better absorb liquids and sugars. It is also softer than pastry flour, helping it impart the characteristic lightness and tenderness associated with cakes.



Durum has a substantial amount of protein; however, the balance of glutenin and gliadin is skewed, resulting in more extensibility and less elasticity, making it better for pasta than pastry. It is used to make bread, but in conjunction with other types of wheat flour.

Protein Levels in Flour

North American millers use protein content as a specification. European millers use the ash content of the flour, an indication of the mineral content. For example, in France, many bread bakers use Type 55 or Type 65 flour for bread making. That means that the ash content is 0.55 or 0.65 percent. The higher the number, the higher the ash content, indicating that less of the bran and germ (where the minerals are found) were discarded during milling.



Protein numbers can be misleading. The quality of the protein is more important than the quantity. For example, preschoolers use drops of white glue to hold pieces of paper in place; carpenters use an industrial glue to hold their work together. But a gallon of the white glue would not hold something together that a few drops of the industrial glue would.

Looking at the chart to the right, you see that whole wheat flour has the most protein and think that if you used it in place of white flour, your products would have greater volume. The truth is, however, that baked goods made with whole wheat flour will have smaller volume because the bran flakes cut and shear the strands of gluten, impairing their ability to stretch.

PROTEIN CONTENT OF FLOURS

Whole wheat	14–15%
High gluten	14%
Durum	13%
Bread	11–12.5%
Pastry	8–10%
Cake	7–8.5%

ALL-PURPOSE FLOUR

A few words about all-purpose flour: It's good for everything and good for nothing. Pastry chefs use specific flours for specific purposes and products. With its wide range of specifications, all-purpose flour is best left on the market shelf. The specifications of all-purpose flour vary by geographic regions and tradition. For example, in the southern United States, all-purpose flour is very soft (low protein) for biscuits, corn bread, etc. There are many excellent regional and ethnic pastries that have been made with all-purpose flour for years; however, for predictable, consistent results, it is best to use specific flours for specific products. The resources available for the modern pantry thanks to specialty markets and the Internet have made formerly hard-to-find ingredients readily available. Disclaimer: If you have made a favorite recipe many times and used all-purpose flour, you should continue to do so. The recipes in this book were made with specific flours.

LOW-PROTEIN BREAD FLOUR

Low-protein bread flour manufactured for artisan breads typically has a protein level of 11 to 12 percent. Many pastry chefs use LPB in place of pastry flour when producing biscuits, scones, cookies, quick breads, and other chemically leavened baked goods.

Low-protein bread flour functions in a manner similar to that of an ideal all-purpose flour. It is strong enough for many tasks, including bread making, yet not too strong for tender cookies, biscuits, muffins, coffee cakes, Danish, and so on. You can use it for everything except cake and some tart/pie crusts. Pastry chefs and bakers prefer it because the specifications of the flour are more consistent from region to region, from season to season, and from year to year.

Occasionally, pastry chefs and bakers will dilute the protein content of stronger flour by exchanging a portion of bread or low-protein bread flour with pastry flour. Another method is to exchange a portion of the flour for cornstarch in some of the lightest cake batters, such as angel food or ladyfingers/roulade (see recipe page 113).

SWEETENERS

Other than flour, sugars are the most commonly used ingredient in pastries. They contain carbon, hydrogen, and oxygen and are classified as carbohydrates. All sweeteners fall into two groups: monosaccharides and disaccharides. When using yeast as a leavening agent, monosaccharides are directly fermentable. Disaccharides must be converted to monosaccharides by enzymatic action in order to be metabolized by yeast.

Sugars come in many forms and from many sources. Pastry chefs usually select **granulated sugar** for creaming with plastic fats (butter, shortening, etc.) in the production of cakes, cookies, and similar products or for whipping with eggs (whether whole, yolks, or whites) in the production of cakes. Moist **brown sugars** are useful for bun fillings, cookies, cakes, and similar products. **Superfine sugar** is desirable for icings and high-ratio cakes (cakes that contain a higher ratio of sugar and liquid than typical cakes) made with the blending method. **Powdered, or confectioners', sugar** is used for flat (water) icings, stiffer cookies, tart crusts, and décor. **Honey, glucose, corn syrup, and agave syrup** are used for their distinctive flavors in specialty products, and they increase the shine of icings, frostings, and glazes. **Molasses**, a byproduct of sugar refining, imparts an unmistakable, earthy flavor and color to pastries, while **maple syrup** is prized for its subtle flavor.

