Chapter 4

Part of procedure for preparing a purée soup, page 246.

Basic Principles of Cooking and Food Science

No written recipe can be 100 percent accurate. No matter how carefully a recipe is written, the judgment of the cook is still the most important factor in a preparation turning out well. A cook's judgment is based on experience, on an understanding of the raw materials available, and on knowledge of basic cooking principles and food science.

Ever since Carême began to define the principles and methods that lie behind the recipes we use (see p. 3), professional cooking has been based on procedures and methods rather than only on recipes. In the twenty-first century, chefs have improved their knowledge not just of cooking theory but also of the science behind it.

This chapter deals with basic principles. You will learn about what happens to food when it is heated, about how food is cooked by different methods, and about rules of seasoning and flavoring. It is important to understand the science of food and cooking so you can successfully use these principles in the kitchen.

After reading this chapter, you should be able to

1. Name the most important components of foods and describe what happens to them when they are cooked.
2. Name and describe three ways in which heat is transferred to food in order to cook it.
3. Describe the two factors or changes in cooked foods that determine doneness.
4. List three factors that affect cooking times.
5. Explain the advantage of boiling or simmering in a covered pot. Describe three situations in which a pot should not be covered during simmering or boiling.
6. Explain how cooking temperature affects the doneness characteristics of a food item.
7. Explain the differences between moist-heat cooking methods, dry-heat cooking methods, and dry-heat cooking methods using fat.
8. Describe each basic cooking method used in the commercial kitchen.
9. Identify the five properties that determine the quality of a deep-fried product.
10. Describe the two main steps in the process of cooking sous vide.
11. List six safety guidelines for cooking sous vide.
12. Explain the difference between a seasoning and a flavoring ingredient and give examples of each.
13. Identify appropriate times for adding seasoning ingredients to the cooking process in order to achieve optimal results.
14. Identify appropriate times for adding flavoring ingredients to the cooking process in order to achieve optimal results.
15. List eleven guidelines for using herbs and spices in cooking.

Heat and Food

To cook food means to heat it in order to make certain changes in it. Skillful cooks know exactly what changes they want to make and what they have to do to get them right. To learn these cooking skills, it is important for you to know why foods behave as they do when heated. For this, you have to study the theory.

Perhaps not all of this section will make sense to you at first. But the ideas should become clearer to you after you think about them in relation to specific techniques, as demonstrated by your instructor. Later in your studies, when you are learning about cooking meats, fish, vegetables, and other foods, review this section from time to time. Not only will you understand it better but also it should help you make more sense of the procedures you are learning and practicing.

What Is Heat?

Heat is a form of energy associated with the motion of atoms or molecules. When a substance absorbs heat, its molecules move faster. In liquids and gases, the molecules move more quickly from place to place and bounce off each other more frequently. In solids, the molecules stay mostly in place, but they vibrate with more energy. *Temperature* can be defined as a measure of this molecular activity. The higher the temperature, the faster the molecules are moving.

When fast-moving molecules in hot substances come in contact with slower molecules in cold substances, the fast molecules bump into the slower ones and transfer some of their energy, making the slower molecules move faster, or heat up. Thus, as heat is transferred, the hot substance loses energy and the colder substance gains energy.

The moving molecules in a liquid such as water sometimes move to the surface with enough energy to break through and escape to become a gas. This is called *evaporation*. When the molecules in the liquid move faster, more of them can escape in a shorter time. This is why hot water evaporates more quickly than cold water.

When we add enough heat to foods, the molecules may move so fast the structure of the food changes. For example, sucrose (regular sugar) may break apart and form new molecules that happen to have a brown color and the taste of caramel. Or protein molecules may break apart and reform with a different structure. Creating these molecular changes is called ***cooking***.

Effects of Heat on Foods

Foods are composed of proteins, fats, carbohydrates, and water, plus small amounts of other compounds such as minerals (including salt), vitamins, pigments (coloring agents), and flavor elements. It is important to understand how these components react when heated or mixed with other foods. You will then be better equipped to correct cooking faults when they occur and to anticipate the effects of changing cooking methods, cooking temperatures, or ingredient proportions.

In other words, when you know why foods behave as they do, you can understand how to get them to behave as you want them to.

The following discussion is concerned with the physical and chemical reactions that affect the components of food. The nutritional aspects of these components are discussed in Chapter 6.

CARBOHYDRATES

1. Starches and sugars are carbohydrates. Both compounds are present in foods in many forms. They are found in fruits, vegetables, grains, beans, and nuts. Meats and fish also contain a small amount of carbohydrate.

2. For the cook, the two most important changes in carbohydrates caused by heat are caramelization and gelatinization.

- ***Caramelization*** is the browning of sugars. The browning of sautéed vegetables and the golden color of bread crust are forms of caramelization.
- ***Gelatinization*** occurs when starches absorb water and swell. This is a major principle in the thickening of sauces and in the production of breads and pastries.

Acids inhibit gelatinization. A sauce thickened with flour or starch will be thinner if it contains acid.

FRUIT AND VEGETABLE FIBER

1. ***Fiber*** is the name for a group of complex substances that give structure and firmness to plants. Fiber cannot be digested.
2. The softening of fruits and vegetables in cooking is, in part, the breaking down of fiber.
3. Sugar makes fiber firmer. Fruit cooked with sugar keeps its shape better than fruit cooked without sugar.
4. Baking soda (and other alkalis) makes fiber softer. Vegetables should not be cooked with baking soda because they become mushy and lose vitamins.

PROTEINS

1. Protein is a major component of meats, poultry, fish, eggs, milk, and milk products. It is present in smaller amounts in nuts, beans, and grains.
2. Proteins consist of long chains of components called *amino acids*. These chains normally form tight coils. As proteins are heated, the coils gradually unwind. At this point, the protein is said to be ***denatured***.

   For the cook, the important fact about denaturing is that, when the protein coils unwind, they become attracted to each other and form bonds. This bonding is called ***coagulation***. The coagulated proteins form a solid network of bonds and become firm. As the temperature increases, the proteins shrink, become firmer, and lose more moisture. Exposure of proteins to excessive heat toughens them and makes them dry. Most proteins complete coagulation or are cooked at 160°–185°F (71°–85°C).
3. Many protein foods, such as meats, contain small quantities of carbohydrate. When proteins are heated to about 310°F (154°C), the amino acids in the protein chains react with the carbohydrate molecules and undergo a complex chemical reaction. The result is that they turn brown and develop richer flavors. This reaction is called the ***Maillard reaction***. It is what happens when meat browns. Because of the high temperature it requires, the Maillard reaction takes place only on the dry surface of the food. Because of its water content, the interior of the meat cannot get this hot.
4. ***Connective tissues*** are special proteins present in meats. Meats with a great deal of connective tissue are tough, but some connective tissues are dissolved when cooked slowly with moisture. Cooking tough meats properly, therefore, makes them more tender. These techniques are explained in Chapter 10.
5. *Acids*, such as lemon juice, vinegar, and tomato products, have two effects on proteins:
   - They speed coagulation.
   - They help dissolve some connective tissues.

FATS

1. Fats are present in meats, poultry, fish, eggs, milk products, nuts, whole grains, and, to a lesser extent, vegetables and fruits. Fats are also important as cooking mediums, as for frying.
2. Fats can be either solid or liquid at room temperature. Liquid fats are called ***oils***. When solid fats are heated, they melt, or change from solid to liquid. The melting point of solid fats varies.
3. When fats are heated, they begin to break down. When hot enough, they deteriorate rapidly and begin to smoke. The temperature at which this happens is called the ***smoke point***, and it varies by type of fat. A stable fat—one with a high smoke point—is an important consideration in deep-fat frying.

4. Many flavor compounds dissolve in fat, so fats are important carriers of flavor. When fats melt and are lost from food, some flavors, as well as some vitamins, are lost with them.
5. For the functions of fats in baked goods, see page 927.

MINERALS, VITAMINS, PIGMENTS, AND FLAVOR COMPONENTS

1. Minerals and vitamins are important to the nutritional quality of the food. Pigments and flavor components are important to a food's appearance and taste and may determine whether the food is appetizing enough to eat. So it is important to preserve all these elements.
2. Some of these components are soluble in water, and others are soluble in fats. All of these components may be leached out, or dissolved away, from foods during cooking.
3. Vitamins and pigments may also be destroyed by heat, by long cooking, and by other elements present during cooking.
4. It is important, then, to select cooking methods that preserve, as much as possible, a food's nutrients, taste, and appearance. This is addressed whenever cooking techniques are explained in the remainder of this book.

WATER

1. Nearly all foods contain water. Dried foods may contain as little as a fraction of 1 percent water, but fresh meats, fish, vegetables, and fruits consist mostly of water.
2. Water exists in three states: solid (ice), liquid, and gas (water vapor or steam). At sea level, pure liquid water becomes solid, or freezes, at 32°F (0°C) and turns to steam at 212°F (100°C). When water molecules turn to steam and energetically escape into the atmosphere, water is said to be *boiling*.
3. Water can also turn from liquid to gas at lower temperatures. When water turns to gas at any temperature, the process is called ***evaporation***. Evaporation occurs more slowly the lower the temperature is. Evaporation is responsible for the drying of foods. The drying of food surfaces as they are cooked enables them to be browned.
4. Many minerals and other compounds dissolve in water, so water can be a carrier of flavor and of nutritional value.
5. When water carries dissolved compounds, such as salt or sugar, its freezing point is lowered and its boiling point is raised.

Heat Transfer

In order for food to be cooked, heat must be transferred from a heat source (such as a gas flame or an electric element) to and through the food. Understanding the ways in which heat is transferred and the speed at which it is transferred helps the cook control the cooking process.

Heat is transferred in three ways: conduction, convection, and radiation. It is important to remember that, during a cooking process, more than one of these methods of transfer may be happening at the same time. For example, food on a grill may be heated by conduction from the hot metal grill, by convection from hot air rising from the burner or charcoal, and by radiation from the glowing burner or coals.

Conduction

Conduction occurs in two ways:

1. When heat moves directly from one item to something touching it—for example, from the top of the range to a soup pot placed on it, from the pot to the broth inside, and from the broth to the solid food items in it.
2. When heat moves from one part of something to an adjacent part of the same item—for example, from the exterior of a roast to the interior, or from a sauté pan to its handle.

Different materials conduct heat at different speeds. Heat moves rapidly through copper and aluminum, more slowly in stainless steel, more slowly yet in glass and porcelain. Air is a poor conductor of heat.

Convection

Convection occurs when heat is spread by the movement of air, steam, or liquid (including hot fat). There are two kinds of convection:

1. **Natural.**
   Hot liquids and gases rise, while cooler ones sink. Thus, in any oven, kettle of liquid, or deep-fat fryer a constant, natural circulation distributes heat.
2. **Mechanical.**
   In convection ovens and convection steamers, fans speed the circulation of heat. Thus, heat is transferred more quickly to the food, and the food cooks faster.

Stirring is a form of mechanical convection. Thick liquids cannot circulate as quickly as thin ones, so the rate of natural convection is slower. This explains, in part, why it is so easy to scorch thick soups and sauces. The heat is not carried away from the bottom of the pan quickly enough, so it stays concentrated on the bottom and scorches the food. Stirring redistributes the heat and helps prevent this. (Using heavy pots made of a material that conducts heat well also helps prevent scorching because the pot conducts the heat more quickly and evenly across the bottom and up the sides.)

