Chapter 18
Eggs

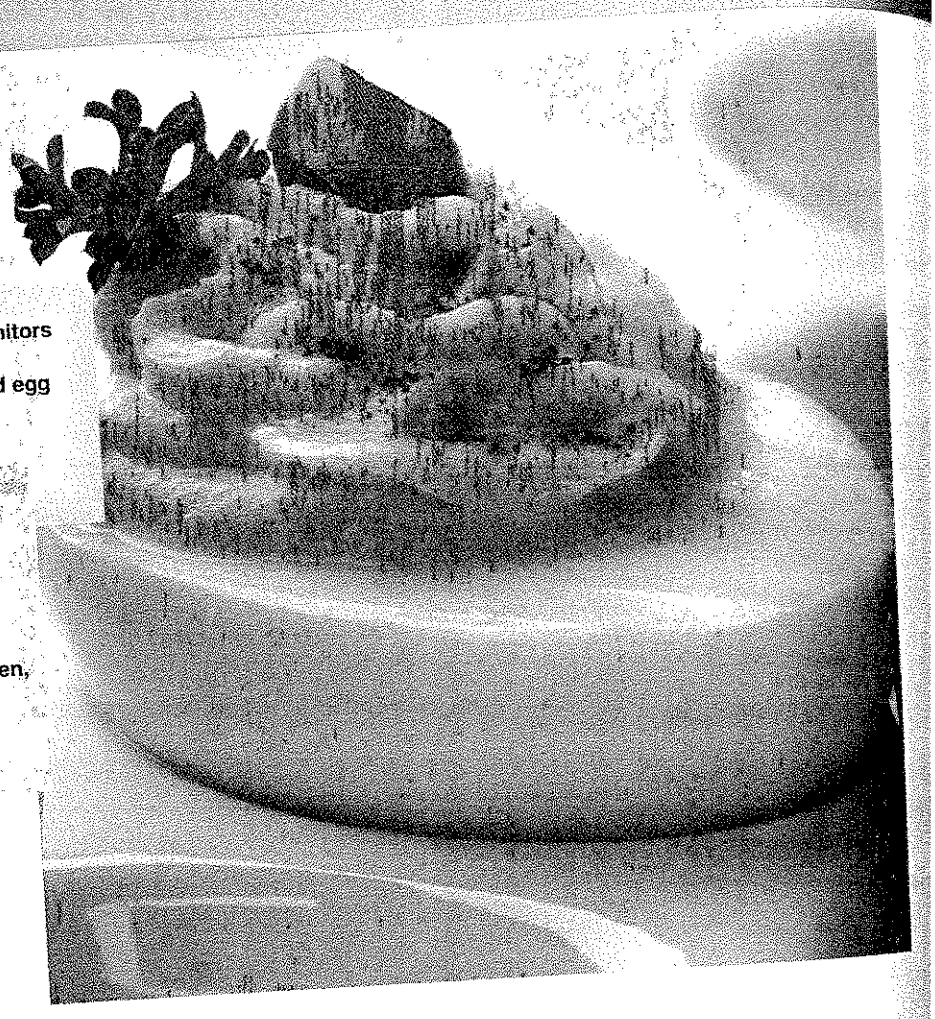
Career Path
Ask students where egg candlers, egg pasteurizers, and egg-producing farm farmworkers might work.

Egg Candler
Inspects eggs to ascertain quality and fitness for consumption or incubation according to prescribed standards.

Egg Pasteurizer
Controls and monitors equipment that pasteurizes liquid egg product.

Egg-Producing Farm Farmworker
Collects eggs from trap nests, releases hens from nests, records number of eggs laid by each hen, and packs eggs in cases or cartons.

Vocabulary Builder
Have each student suggest a meaning for each of the *Terms to Know*. Then have students look up terms in the glossary to check their accuracy.



Terms to Know

candling
emulsion
coagulum
omelet
soufflé
meringue
weeping
beading
custard

Objectives

After studying this chapter, you will be able to
- ❑ list factors affecting the selection of eggs.
- ❑ describe the principles and methods for cooking eggs.
- ❑ cook eggs correctly for breakfast menus and use eggs as ingredients in other foods.

Meeting Special Needs
Challenge academically gifted students in your class to attain the following higher-order objectives as they study the chapter:
- consider nutritional value, grade, and size when selecting eggs.
- demonstrate food science principles of cooking eggs while preparing eggs by various methods.
- evaluate eggs cooked for breakfast menus along with other foods that contain eggs as ingredients.

Eggs are one of the most versatile and nutritious food sources. You can prepare them in many ways. Because eggs are easy to digest, you can serve them to people at nearly all stages of the life cycle.

Selecting and Storing Eggs

Egg prices vary according to grade and size. Large eggs are the size most shoppers buy, regardless of price.

Nutritional Value of Eggs

Eggs are in the meat and beans group of the Food Guide Pyramid. One egg is equal to 1 ounce of lean, cooked meat. Most people should consume the equivalent of 5 to 7 ounces of lean, cooked meat per day.

Eggs are one of the best sources of complete protein. They also contain a number of vitamins and minerals. Egg yolks are high in cholesterol. Therefore, many health experts recommend using egg yolks and whole eggs with moderation. However, egg whites are cholesterol free, so you can use them freely.

Q: Are eggs a good choice if I'm trying to increase my iron intake?

A: Yes. One egg provides about as much iron as an ounce of lean, cooked meat, fish, or poultry. However, the form of iron in eggs is not as easy for your body to absorb. Having orange juice, or any other food rich in vitamin C, with your eggs will maximize your iron absorption.

Egg Grades

Eggs for retail sale are graded for quality. Grading is done by a system called ***candling.*** The eggs move along rollers over bright lights. The lights illuminate the eggs' structure. Skilled people can then look at the eggs carefully and remove any that do not meet standards.

Look for grade shields on egg cartons or on the tape that seals the cartons. The two grades of eggs available in most supermarkets are U.S. Grade AA and U.S. Grade A. These grades are given to high-quality eggs that have clean, unbroken shells and small air cells. The egg whites are thick and clear, and the yolks are firm and stand high above the whites.

