

Chapter 19

Meat

Career Path

Ask students what aspects of the occupations of barbecue cook, meat cutter, and livestock sales representative interest them.

Vocabulary Builder

Ask students which of the *Terms to Know* they already know. Have them look up the terms in the glossary to see if their definitions match glossary definitions.

Barbecue Cook

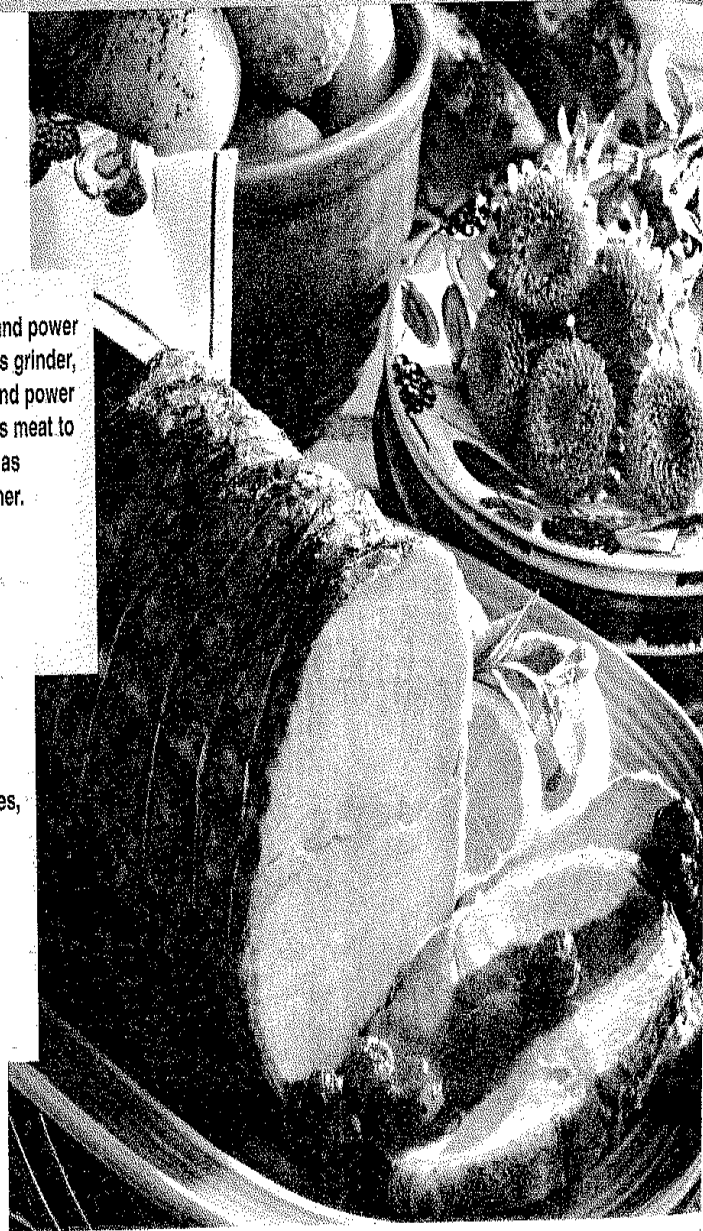
Prepares, seasons, and barbecues pork, beef, and other types of meat.

Meat Cutter

Using hand tools and power equipment, such as grinder, cubing machine, and power saw, cuts and trims meat to size for display or as ordered by customer.

Livestock Sales Representative

Sells cattle, hogs, and other livestock to farmers, packinghouses, and other purchasers. Reviews market information and inspects livestock to determine value.



courtesy of National Pork Board

Terms to Know

meat
beef
wholesale cut
retail cut
veal
pork
lamb
variety meats
marbling
elastin
collagen
coagulate
cooking losses

Objectives

After studying this chapter, you will be able to

- list factors affecting the selection of meats.
- describe how to properly store meats to maintain their quality.
- describe the principles and methods of cooking meat.
- prepare meats by moist and dry cooking methods.

Many meal managers choose the meat course first when planning menus. The meat you prepare should be tender, flavorful, and attractive.

What Is Meat?

Meat is the edible portions of mammals. It contains muscle, fat, bone, connective tissue, and water. The major meat-producing animals in the United States are cattle, swine, and sheep.

Nutritional Value of Meat

You need two to three daily servings from the meat and beans group of the Food Guide Pyramid. These servings should total only the equivalent of 5 to 7 ounces (140 to 190 g) of lean, cooked meat. All meat and meat products contain proteins essential for building and repairing tissue. Meats are also good sources of iron, phosphorus, copper, thiamin, riboflavin, and niacin.

The amount of fat meat contributes to the diet depends on the kind and quality of the meat. Ground meats are generally higher in fat than all other cuts. Fat gives meat flavor and appeal. However, experts recommend that people in the United States limit the percentage of calories they get from fats in their diet. These experts especially stress limiting saturated fats, which occur in larger amounts in meat cuts that are less lean.

Following a few tips can help you limit fat and enjoy meat as part of a healthful diet. Choose lean cuts, such as the round and loin sections of beef and the loin and leg sections of pork. Use cooking methods like broiling and grilling, which allow fat to drip away during cooking. Use nonstick pans when frying and browning meat to eliminate the need for added fat during cooking. Skim the fat from the surface of chilled meat soups and stocks.

Beef

Beef comes from mature cattle over 12 months of age. It has a distinctive flavor and firm texture. Beef is usually bright, cherry red in color with creamy white fat.

Beef carcasses are classified according to age and sex. Animals sold for meat are most often steers and heifers. **Steers** are young,

Q: Shouldn't people who are trying to limit fat and cholesterol in their diets stop eating red meat?

A: Limiting fats and cholesterol does not mean you have to eliminate meat from your diet. However, you should limit portion sizes to three-ounce (85-g) cooked servings (four ounces, 113 g, of boneless raw meat). A three-ounce (85-g) serving is about the size of a deck of playing cards.

castrated males. **Heifers** are young females who have never had a calf.

Of all animals used for food, the beef carcass is the largest. The carcass first is cut lengthwise through the backbone into halves. The two halves are called **sides**. The sides are cut into **quarters** and then into smaller pieces, called **wholesale cuts**, for easier handling. Meat cutters divide the wholesale cuts into still smaller pieces, called **retail cuts**, at the grocery store.

Ground Beef

Some people incorrectly call ground beef, hamburger. **Ground beef** contains only the fat originally attached to the meat before grinding. **Hamburger** can have extra fat added to it during grinding. The fat content of neither ground beef nor hamburger can be more than 30 percent of the total weight. However, you can buy ground beef that is leaner. The label lists the percentage lean.

Veal

Veal is very young beef. It comes from cattle that are less than three months of age. Because the animals are so young, little fat has developed. Thus, most veal is lean. Veal also has quite a bit of connective tissue, but it is still considered to be tender. Veal has a light pink color and a delicate flavor. See 19-1.

A veal carcass is next to beef in size, but it is still much smaller. It does not require splitting for shipment. Because the wholesale cuts are smaller than beef, **retail cuts** differ somewhat. For example, the loin and rib sections of beef

Vocabulary

Builder

The definition of **meat** also includes the edible portions of fowl. This chapter focuses on the meat of mammals. The meat of fowl is discussed in Chapter 20.

Discuss

Ask students how vegetarians can get the nutrients supplied by meats in their diets. (See *nutrient tables in Chapter 2, "Nutritional Needs."*)

For Example...

Lean cuts of beef include eye of round; tip round roast; top round, top loin, sirloin, and tenderloin steaks; and arm pot roast. Lean cuts of pork include top loin and sirloin roast; top loin, loin center, and loin rib chops; shoulder blade steak; and pork tenderloin.

Enrich

Invite a health expert to speak to the class about the dangers of eating undercooked ground meat due to the increased risk of *E. coli* infection.