Convection is the process that carries the heat from the heat source to the food. Once the carrier of the heat (air or liquid) comes in contact with the food, the heat is transferred from the carrier to the food by conduction.

Radiation

Radiation occurs when energy is transferred by waves from a source to the food. The waves themselves are not actually heat energy but are changed into heat energy when they strike the food being cooked. (Light waves, radio waves, and X-rays are examples of radiation not used for cooking.)

Two kinds of radiation are used in the kitchen:

1. *Infrared*.
   Broiling is the most familiar example of infrared cooking. In a broiler, an electric element or a ceramic element heated by a gas flame becomes so hot it gives off infrared radiation, which cooks the food. High-intensity infrared ovens are designed to heat food rapidly.
2. *Microwave*.
   In microwave cooking, the radiation generated by the oven penetrates partway into the food, where it agitates the molecules of water. The friction this agitation causes creates heat, which cooks the food.
   - Because microwave radiation affects only water molecules, a completely waterless material will not heat in a microwave oven. Plates become hot only when heat is conducted to them by hot foods.
   - Because most microwaves penetrate no more than about 2 inches (50 mm) into foods, heat is transferred to the center of large pieces of food by conduction, just as in roasting.

   Cooking with microwaves is discussed in more detail later in this chapter.

Heat Management

The final temperature to which we cook a food ranges from about 120°F (49°C) for rare meats and fish to about 400°F (200°C) for the crisp exterior of such foods as breads and seared meats. The boiling point of water, 212°F (100°C), falls within this range. Notice, however, the

heat sources we use in the kitchen, from electric elements to gas flames, are much hotter than this temperature. Managing the heat to cook foods to the desired degree is an important part of cooking.

In the discussion that follows, we first consider cooking time—that is, the time it takes to heat food until it changes to a condition that we call *done*. We then look at other problems with controlling heat in cooking.

Doneness and Cooking Times

We say a food is "done" when two things have happened:

1. **The interior temperature has risen to the desired degree.**
   Interior temperature is the most important factor when we are cooking tender meats. The difference between rare, medium, and well done (see p. 298) is a difference in temperature, and we can measure this doneness with a thermometer. Interior temperature is also important for food safety, as we learned in the discussion of minimum internal cooking temperatures on page 29.

2. **The desired changes have taken place in the food.**
   Earlier in this chapter, we discussed the changes that take place in foods as they are heated. These changes include gelatinization of starches, coagulation of proteins, breaking down of connective tissues, caramelization of sugars, and Maillard browning.

   In many foods, creating these changes is more important than simply heating the interior to a desired temperature. For example, the inside of a small piece of stew meat quickly becomes just as hot as the liquid in which it is simmering. However, we don't say it is "done" until enough connective tissue has broken down so it has a tender texture. It's not enough just to heat it to the desired degree.

   Similarly, the inside of a strand of spaghetti quickly rises to the temperature of boiling water, but it is not done until enough starch has absorbed water and gelatinized, so it has the desired texture.

Standards of doneness are different for every type of food and for every cooking method. As we discuss individual foods throughout the remainder of this book, we learn more about doneness in meats, poultry, fish, vegetables, starches, and other foods.

The time it takes to achieve doneness is affected by three factors:

1. **Cooking temperature.**
   This means the temperature of the air in the oven, the fat in the fryer, the surface of a griddle, or the liquid in which a food is cooking.

2. **The speed of heat transfer.**
   Different cooking methods transfer heat at different rates, as shown by these examples:

   Air is a poor conductor of heat, while steam is much more efficient. A jet of steam (212°F/100°C) will easily burn your hand, but you can safely reach into an oven at 500°F (260°C). This is why it takes longer to bake potatoes than to steam them.

   A convection oven cooks faster than a conventional oven, even if both are set at the same temperature. The forced air movement transfers heat more rapidly.

3. **Size, temperature, and individual characteristics of the food.**
   For example:

   A small beef roast cooks faster than a large one.

   A chilled steak takes longer to broil than one at room temperature.

   Fish items generally cook more quickly than meats.

   Beef shank, which has a lot of connective tissue, takes longer to cook than beef tenderloin.

Because there are so many variables, it is difficult or even impossible to determine exact cooking times in most recipes. Individual ovens, fryers, and steamers, for example, may transfer heat more or less efficiently or have different recovery times. Roasting charts that

give cooking times for various cuts of meat can be used only as guidelines, and the cook must use his or her judgment to make the final determination of doneness. Cooking times are discussed again in the next chapter.

Controlling Heat

To control cooking, we must control how heat is transferred. The kitchen contains dozens of kinds of heat sources as well as a great array of pots, pans, and other cooking tools, Controlling cooking with so many options is a skill a cook gains with experience, by performing cooking tasks over and over.

In this section, we introduce the topic of heat management with a summary of two of the most common kinds of heat control problems.

HOW TO BOIL WATER

It's a common joke that boiling water is a cooking skill many noncooks have never learned. However, boiling water is a little more complex than such quips suggest. There is more to boiling water than just putting a pot on the stove.

Covering the Pot

To bring water to a boil on a cooktop, we apply heat to the bottom of a pot containing the water. The heat is transferred to the water, raising its temperature. Some of this heat energy quickly escapes from the top of the pot. If the pot is covered, much of the heat is trapped inside, and the water comes to a boil much more quickly. To raise the temperature of 1 gram of water 1 degree Celsius takes only 1 calorie of heat energy. But to turn 1 gram of boiling water to steam takes 539 calories. When the steam escapes, it takes this energy with it. A lot of energy is lost from an uncovered pot. By covering it, we save energy and shorten heating times.

After a liquid has come to a boil, keeping the pot covered can still be helpful. You have probably had the experience of removing the lid from a pot simmering over a low flame and seeing the bubbling slow down as soon as the lid is off. This is because so much heat escapes as soon as the cover is removed. By keeping the pot covered, you can maintain the desired cooking temperature using a lower burner setting.

Although covering pots is a more efficient use of energy, sometimes you must keep them uncovered:

- *When evaporation is desired.* In many cooking operations, one of the goals is to evaporate moisture to concentrate flavors or change textures. Keep the pot uncovered to speed evaporation.
- *When the contents must be visually monitored.* In some cases, you must keep an eye on the food as it simmers or boils, if only to make sure it continues to simmer at the proper rate, not too fast or too slow.
- *When green vegetables are cooked.* Plant acids that destroy green pigments must be allowed to escape, as explained on page 527.

Controlling the Heat

Water boils at 212°F (100°C) at sea level and at standard atmospheric pressure. When water is boiling, any additional heat is used to turn water to steam, which then carries the heat away. No matter how high you turn the heat, the water can never rise above 212°F (100°C). In other words, turning up the heat under a pot that is already boiling is a waste of energy and does not decrease cooking time. Furthermore, the increased agitation of rapidly boiling water does more damage to delicate foods. Remember, a rapid boil is no hotter than a slow boil.

COOKING TO THE CENTER

As we read earlier, heat is transferred from the outside of food to the inside by conduction. Conduction takes time, so cooking takes time.

Think of a steak cooking on a grill. Let's say we want to cook the steak to an interior temperature of 140°F (60°C), for medium doneness. When we first put the steak on to cook, the interior temperature is room temperature, or possibly refrigerator temperature. The outside,

BOILING OIL

The term *boiling oil* is commonly heard, but oil doesn't boil, at least in the way water does. The bubbling of boiling water, as the text explains, occurs when heated molecules of liquid water turn to gas—that is, steam—and rise to the surface. Oil that is free of water does not boil at normal cooking temperatures. The bubbling we see in cooking fat, such as that in deep fryers, is caused by water in submerged foods turning to steam. It's not the oil that is boiling.

KEY POINTS TO REVIEW

- What is caramelization? gelatinization? coagulation?
- What are the three ways in which heat energy is transferred to foods?
- What do we mean when we say a cooked food is "done"? What factors affect how long it takes to cook a food until it is "done"?
- When you are cooking food in a saucepan, when would you cover it, and when would you keep it uncovered?
- How does cooking temperature affect the doneness of foods such as roasts?

however, rises to perhaps 400°F (200°C) very soon after we place it on the grill. Gradually, this heat moves to the center. By the time the center reaches the target temperature, the outside is much hotter. If we cut the steak through the center, we see a gradation from very well done at the outside to medium done in the middle.

Often this is just what we want. This is how people are used to eating steaks, so a person might be surprised to get a steak that was a uniform medium done all the way through.

By contrast, if we cook the steak at a low temperature, there is less temperature difference between the outside and inside, so the doneness of the meat is more uniform from outside to inside.

The same is true of large roasts. Roasting at a high temperature produces a strong gradation of doneness, from well done on the outside to less done in the center. Roasting at a low temperature gives more uniform doneness throughout. The roasting temperature we use depends on the results we want.

Of course, cooking at a low temperature doesn't create the well-browned crust most diners desire. We have two options to solve this problem:

- Brown the exterior with high heat, then cook to doneness at lower heat.
- Cook to doneness at low heat, then brown the exterior with a quick blast of high heat.

Cooking Methods

Cooking methods are classified as moist heat or dry heat.

Moist-heat methods are those in which the heat is conducted to the food product by water or water-based liquids such as stock and sauces, or by steam.

Dry-heat methods are those in which the heat is conducted without moisture—that is, by hot air, hot metal, radiation, or hot fat. We usually divide dry-heat methods into two categories: without fat and with fat.

Different cooking methods are suited to different kinds of foods. For example, some meats are high in connective tissue and are tough unless this tissue is broken down slowly by moist heat. Other meats are low in connective tissue and naturally tender. They are at their best and juiciest when cooked with dry heat to a rare or medium-done stage.

Many other factors must be considered when choosing cooking methods for meats, fish, and vegetables, such as the flavor and appearance imparted by browning, the flavor imparted by fats, and the firmness or delicacy of the product. These factors are discussed in later chapters with respect to individual foods.

The basic cooking methods are summarized here. Their practical application to foods is discussed in detail in the remainder of the book and reinforced by your instructors' demonstrations and your own experience and practice.

Moist-Heat Methods

Poach, Simmer, and Boil

Poaching, *simmering*, and *boiling* all involve cooking a food in water or a seasoned or flavored liquid. The temperature of the liquid determines the method.

1. To ***boil*** means to cook in a liquid that is bubbling rapidly and greatly agitated. Water boils at 212°F (100°C) at sea level. No matter how high the burner is turned, the temperature of the liquid will go no higher.

   Boiling is generally reserved for vegetables and starches. The high temperature toughens the proteins of meats, fish, and eggs, and the rapid bubbling breaks up delicate foods.

2. To ***simmer*** means to cook in a liquid that is bubbling gently at a temperature of about 185°F to 205°F (85°C to 96°C).

   Most foods cooked in a liquid are simmered. The higher temperatures and intense agitation of boiling are detrimental to most foods. The word *boiled* is sometimes used as a menu term, as when simmered fresh beef is called "boiled beef."

3. To ***poach*** means to cook in a liquid, usually a small amount, that is hot but not actually bubbling. Temperature is 160°–180°F (71°–82°C).

   Poaching is used to cook delicate foods such as fish and eggs out of the shell. It is also used to partially cook foods such as variety meats in order to eliminate undesirable flavors and to firm the product before final cooking.