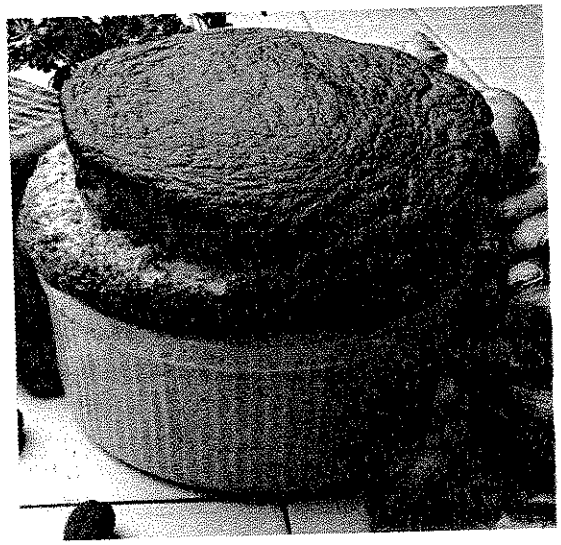
Some eggs are rated Grade B, but you will rarely see these eggs in food stores. They are usually used in other food products.

Egg Size

Eggs are sized on the basis of a medium weight per dozen. Extra large, large, and medium eggs are the most common sizes sold. Size has no relation to quality, however, size does affect price. Eggs of any size can be Grade AA, A, or B. Extra large eggs cost more than large eggs, and large eggs cost more than medium eggs. Most recipes are formulated to use medium or large eggs. See 18-1.

Storing Eggs

Buy eggs only from refrigerated cases. Check to be sure eggs are clean and uncracked before you buy them. Cracked eggs can contain harmful bacteria, which can cause foodborne



18-1 Most egg recipes, like the one for this soufflé, are developed to be made with medium or large eggs.

Integrating Math Concepts
Have students conduct the following activity: Weigh a dozen medium eggs, a dozen large eggs, and a dozen extra large eggs. Calculate the average weight per egg for each size. Also calculate the percentage weight difference between medium and large and between large and extra large eggs.

FYI
Because eggs are a common allergen, most pediatricians do not recommend them for children under 12 months of age.

Resource
Selecting and Storing Eggs, Activity A, SAG. Students are to complete exercises related to the selection and storage of eggs.

Interdisciplinary Connections
Coordinate your unit on eggs with a health teacher's study of the body's circulatory system. Together you can help students distinguish between dietary cholesterol, which is found in eggs, and blood cholesterol, which contributes to the formation of plaque in blood vessels. Have the health teacher point out the health risks involved when plaque forms in the blood vessels.

Break It Down
Have students review the meaning of the term *candling*. Have students answer questions 1–2 under *Review What You Have Read* and complete activity 1 under *Build Your Basic Skills* at the end of the chapter.

Q: Are brown-shelled eggs more nutritious than white-shelled eggs?

A: No. The breed of chicken determines egg color. The color of the shell does not affect quality, flavor, or nutritional value.

Resource
Eggs as Ingredients, color transparency CT-18, TR. Use the transparency to introduce students to some of the basic functions of eggs as ingredients, noting the types of dishes in which eggs perform each function.

FYI
Students can read more about emulsions in Chapter 22, "Salads, Casseroles, and Soups."

Discuss
Ask students what would happen if they beat egg whites in a bowl that had been used to beat egg yolks. Ask them to give the reason for the anticipated outcome. *(The egg whites would not foam well due to fat remaining in the bowl from the yolks.)*

illness. You should discard any eggs that become cracked or broken during transportation or storage.

Store eggs in your refrigerator as soon as you bring them home from the store. You may safely store fresh eggs in the refrigerator for four to five weeks.

Some recipes call only for egg yolks or egg whites. To store leftover yolks, cover them with cold water and refrigerate in a tightly covered container. Store leftover egg whites in the refrigerator in a tightly covered container, too. Use yolks within one or two days. Use whites within four days.

Some eggs contain illness-causing bacteria. These bacteria can multiply rapidly at warm temperatures. Smell, taste, or appearance will not help you identify a contaminated egg. However, proper storage of eggs can help you control any bacteria that may be present. Store eggs, large end up, in their original carton. Keep them in the main compartment of the refrigerator, not on the refrigerator door, which does not stay as cold.

Eggs as Ingredients

Eggs function as emulsifiers, foaming agents, thickeners, binding agents, and interfering agents. They also add structure, nutrients, flavor, and color to foods.

Emulsifiers

An ***emulsion*** is a mixture that forms when you combine liquids that ordinarily do not mix. (Oil and water or a water-based liquid, such as lemon juice, are commonly combined to form an emulsion.) To keep the two liquids from separating, you need an *emulsifying agent*. Egg yolk is an excellent emulsifying agent. The yolk surrounds the oil droplets in an emulsion. It keeps the droplets suspended in the water-based liquid so the two liquids will not separate. Mayonnaise is an example of this type of emulsion.

Foams

Egg foams are used to add air to foods. When you beat air into egg whites, many air cells form. A thin film of egg white protein surrounds each cell. As beating continues, the cells become smaller and more numerous. The protein film also becomes thinner. As a result, the foam thickens.

Factors Affecting Egg Foams

Temperature, beating time, fat, acid, and sugar affect the formation of egg white foams. When preparing egg foams, two temperatures are needed. Eggs separate most easily when they are cold. However, egg whites reach maximum volume when they are at room temperature. Use an egg separator to separate whites from yolks when you take eggs from the refrigerator. Then let the egg whites stand at room temperature for 30 minutes before beating them. Store leftover yolks.

You must avoid both too little and too much beating time when preparing egg foams. Too little beating time produces underbeaten egg whites, which lose volume quickly and do not hold their shape. Too much beating time produces overbeaten egg whites, which also lose volume quickly. In addition, overbeaten egg whites have little elasticity and will break down into curds.

Fat and fat-containing ingredients, such as egg yolk, inhibit the formation of egg white foam. This is why you must be careful that no fat is present on the beaters or in the bowl when beating egg whites.

