

Large Livestock Production

SAE for ALL Profile

Karley Rayfield, Beef Cattle Production

Meet Karley Rayfield, Lubbock-Cooper FFA Member in Lubbock, Texas. Karley has a multifaceted Immersion SAE where she is involved in entrepreneurship and production. Karley's SAE began while she was in middle school. She showed steers and heifers at the Texas major livestock shows, and invested her winnings from her show steers into commercial and registered Hereford and Simmental cattle. She currently owns 18 head of cattle for show and breeding purposes.

As Karley began having success with her show heifers, she created an embryo business to sell embryos to other producers and to mass-produce her herd genetics to sell. Karley has sold cattle and embryos to producers in five states. Karley has a bank of embryos that are ready for transfer to recipient cows in the future. Last year, Karley was recognized as the second place Star Greenhand in production in Texas.

According to Karley, there are many hard lessons learned when you own beef cattle. Karley said, "Sometimes we lose animals. That is just part of the risk/reward nature of entrepreneurship and production. When I lose a calf at birth it is really sad, but many times it is out of our control. I have to move on from the loss and persevere and hope that we can make up the loss by producing top-quality genetics that other producers will purchase at a premium."

Karley believes her SAE has set her on the path for an agricultural career. Although she has not decided what her college major will be, she believes the entrepreneurial skills she has developed in the cattle business will transfer to any career path. The skills Karley has gained through her SAE have already set her on a different pathway than she ever thought possible when she began showing cattle in the third grade. She is well on her way to financial security. When she attends college, she will be competitive for many scholarship opportunities available through the beef cattle industry and major livestock shows.

- How does an Immersion Production SAE differ from other types of SAEs?
- What are some smaller scale Immersion SAEs that would be possible at your home or school?
- What types of Research SAEs could stem from an Immersion SAE?



Karley Rayfield



Joseph Sohm/Shutterstock.com

- Lesson 10.1 **The Beef Industry**
- Lesson 10.2 **The Dairy Industry**
- Lesson 10.3 **The Equine Industry**

LESSON 10.1

The Beef Industry

Greg Westbrook/Shutterstock.com

Essential Question

How does the US beef industry continue to meet consumer demand in an increasingly competitive protein market?

Lesson Objectives

After studying this lesson, you should be able to:

- Understand the size and the scope of the beef industry.
- Understand common terminology of the beef industry.
- Identify the major cuts of beef.
- Describe the components of the beef industry.
- Understand commonly used production systems in the beef industry.
- Describe different breeds of beef cattle in the United States.

Words to Know

backgrounding operation

beef

beef cattle

Bos indicus

Bos taurus

bovine

breed association

brisket

chuck

commercial cattle

cow-calf operation

cud

cutability

feedlot

flank

gestation

herd

loin

offal

plate

polled

primal cut

purebred

purebred breeder

rib

round

seedstock cattle

stocker operation

subprimal cut

Before You Read

Do an internet search for breeds of beef cattle in the United States. Pick three breeds you would like to research and learn more about. Research at least one breed which you have not heard of before.

The term **beef cattle** refers to cattle used to produce beef. **Beef** is the meat we consume from harvested cattle. Examples of beef would be hamburger, steak, and roast beef. Beef cattle are not indigenous to the United States. Many historians report that when Columbus came to America, there were no domesticated animals. Cattle and other domesticated animals came to America on Columbus' second voyage in 1493 and with other explorers.

Beef Industry in the United States

Today, the beef industry in the United States is a large, multibillion-dollar industry that contributes greatly to our economy. According to the USDA, the beef cattle industry generates \$66.2 billion annually in economic impact, and there are approximately 94.8 million head of cattle in our country. The average size cowherd in the United States is 43.5 head. The top five states (in order) in beef cattle production are Texas, Nebraska, Kansas, California, and Oklahoma, **Figure 10-1**.

US Beef Exports

In 2018, the US beef industry exported 3 billion pounds of beef with the top export markets being Canada, Japan, Mexico, South Korea, and Hong Kong. In 2018, Americans spent an average of \$219 on beef annually.