4. A rule of thumb: Whether a food is to be simmered or boiled, the liquid is often brought to a full boil at first. This compensates for the lowering of the temperature when the food items are added. The heat is then adjusted to maintain a steady temperature.

5. To ***blanch*** means to cook an item partially and briefly, usually in water but sometimes by other methods (as when French fries are blanched in deep fat).
   There are two ways of blanching in water:

   - Place the item in cold water, bring to a boil, and simmer briefly. Cool the item by plunging it into cold water.

     Purpose: to dissolve out blood, salt, or impurities from meats and bones.

   - Place the item in rapidly boiling water and return the water to the boil. Remove the item and cool in cold water.

     Purpose: to set the color and destroy harmful enzymes in vegetables, or to loosen the skins of tomatoes, peaches, and similar items for easier peeling.

6. Altitude note: The boiling point of water decreases as altitude above sea level is increased. At 5,000 feet (1,500 m) above sea level, water boils at about 203°F (95°C). Thus, it takes longer to boil foods to doneness at high altitudes because the temperature is lower.

Steam

To ***steam*** means to cook foods by exposing them directly to steam.

1. In quantity cooking, steaming is usually done in special steam cookers, which are designed to accept standard-size pans. Steaming can also be done on a rack above boiling water. This method is more cumbersome, however, and is used only occasionally in food service. Cooking in a steam-jacketed kettle is not steaming because the steam does not actually touch the food.

2. The term *steaming* also refers to cooking an item tightly wrapped or in a covered pan so it cooks in the steam formed by its own moisture. This method is used in cooking items ***en papillote***, meaning "wrapped in parchment paper" (or foil). "Baked" potatoes wrapped in foil are actually steamed.

3. Steam at normal pressure is 212°F (100°C), the same as boiling water. However, it carries much more heat than boiling water and cooks foods very rapidly. Cooking times must be carefully controlled to avoid overcooking.

4. A *pressure steamer* is a steam cooker that holds in steam under pressure. The temperature of the steam then goes higher than 212°F (100°C), as the following chart shows:

Pressure	Steam Temperature
5 psi (pounds per square inch)	227°F (106°C)
10 psi	240°F (116°C)
15 psi	250°F (121°C)

   Because of these temperatures, pressure steaming is an extremely rapid method of cooking and must be carefully controlled and timed.

5. Steaming is widely used for vegetables. It cooks them rapidly, without agitation, and minimizes the dissolving away of nutrients that occurs when vegetables are boiled.

Note that steaming doesn't completely eliminate leaching. Some steam condenses on the vegetables and drips off, carrying some pigments and nutrients with it. This liquid can be collected in drip pans below the steamer pans and saved for later use.

Braise

To ***braise*** means to cook covered in a small amount of liquid, usually after preliminary browning. In almost all cases, the liquid is served with the product as a sauce.

Braising is sometimes referred to as a *combination cooking method* because the product is first browned, using dry heat, before it is cooked with a liquid. Nevertheless, in most cases, moist heat is responsible for most of the cooking process, and the browning may be thought of as a preliminary technique. The purpose of the browning step is not so much to cook the item as to develop color and flavor.

Some references describe braising and ***stewing*** as two different cooking methods. The term *braising* is used for large cuts of meat, and *stewing* is used for smaller items. In this book, however, we use the term *braising* for both methods because the basic procedure in both cases is the same—first browning with dry heat, then cooking with moist heat. (Note that the term *stewing* is also used for simmering in a small amount of liquid without preliminary browning.)

1. Braised meats are usually browned first using a dry-heat method such as pan-frying. This gives a desirable appearance and flavor to the product and sauce.
2. Braising also refers to cooking some vegetables, such as lettuce or cabbage, at low temperature in a small amount of liquid without first browning in fat, or with only a light preliminary sautéing.
3. Braises (see sidebar) are usually not completely covered by the cooking liquid. The top of the product is actually cooked by the steam held in the covered pot. Pot roasts, for example, are cooked in liquid that covers the item by one-third to two-thirds. The exact amount depends on how much sauce is needed for service. This method yields a flavorful, concentrated sauce.

   Stews are usually cooked in just enough liquid to cover them completely. Because the pieces of food in a stew are bite-sized, there is little space between them. Therefore, it doesn't take much cooking liquid to cover them, so this method also yields a flavorful, concentrated sauce.
4. In some preparations, especially of poultry and fish, no liquid is added. This is still considered braising because steam is trapped by the cover and the item cooks in its own moisture and in the moisture of other ingredients, such as vegetables.
5. Braising may be done on the range or in the oven. Oven-braising has three major advantages:
   - Uniform cooking. The heat strikes the braising pot on all sides, not just the bottom.
   - Less attention required. Foods braise at a low, steady temperature without having to be checked constantly.
   - Range space is free for other purposes.

TERMINOLOGY: BRAISES AND STEWS

- A ***braise*** consists of large pieces of food, at least portion-size, cooked by the braising method—first dry heat, then moist heat.
- A ***stew*** consists of small pieces of food, bite-sized or slightly larger, cooked either by the braising method—first dry heat, then moist heat—or by the simmering method—moist heat only.

RUBS AND MOPS

There is more to a traditional barbecue than long, low-temperature roasting with wood smoke. Blends of seasonings and flavorings applied before, during, and after cooking account for much of the popularity of barbecue.

Before cooking, foods are often coated with a *rub* and allowed to stand for several hours or overnight to absorb the flavors. A rub is a blend of herbs and spices, plus salt and sometimes sugar. The blend may be a *dry rub*, made of dried herbs and spices, or a *wet rub*, made of dried spices plus ingredients, like fresh garlic and chiles, that supply enough moisture to make a paste. An example of a dry rub can be found on page 394. For a wet rub, see the jerk recipe on page 403.

During cooking, the food is sometimes basted with a highly seasoned sauce called a *mop*. Mops usually contain vinegar or other acidic ingredients in addition to spices. Sugar is usually avoided in mops because it burns too easily.

After cooking, the food may be glazed with a barbecue sauce, or it may be served dry, with barbecue sauce on the side.

Dry-Heat Methods

Roast and Bake

To ***roast*** and to ***bake*** both mean to cook foods by surrounding them with hot, dry air, usually in an oven. Cooking on a spit in front of an open fire may also be considered roasting.

The term *roasting* usually applies to meats and poultry. The term *baking* usually applies to breads, pastries, vegetables, and fish. It is a more general term than roasting, although, in practice, there is little or no difference in actual technique, and the terms are often interchangeable (except for breads and pastries).

Please note, however, that it has recently become fashionable on menus to apply the term *roasted* to a wide variety of foods, including meats, poultry, fish, and vegetables that

are not actually baked or roasted but rather sautéed, fried, or braised. One restaurant even labeled steamed vegetables as "roasted baby vegetables."

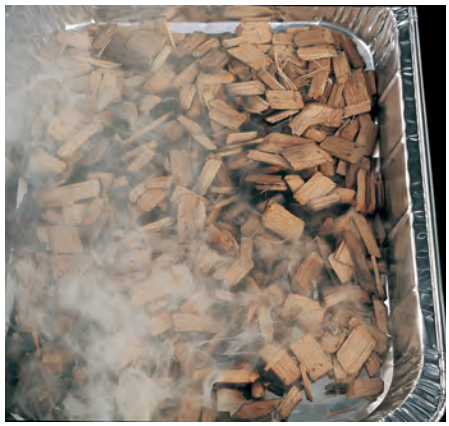
1. Cooking *uncovered* is essential to roasting. Covering holds in steam, changing the process from dry-heat to moist-heat cooking, such as braising or steaming.
2. Meat is usually roasted on a rack (or, if it is a rib roast, on its own natural rack of bones). The rack prevents the meat from simmering in its own juices and fat. It also allows hot air to circulate around the product.
3. When roasting in a conventional oven, the cook should allow for uneven temperatures by occasionally changing the position of the product. The back of the oven is often hotter because heat is lost at the door.
4. A roast may be browned by another cooking method, such as pan-frying or broiling, before being placed in the oven. This technique is most useful for small poultry and small cuts of meat, which may not brown sufficiently in the oven due to their short roasting times.
5. To ***barbecue*** means to cook with dry heat created by the burning of hardwood or by the hot coals of this wood. In other words, barbecuing is a roasting or grilling technique requiring a wood fire.

   Authentic, traditional barbecue is done in wood-burning ovens or pits, but these are not practical for the average restaurant that wants to add barbecued items to the menu. So today, most barbecuing is done in specially designed smoke ovens or cookers. In principle, these units work like regular ovens, except they also have a device that heats small pieces of hardwood to produce smoke. Foods should be suspended in the ovens or placed on racks so the smoke can contact all surfaces.

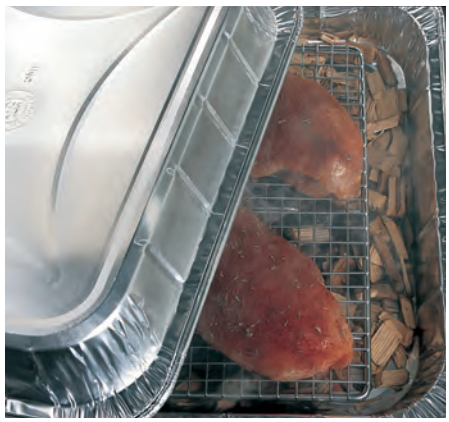
   Cooking temperatures in these ovens are kept low, 225°–250°F (107°–121°C). This is an ideal temperature range for cooking tougher cuts of meat, such as beef brisket and pork shoulder, to tenderness over a period of hours. (When tender meats are roasted with smoke at a higher temperature, the process is usually called *smoke-roasting* rather than *barbecuing*.)
6. ***Rangetop smoke-roasting***, also called ***pan-smoking***, is a procedure done in a closed container, using wood chips to make smoke. Use this procedure for small, tender, quick-cooking items such as fish fillets, tender meat and poultry pieces, and some vegetables.

   To smoke-roast, place a layer of fine hardwood chips or shavings on the bottom of a hotel pan (see Figure 4.1). Disposable pans may be used for light smoking. Place a rack in the pan over the chips and lay the seasoned food items on the rack. Cover tightly with a second hotel pan or with aluminum foil. Place on the cooktop (making sure the ventilating hood is on!) over moderate heat. Smoke will begin rising from the wood chips. After about 5 minutes, remove the food items from the smoke-roaster and, if necessary, complete the cooking in the oven. Leaving the food in the smoke too long results in a strong, bitter taste.

Figure 4.1 Rangetop smoke-roasting:



(a) Place hardwood chips or sawdust in a disposable hotel pan. Place over moderately high heat and heat until the wood begins to smoke.



(b) Place the items to be cooked on a rack and set the rack over the chips so the food is not touching the chips. Cover tightly with another pan and cook for the desired time.

Broil

To ***broil*** means to cook with radiant heat from above.

Note: The terms *broiling, grilling,* and *griddling* are sometimes confused. Grilling (see following) is often called *broiling*, and griddling is called *grilling*. This book uses the terms that refer to the equipment involved. Thus, broiling is done in an overhead broiler, grilling on a grill, and griddling on a griddle.