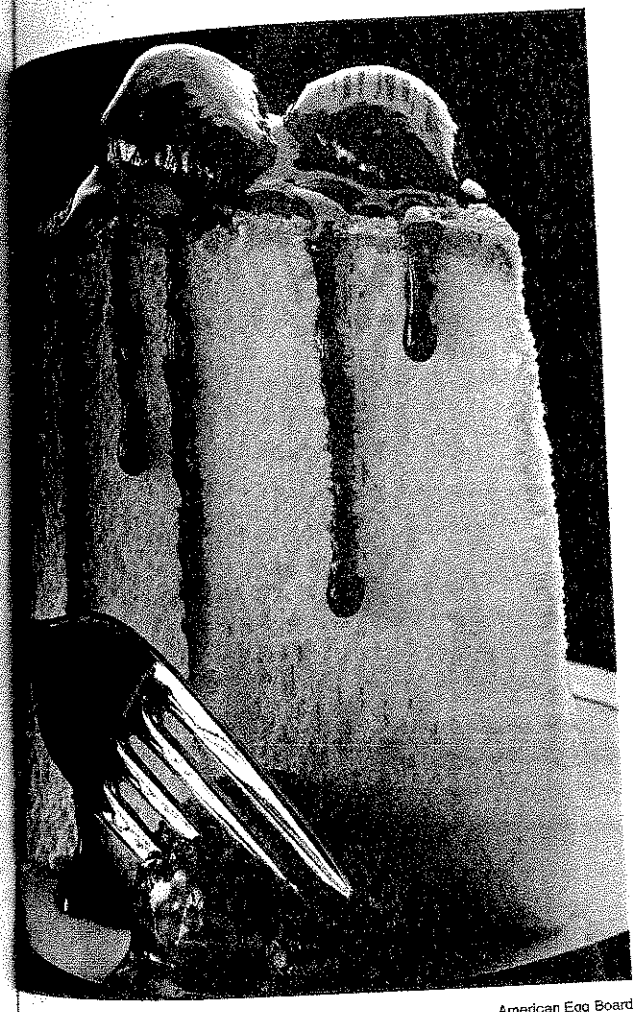
Acid makes egg white foams more stable. It also adds whiteness. This is why many recipes that use egg white foams call for a small amount of cream of tartar. See 18-2.

Think Outside the Box
Ask students how long eggs can be left at room temperature before they become unsafe to eat. *(2 hours)* Discuss the risks involved when eggs are dyed for Easter and then displayed at room temperature for days. These eggs should not be eaten, even if they have been cooked. For more information on the safe storage and handling of eggs, have students visit the Web site for the American Egg Board at www.aeb.org. Most questions concerning the safe handling of eggs can be answered at this Web site.

Sugar increases the stability of egg white foam. It also increases beating time. You will usually add sugar to the foam after it has reached most of the volume.

Stages of Egg Foams

Recipes will direct you to beat egg whites to one of three stages: foamy, soft peak, or stiff peak. Each stage requires increased beating time. Egg whites at the *foamy stage* have bubbles and foam on the surface. Egg whites beaten to the *soft peak stage* will form peaks that bend at the tips when you lift the beater. Egg whites beaten to the *stiff peak stage* will form peaks that stand up straight when you lift the beater. If you beat egg whites past the stiff peak stage, you have overbeaten them.



American Egg Board

***18-2** Most recipes for angel food cake call for cream of tartar to create a whiter, more stable egg foam.*

Using Egg Foams

You will use foams to make soft and hard meringues. You will also use them to give structure to angel food and sponge cakes, soufflés, and puffy omelets.

To avoid a loss of air, you must quickly but gently blend other ingredients into egg white foams. This blending process is called *folding.* Wire whisks and rubber spatulas are the best tools for folding. Using either tool, cut down into the mixture, across the bottom, up the opposite side, and across the top. The whisk or spatula should remain in the mixture the entire time you are folding.

Thickeners

Heat causes egg proteins to coagulate (thicken). Because of this property, whole eggs and egg yolks are used as thickening agents in such foods as sauces, custards, and puddings.

When you must add eggs to a hot mixture, you should quickly fold a small amount of the hot mixture into the beaten eggs. Then, you can add the warmed eggs to the rest of the hot mixture. Warming the eggs slightly keeps them from coagulating into lumps.

Binding and Interfering Agents

You can use eggs as binding and interfering agents. Eggs act as binding agents that hold together the ingredients in foods such as meat loaf and croquettes. Frozen desserts like ice cream and sherbet stay creamy because the eggs in them act as interfering agents. The eggs inhibit the formation of large ice crystals, which would ruin the texture of frozen desserts.

Structure

Eggs add structure to baked products, such as muffins and cakes, 18-3. People limiting cholesterol in their diets can still use eggs as ingredients in recipes for baked goods. You can substitute two egg whites for each whole egg. Add 1 teaspoon (5 mL) of oil and decrease liquid in the recipe by 1⅓ tablespoons (20 mL) for each egg being replaced.

Reflect
Ask students what foods they have eaten that contained egg white foam.

Activity
Have students compare a recipe for custard with a recipe for cornstarch pudding. Note the ingredients that are used as thickeners in each recipe.

FYI

- Eggs are the only thickening agent in some food products, such as custards. In other food products, such as sauces and puddings, both eggs and starch are used as thickening agents.
- In egg-starch mixtures, you can add eggs in two ways. You can mix the eggs with the other ingredients and cook the mixture over low to moderate heat until thickened. You can also add the eggs to the mixture after the starch paste has cooked and thickened. Once you add the eggs, return the mixture to the heat and cook it for a short time longer.

Interdisciplinary Connections
Team your teaching of this chapter with a chemistry teacher. You can focus on the functions of eggs as ingredients. Ask the chemistry teacher to discuss the chemical structures of oils, water-based liquids, and emulsifying agents.

Resource
Functions of Eggs, Activity B, SAG. Students are to complete a chart describing the various functions performed by eggs and give examples of food products in which eggs perform each function.

FYI
When cooking separated eggs for use in recipes, using less than 2 tablespoons sugar per egg white will cause the egg whites to coagulate too quickly, producing an unsatisfactory meringue. Using less than 2 tablespoons liquid per yolk will result in scrambled eggs.

Reflect
Ask students if they have ever tasted foods made with egg substitutes. How did they think it compared with its fresh egg counterpart?