Careers

There are many careers within the beef industry. It is easy to become a rancher or cattle producer if your family raises cattle, **Figure 10-2**. What if you grow up in the city or have little experience with cattle? There are many opportunities to become engaged in the beef industry through breed associations, cattle shows, working on a farm or ranch that raises cattle, working at a feedlot, or being a large-animal veterinarian—the opportunities are endless!

Working on a farm, ranch, or at a feedlot requires some education. Working for a breed association usually requires a college degree, and being a veterinarian requires approximately eight years of college.

Production Cycle of Beef Cattle

Cows are bred through natural means (exposure to a bull) or through artificial insemination. Artificial insemination (AI) is a process in which sperm is collected from a bull, processed and frozen for storage, and then thawed and placed in the reproductive tract of the cow. Once the cow is pregnant, she will carry the calf in **gestation** (pregnancy) for approximately 279 to 290 days. The gestation period varies, depending on the breed of cattle. The term **calving** is used to describe a cow that is in the process of giving birth. When the calf is born, it will nurse from its mother until six months of age when it is weaned or separated into a different pen or pasture from the cow.

At weaning, calves of both sexes are sent to backgrounding operations to graze and gain weight before being sent to a feedlot. Some calves are kept as potential replacement breeding animals. These bulls and heifers are usually grazed and fed until an acceptable breeding age. Bulls usually reach breeding age at two years. Heifers are usually bred when they are 15 to 18 months of age so they can calve at approximately two years of age, **Figure 10-3**.

The Beef Cattle Industry

There are many different segments of the beef cattle industry. The following are examples of different types of beef cattle operations in the United States. Some of these examples may be common in your geographic region.



Mirec/Shutterstock.com

Figure 10-1. The top states in beef cattle production. *Are there certain climates or topography that make an area better suited for raising beef cattle?*



KMR Herefords

Figure 10-2. Careers in the beef cattle industry often begin with raising and showing cattle as part of an SAE or 4-H program.

Beef Cattle Terminology

- bull** mature male, young male
- calf** young
- calving** act of giving birth
- cow** mature female
- heifer** young female
- steer** castrated male

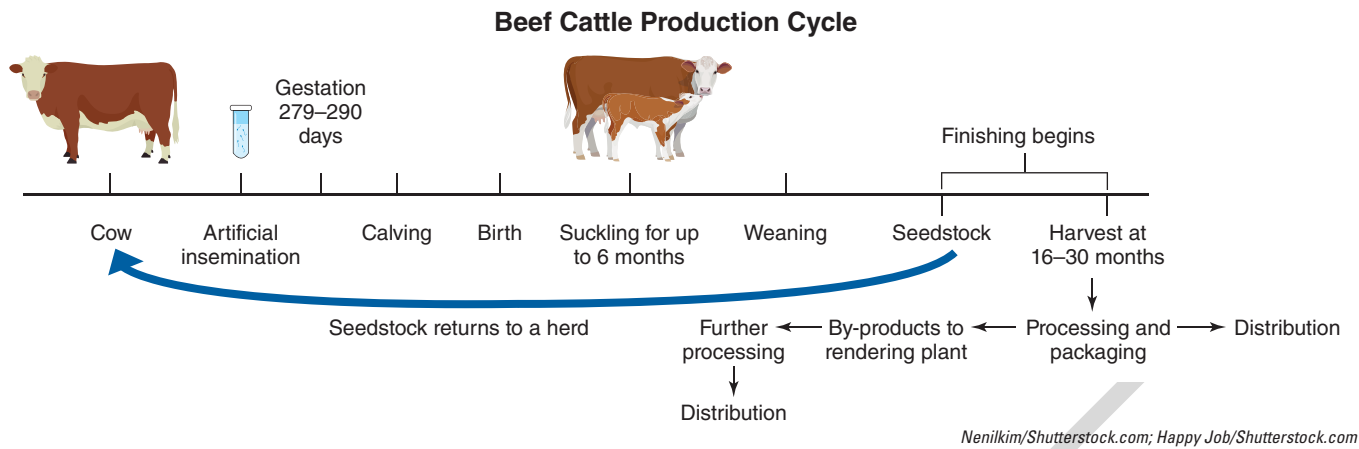


Figure 10-3. The production cycle of beef cattle begins with the cow being artificially inseminated. *How many days are there from the AI and the cattle going to market?*

Did You Know?