1. Broiling is a rapid, high-heat cooking method used mainly for tender meats, poultry, fish, and a few vegetable items.
2. Note the following rules of broiling:
   - *Turn heat on full*. Cooking temperature is regulated by moving the rack nearer to or farther from the heat source.
   - *Use lower heat for larger, thicker items and for items to be cooked well done*. Use higher heat for thinner pieces and for items to be cooked rare. This is done so the inside and outside are cooked to the desired degree at the same time. It takes

practice and experience to cook foods of different thickness to the right degree of doneness inside with the desired amount of surface browning.

- *Preheat the broiler*. This helps sear the product quickly, and the hot broiler makes the desired grill marks on the food.
- Foods may be dipped in oil to prevent sticking and to minimize drying. (This may not be necessary if the food is high in fat.) Care should be taken, as too much oil on a hot broiler grate may cause a fire.
- Turn foods over only once, to cook from both sides and to avoid unnecessary handling.

3. A low-intensity broiler called a *salamander* is used for browning or melting the top of some items before service.

Grill, Griddle, and Pan-Broil

Grilling, griddling, and pan-broiling are all dry-heat cooking methods that use heat from below.

1. ***Grilling*** is done on an open grid over a heat source, which may be charcoal, an electric element, or a gas-heated element. Cooking temperature is regulated by moving the items to hotter or cooler places on the grill. Grilled meats should be turned to achieve desired grill marks, just as in broiling.
2. ***Griddling*** is done on a solid cooking surface called a *griddle*, with or without small amounts of fat to prevent sticking. The temperature is adjustable and much lower (around 350°F/177°C) than on a grill. In addition to meats, items such as eggs and pancakes are cooked on a griddle.

   Grooved griddles have a solid top with raised ridges. They are designed to cook like grills but to create less smoke. Meats cooked on a grooved griddle do not have the charcoal-grilled flavor imparted by smoke from burning fats.
3. ***Pan-broiling*** is like griddling except it is done in a sauté pan or skillet instead of on a griddle surface. Fat must be poured off as it accumulates, or the process becomes pan-frying. No liquid is added, and the pan is not covered, or else the item would steam.

Dry-Heat Methods Using Fat

Sauté

To ***sauté*** means to cook quickly in a small amount of fat.

1. The French word *sauter* means "to jump," referring to the action of small pieces of food tossed in a sauté pan (see Figure 17.1). However, larger foods, such as slices of meat and pieces of chicken, may be sautéed without actually being tossed in the pan.
2. Note these two important principles:
   - Preheat the pan before adding the food to be sautéed. The food must start cooking at high heat, or it will begin to simmer in its own juices.
   - Do not overcrowd the pan. Doing so lowers the temperature too much, and again the food begins to simmer in its own juices.
3. Meats to be sautéed are sometimes dusted with flour to prevent sticking and to help achieve uniform browning.
4. After a food is sautéed, a liquid such as wine or stock is often swirled in the pan to dissolve browned bits of food sticking to the bottom. This is called ***deglazing***. The liquid becomes part of a sauce served with the sautéed items.
5. Stir-frying is a variation of sautéing. See pages 333–334 for a discussion and basic procedure. Stir-frying is especially popular for vegetables.

Pan-Fry

To ***pan-fry*** means to cook in a moderate amount of fat in a pan over moderate heat.

1. Pan-frying is similar to sautéing except more fat is used and the cooking time is longer. The method is used for larger pieces of food, such as chops and chicken pieces, and the items are not tossed by flipping the pan, as they often are in sautéing.
2. Pan-frying is usually done over lower heat than sautéing because of the larger size of the pieces being cooked.
3. The amount of fat depends on the food being cooked. Only a small amount is used for eggs, for example, while as much as 1 inch (2.5 cm) or more may be used for pan-fried chicken.
4. Most foods must be turned at least once for even cooking. Some larger foods may be removed from the pan and finished in the oven to prevent excessive surface browning. This method of finishing in the oven is also used to simplify production when large quantities of foods must be pan-fried.

Deep-Fry

To ***deep-fry*** means to cook a food submerged in hot fat. High quality in a deep-fried product is characterized by the following properties:

Minimal fat absorption

Minimal moisture loss (that is, not overcooked)

Attractive golden color

Crisp surface or coating

No off-flavors imparted by the frying fat

Many foods are dipped in a breading or batter before frying. This forms a protective coating between food and fat and helps give the product crispness, color, and flavor. Obviously, the quality of the breading or batter affects the quality of the finished product (see Chapter 7, pp. 152–154).

Guidelines for Deep-Frying

1. Fry at proper temperatures.
   Most foods are fried at 350°–375°F (175°–190°C). Excessive greasiness in fried foods is usually caused by frying at too low a temperature.
2. Don't overload the baskets.
   Doing so greatly lowers the fat temperature.
3. Use good-quality fat.
   The best fat for frying has a high smoke point (the temperature at which the fat begins to smoke and to break down rapidly).
4. Replace 15–20 percent of the fat with fresh fat after each daily use.
   This extends frying life.
5. Discard spent fat.
   Old fat loses frying ability, browns excessively, and imparts off-flavors.
6. Avoid frying strong- and mild-flavored foods in the same fat, if possible.
   French fries should not taste like fried fish.
7. Fry as close to service as possible.
   Do not leave foods in the basket above the fry kettle, and do not hold under heat lamps for more than a few minutes. The foods' moisture quickly makes the breading or coating soggy.
8. Protect fat from its enemies:

   Heat. Turn the fryer off or to a lower holding temperature (200°–250°F/95°–120°C) when not in use.

   Oxygen. Keep fat covered between services, and try to aerate the fat as little as possible when filtering.

   Water. Remove excess moisture from foods before frying. Dry baskets and kettle thoroughly after cleaning. Keep liquids away from the fryer to prevent accidental spills.

   Salt. Never salt foods over the fat.

   Food particles. Shake loose crumbs off breaded items before placing over the fat. Skim and strain the fat frequently.

   Detergent. Rinse baskets and kettle well after cleaning.

PRESSURE FRYING

Pressure frying means deep-frying in a special covered fryer that traps steam given off by the foods being cooked and increases the pressure inside the kettle.

In a standard fryer, even though the fat may be at 350°F (175°C), the temperature inside the food will not rise above 212°F (100°C), the boiling point of water. Just as in a pressure steamer, a pressure fryer raises this temperature and cooks the food more quickly without excessive surface browning. At the same time, the fat temperature can be lower, 325°F (165°C) or less.

Pressure frying requires accurate timing because the product cannot be seen while it is cooking.

Microwave Cooking

Microwave cooking refers to the use of a specific tool rather than to a basic dry-heat or moist-heat cooking method. The microwave oven is used mostly for heating prepared foods and for thawing raw or cooked items. However, it can be used for primary cooking as well.

Microwave oven models range in power from about 500 watts up to about 2,000 watts. The higher the wattage, the more intense the energy the oven puts out and the faster it heats foods. Most models have switches that allow you to cook at different power levels.

One of the most important advantages of the microwave oven in à la carte cooking is that it enables you to heat individual portions of many foods to order quickly and evenly. Instead of keeping such foods as stews hot in the steam table, where they gradually become overcooked, you can keep them refrigerated (either in bulk or in individual portions) and reheat each order as needed. This is perhaps the main reason why most restaurants have one or more microwave ovens, even though they may not use them for primary cooking.

Because the microwave oven is a unique tool in food service, the cook should observe the following special points regarding its use:

1. Small items will not brown in a standard microwave. Large roasts may brown somewhat from the heat generated in the item itself. Some models have browning elements that use conventional heat.
2. Watch timing carefully. Overcooking is the most common error in microwave use. High energy levels cook small items very rapidly.
3. Large items should be turned once or twice for even cooking.
4. An on/off cycle is often used for large items to allow time for heat to be conducted to the interior.
5. If your equipment has a defrost cycle (which switches the oven to lower power), use this cycle rather than full power to thaw frozen foods. Lower power enables the item to thaw more evenly, with less danger of partially cooking it. If your oven does not have this feature, use an on/off cycle.
6. Sliced, cooked meats and other items that are likely to dry out in the microwave should be protected either by wrapping them loosely in plastic or wax paper or by covering them with a sauce or gravy.
7. Because microwaves act only on water molecules, foods with high water content, such as vegetables, heat faster than denser, drier foods, such as cooked meats.
8. Foods at the edge of a dish or plate heat faster than foods in the center. This is because they are hit by rays bouncing off the walls of the oven as well as by rays directly from the energy source. Therefore:
   - Depress the center of casseroles so the food is not as thick there as at the edges. This will help it heat more evenly.
   - When you are heating several foods at once on a plate, put the moist, quick-heating items like vegetables in the center and the denser, slower-heating items at the edges.
9. Because microwaves do not penetrate metal, aluminum foil and other metals shield foods from the radiant energy. For example, a potato wrapped in foil will not cook in a microwave oven.

With older machines, it was a general rule not to put any metal in the oven, as the radiation could bounce off the metal and damage the magnetron (the oven's generator). With newer machines, it is possible to heat foods in foil pans and to shield certain parts of the food by covering them with pieces of foil so they do not overheat. Follow the procedures recommended by the manufacturer of the oven.

Because microwaves cook so rapidly, they will not break down the connective tissues of less tender meats. Slow, moist cooking is necessary for dissolving these connective tissues.

The more food placed in a microwave at once, the longer the cooking time. Thus, the primary advantage of microwave cooking—speed—is lost with large roasts and other large quantities.

Cooking Sous Vide

A new technology that has had a rapid growth in popularity among the world's top chefs is ***sous vide*** (soo veed) cooking. French for "under vacuum," the term is applied to cooking foods that have been vacuum-sealed in plastic bags.

In simplest terms, this food preparation technique is a two-step process:

1. Vacuum-pack the food item, plus any seasonings or marinades, in an appropriate plastic bag.
2. Cook the food item, while in the bag, at a constant low temperature, usually in a special water bath.

Precision Cooking

Although the name of the technique refers to the vacuum packing, the heart of sous vide cooking—and the reason many chefs are so excited about it—is the precise temperature control it permits.

As an example, think of roasting a boneless loin of lamb. We could place the meat in an oven at 400°F (200°C) and roast it until the center reaches a temperature of 140°F (60°C) for medium doneness. As we discussed on pages 69–70, however, the lamb will be medium done only in the center and more done everywhere else. In addition, we would have to monitor the cooking closely to make sure we remove it from the oven at the right time.

On the other hand, we could vacuum-pack the lamb loin in plastic and place it in a water bath heated to an exact 140°F (60°C). The temperature of the lamb would never go above that temperature, no matter how long we left it in the water bath. And it would be at exactly the same doneness from outside to center.

Because we like a browned exterior on the lamb, we could then remove it from the bag, brown it quickly in a hot sauté pan, and serve it immediately.

Sous Vide Applications

Sous vide cooking is such a new science that chefs are only beginning to explore its possibilities. Techniques will surely evolve and change in years to come.

Some of the main applications of sous vide cooking as it is practiced today are detailed below. Please note temperature ranges are approximate. Immersion circulators (p. 52) are extremely accurate, and chefs may specify temperatures to within a fraction of a degree to get the precise results they want.

TENDER MEATS AND POULTRY

Tender meats and poultry are usually cooked in a water bath heated to the exact doneness temperature desired. The lamb loin described above is a typical example. Cooking temperatures usually range from 140° to 149°F (60°–65°C), although higher or lower temperatures are also used, and cooking times may range from 20 to 60 minutes, or sometimes longer.