Online Resource

Have students visit the American Meat Institute Web site at meatami.org. Have each student find a food safety topic to use as the basis for a two-page written report.

Enrich

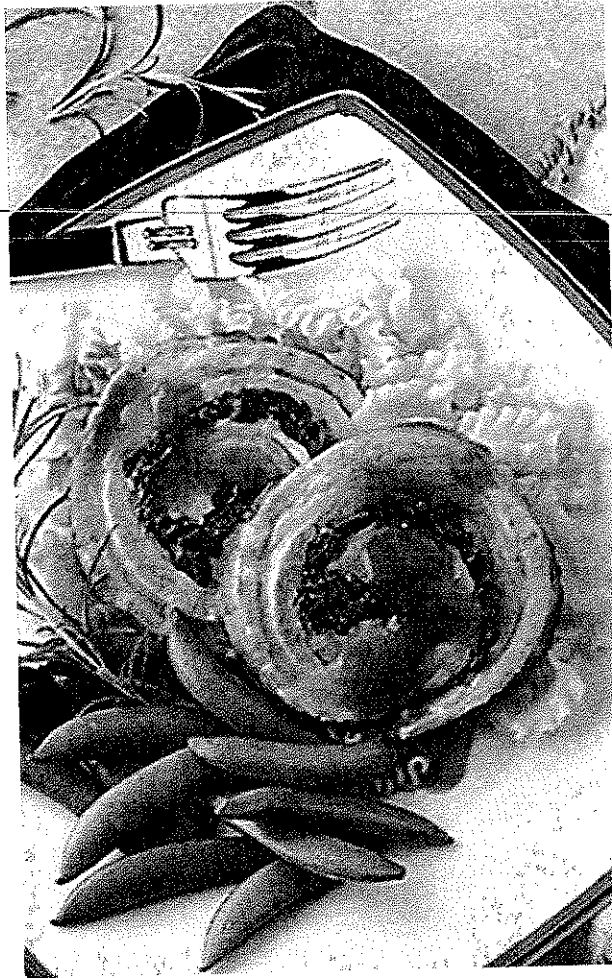
Have students investigate and compare the fat content of bacon with that of Canadian bacon.

Break It Down

Have students review the meanings of the terms *meat, beef, whole-sale cut, retail cut, veal, pork, lamb,* and *variety meats*. Have students answer questions 1–5 under *Review What You Have Read* at the end of the chapter.

Resource

The Meat Case, Activity A, SAG. Students are to answer questions related to types of meat, inspection, and grading.



courtesy of National Cattlemen's Beef Association and Cattlemen's Beef Board

19-1 Lean, tender veal has a mild flavor that is enhanced by this olive-mushroom filling.

are used for steaks. Those of veal are used for chops.

Pork

Pork is the meat of swine. Most pork comes from animals that are 7 to 12 months old. Because the animals are so young, most pork is tender. The meat is grayish-pink to light rose in color.

The pork carcass is small enough to be shipped whole, but it is usually split. Pork can be fresh cured or smoked.

Meat packing plants process many pork products. *Ham* comes from the pork leg. It is cured and usually smoked. You can purchase fully cooked canned hams. You can also buy hams that require cooking, which may or may

not include the skin and bone. *Bacon* is smoked pork belly meat. You can buy it as a slab, which you slice yourself, or as pre-cut slices. *Canadian bacon* is made from boneless pork loins.

Lamb

Lamb is the meat of sheep less than one year old. It is tender with a delicate flavor. Fresh lamb is pinkish-red in color with white fat. Older animals are marketed as *yearling lamb* (one to two years of age) and *mutton* (over two years of age). Retail outlets do not sell much mutton. It has a stronger flavor than lamb and is less tender.

Lamb is the smallest animal used for meat. Lamb carcasses can be shipped whole. Lamb cuts are similar to veal cuts, but they are smaller in size.

Variety Meats

Variety meats are the edible parts of the animal other than the muscles. Liver, heart, kidney, tongue, and *sweetbreads* (thymus glands) are popular variety meats. Other variety meats include beef *tripe* (stomach lining); brains; *chitterlings* (cleaned intestines); and pork jowls, tail, feet, ears, and snout. Variety meats are usually inexpensive and are rich sources of many vitamins and minerals. For instance, liver is very high in iron.

Inspection and Grading of Meat

Federal inspectors must examine all meat and meat products shipped across state lines. They inspect both the live animal and the carcass. A round purple inspection stamp is placed on all wholesale cuts to indicate the meat is wholesome. This stamp also assures buyers the plant and processing conditions were sanitary. State-supported programs handle the inspection of meat processed and sold within a state.

Animal carcasses may be voluntarily graded for yield and quality. *Yield grades* help wholesalers identify which carcasses will produce the most edible meat per pound. *Quality grades* assure consumers meat has met set standards that predict taste appeal. The USDA oversees the grading program, 19-2.

Quality grades for beef are based on marbling, maturity, texture, and appearance.

Online Resource

Have students visit the National Pork Board Web site at otherwhitemeat.com. Have them navigate the site to find information about specific cuts of meat. Ask students to share their findings in class.

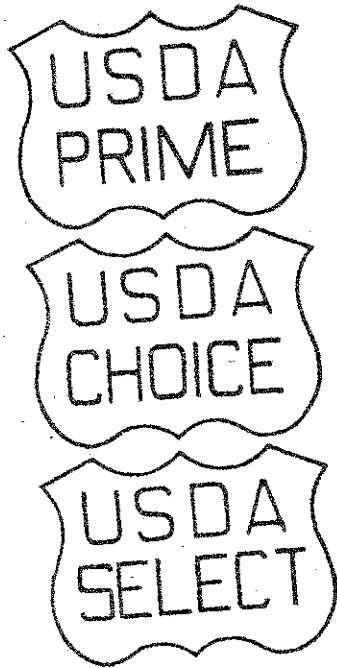
Marbling refers to the flecks of fat throughout the lean. Cuts with more marbling are juicy, flavorful, and tender. Higher quality grades go to cuts with more marbling and fine muscle texture. Meat from younger animals that has characteristic color also qualifies for higher quality grades.

The most common grades of beef sold in retail stores are Choice and Select. *Choice meats* are high quality with good marbling. *Select meats* are leaner than Choice meats, and they usually cost less. Restaurants and hotels often offer *Prime meats* on their menus. Prime cuts have received the highest grade.

The standards used for grading veal, pork, and lamb differ somewhat from those used to grade beef. However, the highest grades are given to carcasses that are expected to provide the tastiest meat.

Selecting Meat

Meats are costly food items. Learning how to judge quality factors and identify meat cuts can help you make wise purchases.



19-2 The USDA grade shield assures consumers meat has met certain standards of quality.

Online Resource

Have students visit American Lamb Council Web site at lambchef.com. Have each student select one of the frequently asked questions or one of the terms from the glossary of lamb terms to learn more about lamb as a meat product.

Characteristics of the Fat

Color, firmness, and location of fat affect meat quality. Quality meats will have firm to medium-firm, creamy white fat. Fat that is yellow and coarse is a sign of poor quality.

Marbling indicates tenderness in a cut of meat. Although more marbling means more tenderness, it also means more total fat, saturated fat, cholesterol, and calories. Cooking can tenderize cuts with less marbling. Therefore, to follow the Dietary Guidelines, you should choose leaner cuts most often. Save cuts with more marbling for special occasions.

Location of the Meat in the Animal

Bone shapes can tell you the part of an animal from which meat was cut. Cuts from an animal's short loin, or back, region have T-shaped bones. Flat bones and wedge bones are cross sections of hip bones. Round bones appear in arm and leg cuts. Blade bones come in cuts from the shoulder area of an animal.