The average person consumes approximately 57 pounds of beef per year.

Cow-Calf Operations

Most beef cattle are born on **cow-calf operations**. These operations are commonly seen as you travel down highways or country roads. Cows are bred each year to produce calves for the market, **Figure 10-4**. These operations are usually family-owned with families providing the daily care and maintenance of the cowherd. These producers profit mainly from the sale of calves at weaning age, which is usually around 6 to 8 months of age.

Stocker Operations

When calves are weaned from their mothers (6 to 8 months), they are often transferred to **stocker operations**. These operations use grazing pastures for cattle to provide moderate weight gain with minimal grain being added to their diet. This stage of production usually lasts from when calves are weaned until they are 12 to 18 months. At this time, they are taken to a feedlot. Stocker operations are also referred to as **backgrounding operations**.

Feedlot Operations

In **feedlots**, large numbers of cattle are grouped based on size, genetics, and consistency to maximize profit for the feedlot. Cattle are not allowed to graze at feedlots. They are fed high-grain diets with roughage (hay) to increase fat deposition, which increases the quality of beef. Cattle usually spend four to six months in the feedlot. Most feedlots are located in the high plains of the United States. The Texas panhandle, Nebraska, Kansas, Iowa, and Colorado are the leading states in feedlot production, **Figure 10-5**.

Seedstock Operations

Seedstock cattle producers raise cattle that are typically registered with a **breed association**. They may be referred to as **purebred breeders**. (A **purebred** animal is an animal species or breed achieved through the process of selective breeding.) They produce **seedstock cattle**, which are the bulls, heifers, and cows used in registered breeding herds as well as commercial cattle operations. These cattle are usually registered in a breed association with a documented pedigree and performance data (birth date, birth weight, weaning weight, yearling weight, maternal/milk or carcass data) that is useful to purebred and commercial cattlemen.



Red Angus Association

Figure 10-4. Calves nurse for six months before weaning. *Do nursing cows have additional nutritional needs?*

Associations

Each breed of cattle has an association for cattle producers who raise that specific breed. Most breed associations have websites and promotional materials about their breed available so you can learn more about them. Most states have a cattle producers' or cattlemen's association. The National Cattlemen's Beef Association (NCBA) is a national organization that promotes beef cattle and the beef industry in the United States.

Commercial Operations

Commercial cattle are typically crossbred (composed of two or more breeds) and are not registered with a breed association. The goal of most commercial cattle producers is to produce cattle to sell to stocker operations and ultimately to feedlots to produce beef.