FUNCTIONS OF SWEETENERS

Sweeteners play a wider role than just simply adding sweetness. Here are several other roles that sweeteners play in pastries. (Keep in mind, all sugars are not created equal. See the chart, "How Sweet It Is," to learn more about relative sweetness.)

Tenderizes: In solution (a dough or batter), sweeteners inhibit gluten development and starch gelatinization. Sugar is hygroscopic (it absorbs and retains moisture) and diverts a portion of the water from structure builders like gluten and starch, resulting in tender products.

Extends shelf life: This is also due to the hygroscopic properties of sweeteners. Honey, glucose, and invert syrups (made with equal amounts of fructose and glucose) keep products fresher longer than other sweeteners due to their increased hygroscopic properties. A hygroscopic ingredient attracts and retains moisture.

Promotes leavening: When you cream dry, crystalline sugar with plastic fats or whip it with eggs, the process traps air that is useful for leavening. (Read more about this in Chapter 3.)

Stabilizes egg foams: The dissolved sugar inhibits the unfolding and subsequent linking of the proteins. This is especially important when making meringues, whether for leavening baked goods or for aerating mousses. Superfine sugar works best for this application because it dissolves more quickly than other granulations.

Contributes to crust color and caramelized flavor: Sugar caramelizes when it is heated over 320°F (160°C). A caramelized crust is the first part of a baked good to touch the tongue, and it delivers a pronounced flavor. Some flavors from the crust migrate to the interior of the product, creating layers of flavor.

Complements: Sugars complement other ingredients, especially salt.

Contributes flavor: Sweetness is one of the five tastes. Sweeteners such as honey, molasses, piloncillo, palm sugar, jaggery, demerara, and muscovado imbue pastries with their unique, characteristic flavors.

Preserves: Sugars inhibit mold development.

HOW SWEET IT IS: A TABLE OF SWEETNESS VALUES

Sucrose, or table sugar, is considered the control in comparing the sweetness values of different sweeteners. It has a value of 100. For example, if molasses were exchanged with sucrose (by weight), because it has a sweetness value of only 70, the baked product would not be as sweet.

Fructose	172
Invert syrups	102
Sucrose (the control)	100
High fructose corn syrup	100
Brown sugar	97
Powdered sugar	97
Honey	80
Dextrose	75
Molasses	70
Maltose	65
Corn syrup (enzyme converted)	60
Malt syrup	42
Corn syrup (acid converted)	31
Lactose	16

A SPECIAL SWEETENER

Honey was the first sweetener harvested by humans. Cave drawings clearly detail the use of and value placed on honey. Different floral sources influence pronounced flavors in different honeys. Honey from a specific floral source is known as a varietal. Honey from multiple floral sources is referred to as wildflower. Honey is the only sweetener that does not require refining. When beekeepers harvest the honey, the activity in the hive has already refined it. Its benefits to baked goods are the same as other sweeteners, yet at a higher level. For example, honey contains amylase, an enzyme that converts starches to sugar, which is beneficial when included in yeasted breads. Its low pH makes it an ideal acid catalyst when using baking soda as a leavening agent (see page 15).

Honey is the only food that will not spoil. It may crystallize, however this can be remedied by immersing the container in hot water.

Some interesting facts about honey:

A bee weighs 0.004 ounce and can transport half its weight (0.002 ounce) in nectar.

For one pound of honey harvested, nine must be produced, with eight remaining in the hive to sustain the colony.

50,000 miles of flight time are required to gather enough nectar for those nine pounds, yielding one pound for human consumption.

The pH of honey is between 3.9 to 4.4, similar to sourdough bread.

Bees have two sets of wings, one to fly and one to fan nectar moisture out of the hive.

The internal temperature of the hive is 92 to 95°F (33.3 to 35°C), which reduces the water content until the honey consistency is achieved.

FATS AND OILS

If any food group other than carbohydrates has come under public (or media) scrutiny in recent history, it is most certainly fats. Fats and oils also consist of carbon, hydrogen, and oxygen. They are an important dietary source of body heat/energy. Fats are a mixture of triglycerides that are semi-solid or solid at room temperature. Oils are also a mixture of triglycerides; however, they are liquid at or below room temperature. Fats normally used in pastry kitchens include shortening, margarine, lard, butter, and oils.

Shortening may be of animal or vegetable origin, or a combination. It has a melting point of 110°F (43.3°C) and is excellent for creaming with crystalline sugars. Due to its high melting point, products made with it may leave a waxy coating in your mouth.