The location of muscle tissue in an animal indicates the tenderness of the meat cut the tissue becomes. Rib and loin muscles are quite tender because they lie along the backbone where they receive little exercise. Leg and shoulder muscles are less tender because the animal uses them more. See 19-3.

The tenderness of a meat cut gives you a clue about how to cook it. You can cook tender cuts of meat by dry heat methods, such as broiling or roasting. You can identify these cuts by a T-bone, rib bone, flat bone, or wedge bone. Sirloin and porterhouse steaks, pork and lamb loin chops, and beef and pork rib roasts are examples of tender cuts of meat. Lamb and pork cuts with leg bones are also tender enough to cook with dry heat.

You may prefer to cook less tender cuts of meat by moist heat methods, such as stewing or braising. All cuts containing a blade bone, arm bone, or breast bone are less tender cuts of meat. Beef cuts with a leg bone are also less tender. Examples of these cuts include round steak, rump roast, and shoulder steak.

Meat Labeling

To help consumers with meat selection, most retail stores follow a labeling system. Meat

receives

Meat that now receives the Select grade was once marketed as Good. Ask students which of these terms appeals to them more and why.

FYI

In addition to Prime, Choice, and Select, beef quality grades include Standard, Commercial, Utility, Cutter, and Canner. These lower grades of beef are less tender and are often used in manufactured meat products. Quality grades for veal are Prime, Choice, Good, Standard, Utility, and Cull. Pork grades are Acceptable and Utility. Lamb grades are Prime, Choice, Good, Utility, and Cull.

Break It Down

Have students review the meaning of the term *marbling*. Have students answer question 6 under *Review What You Have Read*. Have them complete activity 1 under *Build Your Basic Skills* and activity 2 under *Build Your Thinking Skills* at the end of the chapter.

FYI
 Choosing lean cuts of meat is easier than it was in days past. Breeders now use scientific breeding techniques and feed livestock monitored diets to produce leaner meats.

Activity
 Bring in food models or actual samples of various cuts of meat. See how many cuts students can identify based on bone shape.

Resource
 Tough or Tender? Activity B, SAG. Students are to complete a chart identifying the location of meat in the animal, cut, and preferred cooking method.

Beef

• RETAIL CUTS •
 WHERE THEY COME FROM
 HOW TO COOK THEM

ROUND

Round Steak
Braise, Panfry

Top Round Roast
Roast

Top Round Steak
Broil, Panbroil, Panfry

Boneless Rump Roast
Roast, Braise

Bottom Round Roast
Braise, Roast

Tip Roast, Cap Off
Roast, Braise

Eye Round Roast
Braise, Roast

Tip Steak
Broil, Panbroil, Panfry

SHORT LOIN

Boneless Top Loin Steak
Broil, Panbroil, Panfry

T-Bone Steak
Broil, Panbroil, Panfry

Porterhouse Steak
Broil, Panbroil, Panfry

Tenderloin Roast
Roast, Broil

Tenderloin Steak
Broil, Panbroil, Panfry

RIB

Rib Roast, Large End
Roast

Rib Roast, Small End
Roast

Rib Steak, Small End
Broil, Panbroil, Panfry

Rib Eye Roast
Roast

Rib Eye Steak
Broil, Panbroil, Panfry

Back Ribs
Braise, Cook in Liquid, Roast

SIRLOIN

Sirloin Steak, Flat Bone
Broil, Panbroil, Panfry

Sirloin Steak, Round Bone
Broil, Panbroil, Panfry

Top Sirloin Steak
Broil, Panbroil, Panfry

CHUCK

Chuck Eye Roast
Braise, Roast

Boneless Top Blade Steak
Braise, Panfry

Arm Pot Roast
Braise

Boneless Shoulder Pot Roast
Braise

Cross Rib Pot Roast
Braise

Mock Tender
Braise

Blade Roast
Braise

Under Blade Pot Roast
Braise, Roast

Short Ribs
Braise, Cook in Liquid

7-Bone Pot Roast
Braise

Flanken-Style Ribs
Braise, Cook in Liquid

FLANK & SHORT PLATE

Flank Steak
Broil, Braise, Panfry

Flank Steak Rolls
Braise, Broil, Panbroil, Panfry

Skirt Steak
Braise, Broil, Panbroil, Panfry

FORE SHANK & BRISKET

Shank Cross Cut
Braise, Cook in Liquid

Brisket, Whole
Braise, Cook in Liquid

Comed Brisket, Point Half
Braise, Cook in Liquid

Brisket, Flat Half
Braise

OTHER CUTS

Ground Beef
Broil, Panfry, Panbroil, Roast (Bake)

Cubed Steak
Panfry, Braise

Beef for Stew
Braise, Cook in Liquid

Cubes for Kabobs
Broil, Braise

THIS CHART APPROVED BY
 NATIONAL LIVE STOCK & MEAT BOARD

courtesy of National Cattlemen's Beef Association and Cattlemen's Beef Board

19-3 The part of the animal from which meat comes indicates how tender the meat is and how to cook it.

Community Interactions

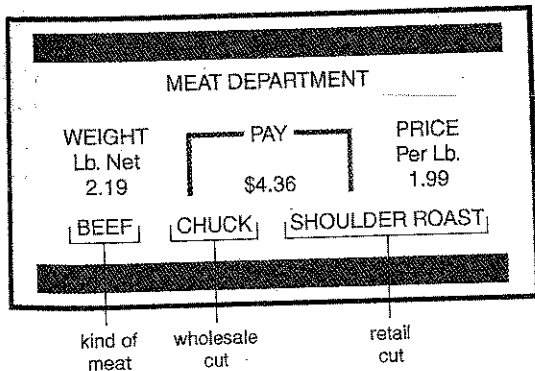
Have students create a pamphlet titled "Lean Is Keen," identifying the leanest cuts of meat. The pamphlet should also list tips for using moderate meat portions in a diet focused mostly on grains, vegetables, and fruits. Place stacks of pamphlets in your local library or community center.

Q: Isn't eating a high-protein diet that includes a lot of meat a good way to build muscle tissue?

A: Amino acids from proteins are needed to build muscle tissue. However, eating more protein will not make your muscles bigger. Eating a diet that contains too much meat may supply excess calories and fat, which could lead to weight gain. Excess protein in the diet can also put a strain on the kidneys and may increase calcium loss from bone tissue.

names on labels follow a three-part format. The kind of meat appears first. This might be *beef*. Next is the name of the wholesale cut. It tells you the part of the animal from which the cut came. *Chuck* is an example of a beef wholesale cut. Third is the name of the retail cut. It tells you from what part of the wholesale cut the meat comes. A *shoulder roast* is an example of a beef retail cut. Using this system, the cut described would be a *Beef Chuck Shoulder Roast*. See 19-4.

The label also lists the net weight of the meat, the price per pound (kilogram), and the price you pay. This information lets you compare shop more easily.



19-4 Standard three-part names on meat labels help consumers identify cuts.

Deciding How Much Meat to Buy

The amount of meat you need to buy depends on several factors. The number of people you will serve and the amount of bone in the meat will affect your purchase. You will also have to keep in mind whether or not you want to have leftovers.

All meat is sold by the pound (kilogram). You need to know how many people 1 pound (0.45 kg) of meat will serve. Boneless meat will serve more people per pound (0.45 kg) than meat with bones. See 19-5.

To determine how much to buy, multiply the amount of meat per serving by the number of people being served. Then add the amount of leftover meat you plan to serve later.

Cost of Meat per Serving

The cost per serving of meat depends partly on the tenderness of the meat. Usually, tender cuts cost more than less tender cuts. That is why sirloin steak costs more than round steak.

The amount of waste in a meat cut also affects the cost per serving. Meat with bones often is priced lower per pound (0.45 kg) than boneless cuts. For example, a bone-in rump roast usually costs less per pound (0.45 kg) than a boneless rump roast.