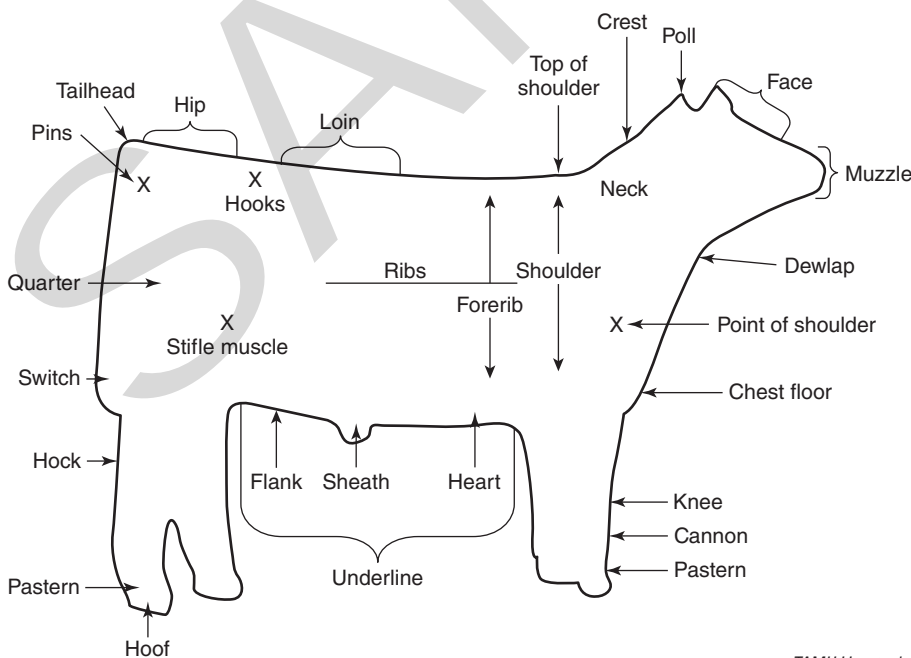


Santa Gertrudis Breeders International, Kingsville, Texas

Figure 10-5. Cattle on feedlots are grouped to maximize profit for the feedlot. *How does grouping the animals by size, genetics, and consistency help maximize profit for the feedlot?*

Anatomy of Beef Cattle

To understand many of the principles behind the growth and physiology of beef cattle, you must know the basic parts of the animal. **Figure 10-6** illustrates the parts of a beef steer. Knowledge of these parts becomes even more critical when participating in FFA Career Development Events, such as Livestock Evaluation or Meats Evaluation. Beef cattle are ruminants and can digest high amounts of roughage or forage, usually grass or hay. Their stomach is divided into four compartments: rumen, omasum, abomasum, and the reticulum. Ruminants such as cattle are commonly seen chewing their **cud**, which is a regurgitation of the roughage and feed they have eaten to aid in further digestion.



TAMU Livestock Judging

Figure 10-6. Aside from the distinctive physical variations of each breed, all beef cattle share the same basic anatomy.

Herd Behavior

Cattle stay together in groups called **herds**, **Figure 10-7**. You must understand how herd animals behave as a group when working with livestock. Each animal will imitate the behavior of other animals in the herd, particularly the nearest ones. This behavior causes the herd to function as a single entity. For example, the herd will move in one direction away from perceived danger, such as a predator. This movement occurs spontaneously as lead animals begin the movement and each subsequent animal makes the same move. This is essential to understand because any real or perceived danger may cause a herd to panic, creating a dangerous situation for workers and cattle alike.

It is also essential to understand the natural hierarchy that forms in a herd. Lead animals establish their position and usually maintain it for extended periods. The herd composition continually changes as animals are added or culled (removed from the herd). This means the social structure changes each time the herd changes. Careful introduction of new cattle will help reduce the aggressive behavior and prevent potentially dangerous situations for workers and cattle.

Maintaining Herd Health

Since cattle are herd animals, sickness and disease may easily spread throughout a herd if the animals are not properly vaccinated or if they live in unsanitary conditions. Keep the following points in mind when raising cattle:

- Establish a complete herd health program and consistently implement regular vaccination and parasite control programs.
- Have a good working relationship with a large-animal veterinarian to ensure proper herd health management, **Figure 10-8**.
- Purchase cattle only from reputable breeders who maintain high herd health standards.
- Observe newly introduced animals for possible diseases and parasites.
- Maintain clear, complete, and accurate records for calving, breeding, weaning, and vaccination.
- Monitor cows during calving, especially first-calf heifers, to minimize potential harm to or loss of calves and cows.



American Hereford Association

Figure 10-7. A good understanding of natural herd behavior may help workers stay safe and prevent harm to the cattle. *Aside from reading reputable publications, how can you develop your own understanding of herd behavior? Who would be a good resource?*



Elgin Veterinary Hospital, Bovine Division, Elgin, Texas

Figure 10-8. Although large-animal vets schedule regular visits to examine and treat animals, animals must sometimes be transported to veterinary facilities for surgery or other specialized treatment. Here, Dr. Gary Warner is performing a complex orthopedic procedure on a bovine athlete (bucking bull).