Remember that if the cooking temperature is within the Food Danger Zone (p. 18), cooking time must be counted as part of the four-hour rule (p. 26). For this reason, tender meats and

poultry are almost always finished and served immediately after cooking and not chilled and stored for later use.

TOUGH MEATS

Tough meats can be cooked to tenderness while retaining more moisture than if they were braised or simmered. Cooking temperatures range from 149° to 158°F (65°–70°C). These temperatures are much lower than usual braising temperatures, but they are high enough to break down connective tissue. At the higher end of this range, meats become falling-apart tender, while at the lower end they retain more of their shape and have a firmer texture while still being tender and juicy.

Because it takes time to break down connective tissue, often 12–48 hours, tough meats are usually cooked to doneness, then immediately chilled and refrigerated for later use.

Because of the long cooking times, avoid cooking temperatures below 149°F (65°C). Higher temperatures provide more safety from bacterial growth.

FISH AND SEAFOOD

Fish are naturally tender and have even more delicate connective tissue than tender meats. Cooking procedures are similar to those for tender meats, but often with even lower temperatures and/or shorter cooking times. Typical cooking temperatures may range from 122° to 140°C (50°–60°C), or sometimes higher, with cooking times as short as 10–15 minutes. Use only the freshest, cleanest fish, and finish and serve it immediately after cooking.

Shellfish such as lobster and shrimp can be toughened by the higher heat of traditional cooking techniques, so sous vide cooking can be a benefit. Cooking temperature for these items is typically around 140°F (60°C).

VEGETABLES

Vegetables can benefit from sous vide techniques, especially those that discolor when exposed to air, such as artichokes. Vegetables are usually cooked at 185°F (85°C).

Safety Factors

Working with vacuum-packed foods increases the health dangers caused by anaerobic and facultative bacteria (p. 18)—that is, bacteria that can grow without oxygen. Because cooking temperatures are so low, there is danger that bacteria will not be killed if cooking is not carefully done. Salmonella, *E. coli*, listeria, and botulism bacteria are the most serious risks.

For these reasons, chefs and health officials are especially cautious about sous vide cooking and have instituted strict guidelines. The following steps summarize the most important aspects of these safety rules:

1. Know the rules for sous vide set up by your local health department, and follow them carefully. Health departments usually require that you establish a HACCP system (p. 33) for sous vide cooking.
2. Use only the freshest, most wholesome foods from reputable purveyors.
3. Chill all foods thoroughly before vacuum packing. If you sear a food item before packing, chill it after searing and before packing.
4. After packing, cook the food at once, or immediately refrigerate it at 38°F (3.3°C) or lower—or, even better, freeze it.
5. After cooking, serve the food immediately, or chill it as quickly as possible in an ice bath or a blast chiller.
6. Thaw cooked food frozen in its package in the refrigerator.

Sous vide cooking involves complex procedures, and the above summary is only a short introduction to its techniques and safety factors. Entire books have been written on the subject, some of which are listed in the Bibliography on page 1059. Later in this text, you will find three recipes illustrating some of these techniques: a recipe for long cooking of a tough meat (p. 352), for short cooking of fish (p. 516), and for cooking a vegetable (p. 575). Once again, these are only examples that can help you begin to understand the nature of sous vide. You should seek more information before you plan to put any recipes into production.

Finally, using the proper equipment, especially a chamber vacuum packager and an immersion circulator (described on p. 52), is important. Home-style vacuum packers might be useful for experimenting, but only a chamber packer can achieve the vacuum pressures chefs find they need. Furthermore, home machines are not able to pack liquids, so they can't pack meats with marinades. Most important, precise temperature control is critical when you are cooking at such low temperatures, and you need equipment with the capability of an immersion circulator for cooking sous vide.

Molecular Gastronomy

The approach to cooking known as *molecular gastronomy*, introduced on page 7, is the latest effort by creative chefs to find new ways of preparing and presenting food. The manipulation of food ingredients in new ways by the use of technology is known as ***molecular gastronomy***. However, this description is misleading, because it suggests to many people that the technology is the most important part of this way of cooking. Even the name, molecular gastronomy, suggests scientists making artificial food in test tubes. Perhaps a better name might be *avant-garde cuisine* (see sidebar).

For the best chefs in the field, molecular gastronomy is not so much a culinary movement as a new collection of tools for their toolkit. Their focus is still the food and the dining experience, and they use all their judgment and skills, including their training in classical techniques, to put good food on the plate. In the hands of great chefs, what could be nothing more than clever stunts with food becomes a great dining experience.

With this in mind, we can offer a second definition of *molecular gastronomy*: the selective use of technology and nonstandard ingredients to help enhance the flavors, aromas, appearance, and textures of natural foods.

Avant-Garde Techniques and Ingredients

It is a challenge, in a short space, to describe molecular gastronomy because it consists of so many unrelated techniques. Also, every chef has his or her own style of cooking and uses a different set of favorite techniques and plating styles. Furthermore, it is important to understand that many or even most items on an avant-garde chef's menu are made with traditional techniques. The chef uses whatever cooking methods he or she feels are appropriate to the dish, whether a traditional technique or a molecular-gastronomy technique. You shouldn't think that such a menu is composed entirely of foams, bubbles, powders, and gels. In the definition in the preceding paragraph, the word *selective* is used to mean the chef selects a nonstandard technique when, and only when, it helps intensify a flavor or aroma or in another way to improve the dining experience.

The chef may use these techniques to change familiar foods into unfamiliar forms, to make unexpected combinations of foods, or to make one food look like another. Tricking the diner's expectations is another way the chef draws attention to flavors and aromas. One does not eat this food absentmindedly. Every bite is intended to be an exploration or an adventure.

In this style of cooking, using the best ingredients is necessary. Because the techniques are used to focus attention on flavors, colors, textures, and aromas, only the freshest foods have the quality to work in these dishes.

Chefs use countless individual techniques to create their versions of molecular gastronomy, and new ones are invented all the time. Just a few of the better-known and most talked-about of these techniques are described below. Following this list is a description of some of the ingredients used to achieve these effects.

- **Nontraditional thickeners.** In addition to the traditional starches, chefs have new ways to thicken sauces and to change the texture of liquids. Some of these thickening agents work without heating and are simply blended with the cold liquid. This allows the chef to create sauces and other liquids with a fresh, uncooked taste.
- **Foams, froths, and bubbles.** For many years, chefs have made foamy sauces by whipping or blending a sauce just before plating. These foams collapse quickly, however.

AVANT-GARDE CUISINE

The term *avant garde* means "advance guard," and it was originally used to indicate the front ranks of an army advancing into battle. Today the term is used to describe any group that pushes the boundaries of a discipline beyond what is considered normal. The term is used most often in the arts and culture. Members of an avant-garde group experiment with and invent new techniques and new ways of applying new as well as old techniques.

Avant-garde chefs stabilize foams with gelatin, lecithin, and other ingredients. A well-made foam adds an additional flavor dimension to the plate without adding bulk.

- **Gels.** Turning a liquid, such as a vegetable juice, into a solid not only gives it a different texture but also enables the food to be cut into many shapes, allowing the chef to create different visual presentations. Chefs use regular gelatin as well as other jelling agents, such as agar-agar, which is derived from seaweed.
- **Drying and powdering.** Drying a food intensifies its flavor and, of course, changes its texture. Eating a cauliflower floret that was deep-fried and then dehydrated until crisp is a much different experience than eating steamed, buttered cauliflower. If the dehydrated food is powdered, it becomes yet another flavor and texture experience.
- **Spherification.** This technique creates spheres of liquid contained inside a thin gel wall. In the standard method, the liquid is mixed with a hydrocolloid (see sidebar) called *sodium alginate*. In a separate container is a water bath containing calcium. When the liquid is dropped into the calcium bath, the alginate and the calcium react to form a thin wall of gel surrounding a liquid center. The chef can make tiny spheres by using an eye dropper or larger ones by freezing the liquid in a mold before dropping it into the calcium bath.

  The opposite method is to dissolve the calcium in the flavorful liquid and drop it in an alginate bath. This is called *reverse spherification*.

Below is an alphabetical list of some of the specialized ingredients used in molecular gastronomy. Many of these ingredients are used in tiny quantities. For this reason, avant-garde chefs are likely to be working in the metric system (see p. 107). It is easier to scale 2 grams of xanthan gum, for example, than 0.07 ounces. This need for precision carries over into every aspect of the chef's work, from scaling all ingredients and measuring temperatures to cutting ingredients and creating plate arrangements.

Agar-agar. A jelling agent derived from seaweed. Agar-agar is a traditional ingredient in Asian cuisines and has long been used in Western cooking as a vegetarian substitute for gelatin. To use, stir into a cold liquid and bring to a boil. The liquid sets to a gel when cooled to 95°F (35°C). Once jelled, it can be reheated to serve warm because it does not melt until heated to at least 185°F (85°C). To use as a thickener, jell the liquid and then blend in a blender.

Calcium lactate and **calcium choride.** Calcium compounds used in the process of spherification (see above).

Carageenan. A hydrocolloid or thickener derived from seaweed. Carageenans are mixed with cold liquids and then heated to thicken.

Guar gum. A hydrocolloid or thickener derived from the guar bean plant. This is a powerful stabilizer and thickener that has long been used in commercial ice creams.

Methylcellulose. A hydrocolloid derived from plant fiber. It has long been used as a dietary fiber supplement. It is an unusual thickener and jelling agent because it thickens as it is heated and thins out or melts when cooled. This allows the chef to create unusual effects. Methylcellulose is also used to stabilize foams.

Sodium alginate. A hydrocolloid derived from seaweed. This ingredient is used in the process of spherification. It does not have to be heated to make a gel, and the gel is *nonreversible*. This means once the gel formed, it stays solid even when heated.

Soy lecithin. A powerful emulsifier. Lecithin is the component of egg yolks that makes mayonnaise possible (see p. 702). Also extracted from soybeans, lecithin is used to stabilize many mixtures that would separate without it.

Tapioca maltodextrin. A modified food starch that, when mixed with fat, changes it to a powder. Because maltodextrin dissolves in water, an oil, such as olive oil, that has been powdered changes back to an oil in the mouth.

Ultra-Tex 3. A modified food starch extracted from tapioca. The name is a trademark of the National Starch Company, which makes it. Ultra-Tex 3 thickens cold liquids without heating. If the thickened liquid is poured into a thin layer, it dries to form a thin film or sheet.

Xanthan gum. A hydrocolloid or thickener made by fermenting sugar with a special bacterium. It has been used for years to give structure to gluten-free breads and other

HYDROCOLLOIDS

A *colloid* is a mixture in which one substance (called the *dispersed phase*) is evenly mixed throughout another substance (called the *continuous phase*). Many colloids are familiar to us. Milk, for example, is liquid water in which milk solids and tiny butterfat globules are evenly mixed. Foams are colloids in which air bubbles are evenly distributed throughout a liquid. Smoke is a colloid of soot particles mixed in air. Emulsions such as mayonnaise (p. 705) are familiar colloids from the kitchen.

A *hydrocolloid* is a colloid in which the continuous phase is water. The presence of particles mixed throughout the water changes the water's characteristics. For example, gelatin is a hydrocolloid familiar to all chefs. In this product, strands of proteins are mixed in water. Because these strands bind to each other, even a small amount of gelatin is enough to turn water from a liquid to a soft solid, called a *gel*. Another familiar example of a hydrocolloid is a sauce thickened with starch. The strands of starch change the water base from a thin liquid to a thicker one.