Nutrition, Flavor, and Color

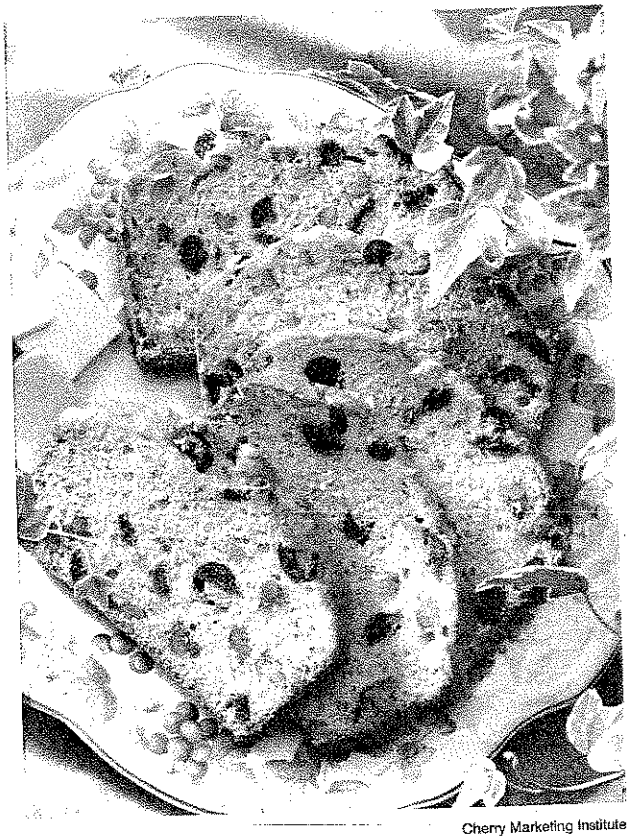
Eggs contribute important nutrients to food products. Eggs add flavor and color to foods such as custards and puddings. Eggs also give an appealing color to the interior of baked goods like cakes.

Healthy Living

A small percentage of raw eggs may be tainted with salmonella bacteria, which can cause foodborne illness. Thorough cooking and pasteurization destroy these bacteria. However, they may be present in raw and lightly cooked egg dishes. Children, pregnant women, older adults, and ill people should not eat egg dishes that are not thoroughly cooked. These groups of people are at a greater risk of complications if they contract a foodborne illness.

Using Raw Eggs

The risk of foodborne illness due to contaminated eggs is small, especially for healthy people. However, it is safest not to use raw eggs in any dish that is not thoroughly cooked.



Cherry Marketing Institute

***18-3** Eggs help strengthen the structure of this quick bread.*

If a recipe calls for whole eggs, you can use a pasteurized egg product. A recipe that calls for separated eggs requires some special preparation steps.

Instead of using raw beaten egg whites in an uncooked dish, you can cook the whites. Using a specific technique, you will beat the egg whites into a fluffy frosting before adding them to your recipe. Combine the egg whites with the sugar from the recipe in a heavy saucepan or double boiler. (You will need at least 2 tablespoons [30 mL] of sugar per egg white.) Cook the mixture over low heat while beating it to the soft peak stage with an electric mixer.

Instead of adding raw egg yolks to a recipe, cook them as though you were making stirred custard. Combine the yolks with the liquid from the recipe in a heavy saucepan. (You will need at least 2 tablespoons [30 mL] of liquid per yolk.) Cook the mixture over low heat, stirring constantly until the mixture coats a metal spoon. Cool the mixture quickly and add it to the recipe when you would add the egg yolks.

Another option when preparing uncooked or lightly cooked recipes that call for raw eggs is to use pasteurized shell eggs. These are whole eggs that have been treated using the same heating process used to kill harmful bacteria in milk. This process does not affect the taste or cooking performance of the eggs.

Egg Substitutes

Egg substitutes provide an option for people who want to limit cholesterol and saturated fat from eggs in their diets. Egg substitutes are pasteurized. Therefore, you can use them in place of raw eggs in recipes that will not be cooked.

Egg substitutes are made largely from real egg whites. They contain no egg yolks. Therefore, these products are cholesterol-free, fat-free, and lower in calories than whole eggs. They compare closely to whole eggs in most other nutrient values. However, they may cost over three times as much as fresh eggs.

Think Outside the Box
Ask students what egg dishes call for little or no cooking. *(Caesar salad dressing, mayonnaise, Hollandaise sauce, chilled soufflés, chiffons, mousses, some frosting recipes, meringues)* Point out instructions given above for cooking eggs for use in these recipes, or recommend the use of pasteurized shell eggs or egg substitutes.

Egg substitutes are nearly as versatile as whole eggs. You can scramble them or use them to prepare omelets or quiches. You can also use them in most recipes calling for eggs. Typically, you will use ¼ cup (50 mL) of egg substitute in place of each whole egg or egg yolk. You can even use egg substitutes in recipes calling for hard-cooked eggs.

Q: Shouldn't I stop eating eggs if I'm concerned about cholesterol in my diet?

A: Large eggs provide an average of 213 mg of cholesterol each. With balance and moderation, most people can easily include eggs as part of a healthful diet. Also, remember that eggs are only one source of dietary fat and cholesterol. Simply limiting eggs will not lead to a lowfat, low-cholesterol diet. Lowering cholesterol and fat in the diet must become part of a total eating plan.