Margarine is made from partially hydrogenated soybean and palm oils and includes diglycerides and artificial flavors and colors. Professional pastry chefs largely eschew it. Its most notable benefit is its low cost. It is best left as a table spread.

Lard is rendered from the internal organs of hogs. It is the hardest of all fats. Like shortening, it is 100 percent fat. It is prized for its distinct smoky flavor in certain traditional pastries. Its hard, granular texture produces flakier pie crusts than other fats, and it is an excellent medium for frying. It has a melting point of 112°F (44.4°C). It is not as good for creaming.

All the recipes in this book call for unsalted European-style butter. American butter is 80 percent butterfat; European style is 82 percent. It is most pliable at 60 to 70°F (15.5° to 21.1°C). It is soft at 80°F (26.6°C), and it has a melting point of 88°F (31.1°C) with a final melting point of 94°F (34.4°C). It is the only fat that will melt in the mouth, creating a clean "finish" or luxurious mouthfeel. Butter flavorings have been developed in laboratories and added to other fats, but no other fat can match the complex flavor and mouthfeel of butter. European-style butter is especially beneficial for use in laminated dough such as puff pastry (see page 65).

Oils used in the pastry kitchen are derived from vegetable sources and have a greater tenderizing effect than many fats. Their flavor derives from their plant source. They do not contribute to leavening, but they produce a moister product with an extended shelf life. They are frequently used in quick bread products, such as *pain d'epices* (see page 40)

FUNCTIONS OF FATS AND OILS

Fats and oils, also known as lipids, are an essential food group. All fats and oils are derived from animal or plant sources. When choosing fat for a baked item, it is good to understand the source and the properties and characteristics associated with each type of fat. Some fats are better for creaming, others contribute to greater shelf life, or flakiness, or specific flavors.

- **Tenderizing:** Fat and oils encapsulate flour particles, rendering them impermeable to water. Gluten is less likely to form if water is unavailable to the flour. Fats coat gluten strands, lubricating and shortening them, making pastries more tender.
- **Flavor:** While shortening has no flavor, butter, lard, and vegetable oils have distinctive flavors.
- **Flakiness:** In pie dough, pieces of fat in the dough melt in the oven, creating layers. In puff pastry, layers of fat separate layers of dough. As the pastry bakes, the water in the dough leavens the product, and the fat keeps the layers from merging.
- **Leavening:** Air is incorporated into fats during the manufacturing process. Highly emulsified fats created for high-ratio cakes, such as shortenings formulated specifically for cakes and icings, contain up to 10 percent air. These and other fats trap additional air during the creaming process. Carbon dioxide and steam collect in the air cells created during creaming and allow the product to expand.
- **Body and texture:** Icings, frostings, and fillings benefit from the use of solid fats, most notably butter.

DEFLATING A MYTH

It is widely believed that the water in the fat used to laminate puff pastry is converted to steam during baking and that this steam leavens the pastry. Some of the flakiest puff pastry is made with special 100% shortening (0% water). In Europe, extra dry butter is used for lamination and has little to no water, yet the products made with it are quite flaky. Puff pastry dough is made with two parts flour and one part water. It is the water that leavens the pastry.

A LITTLE BIT ABOUT BUTTER

It takes 21 pounds (9.5 kg) of milk to make 1 pound of butter.

Unsalted butter is often referred to sweet butter; it should not be confused with sweet cream butter, which may or may not be salted. Most butter in the United States and Europe is made from sweet cream.

Cultured butter is made from fresh cream to which a lactic acid bacteria culture is added, resulting in a tangy, complex flavor.

The amount of salt in salted butter varies with manufacturers. Additionally, salted butter contains more water than unsalted butter. Using unsalted butter and adding a specified amount of salt to recipes will yield predictable, consistent results.

THE pH VALUE OF BAKED GOODS

The pH number represents the power of hydrogen to form ionic bonds. The pH level has a pronounced effect on baked goods, including their quality, flavor, and shelf life.

Low pH (Acid)	High pH (Alkaline)
Tart or sour taste	Soapy or sodalike taste
Whiter crumb	Darker crumb
Whiter crust	Darker crust
Reduced volume	Normal volume
Tighter grain	More open grain
Silky texture	Crumbly texture
Moister—longer shelf life	Moisture loss—shorter shelf life

LEAVENING AGENTS

Baked pastries are leavened by introducing one or more gasses into the dough or batter, creating products that are light and more easily chewed, are more digestible and palatable, and have greater volume. Leavening agents are categorized as physical, chemical, and biological.