Handling Cattle

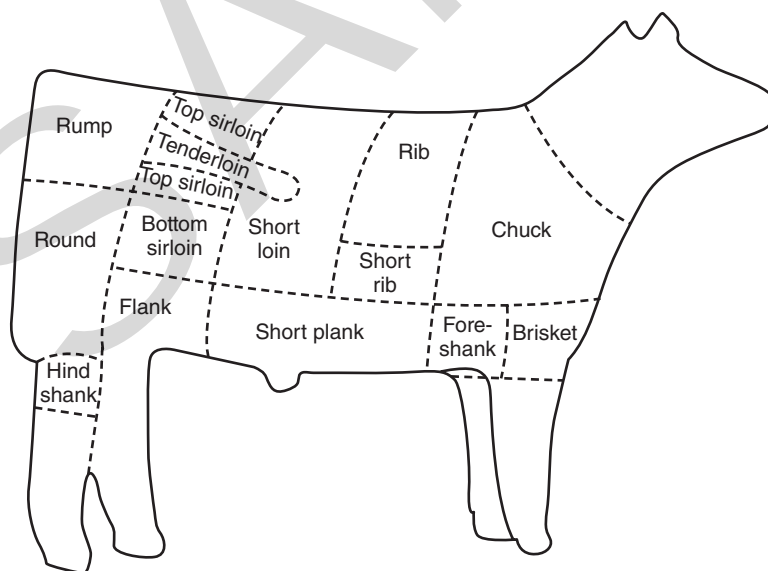
There is a great deal more information regarding breeding and handling of beef cattle than can be included in this chapter. Many of these concepts will be learned in other agricultural classes or in a real-world career setting working with beef cattle. The following list of tips is not all-inclusive, but each point is significant enough to remember when working with or around beef cattle:

- Cattle should be selected according to their intended use, the geographical area and environment in which they will be raised, and the breeder's personal preference of the traits he or she wants to produce with the cattle.
- Maintain human contact with the beef herd to make it easier to handle cattle when necessary.
- Break young calves to lead at an early age if they are going to be exhibited in shows and fairs.
- Maintain the correct ratio of cows to bulls for breeding purposes.
- Provide sufficient access to clean water at all times and provide shelter from harsh weather conditions when possible.
- Use safe actions when working around cattle.
- Avoid situations that startle or frighten them and always employ enough help when needed.

Cuts of Beef

When beef cattle are harvested for meat, the beef carcass is cut into large primary pieces called primal cuts. The **primal cuts** of beef are chuck, rib, loin, round, brisket, plate, and flank (**Figure 10-9**):

- **Chuck** is the primal cut from the shoulder and neck of beef cattle. It may be flavorful, but it may also be tough and fatty and contain excess bone and gristle. Cuts of meat from the chuck include: 7-bone roast, arm pot roast (bone-in/boneless), blade roast, eye roast (boneless), eye steak (boneless), mock tender roast, mock tender steak, petite tender, shoulder pot roast (boneless), and top blade steak (flat iron).



TAMU Livestock Judging

Figure 10-9. The primal cuts of beef include the chuck, rib, loin, round, brisket, plate, and flank.

- The **rib** is a tender primal cut made from the center section of rib (specifically the sixth through twelfth ribs). Cuts of meat from the rib include rib or ribeye roast (large end), rib or ribeye roast (small end), rib steak (small end), rib eye steak (boneless or lip-on), back ribs, and short ribs.
- The **loin** is a primal cut from the section between the ribs and the round, and above the flank. Cuts of meat from this area include the porterhouse steak, T-bone steak, tenderloin roast, tenderloin steak, top loin steak, top sirloin cap steak, top sirloin steak (cap off), top sirloin steak, and tri-tip roast.
- **Round** is a primal cut of meat from the hindquarters of beef cattle. It is lean and may be tough. Cuts from the round include bottom round roast, rump roast, eye round roast/steaks, top round steak, round steak, round tip roast, round tip steak, and top round roast.
- **Brisket** is a tough, boneless primal cut that lies over the sternum, ribs, and connecting cartilage of beef cattle. Cuts of meat from this section include corned beef, flat half, and whole brisket.
- The **plate** is a tough, fatty primal cut of meat from the front belly of beef cattle, just below the rib cut. Cuts of meat from this section include short ribs and skirt steak.
- The **flank** is a primal cut from the abdominal muscles of beef cattle. Cuts of meat from this section include the long, flat flank steak.
- **Offal** is the edible offal of cattle, including the liver. Offal is the entrails and internal organs of animals processed for food.