When chefs who practice molecular gastronomy use the word *hydrocolloid* to describe unusual thickeners and jelling agents, such as sodium alginate and other gums, it makes them sound especially scientific and mysterious. But remember, chefs have been using hydrocolloids their entire careers. They just haven't called them that.

baked goods. Liquids thickened with xanthan gum have the same thickness whether hot or cold.

To give you a sense of how some of these ingredients and techniques are used, several recipes are included in Chapter 8 (pp. 219–220) and Chapter 9 (p. 231). Understand, however, this material gives you only a brief introduction to one aspect of molecular gastronomy. (When you consider that Chef Ferran Adrià closes his restaurant for six months a year in order to develop new recipes and techniques, you begin to realize how vast the subject is.) To get a fuller sense of the subject, you must do a lot more reading (see Bibliography, page 1059).

Summary of Cooking Terms

The following is an alphabetical list of terms that describe ways of applying heat to foods. Basic cooking methods described earlier are included, as are more specific applications of these basic methods.

bake. To cook foods by surrounding them with hot, dry air. Similar to *roast*, but the term *bake* usually applies to breads, pastries, vegetables, and fish.

barbecue. (1) To cook with dry heat created by the burning of hardwood or by the hot coals of this wood. (2) Loosely, to cook over hot coals, such as on a grill or spit, often with a seasoned marinade or basting sauce.

blanch. To cook an item partially and very briefly in boiling water or in hot fat. Usually a pre-preparation technique, as to loosen peels of vegetables, fruits, and nuts, to partially cook French fries or other foods before service, to prepare for freezing, or to remove undesirable flavors.

boil. To cook in water or other liquid that is bubbling rapidly, about 212°F (100°C) at sea level and at normal pressure.

braise. (1) To cook covered in a small amount of liquid, usually after preliminary browning. (2) To cook certain vegetables slowly in a small amount of liquid without preliminary browning.

broil. To cook with radiant heat from above.

deep-fry. To cook submerged in hot fat.

deglaze. To swirl a liquid in a sauté pan, roast pan, or other pan to dissolve cooked particles of food remaining on the bottom.

dry-heat cooking methods. Methods in which heat is conducted to foods without the use of moisture.

fry. To cook in hot fat.

glaze. To give shine to the surface of a food by applying a sauce, aspic, sugar, or icing, and/or by browning or melting under a broiler or salamander or in an oven.

griddle. To cook on a flat, solid cooking surface called a *griddle*.

grill. To cook on an open grid over a heat source.

moist-heat cooking methods. Methods in which heat is conducted to foods by water or other liquid (except fat) or by steam.

pan-broil. To cook uncovered in a skillet or sauté pan without fat.

pan-fry. To cook in a moderate amount of fat in an uncovered pan.

(en) papillote. Wrapped in paper (or sometimes foil) for cooking so the enclosed food is steamed in its own moisture.

parboil. To cook partially in a boiling or simmering liquid.

parcook. To cook partially by any method.

poach. To cook gently in water or other liquid that is hot but not actually bubbling, 160°–180°F (71°–82°C).

reduce. To cook by simmering or boiling until the quantity of liquid is decreased, often to concentrate flavors.

roast. To cook foods by surrounding them with hot, dry air in an oven or on a spit in front of an open fire.

sauté. To cook quickly in a small amount of fat, usually while mixing or tossing the foods by occasionally flipping the pan.

sear. To brown the surface of a food quickly at a high temperature.

simmer. To cook in water or other liquid that is bubbling gently, 185°–205°F (85°–96°C).

smoke-roast. To cook with dry heat in the presence of smoke, as on a rack over wood chips in a covered pan.

sous vide. Vacuum-packed. Refers to techniques for cooking foods that are packaged under vacuum in plastic bags.

steam. To cook by direct contact with steam.

stew. To simmer or braise a food or foods in a small amount of liquid, which is usually served with the food as a sauce.

stir-fry. To cook quickly in a small amount of fat by tossing cut-up foods in a wok or pan with spatulas or similar implements. Similar to sauté, except the pan is stationary.

sweat. To cook slowly in fat without browning, sometimes under a cover.

KEY POINTS TO REVIEW

- What cooking methods are classified as dry-heat methods? What methods are dry-heat methods with fat? What methods are moist-heat methods? Describe each of these cooking methods.
- How do you determine quality in a deep-fried food?
- What are the two main steps in sous-vide cooking? List six safety guidelines to observe when cooking sous vide.

Building Flavor

People eat because they enjoy the flavors of good food, not just because they must fill their stomachs to stay alive. Appearance, texture, and nutrition are important, too, but good taste is the first mark of good cooking. Enhancement and adjustment of flavors are among a cook's most critical tasks, one requiring experience and judgment.

The most important flavors of a given preparation are those of its main ingredients. A grilled beef tenderloin steak should taste like beef, green beans should taste like green beans, tomato soup should taste primarily of tomato. Plain, unseasoned foods, however, usually taste a little bland and one-dimensional, so it is the cook's job to add interest by combining ingredients to build depth of flavor. The harmony of ingredient flavors and aromas the cook creates by combining ingredients skillfully is sometimes called a ***flavor profile***.

Building Flavor Profiles

Foods offer complex experiences for the senses. When composing a new dish, a cook must first of all understand that more than just taste should be considered. The senses of sight, smell, taste, and touch all come into play. The fifth sense, hearing, also plays a role, as when we react to the sizzle of a steak or the crunch of a potato chip, but this sense is less of a concern for the cook than the other four. Consider how we perceive these characteristics of a dish:

- Appearance (color and color contrast, shape, shine, arrangement on the plate)
- Aroma
- Taste
- Mouthfeel (texture, moistness or dryness, softness or crispness) and temperature

All of these factors are important to making a dish appealing to the diner. The discussion in this section, however, is concerned mostly with aroma and taste. Why not just taste? Taste buds on the tongue perceive only four basic sensations: salty, sweet, bitter, and sour (but see sidebar). What we think of as flavor is a combination of taste and aroma. When the sense of smell is lacking, such as when you have a cold, foods seem to have little flavor.

The flavors in a dish can be thought of as primary flavors and supporting, or secondary, flavors. The primary flavors are the flavors of the main ingredients. For example, in blanquette of veal (p. 346) the ***primary flavor*** is veal; the primary flavors in calf's liver lyonnaise (p. 340) are liver and onions; and the primary flavors in Irish lamb stew (p. 346) are lamb, onions, leeks, and potatoes. These are the flavors that predominate. When you taste each of these dishes, the first tastes you encounter are the main ingredients. Other flavors, which we can call ***supporting flavors***, support and enhance the primary flavors of the main ingredients.

Examining how a flavor profile is built in a single classic and fairly simple recipe can help you begin to understand the general principles involved.

UMAMI

Although European and North American tradition recognizes four basic tastes—salty, sweet, bitter, and sour—food authorities have recently identified a fifth, called ***umami***, which has long been recognized by Asian cultures. Sense receptors on the tongue react to certain amino acids (see p. 128). Because amino acids are components of proteins, this taste is strong in foods high in protein. In fact, *umami* is often translated as "meatiness." Beef, lamb, certain cheeses, and soy sauce are especially high in umami. The food additive monosodium glutamate (MSG), used as a seasoning or flavor enhancer in some Asian cuisines, produces strong umami.

An Example of Flavor Building

Let's look more closely at the recipe for blanquette of veal mentioned above. Veal, by itself, does not have a strong or pronounced flavor. Unlike meats such as beef or venison, veal has a mild, subtle flavor. In this recipe, the veal is simmered, so the flavor is even milder than it would be if the meat were browned by roasting, sautéing, or braising. For this reason, when choosing seasonings and other supporting flavors, we want to avoid strong flavors that will mask the delicate flavor of the veal. Using white veal stock as a cooking medium reinforces and strengthens the primary flavor. We could use water, but the result would be a less flavorful dish. Brown stock would be too strong for our purpose and would completely change the character of the dish. White chicken stock might be an acceptable substitute, but it wouldn't reinforce the veal flavor as well. The onion and bouquet garni are added to the stock to give it more depth and fullness of flavor.

Continuing to the finishing ingredients, we find roux, a cream-and-egg liaison, lemon juice, nutmeg, and white pepper. The roux functions as a thickener and contributes primarily to texture, although the butter in the roux also gives some richness to the flavor. The liaison is used for both texture and flavor, adding richness and creaminess. The cream and the simmered veal are a classic marriage of flavors that work well together in many dishes. However, too much richness, combined with the mildness of the veal, could make the dish cloying. The acidity of the lemon juice cuts through the richness of the cream and egg yolks, gives a more balanced flavor, and perks up the taste buds. Just enough lemon is used to balance the richness of the cream and egg, not so much as to make the dish taste lemony. Finally, the smallest amount of nutmeg and white pepper gives a pleasing complexity to the finished taste without adding identifiable flavors. If one of the first things you taste is nutmeg, then too much nutmeg has been used.

If the dish is well composed, all of these flavors, primary and supporting, combine to form a complex but unified whole we identify as the taste of veal blanquette.

General Concepts in Flavor Building

There are no fixed rules for combining flavors, but the example just discussed suggests some general principles. When you are developing or modifying a recipe, think about the following points.

Every ingredient should have a purpose. Start with the main ingredients, and then think about what will work with them. Continue to build the flavor, using just the ingredients you need.

Ingredients can work together by harmonizing or by contrasting. In the example above, the rich taste of the liaison and the mild taste of the veal harmonize. The tartness of the lemon, on the other hand, contrasts with the cream.

When two ingredients contrast, be sure they balance. For example, add just enough lemon juice to the blanquette to balance the cream, not too much or too little.

Consider not only the components of the single recipe but also the other items that will be served with it on the plate. For example, think of how we use lemon to balance the richness or fattiness of the cream in the blanquette. We can use the same idea to balance the fattiness of a pork pâté or sausage by serving it with a tart mustard or chutney on the side. In other words, think of building the flavor profile of the entire plate. Plan sauces, accompaniments, and garnishes to balance, enhance, and contrast with the main item and with each other, just as the flavors in an individual recipe do.

SIMPLICITY AND COMPLEXITY

Simpler is usually better. Some cooks mistakenly think that adding more ingredients is always preferable to adding fewer. But the more flavors you combine, the harder you have to work to balance them all. Further, the more competing flavors you have, the more you have to take care that the primary flavors of the main ingredients aren't lost.

This is true whether you are planning the ingredients in a single recipe or the components on a plate. Some cooks are tempted to put too many things on a plate. When you have a meat item perched on layers of three or four vegetables and starches, with additional garnishes and two or three sauces, the result is often a confused jumble.

It would be incorrect, however, to say that simpler is *always* better. Classic dishes from many of the world's regions have complex flavor profiles. Look through any collection of recipes from India, China, or Mexico, and you will find dishes that use a large number of spices and other flavoring ingredients. The recipe for mole poblano on page 426 is an example. When these dishes work, all the ingredients blend well. In a good curry, for example, it is difficult, if not impossible, to taste each of the individual spices.

CLASSIC FLAVOR PROFILES

How do you know what flavors work together? Perhaps the best place to start is to study traditional recipes from around the world as well as from the classical cuisine passed down to us through Escoffier. These are dishes that have stood the test of time. We know the flavor combinations work because they have been used over and over for decades or even centuries.