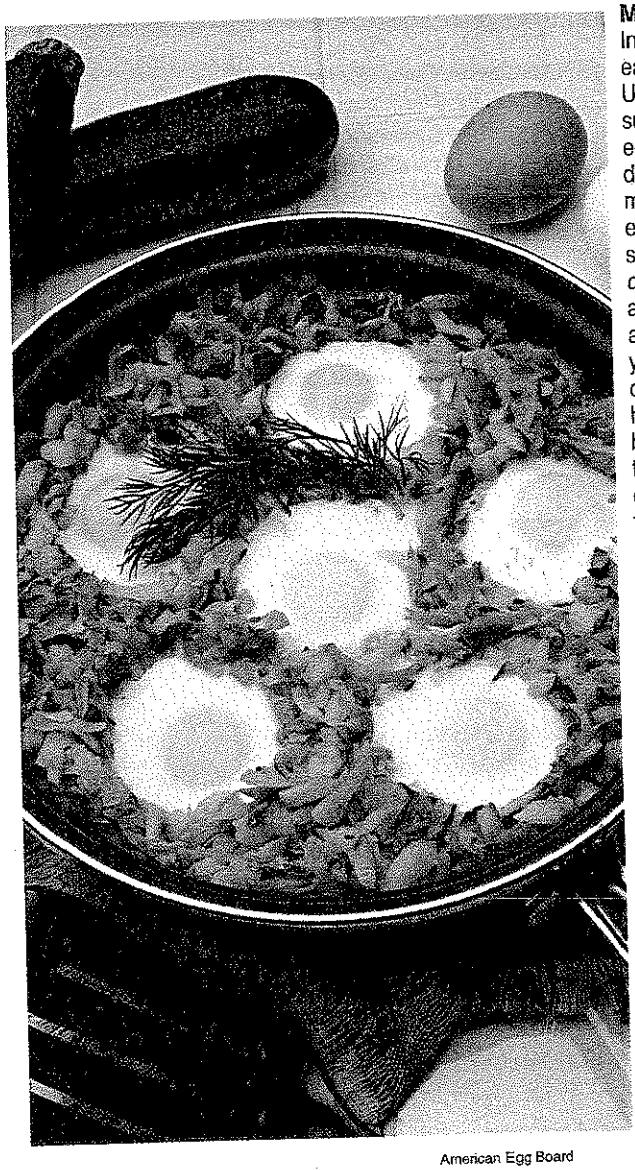
Food Science Principles of Cooking Eggs

Eggs coagulate when heated during cooking. Temperature, time, and the addition of other ingredients affect coagulation.

Egg white coagulates at a slightly lower temperature than egg yolk. The coagulation temperature of both egg white and egg yolk is below boiling. Temperatures that are too high can cause egg proteins to lose moisture, shrink, and toughen. This is why you should use low to moderate temperatures for cooking eggs. See 18-4.

Cooking time also affects coagulation. Cooking egg proteins too long can cause them to lose moisture and shrink. When both high temperatures and long cooking times are used, moisture loss and shrinkage become even greater.

The addition of other ingredients changes the coagulation temperature of eggs. This is because extra ingredients dilute the proteins found in eggs. As the concentration of egg proteins decreases, the coagulation temperature increases. For instance, eggs scrambled with added milk will coagulate at a higher temperature than eggs scrambled without milk. On the other hand, acid and salt both lower the coagulation temperature of eggs.



American Egg Board

18-4 Moderate temperatures help egg whites and yolks cook completely without allowing the egg proteins to become tough.

FYI
Besides their uses as ingredients in food products, eggs are used to propagate viruses for various vaccines. Eggs are also added to culture media, animal feed, and shampoos and cosmetics.

Integrating Math Concepts
In a recent year, each person in the United States consumed about 255 eggs. Have students calculate how many dozen eggs each person consumed. *(21.25 dozen)* The average hen lays about 260 eggs per year. Have students calculate how many hens would have been needed to lay the 79.884 billion eggs produced in the United States in a recent year. *(approximately 307,246,154 hens)*

Break It Down
Have students review the meaning of the term *emulsion*. Have students answer questions 3–7 under *Review What You Have Read*. Have them complete activity 2 under *Build Your Basic Skills* and activity 1 under *Build Your Thinking Skills* at the end of the chapter.

Online Resource
Have students visit the California Egg Commission Web site at eggcom.com/index.htm. Have each student select one of the consumer recipes found at the site and prepare it for family members. Have students report back to class on how well the recipe was received by family members. Share copies of recipes with class members.

Break It Down
Have students answer questions 8 under *Review What You Have Read* and complete activity 2 under *Build Your Thinking Skills* at the end of the chapter

Reflect
Ask students how they like eggs to be prepared.

Discuss
Ask students why adding a small amount of salt or acid will cause the egg proteins to coagulate faster. *(because salt and acid lower the coagulation temperature of eggs)*

FYI
You can also use an egg poacher to poach eggs. Break an egg into the poacher cup. If desired, place a small amount of butter or margarine in the cup. Place the cup on the rack over simmering water and cover the poacher. The eggs cook from the heat of the steam.

Methods of Cooking Eggs

You can scramble, poach, fry, bake, hard-cook, soft-cook, or microwave eggs. You can use them to prepare plain and puffy omelets, soufflés, soft and hard meringues, and stirred and baked custards, too. In all methods of cooking eggs, low to moderate temperatures and accurate cooking times are important.

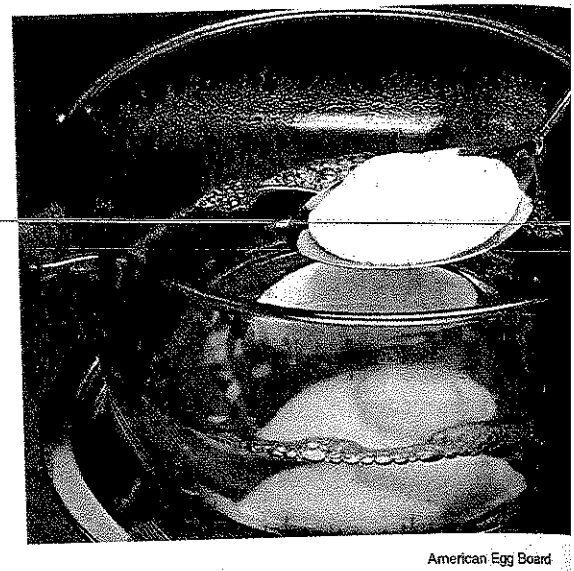
Safely cooked eggs have completely set whites and thickened yolks. Yolks do not need to be hard, but they should not be runny. Dishes made with beaten eggs are thoroughly cooked when they no longer contain any visible liquid egg. The most accurate way to test the doneness of casseroles, soufflés, and other egg dishes is with a food thermometer. These dishes should reach the safe internal temperature of 160°F (71°C).

When cooking eggs in a skillet, your pan should be moderately hot before you place the eggs in it. Add any cooking fat you will be using to your skillet before heating it. The skillet is hot enough if a drop of water sizzles when it hits the surface of the pan. Using a pan that is too cool can cause the egg white to spread too far before it sets. As soon as the eggs are in the skillet, you should turn the heat down to low. Cooking temperatures that are too high quickly toughen egg proteins.

Scrambling Eggs

To scramble an egg, break the egg into a bowl. Beat the egg with a fork or whisk until blended. For variety, you can add bits of cooked bacon or finely chopped chives to eggs before scrambling. You can also add milk, tomato juice, or other liquid. However, the amount of liquid cannot exceed the amount of protein available to thicken the mixture. Using too much liquid will cause the eggs to be watery. Use about 1 tablespoon (15 mL) of liquid per egg.