The steaks, roasts, and hamburger meat that are used as a source of protein in our diets are cut mainly from the round, loin, rib, and chuck. The cuts made from the primal cuts are called **subprimal cuts**. The way the subprimals are cut determines the quality of the final cut and its cost. Less expensive cuts of beef are cut from the brisket, plate, and flank.

Did You Know?

There are more than 50 breeds of cattle in the United States and over 800 breeds recognized worldwide.

Beef Cattle Breeds

The species name for cattle is **bovine**. There are two subspecies within the bovine species: **Bos taurus**, which describes the breeds originating in Europe (England, Scotland, France, Germany, and Italy), and **Bos indicus**, which describes cattle from more tropical countries (Asia, Africa, and India), **Figure 10-10**. A breed is a specific group of cattle with similar appearance, characteristics, and behaviors that distinguish it from other cattle in the same species. **Bos indicus** breeds have Brahman influence in their pedigree. They are typically well suited to warmer climates and have a higher resistance to diseases and insects. They are popular in the Southeastern part of the United States because of their heat tolerance and ability to thrive on limited forage.

There are many other breeds of beef cattle other than those covered in the following sections. Several of the breeds discussed also have miniature breeds, such as Miniature Herefords, Lowline Angus, and Miniature Zebu, to name a few. To find out more about breeds of beef cattle, contact the specific breed association.

Bos taurus Cattle Breeds



American Angus Association

Angus—Angus cattle originated in Scotland in the shires of Aberdeen and Angus. They are black in color and naturally **polled** (hornless). Angus cattle are known for their maternal ability as well as carcass quality. Angus cattle are found in all 50 states in the United States, and the American Angus Association's branded beef program, Certified Angus Beef (CAB) is world-renowned.



Thomas Ranch, Harrold, South Dakota

Charolais—Charolais is one of the oldest French breeds of cattle. Charolais are solid white in color and are known for high growth rates and heavy muscling. Most Charolais cattle are naturally horned, but some are polled. They are commonly used in crossbreeding programs to produce smoky-gray colored calves that perform well in stocker and feedlot operations.



American Chianina Association

Chianina—Chianina cattle originated in Italy. They are one of the oldest breeds of cattle in the world. Chianinas are white with black skin pigment. In the United States, Chianinas are black and predominantly used in crossbreeding programs. They are known for exceptional growth. The terms Chi (pronounced key), Chi-Angus, and Chi-Maine are all associated with modern day Chianina-influenced cattle.



Photos provided by the American Gelbvieh Association

Gelbvieh—Gelbvieh cattle are originally from Germany. They are a reddish-yellow color and are known for having excellent maternal characteristics. Many Gelbviehs in the United States today are black in color because of crossbreeding programs. The term *balancer* is used to describe Gelbvieh cattle that have 25% to 75% Gelbvieh in their pedigree, with the remaining portion of the breed makeup being Angus or Red Angus.



Photos provided by American Hereford Association

Hereford/Polled Hereford—Hereford cattle originated in Herefordshire, England. Herefords are easily recognizable with their white face, red body, and white belly and legs. More Hereford cattle are registered than any other breed of cattle. They are known for their longevity and for being docile. Polled Herefords were developed in Iowa by Warren Gammon. He sought out naturally polled Hereford cattle and started developing them as a breed. In 1995, the American Hereford Association and the American Polled Hereford Association merged to create the American Hereford Association, which today registers polled and horned Herefords.



North American Limousin Foundation

Limousin—Limousin cattle originated in France. When they were imported to the United States in the late 1960s, they were yellow to red in color. These cattle were known for their cutability and heavy muscling. (**Cutability** is the proportion of lean, salable meat yielded by a carcass.) Although most Limousin cattle are black, some red genetics still exist. Today, Lim-Flex cattle are gaining popularity. Lim-Flex must be 25% to 75% Limousin and 25% to 27% Angus or Red Angus and may have 12.5%, or 1/8, of their breed composition being another breed.