Meat extenders like dried beans and rice can stretch meat dollars. For instance, ham will go farther when mixed with nutritious navy beans than when served alone.

Storing Meat

Store sausage and fresh, cured and smoked, and ready-to-serve meats (cold cuts) in the refrigerator for use within a few days. You

Amount of Bone	Amount to Buy per Serving
Boneless	1/4 to 1/3 lb (115 to 150 g)
Small bone	1/3 to 1/2 lb (150 to 225 g)
Many bones	1/2 to 3/4 lb (225 to 340 g)

19-5 Use this chart as a rough guide when determining how much meat to buy per serving.

Resources

- *Wrapped in Information*, color transparency CT-19, TR. Use the transparency to introduce students to the types of information found on meat packages.
- *Safe Food Handling Label*, transparency master 19-2, TR. Use the transparency to point out to students the information found on perishable meat and poultry products.

FYI

The retail meat labeling system was developed under the Uniform Retail Meat Identity Standards (URMIS) program. More than 300 standard names are used nationwide to identify retail meat cuts.

Activity

Ask students to identify the three parts of several standard names for meat cuts.

Integrating Math Concepts

Have students use Table 19-5 to calculate how much meat they would buy in each of the following situations: ground beef for six people, pork rib chops for four people, beef short ribs for five people.

Interdisciplinary Connections

Incorporate math concepts into your meat lesson by buying a bone-in meat cut. Tell students the weight, unit cost, and total cost listed on the label. Carefully trim the meat from the bone. Ask a student volunteer to separately weigh the lean and bone portions. Have the class calculate the percentage of waste in the cut you bought. Then have students figure the cost of the waste.

Resource

Buying and Storing Meat, Activity C, SAG. Students are to complete activities about meat labels, buying meat, and storing meat.

Break It Down

Have students answer questions 7-9 under *Review What You Have Read* and complete activity 2 under *Build Your Basic Skills* at the end of the chapter.

FYI

An advantage of marinating when preparing meat for grilling is that it reduces the formation of carcinogens. However, it is important to use a thin marinade. Thick sauces, such as commercial barbecue sauce, have been found to increase the formation of harmful substances on grilled meat.

should also refrigerate canned hams until ready for use unless the label says otherwise. Store meats in the meat storage compartment or the coldest part of the refrigerator. The temperature of the refrigerator should be 40°F (5°C) or lower. You can refrigerate prepackaged meats in their original wrappers. After cooking meats, store them in a tightly covered container in the refrigerator.


Freeze meats for longer storage. (You should not freeze canned hams.) The temperature in the freezer should remain at 0°F (-18°C) or colder for maximum keeping quality. To store meats in the freezer, you should rewrap them in moistureproof and vaporproof paper. Label each package with the date and the name and weight of the cut. Be sure to use meats within recommended storage times. See 19-6.

meat's flavor and makes it easier to digest. Cooking also makes some meats more tender.

Remember that meat consists of muscle tissue, connective tissue, fat, and bone. Connective tissue holds together fibers in the muscle tissues. The connective tissue contains two proteins: elastin and collagen. **Elastin** is very tough and elastic, and cooking cannot soften it. **Collagen** is also tough and elastic, but cooking can soften and tenderize it.

Some meat cuts have more collagen than others. Meat cuts with little collagen are tender. Cuts with a lot of collagen are less tender.

You can use certain food preparation techniques to break down connective tissue in meat before cooking. Elastin can be broken down mechanically or chemically. Pounding, sometimes done to round steak, and grinding, done to ground beef, are two mechanical methods of breaking down elastin. Commercial meat tenderizers can soften collagen chemically. These products contain enzymes that break down the tissue. Marinating meat can also soften collagen chemically. Marinating involves soaking meat in a solution called a *marinade*. The marinade contains an acid, such as vinegar or tomato juice, that helps tenderize the connective tissue. See 19-7.



Food Science

Principles of Cooking Meat

Cooking meat destroys harmful bacteria that can be present in raw meat. Cooking improves

Storage Times for Meat	
Refrigerated Storage	
Type of Meat	Time
Fresh meat cuts	3-4 days
Ground meats	1-2 days
Variety meats	1-2 days
Leftover cooked meats	3 days
Freezer Storage	
Luncheon meats, hot dogs	2 months
Ham	2 months
Ground meats	3 months
Pork cuts	6 months
Lamb	9 months
Beef	12 months

19-6 Keep fresh meat safe to eat by cooking or freezing it within a few days of purchase. Date frozen meat and use it within recommended storage times for best quality.

Interdisciplinary Connections

As a prelude to your study of food science principles of cooking meat, invite a chemistry teacher to speak to your class about the denaturation of proteins. Incorporate points from this discussion into your coverage of the effects of marinades (acids) and heat on meat protein.

During cooking, heat **coagulates** (thickens into a mass) the proteins in the muscle fibers. It also softens the collagen in the connective tissue. You need low temperatures and careful timing when cooking meats. Cooking meats at too high a temperature or for too long a time will make them tough and dry. (Meat cuts cooked in liquid will fall apart.) This is due to overcoagulation of the proteins.

Controlling Temperature When Cooking Meat

Temperature control is a key principle to follow when cooking meat. You need to note the cooking temperature and the internal temperature of the meat.

Using too high a cooking temperature can result in excessive cooking losses. **Cooking losses** include fat, water, and other volatile (easily vaporized) substances that evaporate from the surface of the meat. Some of the cooking losses are retained in the pan drippings or cooking liquid. However, loss of these substances causes meat to shrink during cooking, decreasing in size and weight.

Cooking losses are important because they can affect the appearance and eating quality of meat. Meat cooked at too high a temperature can develop a hard crust. This can make carving and eating difficult. Excessive cooking losses can also cause meat to be tough and dry.

Cooking losses can even affect the number of servings meat will provide. For instance, you can expect a 6-pound (2.6 kg) bone-in roast to provide about 15 servings. However, excessive cooking losses could reduce the number of servings by two or more.

Low temperatures will keep cooking losses to a minimum. Meat will be juicier, more flavorful, and easier to carve. Cleanup will be easier because less fat will have spattered on the oven walls or burned onto the pan. Although low cooking temperatures have these pluses,

Be a Clever Consumer

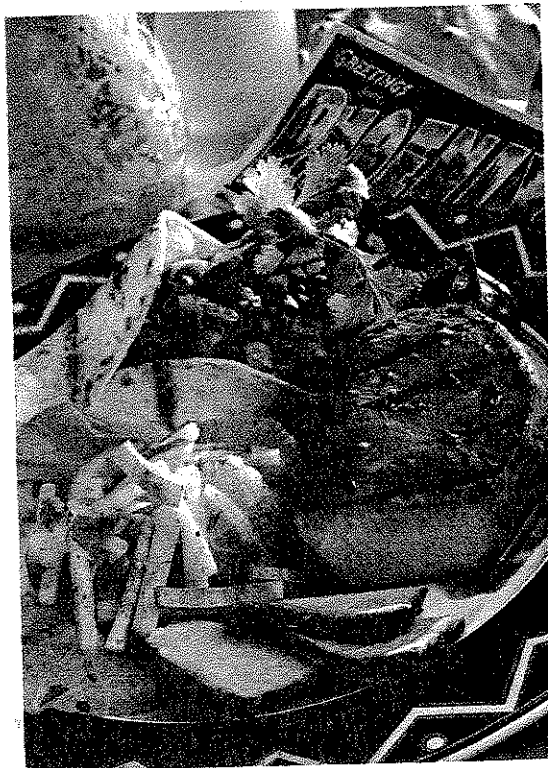
Compare meat prices on a cost per serving basis. Sometimes you will find more costly boneless cuts are a better buy.