Pour the egg mixture into a lightly greased or nonstick heated skillet. When the egg begins to set, draw a bent-edged spatula across the bottom of the skillet. This will allow more of the liquid egg mixture to come in contact with the hot surface of the skillet. The egg will thicken into large, soft clumps, which are called ***coagulum.*** Gently continue drawing the spatula across the skillet until all the egg mixture has set. However, avoid constant stirring. Too much stirring will cause the coagulum to be small.



American Egg Board

18-5 *A properly prepared poached egg will have a uniform appearance with a smooth, firm egg white surrounding a thickened yolk.*

Poaching Eggs

You can poach eggs in water, milk, broth, or some other liquid. If using water, you may wish to add a small amount of salt or acid (such as vinegar). This will cause the proteins to coagulate faster and help keep the egg from spreading.

To poach an egg, break the egg into a custard cup. Slip the egg into a saucepan filled with 2 to 3 inches (5 to 7.5 cm) of simmering liquid. Cook the egg until the white is firm and the yolk is thickened. This will take about three to five minutes. Remove the egg from the cooking liquid with a slotted spoon. See 18-5.

Frying Eggs

To fry an egg, add the egg to a moderately hot skillet containing vegetable oil spray or a small amount of fat (1 teaspoon, or 5 mL, per egg). You may add a little water to the skillet, too. Cover the skillet and cook the egg until the white is completely set and the yolk begins to thicken. The steam that forms in the covered skillet will cook the upper surface of the egg. You can also cook the upper surface by gently turning the egg over.

Online Resource
Have students visit the American Egg Board Web site at aeb.org. Have each student visit the Eggcyclopedia section of the site and select a different topic to share with the class. Conclude the activity by asking each student to state something new that he or she learned from listening to the reports.

Baking Eggs

Baked eggs are also called *shirred* eggs. To bake an egg, break the egg into an individual, greased baking dish. Then put the baking dish in a shallow casserole filled with 1 inch (2.5 cm) of warm water. Bake the egg in a 350°F (175°C) oven for 12 to 18 minutes, depending on the firmness desired. Try adding variety to baked eggs by sprinkling them with finely chopped green pepper and onion or grated cheese.

Cooking Eggs in the Shell

Eggs cooked in the shell can be soft-cooked or hard-cooked. Time determines the degree of doneness.

To prepare soft-cooked eggs, place the eggs in a deep pan. Add enough cold water to come 1 inch (2.5 cm) above the eggs. Cover the pan and quickly bring the water to a boil. Immediately remove the pan from the heat. Let the eggs remain in the water for four to five minutes, depending on the desired degree of doneness.

To prepare hard-cooked eggs, use the same method used for soft-cooked eggs, but keep the eggs in the water longer. Large eggs will take about 15 minutes. Medium eggs will take only about 12 minutes. Extra large eggs may take about 18 minutes.

Immediately cool soft- and hard-cooked eggs under cold running water or place them in a bowl of ice water. Rapid cooling stops the eggs from cooking and prevents the formation of greenish rings around the yolks. A chemical reaction between iron in egg yolk and hydrogen sulfide in egg white causes this discoloration in overcooked eggs. The discoloration is harmless, but it looks unappetizing.

When soft-cooked eggs are cool enough to handle, they are ready to eat. A popular way to eat them is to place them in eggcups, small end down. Cut off the large end of the egg and eat the egg out of the shell.

When hard-cooked eggs are completely cooled, store them in the refrigerator. You can keep them for up to one week. You should not eat hard-cooked eggs, or any other perishable food, kept at room temperature for over two hours.

Good Manners Are Good Business

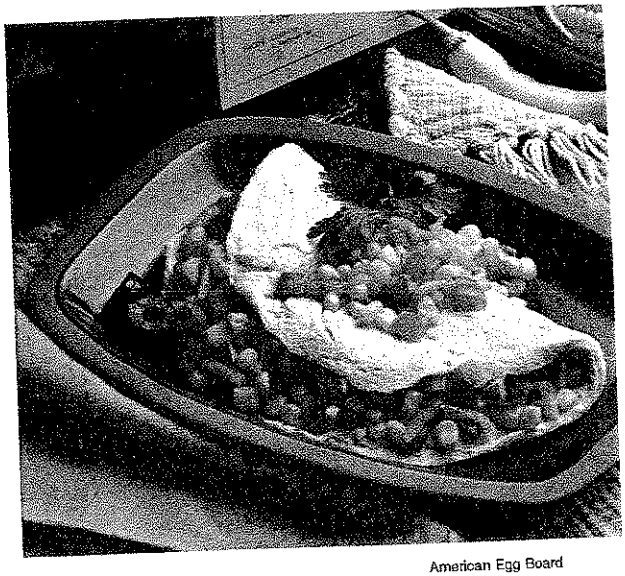
Some people like to eat their scrambled eggs with catsup. If you are one of those people, you might want to order something besides scrambled eggs at a business breakfast. Putting anything on any food that was not prepared and served with the food is considered an insult to the chef.

Microwaving Eggs

You can scramble, poach, fry, and hard-cook eggs in a microwave oven. You can also make them into plain omelets or use them to make tasty egg dishes such as quiche, 18-6. However, conventional cooking methods are best for airy egg dishes, such as puffy omelets and soufflés.

Eggs cook rapidly in a microwave oven, and they continue to cook during standing time. Overcooking toughens the protein and produces a rubbery egg. Therefore, start cooking eggs with the minimum time stated in microwave recipes. Remove eggs from the microwave oven just before they are done.

In a microwave oven, steam builds up in foods covered by a tight skin or shell. This buildup could cause these foods to explode. For



American Egg Board

18-6 Plain omelets come out moist and delicious when cooked in a microwave oven.

For Example...
Hard-cooked eggs are used to make deviled, pickled, and Scotch eggs; egg, potato, and macaroni salads; and eggs goldenrod.

Resource
Egg Dishes, Activity C, SAG. Students are to indicate whether various statements about cooking eggs are true or false.

Enrich
Ask each student to interview a waiter or cook who works the breakfast shift at a restaurant. Ask how most people order their eggs.

Think Outside the Box
Ask students what other condiments they might want to avoid using at business meals. Also ask if students agree or disagree with the statement "Putting anything on any food that was not prepared and served with the food is considered an insult to the chef."

this reason, you should remove eggs from the shell before cooking them in a microwave oven. In addition, gently puncture egg yolks with a fork or toothpick before microwaving to prevent them from bursting.