PHYSICAL LEAVENING AGENTS

Air and steam leaven baked goods by physical means. Air is incorporated into mixtures by creaming plastic fats and crystalline sugar. The sharp edges of the sugar cut into the fat, trapping air in newly formed cells. It is in these cells that steam and/or carbon dioxide will collect and expand when heated. Products made with the creaming process include quick breads, cookies, and cakes. Another method of incorporating air is through the use of egg foams. Whipping whole egg, egg yolk, or egg white with crystalline sugar creates a stable foam of air cells that will expand when heated, as well as trapping gasses that will expand when heated. Products made by whipping eggs with crystalline sugar include ladyfingers, angel food cake, and genoise.

Steam is generated from the evaporation of moisture in certain doughs and batters. At 212˚F (100˚C), water converts to vapor and expands up to 1,600 times in volume. The rapid expansion leavens products such as pâte à choux (used to make cream puffs, éclairs, etc.) and puff pastry (palmiers, jalousies, etc.).

CHEMICAL LEAVENING AGENTS

There are two main chemical leavening agents: baking soda, also known as sodium bicarbonate, and baking powder. When you combine baking soda with moisture and an acid, it generates carbon dioxide. Baking soda has twice the gassing power of baking powder. It is alkaline, with a pH of 8.4 to 8.9, and when heated without an acid, it generates carbon dioxide and sodium carbonate, which combines with the fatty acids in the recipe to produce a soapy taste. Since baked products brown better when they're alkaline, baking soda promotes good crust and crumb color and may be used in conjunction with baking powder to adjust a recipe's alkalinity for this purpose. Baking soda also has a weakening effect on proteins. This contributes to spread in cookies, which contain proteins in eggs and flour.

The most widely used type of baking powder used by professionals and home bakers is double acting. Double-acting baking powder has a neutral pH of 7. Baked goods made with baking powder will generally have a pH of 6.5 to 7.5 (see chart above).

Double-acting baking powder is made from one slow-acting and one fast-acting acid ingredient, baking soda, and a filler starch to keep the baking soda and acids separated, preventing premature release of the carbon dioxide. It also absorbs moisture that may have been incorporated during manufacturing or from the environment. (Always keep baking powder tightly covered.) After mixing, 20 to 30 percent of the carbon dioxide is released at room temperature, leaving 70 to 80 percent to be released in the oven, giving it good "bench tolerance," or the ability to withstand the rigors of production and delays in production without any discernable damage. When exposed to heat in the oven, the generated gas seeps into air cells and is trapped by the coagulation of gluten and other proteins (such as egg white) in the recipe.

BIOLOGICAL LEAVENING AGENT

Yeast is used to leaven breads and pastries. In an environment of warmth, moisture, and an abundant food source, it produces carbon dioxide, which leavens baked goods. None of the pastries chosen for this book are leavened with yeast, so we will not spend a lot of time discussing it.

Understanding the composition of ingredients leads to a greater understanding of their contributions to the final product.

DAIRY PRODUCTS

All the recipes in this book that require milk were made with whole milk. Pastry chefs have many forms of dairy from which to choose: buttermilk, whipping cream, heavy cream, yogurt, sour cream, crème fraîche, and, of course, butter. They all originate with dairy cows. Some chefs use goat's milk to create different flavor profiles.

Their functions in baked goods are

- **Flavor:** Most dairy products are characterized as having a tangy flavor. Fermented dairy products (buttermilk, sour cream, crème fraîche, yogurt, and so on), have a more distinctively sour, or tangy, flavor.
- **Crust color:** Lactose, or milk sugar, is not fermentable by yeast, which means that when milk or milk sugars are used in yeasted dough, more sugars are available for crust coloration.
- **Nutritional value:** Dairy products contain protein, fat, sugar, and minerals. Incorporating dairy products in a recipe adds nutritional value.
- **Tenderizing:** The fat in dairy products, like other fats, inhibits gluten formation and lubricates gluten that is able to form.

Whole milk is an emulsion of tiny fat globules in a water solution of protein, sugar, and mineral salts. Its composition varies with the breed of cow, food available to the cow, time of day for milking, and geographic location. Fat and protein quality are the most susceptible to variation. Whole milk is preferred over skim and low-fat milks for pastry making due to its physical makeup. Products made with whole milk will have a more pronounced flavor, crust color, and nutritional value, and they will be more tender and have greater keeping qualities.