Boneless pork chops may cost \$3.99 a pound (\$8.78 a kg), while center cut chops cost \$3.29 a pound (\$7.24 a kg). A pound of boneless chops will give you about four servings at \$1.00 a serving. A pound of center cut chops will give you only two and a half servings at \$1.32 a serving. Although the center cut chops cost less per pound, much of what you are buying is inedible bone. Therefore, the center cut chops end up costing \$.32 a serving more than the boneless chops.

you should not cook meat at temperatures below 325°F (165°C). Temperatures lower than this may allow bacteria to grow before meat has finished cooking.

The second type of temperature you need to be aware of when cooking meat is the internal temperature of the meat. The type of meat and the desired degree of doneness determine the correct internal temperature. Overcooked meat is cooked to an internal temperature that is too

high. Such meat has more cooking losses than meat cooked to the correct temperature. See 19-8.



courtesy of National Pork Board

19-7 Besides softening connective tissue, marinades have the advantage of adding flavor to meat dishes.

Discuss

Ask students why, besides tenderizing, they might want to marinate meat before cooking. (to add flavor)

Food Science

Evaluating Cooking Losses, food science master 19-1, TR. This experiment is designed to be completed over a two-day period. On the first day, students will record weights and prepare roasts for cooking. On the second day, you will place roasts in 325° and 450°F ovens and cook them to the medium stage (160°F) before class. Students will then calculate and compare cooking losses due to evaporation and drippings of roasts cooked at different temperatures.

Reflect

Ask students to identify the degree of doneness to which they and their family members prefer their meat to be cooked.

Think Outside the Box

Ask students what inedible portions of meat other than bone are included in the weight on which the cost is based. Ask them to explain what functions, if any, these portions play in the cooking process.

Discuss

● Ask students why the probe of a meat thermometer should not touch bone, fat, or gristle. (These components will not give accurate readings of the internal temperature in edible portions of the meat.)

● Ask students what factors affect cooking time when preparing meat. (cooking temperature, size and shape of meat cut, desired degree of doneness)

Break It Down

Have students review the meanings of the terms *elastin*, *collagen*, *coagulate*, and *cooking losses*. Have students answer questions 10–12 under *Review What You Have Read* and complete activity 1 under *Build Your Thinking Skills* at the end of the chapter.

Recommended Internal Temperatures for Meat

Medium rare	145°F (65°C)
Medium	160°F (70°C)
Well done	170°F (75°C)

19-8 Meat is moist and flavorful when it has been cooked to the recommended temperature.

The only accurate way to determine the internal temperature of meat is to use a meat thermometer. Insert the thermometer into the thickest part of the muscle. Make sure the probe is not touching bone, fat, or gristle. Check the temperature of uneven cuts in several places. Insert the probe sideways into thin cuts, such as chops and meat patties.

Preventing foodborne illness is also a key reason to be aware of internal temperatures when cooking meat. Thorough cooking kills harmful bacteria. You cannot rely on the color of cooked meat to tell you if the meat has reached a safe internal temperature.

Controlling Time When Cooking Meat

The total time you cook a cut of meat affects its appearance and eating quality just as temperature does. Several factors affect cooking time.

One factor that affects cooking time is cooking temperature. Higher temperatures result in shorter cooking times. Lower temperatures result in longer cooking times. Changing the cooking temperature by just a few degrees can affect cooking time. For instance, suppose you are broiling a steak and open the broiler door every few minutes to check it. Each time you open the door, cool air enters the broiler compartment. This reduces the cooking temperature and will cause the steak to take longer to cook.

The size and shape of the cut of meat are factors that affect cooking time. Large cuts of meat need longer cooking times than small cuts. However, large cuts take fewer minutes *per pound* to cook than small cuts. A rolled rib

roast will take longer to cook than a standing rib roast because the meat is more compact.

The desired degree of doneness is another factor that affects cooking time. The cooking time for rare beef is less than for well-done beef. The more well done the meat is to be, the longer it will take to cook.

Methods of Cooking Meat

You can use variations of six methods for cooking meat: roasting, broiling, panbroiling, frying, braising, and cooking in liquid. Consider the tenderness of the meat and its size and thickness as well as your taste preferences when choosing a cooking method. Roasting, broiling, grilling, panbroiling, and frying are *dry cooking methods*. Use them for tender cuts of meat, such as steaks and rib roasts. Braising and cooking in liquid are *moist cooking methods*. Use them for less tender cuts of meat, such as chuck roasts and corned beef brisket.

Cooking Meat Safely

Meats are often identified as the source of bacteria that cause foodborne illness. Most cases of foodborne illness result from improper food handling. Using care when buying, storing, cooking, serving, and reheating foods will help you avoid illness. Review the food handling precautions outlined in Chapter 6. In addition,

be aware of the following guidelines when cooking meat:

- Store meats at or below 40°F (5°C).
- Cook or freeze refrigerated meats within recommended time frames (1 to 2 days for ground meats, 3 to 4 days for nonground products, 3 days for leftovers).
- Wash your hands for 20 seconds with hot, soapy water before you begin cooking. Wash hands again after handling raw meat.
- Thoroughly wash cutting boards and utensils used for raw meat before using them to prepare raw vegetables or cooked meat.

Healthy Living

One of the most significant ways you can reduce the fat content of meats is to trim all visible fat. This can reduce the total fat content by about 50 percent. Trimming meat before cooking results in the greatest fat reduction. This prevents fat from melting into the meat during cooking.

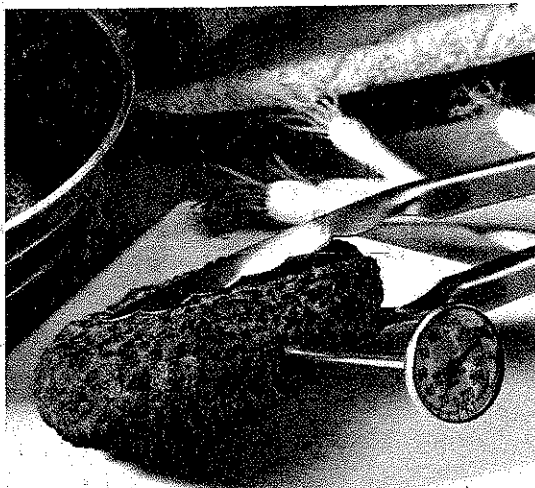
Think Outside the Box

Ask students why limiting fat intake is important to good health. Ask what other techniques can help reduce fat when preparing meat. Ask what steps students can take when selecting and preparing other foods to limit total fat and saturated fat in their diets.

- Marinate meat in the refrigerator, not at room temperature.
- Discard marinade used for raw meat, or bring it to a rolling boil for 1 minute before using it on cooked meat.
- Brush sauces only on cooked surfaces of meat.
- Do not set the oven below 325°F (165°C) when cooking meats.
- Use a thermometer to make sure meat has reached a safe internal temperature. Cook ground meats to an internal temperature of 160°F (70°C) and nonground products to at least 145°F (65°C). See 19-9.
- Reheat leftover meats to an internal temperature of 165°F (75°C).
- Be sure to wash the probe of your meat thermometer in hot, soapy water after each use. Do not reinsert a dirty thermometer into a food or use it to check another food.

Roasting Meat

Roasting is recommended for large, tender cuts of meat. For best results when roasting, place meat with the fat side up on a rack in a large, shallow pan. The fat bastes the meat during cooking, and the rack holds the meat out of the drippings. Season meat with salt



courtesy of National Cattlemen's Beef Association and Cattlemen's Beef Board

19-9 Insert an instant-read thermometer into the side of a ground meat patty to be sure the meat has reached the safe temperature of 160°F (70°C).

and pepper, if desired. Insert a meat thermometer into the thickest part of the muscle, without having the tip touching bone or fat. Roast the meat in a slow oven (325°F to 350°F, 165°C to 180°C), uncovered, until it reaches the desired degree of doneness. (Roast smaller cuts of meat at the higher temperature and larger cuts at the lower temperature.)