Discuss
Ask students what kinds of ingredients might be used to fill an omelet. *(cheese, onions, green peppers, ham, tomatoes, mushrooms)*

Omelets

Omelets are beaten egg mixtures that are cooked without stirring and served folded in half. Omelets can be plain (also called French) or puffy. You make both types of omelets from eggs, a small amount of liquid (usually milk or water), and seasonings. You may serve an omelet with or without a filling.

To make a plain omelet, beat together the eggs, liquid, and seasonings. Pour the mixture into a lightly greased or nonstick heated skillet or omelet pan. The edges of the egg mixture should set immediately. With a wide spatula, gently lift the cooked edges to allow the uncooked egg to run underneath. Tilting the skillet will help. The omelet is ready to fill and serve when the top has set but is still moist.

To make a puffy omelet, beat the egg whites with cream of tartar and water until stiff (but not dry) peaks form. Beat the egg yolks with salt and pepper until they are thick and lemon colored. Gently fold the beaten yolks into the beaten whites. Pour the mixture into a lightly greased ovenproof skillet that is hot enough to sizzle a drop of water. Cook the omelet slowly over medium heat until puffy, about 5 minutes. (The bottom should be lightly brown.) Place the omelet in a preheated 350°F (175°C) oven. Bake it 10 to 12 minutes, or until a knife inserted near the center comes out clean.

FYI
Bake a soufflé in a straight-sided casserole or use ramekins to make individual soufflés. Prepare the baking dish by buttering the bottom and sides. Dust the buttered surfaces with grated Parmesan cheese when making a savory soufflé. Dust the surfaces with sugar for a dessert soufflé.

Vocabulary Builder
Ask students to compare the terms *weeping* and *beading*.

Soufflés

Soufflés are fluffy baked preparations made with a starch-thickened sauce that is folded into stiffly beaten egg whites. Like puffy omelets, they use egg whites for structure. You can serve soufflés for dessert or as a main dish.

To prepare a soufflé, add beaten egg yolks to a basic white sauce. The white sauce may contain chocolate, fruit, cheese, or pureed vegetables or seafood. Gently fold the white sauce mixture into the beaten egg whites. Bake the soufflé in a 350°F (175°C) oven until puffy and golden, about 30 to 40 minutes. Serve the soufflé immediately.

American Egg Board

18-7 *A hard meringue shell filled with fresh fruit makes an elegant dessert.*

Meringues

Meringues are a fluffy, white mixture of beaten egg whites and sugar. Meringues may be soft or hard. Use soft meringues in fruit whips and as toppings on pies and other baked goods like Baked Alaska. Use hard meringues to make meringue shells, which you can fill and serve as desserts, 18-7. You can also use hard meringues to make confections, such as meringue cookies.

Make soft meringues from egg whites, cream of tartar, sugar, and flavoring. Beat the egg whites and cream of tartar to the foamy stage. Add the sugar gradually as you continue beating the egg whites to the upper limit of the soft peak stage. Rub a small amount of meringue between your thumb and forefinger, making sure you do not feel any undissolved sugar. Then beat in the flavoring.

When using a soft meringue on a pie, spread it over hot pie filling. Carefully seal the meringue to the edge of the pastry. These important steps will help minimize weeping and beading. ***Weeping*** is the layer of moisture that sometimes forms between a meringue and a pie filling. ***Beading*** appears as golden droplets on the surface of a meringue. Bake the meringue-topped pie at 350°F (175°C) until lightly browned, about 12 to 15 minutes.

You make hard meringues from the same ingredients as soft meringues. However, they

Community Interactions
Have students prepare hard-cooked eggs and color and decorate them. Students can hold an egg hunt for children in your community, perhaps at a preschool or child care center. Have students distribute food safety information to parents of the children about refrigerating dyed eggs promptly and eating the refrigerated eggs within one week. If the eggs are out of a refrigerator for more than two hours, or if some eggs get cracked or dirty during the egg hunt, tell parents that the eggs should not be eaten.

contain a higher proportion of sugar, and you beat them to the stiff peak stage. You will usually shape hard meringues with a spoon and bake them on an oiled or paper-covered baking sheet. Bake hard meringues at 225°F (105°C) for one to one and a half hours. Then turn off the oven and allow the meringues to stand in the oven with the door closed for another hour. This will produce a meringue with a crisp, dry interior.

Custards

Custards are a mixture of milk, eggs, sugar, and a flavoring that is cooked until thickened. Custards can be soft (sometimes called stirred) or baked. You might serve soft custard as a dessert sauce. You can also use it as the base for desserts like English trifle. Serve baked custard plain or with a topping of caramel, fruit, or toasted coconut. You can make bread pudding by pouring custard over bread cubes before baking.

Stir soft custard constantly as it cooks. This breaks up the coagulum as it forms, giving the custard a creamy texture. Be sure to use low heat to prevent *curdling* (the formation of lumps). Soft custard will coat a metal spoon with a thin film when it is fully cooked. Place the pan of cooked custard in a bowl of ice or cold water. Stir the custard for a few minutes to cool it before covering and storing in the refrigerator. See 18-8.

Lack of stirring causes baked custard to become firm enough to hold its shape when removed from the baking dish. Place dishes of custard in a large baking pan. Place the pan in a preheated oven. Then pour very hot water into the pan around the custard dishes. The water should come within ½ inch (1 cm) of the top of the custard. The water helps prevent the custard from overheating, which can result in *syneresis* (the leakage of liquid from a gel). Overbaked custard will have visible bubbles and leakage. To test baked custard for doneness, insert the tip of a knife near the center. If the knife comes out clean, the custard is baked.

American Egg Board

18-8 *Ripe fruit and creamy custard give this dessert a pleasing combination of textures.*

Food Science
Cooking Soft Custard, food science master 18-1, TR. Have lab groups complete the experiment as directed on the master. Students will be applying principles of cooking eggs to the preparation of soft custard.

Resource
Egg Recipes, reproducible master 18-2, TR. Have students use the recipe master to plan an egg lab. Have each lab group complete a *Market Order Sheet* (TR) and a *Time-Work Schedule* (TR). After preparing their recipe and sampling their egg product, have each lab group complete a *Lab Evaluation Sheet* (TR).