Most milk is pasteurized. Pasteurization is a process used to kill harmful bacteria. Unfortunately, all beneficial bacteria are also destroyed in the process. Milk is also homogenized, which prevents the separation of the fat and water. Milk is whiter as a result, and the flavor may be blander. There is a growing movement toward the consumption of raw milk. At this time, the only means to legally purchase raw milk is to purchase it at the site of production; it is not sold in stores.

Heavy cream is used as a liquid ingredient in baking products such as quiche, crème brûlée, and other custards. More often it is whipped and folded into mousses, Bavarian creams, and similar products. It may be sweetened and flavored as a stand-alone component, such as crème Chantilly (see opposite page). Heavy cream with a fat content of 40 percent is ideal for whipping. Most heavy cream available in the marketplace is 36 to 40 percent fat. When cream is whipped, air is incorporated. Fat globules link together and surround the air cells, creating a stable foam.

FERMENTED DAIRY PRODUCTS

Buttermilk, sour cream, yogurt, and crème fraîche are dairy products that have been acidified by the use of bacteria. Fermented dairy products are common in chemically leavened products such as scones, biscuits, muffins, and cakes, among others. Quite often the ingredient is used in the name of the product, such as sour cream coffee cake or buttermilk biscuits, due to the characteristics they impart to the product. The functions of these products in baked goods are:

- A distinctive tangy, and sometimes sour, flavor
- Increased shelf life by lowering the pH
- An increasing in the gassing power of products leavened with baking soda

A MILK SHAKE-DOWN

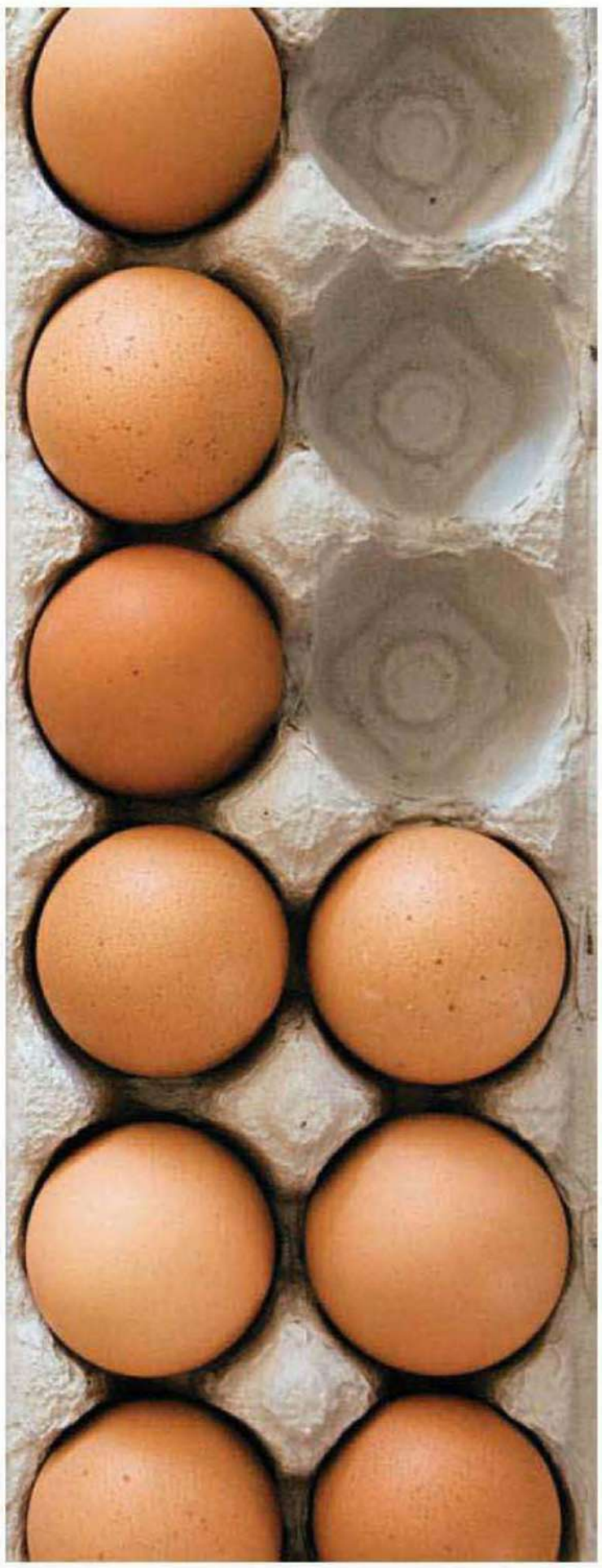
Understanding the composition of ingredients leads to a greater understanding of their contributions to the final product. For example, when using whole milk, the hydration is only 87 to 88 percent of an equal amount of water. If a pastry chef were using 100 units of milk in a recipe, he would be adding only 87 to 88 units of water, so a product might be drier than in a recipe that called for 100 units of water. This chart represents the components of standard whole milk purchased from dairies and markets.