Allowing a roast to stand for 10 to 15 minutes after taking it from the oven makes it easier to carve. As the roast stands, it will continue to cook. For this reason, you should take the roast from the oven when it is about 5°F (3°C) below the desired internal temperature.

Broiling Meat

You can broil tender beefsteaks, lamb and pork chops, ham slices, ground beef, and ground lamb. Steaks and chops that are too thin will dry out before they are thoroughly cooked. Therefore, these cuts should be at least $\frac{3}{4}$ inch (2.3 cm) thick for broiling. Ham slices should be at least $\frac{1}{2}$ inch (1.5 cm) thick.

Broiling is done under a direct flame in gas broilers and under the direct heating element in electric broilers. The closer the meat is to the heat source, the shorter the cooking time will be. Place thick cuts of meat farther away from the heat than thin cuts. Place pork far enough away so the meat will not dry out before it is thoroughly cooked. See 19-10.

For best results when broiling meat, place meat on a cold broiler pan. Adjust the broiler rack to the desired distance from the heat source. Broil the top side of the meat until it is brown. (It should be about half cooked at this point.) Turn the meat and season if desired. (You should not salt meats before broiling because salt draws juices from the meat. You should not salt cured meats at all.) Broil the second side until brown.

Time charts can help you determine the correct cooking time when broiling. They are available in basic cookbooks. Use an instant-read thermometer to check the internal temperature of the meat toward the end of the broiling time. This will help you evaluate the degree of doneness. It will also assure you the meat has reached a safe internal temperature. You should cook pork chops and ground meats to the well-done stage.

Discuss

• Ask students to identify the reason behind each of the guidelines listed for cooking meat safely. (to prevent contamination that could cause food-borne illness)

• Ask students why they would not want to leave a roast in the oven until it reaches the desired internal temperature. (It will become overcooked.)

Reflect

Ask students if they like hamburgers cooked to the well-done stage. Ask if they would choose well-done burgers for food safety reasons even if they prefer their burgers to be less well done.

Interdisciplinary Connections

Discuss the importance of checking the internal temperature of meat with a thermometer. Then ask a science teacher to help students design and conduct an experiment illustrating that color is an unreliable indicator of meat doneness.

FYI

- To avoid cross-contamination, do not put cooked meat on the same plate that held raw meat.
- The cancer-causing compounds that are produced by meat, poultry, and fish during cooking are called HCAs (heterocyclic amines). A second type of cancer-causing substance, called PAHs (polycyclic aromatic hydrocarbons), forms when fat from these foods drips onto hot coals. As smoke and flames rise from the coals, these substances are deposited onto the food being grilled. Note that grilling does not cause harmful substances to form on vegetables, so feel free to grill them often.

Reflect

Ask students whether they prefer to eat roasted, broiled, grilled, pan-broiled, fried, braised, or stewed meats.

Grilling Meat

You can successfully grill the same cuts of meat you use for broiling. Indirect grilling is recommended as the most healthful grilling method. For indirect grilling, move hot coals to the sides of the grill. To grill meat indirectly on a gas grill, turn off the central gas burners after preheating the grill. Place seasoned meat in the center of the grill and cover the grill until the meat is done. Because heat surrounds the meat in the covered grill, there is no need to turn the meat. (You will read more about how to set up a grill and prepare coals for cooking in Chapter 25.)

Grill meat for the correct amount of time needed for the particular cut you are cooking. A grilling time chart in a cookbook or the use and



courtesy of National Pork Board

19-10 These ½-inch thick pork tenderloin medallions are cooked just 5 to 6 inches from the direct heat of the broiler.

care manual for your grill will help you determine cooking times.

To enjoy grilled meats as part of a healthful diet, cut any charred surfaces from meat before eating it. Consider partially precooking meats in a microwave oven immediately before placing them on the grill to reduce grilling time. Also, try wrapping meats in foil for grilling to avoid exposing them to direct flames.



Many reported cases of foodborne illness caused by *E. coli* bacteria have been traced to undercooked ground beef. Thorough cooking will kill these bacteria. Therefore, when you broil burgers, or cook them by any other method, check them with a food thermometer. Make sure they have reached an internal temperature of 160°F (70°C).

Panbroiling Meat

Meat cuts that you can broil you can also panbroil if they are 1 inch (2.5 cm) thick or less. Panbroiling is a good method to use when preparing small quantities of meat. It can save energy and cleanup time when cooking just one or two steaks or chops.

For best results when panbroiling, place the meat in a heavy skillet or griddle. Do not cover the pan or add fat. (If the meat is very lean, you might want to lightly brush the skillet with fat to prevent sticking.) Cook the meat slowly, turning it occasionally to ensure even cooking. Pour off any fat that accumulates. Panbroiled meats need only about half the cooking time of broiled meats. Insert an instant-read thermometer sideways into steaks and chops to be sure they have reached the correct internal temperature.

Q: Do grilled meats cause cancer?

A: Research suggests the high heat used in grilling and broiling can allow cancer-causing compounds to form on meat. Meat juices that drip onto hot coals and cause smoke and flare-ups increase the formation of cancer-causing agents. Marinate meat, limit grilling time, and use indirect heat. These steps can greatly help reduce the formation of harmful substances.

Think Outside the Box

Ask students how to use a food thermometer to check the internal temperature of a burger. Ask what internal temperature nonground cuts of meat need to reach to ensure food safety. Have students investigate why ground meats are more likely to be contaminated with harmful bacteria than nonground cuts.

Frying Meat

Most fried meats are prepared by panfrying, or sauteing. A few can be deep-fried. Panfry meats in a small amount of fat. You may add this fat before cooking, or it may accumulate during cooking. You can panfry fairly thin pieces of tender meat, tenderized meat, ground meat patties, or cooked meat slices.

For best results when panfrying, brown meat on both sides in a small amount of fat. Season meat after browning or add the seasonings to the breading if you bread the meat. Cook the meat uncovered at a moderate temperature, turning occasionally until done. If the temperature is too high, the fat will smoke, and the meat will burn on the outside before the inside is cooked.

A variation of panfrying is *stir-frying*. Stir-fried meats and vegetables are often served together in Asian dishes. Cook thinly sliced meat in a small amount of oil. Use a wok or frying pan. Cook the meat over high heat and stir it constantly until done.

Braising Meat

Braising is cooking in a small amount of liquid in a tightly covered pan over low heat. You can braise less tender meat cuts and tender cuts of pork and veal. You can braise in the oven or on the surface unit of a range. See 19-11.

For best results when braising, first brown meat slowly on all sides in a small amount of fat. (If the meat has sufficient fat, you will not need additional fat.) Browning adds flavor and color. Season browned meat if desired and add a *small* amount of liquid. You can use water, broth, tomato juice, or a flavorful sauce as the braising liquid. Cover the pan tightly, and cook the meat slowly until tender. (Gently simmer braised meat. The cooking liquid should never boil.) You can thicken the juices that accumulate during cooking and make them into gravy. They contain important vitamins and minerals.

Cooking Meat in Liquid

Unlike braising, when cooking meats in liquid, you cover them with the cooking liquid. Use this method for less tender cuts of meat. When used with whole cuts of meat, this method is called *simmering*. Many people simmer corned beef brisket. When small pieces

of meat are cooked in liquid, this method is called *stewing*.

For best results when cooking in liquid, cover the meat entirely with water or stock. This ensures even cooking. Season cooking liquid with salt, pepper, and herbs, if desired. Cover the kettle and simmer until the meat is tender. (Cooking time will vary depending on the meat being cooked. When using this method, you will cook most meat cuts two hours or more.) The cooking liquid should never boil. Boiling can cause meat to shrink and become dry.