Break It Down
Have students review the meanings of the terms *coagulum, omelet, soufflé, meringue, weeping, beading,* and *custard.* Have students answer questions 9–15 under *Review What You Have Read* at the end of the chapter.

Online Resource
Have students visit the Egg Nutrition Center Web site at enc-online.org. Have each student navigate the site to find an editorial about an issue in the egg industry. Have students write letters to the editor supporting or rebutting the positions expressed in the editorials.

Chapter Review

Eggs

Resources

- *Scrambled Eggs*, Activity D, SAG. Students are to unscramble letters and use the words to complete statements about eggs.
- *Chapter 18 Study Sheet*, reproducible master 18-3, TR. Have students complete the statements as they read the chapter.
- ***Chapter Review Games CD.*** Have students play the chapter review game according to the instructions that appear on the screen.

Summary

Eggs are a nutritious, inexpensive, and versatile food. Grade AA and A are the grades of eggs most commonly sold at retail stores. Extra large, large, and medium are the most common sizes. Fresh eggs keep well in the refrigerator, but require careful handling to prevent cracking.

Eggs serve a number of functions in recipes. They are used as emulsifiers to keep oil suspended in water-based liquids. They are used as foams to add air and give structure to foods like meringues and sponge cakes. They are used to thicken puddings and sauces and to hold ingredients together in foods like meat loaf. They interfere with the formation of ice crystals in frozen desserts. Eggs also add structure, nutrition, flavor, and color to many foods.

Eggs are perishable and require careful handling and thorough cooking to protect against foodborne illness. You can use pasteurized egg substitutes in dishes that call for raw or lightly cooked eggs. These products are also good choices for people trying to limit fat and cholesterol in their diets.

You can use a number of methods to cook eggs. You can also use eggs in a variety of dishes. No matter how you prepare them, eggs require moderate cooking temperatures and carefully monitored cooking times. These factors will prevent egg proteins from shrinking and becoming tough.

Review What You Have Read

Write your answers on a separate sheet of paper.

1. How is candling used in the egg industry?
2. How long can you safely store fresh eggs in the refrigerator?
3. How does egg yolk keep the vinegar and water from separating from the oil in mayonnaise?
4. What are four factors that can affect the formation of egg white foams?
5. How should beaten eggs be added to a hot mixture? Explain why.
6. True or false. To reduce cholesterol, two egg yolks can be substituted for each whole egg in a recipe.
7. How can a recipe for an uncooked dish calling for beaten raw egg whites be prepared safely?
8. True or false. Egg yolk coagulates at a slightly lower temperature than egg white.
9. Describe the appearance of safely cooked whole eggs and beaten egg dishes.
10. Describe two basic egg preparation methods.
11. What precautions should be taken to keep eggs from exploding in a microwave oven?
12. Describe the appearance of a plain omelet that is ready to fill and serve.
13. How are soufflés similar to puffy omelets?
14. Golden droplets of moisture that sometimes appear on the surface of a meringue are called _____.
15. The leakage of liquid from baked custard is called _____.
    A. coagulum
    B. emulsion
    C. syneresis
    D. weeping

Build Your Basic Skills

1. **Science.** In a darkened room, hold an egg directly over the lens of a flashlight. Describe characteristics of the egg that you cannot see in normal room lighting.
2. **Math.** Beat the egg white of a small egg in one bowl. Beat the egg white of an extra large egg in a second bowl. Measure and compare the volume of the two egg white foams.

Build Your Thinking Skills

1. **Compare.** Beat four egg whites to the stiff peak stage. Before beating, add nothing to the first egg white. Add ⅛ teaspoon (0.5 mL) oil to the second egg white. Add ⅛ teaspoon (0.5 mL) cream of tartar to the third egg white. Add ¼ cup (50 mL) sugar to the fourth egg white. Compare volume, appearance, and required beating time of the four samples. Summarize your observations in a brief written report.
2. **Evaluate.** Beat three eggs with milk and seasonings. Divide the mixture into three equal portions. Scramble one portion over high heat. Scramble a second portion over low heat, occasionally drawing a bent-edged spatula across the bottom of the skillet. Scramble the third portion over low heat stirring constantly. Evaluate each product on the basis of appearance, tenderness and size of the coagulum, and flavor.

Apply Technology

1. Research how egg substitutes are made. Summarize your findings in a brief written report.
2. Make a poster illustrating the process used to pasteurize eggs in or out of the shell. Write on the poster why you think pasteurized eggs are of value to consumers.

Using Workplace Skills

Deborah is an egg candler for M-G Farms. She inspects eggs as they move along rollers over bright lights. The lights allow her to see the structure of the eggs and evaluate their quality. She separates the eggs by grade. Grades AA and A are sold to supermarkets. Grade B eggs are sold to food product manufacturers.

To be a successful employee, Deborah needs skill in making decisions. Put yourself in Deborah's place and answer the following questions about your need for and use of this skill:

A. What is a decision you will make every day as an egg candler?
B. How might M-G Farms be affected if you do not have adequate skills in making decisions?
C. How might consumers be affected if you do not have adequate skills in making decisions?
D. What is another skill you would need in this job? Briefly explain why this skill would be important.

Career Path
Have students reread the career descriptions of an egg pasteurizer and an egg-producing farm farmworker that appear at the beginning of the chapter. Ask students why people working in these occupations might need skill in making decisions.

Answer Key for *Review What You Have Read* questions

1. to grade eggs for quality
2. four to five weeks
3. Egg yolk acts as an emulsifying agent that surrounds the oil droplets and keeps them suspended in the water-based liquid.
4. (List four:) temperature, beating time, fat, acid, sugar
5. Quickly fold a small amount of the hot mixture into the beaten eggs. Then add the warmed eggs to the rest of the hot mixture. Warming the eggs slightly keeps them from coagulating into lumps.
6. false
7. Combine the egg whites with the sugar from the recipe in a heavy saucepan or double boiler. Cook the mixture over low heat while beating it to the soft peak stage with an electric mixer.
8. false
9. Safely cooked whole eggs have completely set whites and thickened yolks. Yolks do not need to be hard, but they should not be runny. Dishes made with beaten eggs are thoroughly cooked when they no longer contain any visible liquid egg.
10. (Describe two. Student response.)
11. Remove eggs from the shell and gently puncture yolks with a fork or toothpick.
12. The top has set but is still moist.
13. They both use egg whites for structure.
14. beading
15. C