Water	87–88%
Lactose	4.75%
Fat	3.65%
Protein	3.4%
Minerals	0.7%

WHIPPING CREAM

Some recipes advise adding sugar and flavoring before whipping cream. Another school of thought is that more air can be incorporated without interference from other ingredients. In either case, the bowl, whip, and cream should be very cold. For crème Chantilly, or sweetened whipped cream, use confectioners' sugar; with its 3 percent cornstarch, it "holds" the foam stable for a longer period of time. A typical ratio of sugar to cream is approximately 1 ounce (28.5 g) to 17.6 ounces (500 g). Measure the liquid by weight for consistent, accurate results.

To make crème Chantilly: Chill the bowl, whip, and cream. Whip at medium speed. When the cream is almost doubled in volume, add confectioners' sugar and flavoring, such as vanilla extract, if desired. Continue whipping to the desired consistency, a soft peak.



EGGS

An egg minus its shell is approximately 55 percent white and 45 percent yolk. In North America, large eggs average 1.76 ounces (50 g).

Functions of eggs in baked goods:

- **Tenderizing:** Egg yolks are approximately 50 percent moisture and 50 percent solids, which includes 33 percent fat. The fat in egg yolks functions the same as other fats in lubricating gluten strands and keeping gluten at a minimum.
- **Structure:** Albumen (egg white) protein and the small amount of protein found in the yolk coagulate when heated.
- **Leavening:** When eggs are whipped with crystalline sugar, air cells form.
- **Emulsification:** The lecithin found in egg yolks assists in emulsifying doughs, batters, and creams.
- **Nutritional value:** Eggs are a good source of protein and minerals.
- **Moisture:** Eggs are approximately 78 percent water (the remaining 22 percent is solids), which enhances keeping qualities.
- **Color, richness, and flavor:** Products made with whole eggs or egg yolks have a more golden interior, a more browned crust or shell, and, depending on how much egg is incorporated into the recipe, a distinctive "eggy" flavor.
- **Crust color:** Whole egg and water beaten together provide a golden shine when brushed on the surface of products prior to baking; whole egg, yolk, and water beaten together add a luster to the golden shine.

All recipes in this book use hen eggs. They should be as fresh as possible. Due to the high risk of salmonella, eggs should be handled with care. Inspect them before purchasing and do not use eggs with damaged shells. Store in a refrigerator and break eggs directly before using to prevent excessive decomposition. Wash your hands, equipment, and small wares after contact with raw eggs.

Eggs are most easily incorporated into other ingredients when they are at room temperature. It is best to remove eggs from the refrigerator one or two hours prior to use. Or you can remove them right before use and submerge them in warm water until they are at room temperature.

EGG COMPOSITION

Shell	Porous protective layer
Albumen (white)	87–88% water; 12–13% protein
Yolk	50% water; fat, lipoproteins, lecithin
Air cell*	Empty space at the wide end of the egg
Chalazae	Cord that keeps yolk suspended

*A small air cell indicates a fresher egg. Egg shells are porous; gas (oxygen) and moisture can pass through the shell. An egg loses moisture over time, and as moisture leaves the shell over time, the air cell gets larger.

FLAVORINGS

Scientists and chefs recognize four tastes: sweet, salty, sour, and bitter; and they dispute the existence of a fifth: umami. Yet we are able to discern thousands of flavors. It is estimated that flavor is 80 percent aroma and 20 percent taste. Orthonasal receptors alert us to the baking cinnamon rolls or apple pie next door or the orange being peeled behind us. They send signals to the brain as to the experience we can expect when consuming a certain product. Retronasal passages in the sinus and throat transmit the remainder of the information to the brain so that we may make distinctions between different foods, even those closely related, such as oranges, tangerines, tangelos, and clementines.