We have already seen some classic flavor combinations in our discussion of veal blanquette. The combination of white meat, cream, lemon, and a hint of nutmeg is a quartet of flavors you will find repeatedly in classic and regional dishes.

International or ethnic dishes provide other examples. In northern India, many dishes are based on a mixture of onion, garlic, and fresh ginger puréed together and fried in a little oil. Studying these recipes suggests to us that these three flavors might be used together in new dishes as well. Similarly, the combination of ginger and soy sauce from Japan, paprika and cured ham from Spain, garlic, tomato, and parsley from Provence, and olives and anchovies from around the Mediterranean are all successful flavor mixtures we learn to use when we study classic dishes.

For chefs who want to create their own dishes, studying classic recipes is a good place to start.

CLASSIC FLAVORING COMBINATIONS

These are just a few of the many traditional flavoring combinations from around the world. Keep in mind that, although only one or two combinations are given for each country or region mentioned, they are not the only combinations used there. These are merely examples to stimulate your thinking.

- Sour cream, paprika, caraway (Hungary)
- Sour cream or mustard, dill (Scandinavia)
- Caraway, onion, vinegar (Germany)
- Apples, apple cider or apple brandy, cream (France—Normandy)
- Shallot, garlic, parsley (France—Burgundy)
- Tomato, basil, olive oil (Italy)
- Olive oil, garlic, anchovy (Italy)
- Lemon, oregano (Greece)
- Cinnamon, nuts, honey (eastern and southern Mediterranean, Middle East)
- Ginger, onion, garlic (India)
- Fish sauce (nam pla), lemongrass, chiles (Thailand)
- Ginger, soy sauce (Japan)
- Soy sauce, sake or mirin, dried bonito (Japan)
- Ginger, garlic, scallion (China)

Seasoning and Flavoring Ingredients

The preceding discussion of flavor building concerns all ingredients that add flavor to or change the flavor of a dish. These include the primary ingredients and the supporting or secondary ingredients. The remainder of this chapter is concerned primarily with herbs and spices as well as common flavoring ingredients such as onion, garlic, and mustard.

To repeat the most important concept of flavoring, the main ingredients are the primary sources of flavor. Use good-quality main ingredients, handle all foods with care, and employ correct cooking procedures. Remember that herbs and spices play only a supporting role. Badly prepared foods can't be rescued by a last-minute addition of herbs and spices.

Although chefs do not always use the terms this way, it might be said there is a difference between seasoning and flavoring. ***Seasoning*** means enhancing the natural flavor of a food without significantly changing its flavor. Salt is the most important seasoning ingredient. ***Flavoring*** means adding a new flavor to a food, thus changing or modifying the original flavor.

The difference between seasoning and flavoring is often one of degree. For example, salt is usually used only to season, not to flavor. But in the case of potato chips or pretzels, the salt is so predominant it can be considered an added flavoring. On the other hand, nutmeg is normally used for its distinctive flavor, but just a dash can perk up the flavor of a cream sauce without being detectable by most people.

Seasoning

1. The most important time for seasoning liquid foods is at the end of the cooking process.

   The last step in most recipes, whether written or not, is "adjust the seasoning." This means you have to first taste and evaluate the product. Then you must decide what should be done, if anything, to improve the taste. Often, a little salt in a stew or a dash of fresh lemon juice in a sauce is enough.

   The ability to evaluate and correct flavors takes experience, and it is one of the most important skills a cook can develop.
2. Salt and other seasonings are also added at the beginning of cooking, particularly for larger pieces of food, when seasonings added at the end would not be absorbed or blended in but just sit on the surface.
3. Adding some of the seasoning during the cooking process aids in evaluating the flavor along the way.
4. Do not add much seasoning if it will be concentrated during cooking, as when a liquid is reduced.

Flavoring

Flavoring ingredients can be added at the beginning, middle, or end, depending on the cooking time, the cooking process, and the flavoring ingredient.

1. Only a few flavorings can be added successfully at the end of cooking. These include fresh (not dried) herbs, sherry or flamed brandy, and condiments like prepared mustard and Worcestershire sauce.
2. Most flavorings need heat to release their flavors and time for the flavors to blend. Whole spices take longest. Ground spices release flavors more quickly and thus don't require as long a cooking time.
3. Too much cooking results in loss of flavor. Most flavors, whether in spices or in main ingredients, are ***volatile***, which means they evaporate when heated. That is why you can smell food cooking.

We can conclude that herbs and spices should cook with the foods long enough to release their flavors but not so long that their flavors are lost. If cooking times are short, you can generally add spices and herbs at the beginning or middle of cooking time. If cooking times are long, it is usually better to add them in the middle or toward the end of cooking time.

Note: Food safety experts recommend adding dried spices and herbs at least 30 minutes before the end of cooking so any microorganisms they might carry are destroyed.

Common Seasoning and Flavoring Ingredients

Any food product can be used as a flavoring ingredient, even meat (as when crumbled bacon is added to sautéed potatoes or diced ham is included in a mirepoix). Sauces, which are complex preparations containing many flavoring ingredients, are themselves used as flavorings for meat, fish, vegetables, and desserts.

We obviously cannot treat all possible flavoring ingredients here, but we discuss some of the most important. A survey of herbs and spices is provided in Table 4.1. Ingredients used primarily in the bakeshop are discussed in Chapter 29.

Table 4.1 **Herbs and Spices**

Product	Market Forms	Description	Examples of Use
Allspice	Whole, ground	Small brown berry; flavor resembles blend of cinnamon, cloves, and nutmeg	Sausages and braised meats, poached fish, stewed fruits, pies, puddings
Anise seed	Whole, ground	Small seed; licorice flavor	Cookies, pastries, breads
Basil	Crushed leaves	Aromatic leaf; member of mint family	Tomatoes and tomato dishes, pesto (Italian basil sauce), egg dishes, lamb chops, eggplant, peas, squash
Bay leaf	Whole	Stiff, dark green, oblong leaves; pungent aroma	One of the most important herbs for stocks, sauces, stews, braised meats
Caraway seed	Whole	Dark brown, curved seeds; familiar rye bread seasoning	Rye bread, cabbage, sauerkraut, pork, cheese spreads, Eastern European dishes
Cardamom	Whole pod, ground seed	Tiny brown seeds inside white or green pod; sweet and aromatic; expensive	Pickling, Danish pastries, curries
Cayenne (red pepper)	Ground	Ground form of hot red chile; looks like paprika but is extremely hot	In small amounts in many sauces, soups, meat, fish, egg, and cheese dishes (see p. 88)
Celery seed	Whole, ground, ground mixed with salt	Tiny brown seeds with strong celery flavor	Salads, coleslaw, salad dressings, tomato products
Chervil	Crushed leaves	Herb with mild flavor of parsley and tarragon	Soups, salads, sauces, egg and cheese dishes
Chili powder	Ground blend	Blend of spices including cumin, chiles, oregano, garlic	Chili and other Mexican dishes, egg dishes, appetizers, ground meat
Chive	Fresh, dried, frozen	Grasslike herb with onion flavor	Salads, egg and cheese dishes, fish, soups
Cilantro (fresh coriander, Chinese parsley)	Fresh leaves	The plant that produces coriander seeds; delicate texture; assertive, herbaceous aroma and flavor; leaves resemble flat parsley	Widely used in Asian and Southwestern cooking and in dishes with various ethnic influences

Table 4.1 **Herbs and Spices** *(continued)*

Product	Market Forms	Description	Examples of Use
Cinnamon	Sticks, ground	Aromatic bark of cinnamon or cassia tree	Pastries, breads, desserts, cooked fruits, ham, sweet potatoes, hot beverages
Clove	Whole, ground	Dried flower buds of a tropical tree; pungent, sweet flavor	Whole: marinades, stocks, sauces, braised meats, ham, pickling; Ground: cakes, pastries, fruits
Coriander	Whole, ground	Round, light brown, hollow seed, slightly sweet, musty flavor	Pickling, sausage, pork, curried dishes, gingerbread
Cumin seed	Whole, ground	Small seed resembling caraway, but lighter in color	Ingredient of curry and chili powders, sausages and meats, egg and cheese dishes
Curry powder	Ground blend	A mixture of 16–20 spices, including chile, turmeric, cumin, coriander, ginger, cloves, cinnamon, black pepper; brands vary greatly in flavor and hotness	Curried dishes, eggs, vegetables, fish, soups, rice
Dill	Crushed leaves (called *dill weed*), whole seed	Herb and seed with familiar dill pickle flavor; seed is more pungent than the herb	Seed: pickling, sauerkraut, soups; herb: salads, cheese dishes, fish and shellfish, some vegetables
Epazote	Fresh and dried leaves	A pungent herb with coarse-textured leaves	Used in Mexican cooking; often cooked with beans
Fennel	Whole seed	Greenish-brown seeds similar in flavor to anise, but larger in size	Italian sausage, tomato sauce, fish
Garlic	Fresh: whole bulbs; dried: granulated, powder, and mixed with salt	Strong, aromatic member of onion family; fresh bulbs composed of many small cloves	Wide variety of foods
Ginger	Whole, ground (also fresh and candied or crystallized)	Light brown, knobby root of ginger plant	Baked goods and desserts, fruits, curried dishes, braised meats; fresh in Chinese and other Asian dishes
Juniper berry	Whole	Slightly soft, purple berries with piney flavor; principal flavoring of gin	Marinades, game dishes, sauerkraut
Lemongrass	Fresh stalks	A tropical grass with a slightly bulbous base and an aroma of lemon	Used in Southeast Asian dishes and in dishes influenced by Asian cuisine
Mace	Whole (blade), ground	Orange outer covering of nutmeg; similar flavor, but milder	Baked goods, desserts, fruits, sausages, pork, fish, spinach, squash, other vegetables
Marjoram	Crushed leaves	Gray-green herb with pleasant aroma and slightly minty flavor, similar to oregano, but much milder	Pâtés and ground meats, braised meats, sauces, roast lamb, poultry and poultry stuffings
Mint	Leaves	Aromatic herb with familiar cool flavor; two varieties: spearmint and peppermint	Lamb, fruits, tea and fruit beverages, peas, carrots, potatoes
Mustard seed	Whole, ground (also prepared mustard; see p. 88)	Very pungent seed in white or yellow and brown varieties—brown is stronger	Cheese and egg dishes, pickling, meats, sauces and gravies
Nutmeg	Whole, ground	Sweet, aromatic kernel of nutmeg fruit	Soups, cream sauces, chicken, veal, many vegetables (spinach, mushrooms, squash, potatoes), desserts, custards, breads, pastries
Oregano	Leaves, ground	Pungent herb known as the "pizza herb"	Italian and Mexican dishes, tomato products
Paprika	Ground	Ground form of a dried, sweet red chile. Spanish variety is brighter in color, mild in flavor; Hungarian is darker and more pungent	Spanish: used (or overused) primarily as garnish on light-colored foods; Hungarian: goulash, braised meats and poultry, sauces
Parsley	Fresh: whole sprigs, in bunches; dried: in flakes	Most widely used herb; dark green curly or flat leaves with delicate, sweet flavor	Almost all foods
Pepper, black and white	Whole (peppercorns); ground fine, medium, or coarse	Small black or creamy white hard berry; pungent flavor and aroma	Most widely used spice (see p. 87)