If preparing a stew by this method, cut the meat into cubes of uniform size, about 1 to 2 inches (2.5 to 5 cm). Brown the cubes in a small amount of fat, if desired. Cover the meat cubes with liquid and stew until tender. You may add vegetables to the meat later, allowing them to cook just long enough to become tender. Before serving, you can transfer the meat and vegetables to a warm serving platter and thicken the cooking liquid.

Microwaving Meat

Meats cooked in a microwave oven come out flavorful and juicy in a fraction of the time required for conventional cooking. Covering meats in a microwave oven holds in steam. This keeps meats moist and tender and shortens cooking time even further. Remember that microwave cooking time increases as the quantity of food increases. Therefore, large, dense cuts of meat may cook more efficiently in a conventional oven.

You can cook any meat satisfactorily in a microwave oven. However, tender, boneless cuts of uniform shape work best.

Arranging meats will promote even cooking in a microwave oven. Arrange uniformly shaped meat, such as meat patties and sausage links, in a circle. (Remember to pierce the skin on products like sausage to allow steam to escape and prevent bursting.) Overlap sliced meats, such as fully cooked ham or roast beef. Form ground meat into a doughnut-shaped loaf with a hole in the center. Place cuts containing bone with the meatier portions to the outside of the dish. Shield projections and edges on uneven cuts with small pieces of aluminum foil to prevent overcooking. Rotating, turning, and rearranging meats during the cooking period will also help them microwave more evenly.

FYI

Thinly slicing meats for stir-frying is easier when the meat is partially frozen.

Vocabulary Builder

Instead of adding flour or cornstarch to thicken the juices to make gravy, students may consider reducing the juices and serving them as a sauce. *Reduce* means to decrease the volume and concentrate the flavor by boiling.

Discuss

Ask students why the arrangement and/or shape of meats is important in microwave cooking. (They can affect evenness of cooking.)

Online Resource

Have students navigate the National Cattlemen's Beef Association Web site at beef.org to find information about how to prepare meat by various cooking methods. Ask each student to choose a specific method and then search the site for a recipe that employs that method.

For Example...

Cook two pieces of meat in a microwave oven. Prepare the first piece without the use of a browning agent. Prepare the second piece using one of the browning techniques described in the text. Ask students to compare the appearance of the two pieces and state which they find more appetizing and why.

Reflect

Ask how many students have tried variety meats and which ones they have tried. Ask those who have not tried variety meats why they have not tried them.

Resource

Cooking Meats, Activity D, SAG. Students are to answer questions related to meat cookery methods.

Large cuts and meat with a high fat content will brown naturally in a microwave oven. However, cuts requiring less time may need the help of a browning agent. You can collect meat drippings by using a rack. You can add these to a gravy mix or browning sauce to cover the meat. Other browning agents include soy, barbecue, and Worcestershire sauces. Sauces have the added advantage of keeping meat moist in the microwave oven. See 19-12.

Cooking Variety Meats

The cooking method used for preparing variety meats depends on the tenderness of each meat. You will cook most variety meats by moist heat. However, you may cook brains, sweetbreads, and the liver and kidneys of veal and calf by dry heat, usually by broiling or frying.

Brains and sweetbreads are very delicate meats. To retain their shape, precook them for



courtesy of National Pork Board

19-11 These pork medallions braise on top of the range in a matter of minutes.

Meeting Special Needs

Provide rocking T knives for students with limited manual dexterity to use when cutting meat. This type of knife can be used with one hand and requires less strength and dexterity than regular knives. Also, meat will not move around on the plate as it is being cut.

about 20 minutes in salted, acidulated water (water that contains an acid, such as lemon juice). After precooking, you might choose to fry or broil them.

Cooking Frozen Meat

You can cook frozen meats in the frozen state or defrost them before cooking. Cook prepared frozen meats according to package directions.

For safety, thaw meat in its original wrapper in the refrigerator. Do not thaw meat on the kitchen counter. Harmful microorganisms can

grow in meat thawed at room temperature, resulting in foodborne illness.

You must cook frozen meat longer than thawed meat. A frozen roast will need to cook about 50 percent longer than a thawed roast. Cooking time for frozen steaks and chops will vary depending on size and thickness.

When broiling frozen meats, place meat farther away from the heat source. This will prevent the outside from overcooking before the inside is cooked. To panbroil frozen meat, use a hot skillet to brown the meat. Then lower the heat and turn meat occasionally to ensure even cooking.

Discuss

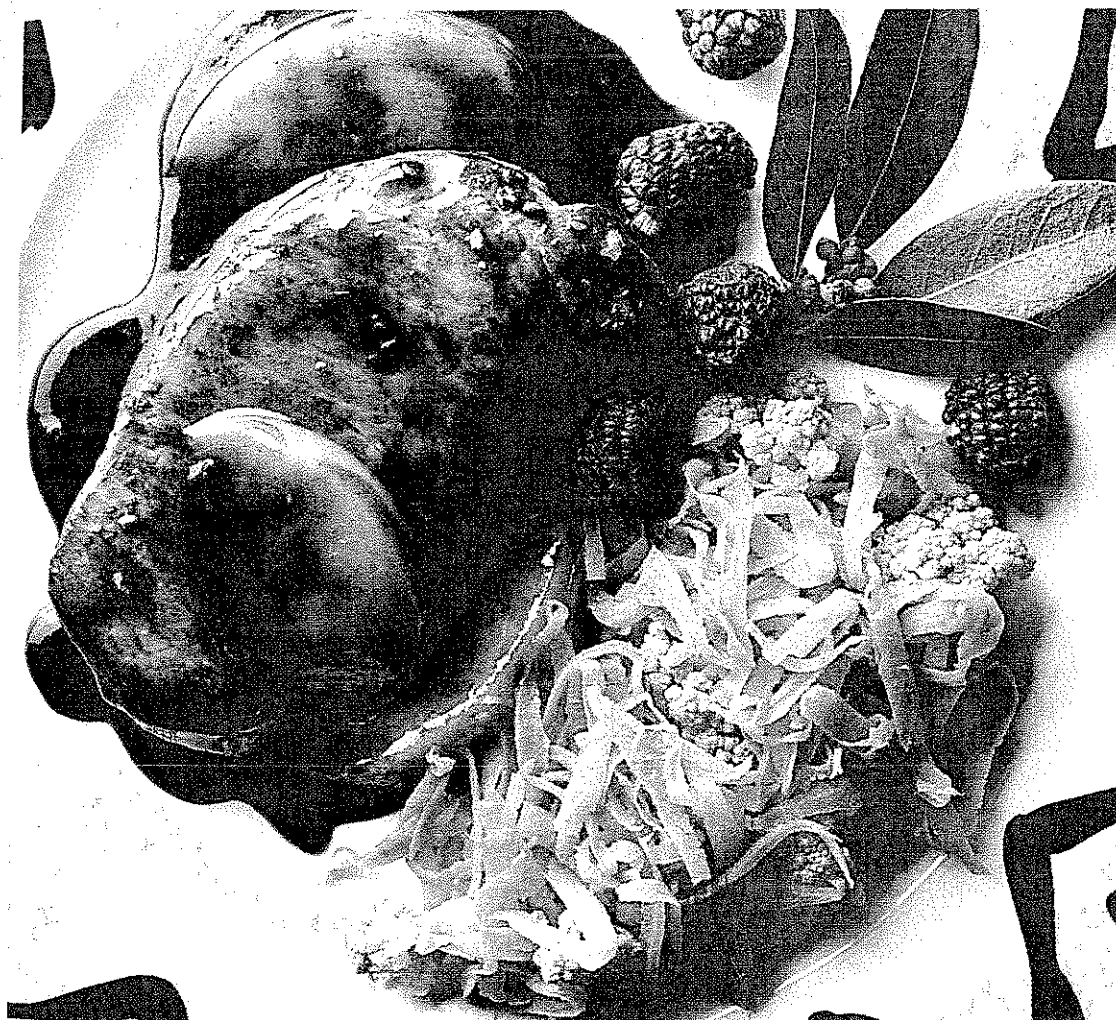
Ask students what techniques can be used to safely thaw meat before cooking other than placing it in the refrigerator. (*If meat will be cooked immediately after thawing it can be safely thawed using the defrost setting of a microwave oven.*)

Resource

Meat Recipes, recipe master 19-3, TR. Have students use the recipe master to plan a meat cookery lab. Have each lab group complete a *Market Order Sheet* (TR) and a *Time-Work Schedule* (TR). After preparing their recipe and sampling their meat product, have each group complete a *Lab Evaluation Sheet* (TR).