SALT

Salt, the organic compound of sodium and chlorine, is indispensible to life. A case could be made that it is equally indispensible in baking bread and pastry. It has a neutral pH of 7, permitting its use in almost all preparations. It harmonizes, enhances, and intensifies flavors. In yeasted dough, it regulates fermentation, tightens gluten, increases shelf life, and promotes crust color in addition to its flavoring properties. In pastries, salt assists in crust formation and color, it makes sweet taste sweeter and diminishes the impact of sour and bitter tastes, and it binds and strengthens the structure-providing proteins found in egg and flour.

Salt in formulations and recipes should be balanced. For example, for bread, you should use 1.8 to 2 percent salt in ratio to the weight of the flour. Other products include salt accordingly.

OTHER FLAVORINGS

Essential oils, extracts, emulsions, and compounds are available in natural and artificial forms. While natural flavorings may not be as uniform as artificial, they provide a truer flavor. They are less stable due to the evaporation and oxidization of some of the components.

Essential oils, also known as essences, are derived from fruits and plants and are highly volatile and aromatic. Stable oils such as clove and peppermint may be extracted by steam distillation. Fruits with soft rinds are hand-pressed to extract their compounds. Ether and alcohol solvents are used to extract other essential oils. Essential oils are more potent than extracts and should be used according the manufacturer's recommendations. Essential oils are more consistent throughout the seasons and the years than fresh fruit. Orange oil and lemon oil would be acceptable to use when recipes call for orange or lemon zest, such as *pain d'epices* (see page 41) or biscotti (see page 32).

Extracts are alcoholic solutions of flavoring compounds, such as vanilla extract. The flavor is typically between 2 to 8 percent essential oil. Extracts are available in natural and artificial forms and sometimes as a combination of the two. There are varying qualities of extracts on the market; purchase them from a reputable source.

Emulsions are widely used in commercial baking. They suspend volatile oils and aromatic substances in a water and glycerin solution or a water and gum solution. Pure emulsions contain 20 percent essential oil. They are stronger than extracts and are easily incorporated into batters. They are used primarily for baked products. Emulsions are a lower-cost alternative to essential oils. They result in recognizable flavors in the final product; however, they do not provide the clarity and brightness is obtained from extracts and essential oils.

Compounds, made with natural, artificial, or a combination of the two flavors, are available in fruit and other flavors. They are viscous solutions of flavorings and/or fruit pulp, sugar, and stabilizers used to flavor unbaked items such as Bavarian creams, pastry cream, whipped cream, mousses, and icings. Compounds are available in popular flavors such as mojito, tiramisu, piña colada, etc. Compounds make it possible to make several flavors of creamy fillings from one batch. For example, a pastry chef could make a single batch of buttercream and flavor one portion of it with Kirschwasser for the Black Forest torte, flavor another portion with mocha for another project, and yet another portion with another flavor of choice.

A VERY SPECIAL FLOWER

Vanilla beans are the pods of *vanilla planifolia*, the only edible member of the orchid family, which has over 25,000 varieties. It is indigenous to Mexico and is now harvested in many regions within 5 degrees of the equator. There are over 400 volatile flavor molecules in vanilla. By comparison, most red wines contain about two hundred. Vanillin, the major flavoring agent in vanilla, has been produced in flavor laboratories. Its flavor profile lacks the complexity and nuances of true vanilla. Using a vanilla flavoring that contains only vanillin will result in a monochromatic flavor profile compared to the sweet, floral, fruity, earthy, woodsy, subtle-yet-complex flavor of pure vanilla.

Milk Chocolate Truffles, Ewald Notter, page 145

CHOCOLATE

Linnaes, the great taxonomist, named the cacao tree *Theobroma cacao*; theobroma is Greek for "food of the gods." Chocolate is derived from this tree, which grows exclusively within the 20th parallel north and south of the equator. Ripe fruit is harvested and opened after a few days to separate the beans from the pulp. The beans and pulp are fermented at ambient temperature (tropical) to begin developing the flavor, and then dried. They are shipped and/or stored for cleaning, blending, and roasting, which encourages more flavor development. After roasting, winnowing removes the nibs, which are then ground, mixed, and kneaded and eventually conched, the final step in chocolate production. Conching improves the smoothness and "finish."

Chocolate has more than 600 volatile flavor molecules—remember, red wine has only around 200—making it one of the most complex flavors of all.

There are three varieties of cacao: Criollos, Forasteros, and Trinitarios. Criollo trees produce the highest quality beans. Because they are susceptible to a bevy of diseases, the yield is low—they account for less than 5 percent of all cacao harvested. Forestero trees, a hardier variety with milder flavored beans, account for most of cacao harvested and used. Trinitarios are hybrids of criollos and forasteros with characteristics of both.