Product	Market Forms	Description	Examples of Use
Pepper, red	(see Cayenne)		
Peppercorn, pink	Whole	Bright pink dried seed or berry; pungent, floral taste; unrelated to black pepper	Limited uses in meat, poultry, and fish dishes; sauce garnish; used in peppercorn mixtures
Poppy seed	Whole	Tiny blue-black seeds with faint but distinctive flavor	Garnish for breads and rolls, buttered noodles; ground: in pastry fillings
Rosemary	Whole	Light green leaves resembling pine needles	Lamb, braised meats and poultry, soups, tomato and meat sauces
Saffron	Whole (thread)	Red stigma of saffron crocus; gives bright yellow color to foods; mild, distinctive flavor; very expensive	Steeped in hot liquid before use; rice dishes, poultry, seafood, bouillabaisse, baked goods
Sage	Whole, rubbed (finer consistency than whole leaves), ground	Pungent gray-green herb with fuzzy leaves	Pork, poultry, stuffings, sausage, beans, tomatoes
Savory	Crushed leaves	Fragrant herb of mint family; summer savory is preferred to winter	Many meat, poultry, fish, egg, and vegetable dishes
Sesame seed	Whole (hulled or unhulled)	Small yellowish seed with nutlike taste; familiar hamburger bun garnish; high oil content	Bread and roll garnish
Sichuan peppercorn	Whole	Brown seed pod, usually partially opened; spicy, peppery flavor, but unrelated to black peppercorns	Spicy meat and poultry dishes
Star anise	Whole or broken	Dried, star-shaped seed pod with an aniselike flavor (but unrelated to anise) but more aromatic	Braised Chinese dishes
Tarragon	Crushed leaves	Delicate green herb with flavor both minty and licoricelike	Béarnaise sauce, tarragon vinegar, chicken, fish, salads and dressings, eggs
Thyme	Crushed leaves, ground	Tiny brownish-green leaves; very aromatic	One of the most important and versatile of herbs; stocks, soups, sauces, meats, poultry, tomatoes
Turmeric	Ground	Intense yellow root of ginger family; mild but distinctive peppery flavor	A basic ingredient of curry powder; pickles, relishes, salads, eggs, rice

1. *Salt* is the most important seasoning ingredient. Don't use too much. You can always add more, but you can't take it out.

   - Table salt has a fine granulation. It may contain iodine as a dietary additive. Table salt also may contain other additives to prevent caking.
   - Kosher salt is prized in the kitchen because of its purity. Unlike table salt, it contains no additives. Because of its coarse or flaky granulation, it does not dissolve as quickly as table salt, but it is easier to use when added to foods by hand, so many chefs prefer it to table salt at their cooking stations.
   - Sea salts of many origins and types are available. Many of them have colors ranging from gray to green to red, from various minerals and other impurities. These impurities also add subtle flavors to the salt. In addition, their coarse granulation gives them a pleasant mouthfeel. More expensive than other salts, sea salts are used primarily as garnishes for plated foods.

2. *Pepper* comes in three forms: white, black, and green. All three are actually the same berry, but processed differently. (Black pepper is picked unripe; white is ripened and the hull is removed; green peppercorns are picked unripe and preserved before their color darkens.)

   - Whole and crushed *black pepper* are used primarily in seasoning and flavoring stocks and sauces and, sometimes, red meats. Ground black pepper is used in the dining room by the customer.


Basil


Chervil


Chives


Garlic chives


Cilantro


Dill


Epazote


Regular ginger and green ginger


Lemongrass


Marjoram


Mint


Parsley, curly


Parsley, flat


Rosemary


Oregano


Tarragon


Sage


Thyme

- Ground *white pepper* is more important as a seasoning in the food-service kitchen. Its flavor is slightly different from that of black pepper, and it blends well (in small quantities) with many foods. Its white color makes it visually undetectable in light-colored foods.
- *Green peppercorns* are fairly expensive and are used in special recipes, primarily in luxury restaurants. The types packed in water, brine, or vinegar (those in water and in brine have better flavor) are soft. Wet-pack peppercorns are perishable. Water-packed peppercorns keep only a few days in the refrigerator after they are opened, while the others keep longer. Dried green peppercorns are also available.

3. *Red pepper* or *cayenne* is completely unrelated to black and white pepper. It belongs to the same family as paprika and fresh sweet bell peppers. Used in tiny amounts, it gives a spicy hotness to sauces and soups without actually altering the flavor. In larger amounts, it gives both heat and flavor to many spicy foods, such as those of Mexico and India.
4. *Lemon juice* is an important seasoning, particularly for enlivening the flavor of sauces and soups.
5. *Fresh herbs* are almost always superior to dried herbs. They should be used whenever cost and availability permit. Not long ago, the only fresh herbs generally available in many areas of North America were parsley, chives, and sometimes mint and dill. Now, however, most herbs are available fresh. The accompanying photos illustrate the most commonly used fresh herbs as well as some unusual fresh flavoring ingredients.
6. *Onion, garlic, shallots,* and other members of the onion family, as well as carrots and celery, are used as flavorings in virtually all stations of the kitchen and even in the bakeshop. Try to avoid the use of dried onion and garlic products, except as a component of spice blends. They have less flavor, and the fresh product is always available.
7. *Wine, brandy,* and other alcoholic beverages are used to flavor sauces, soups, and many entrées. Brandy should be boiled or flamed to eliminate the high percentage of alcohol, which would be unpleasant in the finished dish. Table wines usually need some cooking or reduction (either separately or with other ingredients) to produce the desired flavors. Fortified wines like sherry and Madeira, on the other hand, may be added as flavorings at the end of cooking.
8. *Prepared mustard* is a blend of ground mustard seed, vinegar, and other spices. It is used to flavor meats, sauces, and salad dressings and as a table condiment. For most cooking purposes, European styles such as Dijon (French) or Dusseldorf (German) work best, while the bright yellow American ballpark style is more appropriate as a table condiment than as a cooking ingredient. A coarse, grainy style is sometimes called for in specialty recipes.

9. Grated *lemon* and *orange rind* is used in sauces, meats, and poultry (as in duckling à l'orange) as well as in the bakeshop. Only the colored outer portion, called the *zest*, which contains the flavorful oils, is used. The white pith is bitter.
10. *MSG*, or *monosodium glutamate*, is a flavor enhancer widely used in Asian cooking. MSG doesn't actually change the flavor of foods, but it acts on the taste buds. It has a reputation for causing chest pains and headaches in some individuals.

Using Herbs and Spices

Definitions

Herbs are the leaves of certain plants that usually grow in temperate climates.

Spices are the buds, fruits, flowers, bark, seeds, and roots of plants and trees, many of which grow in tropical climates.

The distinction is often confusing, but it is not as important to know which flavorings are spices and which are herbs as it is to use them skillfully.

Table 4.1 is not a substitute for familiarity with the actual products. Eventually, you should be able to identify any spice on your shelf by aroma, taste, and appearance without looking at the label. The accompanying photos illustrate a number of whole spices.

Top row, left to right: black peppercorns, green peppercorns, pink peppercorns. Bottom row, left to right: white peppercorns, Sichuan peppercorns

Top row, left to right: cloves, nutmeg, allspice, cinnamon sticks. Bottom row, left to right: juniper berries, cardamom, saffron, star anise

Top row, left to right: celery seed, dill seed, coriander seed, caraway seed. Bottom row, left to right: fennel seed, cumin seed, anise seed

Guidelines for Using Herbs and Spices

1. Be familiar with each spice's aroma, flavor, and effect on food. Looking at a spice chart, including the one in this book, is no substitute for familiarity with the actual product.
2. Store dried herbs and spices in a cool place, tightly covered, in opaque containers. Heat, light, and moisture cause herbs and spices to deteriorate rapidly.
3. Don't use stale spices and herbs, and don't buy more than you can use in about 6 months. Whole spices keep longer than ground, but both lose much flavor after 6 months.
4. Be cautious after you have replaced old spices. The fresher products are more potent, so the amount you used before might now be too much.
5. Use good-quality spices and herbs. It doesn't pay to economize here. The difference in cost is only a fraction of a cent per portion.
6. Whole spices take longer to release flavors than ground spices, so allow for adequate cooking time.
7. Whole herbs and spices for flavoring a liquid are tied loosely in a piece of cheesecloth (called a *sachet*) for easy removal.
8. When in doubt, add less than you think you need. You can always add more, but it's hard to remove what you've already added.
9. Except in dishes like curry or chili, spices should not dominate. Often, they should not even be evident. If you can taste the nutmeg in the creamed spinach, there's probably too much nutmeg.
10. Herbs and spices added to uncooked foods such as salads and dressings need several hours for flavors to be released and blended.
11. Taste foods before serving whenever possible. How else can you adjust the seasoning?

KEY POINTS TO REVIEW

- How do chefs use the idea of flavor balance to combine a variety of ingredients into a single dish?
- What is the difference between seasoning and flavoring?
- What guidelines are used for correctly adding herbs and spices to foods?

TERMS FOR REVIEW

cooking
caramelization
gelatinization
fiber
denature
coagulation
Maillard reaction
connective tissues
oils
smoke point
evaporation
conduction
convection
radiation
infrared
microwave
moist-heat methods
dry-heat methods
boil
simmer
poach
blanch
steam
en papillote
braise
stew
roast
bake
barbecue
rangetop smoke-roast
pan-smoke
broil
grill
griddle
pan-broil
sauté
deglaze
pan-fry
deep-fry
pressure fry
sous vide
molecular gastronomy
colloid
hydrocolloid
flavor profile
umami
primary flavor
supporting flavor
seasoning
flavoring
volatile
herb
spice

QUESTIONS FOR DISCUSSION

1. Your broiler cook has just broiled a codfish fillet that turned out dry, rubbery, and shrunken. Explain what happened to it.
2. Why might adding some tomato product to a beef stew help make the meat more tender?
3. You are roasting a large quantity of ducklings and must use both your conventional ovens and your convection oven. You set all the ovens at the same temperature, but find the ducklings in the convection oven are done first. Why did this happen?
4. You are roasting two beef tenderloins of the same size, one in an oven set at 450°F (230°C), and the other in an oven at 250°F (120°C). You remove both of them from the oven when the temperature at the center is 135°F (57°C). Describe the doneness of each tenderloin from outside to inside.
5. Arrange the following cooking methods in three groups, depending on whether they are moist-heat methods, dry-heat methods without fat, or dry-heat methods with fat: braising, roasting, deep-frying, sautéing, poaching, steaming, broiling, pressure frying, grilling, simmering.
6. What are some advantages of braising a pan of Swiss steaks in the oven instead of on the range?
7. A cook in your restaurant is roasting several pans of chickens. He thinks they are browning too fast, and he covers the pans with foil to keep the chickens from browning much more. What is wrong with this?
8. You are sautéing beef tenderloin tips for stroganoff, and you suddenly find the meat is simmering in liquid rather than sautéing. What did you do wrong?
9. Your customers complain your French fries are too greasy and soggy. How can you correct the problem?
10. What food safety problems are posed by the vacuum packaging and the low cooking temperatures of sous vide cooking?
11. Describe the difference between *primary flavor* and *supporting flavor*. Select a favorite recipe and explain the function of each ingredient, indicating which are primary flavors and which are secondary flavors.
12. What is meant by the phrase “adjust the seasoning”?
13. What is wrong with adding whole caraway seed to a portion of goulash just before serving?