Break It Down

Have students answer questions 13–15 under *Review What You Have Read*. Have them complete activity 3 under *Build Your Basic Skills* and activities 3 and 4 under *Build Your Thinking Skills* at the end of the chapter.



courtesy of National Pork Board

19-12 Serving a sauce with meat cooked in a microwave will help hide the lack of browning.

Community Interactions

Have students organize a "Well Done for Outdoor Fun" community cookout. Have them distribute food safety brochures and demonstrate how to use a food thermometer to check the internal temperature of grilled meats.

Chapter 19 Review

Meat

Resources

• **Chapter 19 Study Sheet**, reproducible master 19-4, 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

Beef, veal, pork, and lamb are the most commonly eaten types of meat in the United States. They are all high in protein as well as being good sources of several vitamins and minerals.

Meat is inspected for wholesomeness and may be graded for quality. When selecting meat, the appearance of the fat is a sign of quality. Read the label to identify the part of the animal from which the meat comes. This indicates tenderness. When deciding how much meat to buy, remember boneless cuts yield more servings per pound than bone-in cuts. Compare meats in terms of cost per serving rather than cost per pound to get the best buy.

Meats are highly perishable. Store them in the coldest part of the refrigerator and use them within a few days. Wrap them well and put them in the freezer for longer storage.

The connective tissue in meat contains two types of tough, elastic protein. One of these, collagen, can be broken down by mechanical and chemical methods and softened by cooking.

Meats cooked at lower temperatures, large cuts, and well-done meats all require longer cooking times. However, you need to monitor cooking times and temperatures carefully. Temperatures that are too high or cooking times that are too long can make meat tough and dry.

Roasting, broiling, grilling, panbroiling, and frying are dry heat cooking methods. They generally work best for tender cuts of meat. Braising and stewing are moist heat cooking methods. They are recommended for less tender cuts. You can use a microwave oven to defrost and cook meats. You can cook frozen meats in the frozen state or defrost them in the refrigerator before cooking.

Review What You Have Read

Write your answers on a separate sheet of paper.

1. List five nutrients contributed to the diet by meat.
2. Give three tips for selecting and preparing meat to help limit the amount of fat supplied by meat in the diet.
3. Describe the color and fat of high-quality beef.
4. True or false, Hamburger is another name for ground beef.
5. Meat from cattle that are less than three months of age is called _____.
 - A. beef
 - B. lamb
 - C. pork
 - D. veal
6. What are the most common grades of beef sold in retail stores?
7. How does the location of the meat in the animal affect the tenderness of a cut?
8. Name two factors that affect the cost per serving of meat.
9. Within what time period should refrigerated fresh meats be used?
10. The tough and elastic meat protein that can be softened and tenderized by cooking is _____.
11. List three characteristics of overcooked meat. List three characteristics of meat cooked to the proper degree of doneness.
12. What are cooking losses and how can they affect the appearance and eating quality of meat?
13. List the seven cooking methods used for meats. After each method, state if it is a moist or dry heat method.
14. Give three tips to promote even cooking of meats in a microwave oven.
15. True or false. Frozen meats must be defrosted before cooking.

Build Your Basic Skills

- Writing.** Look at the different cuts of meat in the meat case in a grocery store. Compare the appearance of beef, veal, pork, and lamb. Notice what variety meats are available. Compare the appearance of different grades of meat. Summarize your findings in a brief written report.
- Math.** Figure the cost per serving of a boneless cut and a bone-in cut. Which is the better buy?
- Verbal.** Discuss different ways to cook less tender cuts to make them more tender and flavorful.

Build Your Thinking Skills

- Analyze.** Prepare two identical tender cuts of beef, cooking one with high heat and the other with moderate heat. Compare appearance, flavor, and tenderness to help you analyze the effects of high cooking temperatures on meat.
- Describe.** Select one steak labeled *Choice* and one labeled *Select*. Broil both the same length of time. Sample the steaks and describe the tenderness, appearance, and juiciness of each steak.
- Compare.** Purchase two cuts of less tender beef. Cook one with dry heat and the other with moist heat. Compare appearance, texture, and flavor.
- Evaluate.** Prepare two identical cuts of meat, cooking one in a conventional oven and one in a microwave oven. Compare cooking times, appearance, flavor, tenderness, and juiciness as you evaluate which preparation method you prefer.

Apply Technology

- Broil a ground beef patty and a patty made of texturized vegetable protein. Compare the two products for appearance, texture, and flavor.
- Investigate how ultrasound technology is being used to inspect and grade meat.

Using Workplace Skills

Kevin is a meat cutter at DeLong's Grocery Store. The store is known for its hand-trimmed, cut-to-order meats. Kevin always has a steady stream of customers, but the meat department is especially busy just before holidays.

To be an effective worker, Kevin needs competence in serving customers. Imagine you are one of Kevin's customers. Answer the following questions about his need for and use of this skill:

- What personality characteristics would you expect Kevin to have?
- How would you respond if you felt Kevin was not providing you with adequate service?
- How might DeLong's Grocery Store be affected if Kevin lacked competence in serving customers?
- What is another skill Kevin would need in this job? Briefly explain why this skill would be important.

Career Path

- After reading the *Using Workplace Skills* section, have students role-play a situation in which a customer approaches Kevin with a complaint. Following the role-play, discuss why it is important for Kevin to handle such situations appropriately. Evaluate how Kevin could avoid this type of situation in the future.
- Have students reread the career descriptions of a barbecue cook and a livestock sales representative that appear at the beginning of the chapter. Ask students why people working in these occupations might need competence in serving customers.

Answer Key to Review What You Have Read questions

- (List five:) protein, iron, phosphorus, copper, thiamin, riboflavin, niacin, fat
- (List three:) Choose lean cuts. Limit portion sizes. Trim visible fat before cooking. Use cooking methods that allow fat to drip away. Use nonstick pans. Skim fat after cooking.
- Beef is usually bright cherry red with creamy white fat.
- false
- D
- Choice and Select
- Muscles located in areas of the animal that receive little exercise, such as rib and loin muscles, are the most tender. Muscles located in areas of the animal that receive more exercise, such as leg and shoulder muscles, are less tender.
- tenderness; amount of waste in the cut
- three or four days
- collagen
- (List three for each:) overcooked—tough, dry, large amount of shrinkage, develops a hard crust, difficult to carve and eat; properly cooked—moist and juicy, tender, flavorful, easy to carve, smaller degree of shrinkage
- Cooking losses are fat, water, and other volatile substances that evaporate from the surface of meat. Excessive cooking losses can cause tough, dry meat with a high degree of shrinkage, resulting in a reduced number of servings.
- roasting—dry, broiling—dry, grilling—dry, panbroiling—dry, frying—dry, braising—moist, cooking in liquid—moist
- (List three:) Arrange meats with uniform shapes, such as patties or links, in a circle. Overlap sliced meats. Form ground meat into a doughnut-shaped loaf. Place meatier portions of cuts containing bone to the outside of the dish. Shield projections and edges on uneven cuts. Rotate, turn, and rearrange meats during cooking.
- false