Dark chocolate is made of cacao solids, cocoa butter, and sugar. The amounts of sugar vary, accounting for bitter, semisweet, bittersweet, and sweet chocolates. They are advertised as a percentage, such as 60 percent chocolate, which indicates 60 percent cacao solids and cocoa butter (meaning there is close to 40 percent sugar in the chocolate). The greater the percentage, the stronger the chocolate flavor. Milk chocolate is made of a reduced amount of cacao solids and cocoa butter. The higher percentage of sugar and milk solids can overwhelm the chocolate flavor.

Manufactured chocolate is categorized by its purpose:

- Industrial chocolate (mass marketed) is made from the lowest-quality beans and has the lowest amount of cacao solids and cocoa butter. It usually contains large amounts of sugar and milk or milk solids. Sweetness is the dominant flavor. It is not recommended for baking and pastry.
- Gourmet chocolate (high-end specialty) is made from select beans, either a blend or single origin. It benefits from using more cacao solids and cocoa butter. The flavor and finish of the chocolate is pronounced, smooth, and lingering.
- Couverature (finishing product) contains a minimum of 32 percent fat, which, prior to the year 2000, came exclusively from cocoa butter. Currently, other fats are permissible; however, reputable chocolate manufacturers have disregarded the concessions made to candy manufacturers and have remained true to their original mission of providing the highest quality products made with cocoa butter. Couverature, when tempered, provides shine, finish, snap, flavor, and other qualities to enrobed candies and pastries. With its higher percentage of cocoa butter, couverature is more fluid when melted, resulting in improved shine and snap when used for dipping, enrobing, or molding chocolate confections. It is available in white, milk, and dark forms. See Resources, page 172.

COCOA POWDER

After the cacao beans are roasted and the nibs have been separated, the nibs are ground to a paste. The grinding process creates heat, which liquefies and releases most of the cocoa butter. The remaining mixture is referred to as chocolate liquor. When chocolate liquor is cool, it is firm and known as unsweetened chocolate. Cocoa is the powdered version of chocolate liquor. It is used to flavor and color pastries.

Natural cocoa has a slightly low pH between 5 and 6, making it useful for increasing the gassing power of baking soda. Dutched, or dutch-processed, cocoa has been treated with an alkali to neutralize its acidity, raising its pH to 7 or higher. This darkens and casts a reddish tint to the cocoa in addition to softening and mellowing the bitterness of natural cocoa.

SPICES

Spices are aromatic plant products used to uniquely season pastries and savory foods. Volatile oils provide their characteristic flavors and aromas. They are classified according to the part of the plant used.

PLANT PARTS AND TYPES OF SPICES

This chart lists several plant parts and examples of spices that come from those plant parts.

Root	Ginger
Bud	Clove, Lavender
Bark	Cinnamon
Fruit	Allspice, Star Anise
Seed	Sesame, Poppy, Caraway, Cardamom, Nutmeg, Anise

CINNAMON: BARK & BITE
Cinnamon is from the dried inner bark of the Asian cinnamon tree. Quality (volatile oil content) is determined by the position of the bark in relation to sunlight. Trees or parts of trees that are shaded produce the highest quality oil. It's possible for one side of a tree to yield a higher quality bark than the other side.

The main classifications of cinnamon are Ceylonese (or Sri Lankan) and cassia. Sri Lankan, with its subtle flavor and light tan color, is considered by many to be the highest quality. Cassia, which is redder, stronger, and "hotter," is more widely used.

HERBS

Herbs, which were once used only in cooking, have been growing in popularity with pastry chefs, who are using them in both sweet and savory pastries. Dried herbs will be more consistent in flavor; however, fresh will always provide a truer, more complex flavor. Rosemary, thyme, tarragon, basil, and other leafy green plants have passed members of the mint family in usage in the pastry kitchen. Paired with more traditional pastry ingredients, they add floral accents and inflections. Rosemary/apple, sweet basil/melon, lemon thyme/strawberry are examples of combinations that work well together. Most herbs were originally used for medicinal purposes—much of their early use was based on folklore and superstition. Some were believed to cause illness and bad luck. Other herbs were believed to encourage good health and good fortune, in addition to warding off evil. Beginning in the thirteenth century, herbs became more mainstream as a flavoring agent in the kitchen.