BOSS Beauty 84M



DMCC Limited Edition

Maine Anjou—Maine Anjou cattle originated in France and were the result of mating English Shorthorn bulls with Mancelle cows. They were originally bred to be draft animals. The first Maine Anjou semen was imported to the United States in 1970. These cattle were dark red and white in color. Today, most Maine Anjou cattle are black because of crossbreeding. Maine Anjou cattle grow fast and produce high-quality carcasses. Over the last couple of decades, they have gained popularity in the club calf sector of the beef industry.



Red Angus Association of America

Red Angus—The Red Angus breed originated because of a recessive gene in Angus cattle. They have the same origin as Angus cattle, which are black in color. In the mid-1950s, a group of breeders chose to start raising and registering Red Angus cattle as its own breed. Red Angus have many of the same traits as Angus cattle; they are naturally polled, but due to their red color, are much more heat tolerant than black Angus cattle.



V8 Ranch, Wharton, TX

Shorthorn—The Shorthorn breed originated in Northern England. They were a dual-purpose breed, used for milk and meat, and were originally known as Durhams. They are one of the oldest breeds of cattle. They are red, white, or roan in color and are horned. They are known for their maternal characteristics and their usefulness in crossbreeding programs.

ShorthornPlus is a program designed to recognize and market Shorthorn-influenced genetics with animals that have 1/4 to 7/8 Shorthorn in their pedigree.



Photos courtesy of the American Simmental Association, www.simmental.org

Simmental—Simmental cattle originated in Switzerland and date back to the Middle Ages. Originally, they were a dual-purpose breed used to produce milk and meat. Since arriving in the United States in the late 1960s, they are noted for their fast growth, heavy muscle, and cutability. Simmentals in this era were typically red to yellow with white faces and were sometimes spotted. Today, most Simmentals are black or black with a white face. The terms Sim Angus and Sim Solutions refer to Simmental-influenced cattle that are crossed with other breeds, typically Angus.



Courtesy of the Texas Longhorn Breeders Association of America and Star Creek Ranch

Texas Longhorn—Texas Longhorns are descendants of the Spanish cattle brought over on Columbus' second voyage in 1493. Many of these cattle migrated north from Mexico and acclimated to the environment of the southwestern United States. Texas Longhorns have horns that curve upward and may spread up to four to five feet. They are highly fertile and adapt to harsh conditions. They can survive on little forage, have excellent calving ease, and are known for their longevity.

Bos indicus Cattle Breeds



Emmons Ranch Beefmasters

Beefmaster—Beefmaster cattle originated in south Texas in the 1930s. Tom Lasater developed this breed by crossing Hereford, Shorthorn, and Brahman cattle. There are no breed standards for color. Many Beefmasters are red, gold, or yellow, but some are black or even spotted. Beefmasters are hardy cattle that thrive in harsh conditions. They have excellent maternal ability and fertility.



Courtesy of the United Braford Breeders, Inc.

Braford—Braford cattle were developed by crossing Brahman cows with Hereford bulls. This started at a ranch in Florida in the late 1940s. By crossbreeding these two breeds, cattlemen were able to use positive traits of each breed to form a breed that was well suited for its environment. Brafords have a Hereford-type color pattern: they are dark red with a white face and underline. They are typically 5/8 Hereford and 3/8 Brahman. Brafords are known for their maternal ability, high growth rate, and adaptability to a given environment.



Diamond K Ranch, Hempstead, TX

Brangus—Brangus cattle were derived by crossing Angus and Brahman cattle to arrive at a 3/8 Brahman and 5/8 Angus cross. The early crossing of these two breeds can be traced back to 1912 at a USDA Experiment Station in Louisiana. Brangus cattle are solid black and polled. They are known for maternal ability, rapid growth, and adaptability.



Diamond K Ranch, Hempstead, TX

Red Brangus—Red Brangus cattle originated in Texas in the late 1940s. They are a result of crossing Brahman and Angus cattle. The unique thing about Red Brangus is that the breed percentages of Brahman and Angus can vary. Cattle can be registered with a 5/8 Brahman and 3/8 Angus cross, 1/2 Brahman and 1/2 Angus, or 3/8 Brahman and 5/8 Angus. This allows for geographic adaptability of a certain composite of breeds. Red Brangus cattle are hardy, red, polled, and well suited to a variety of conditions.



V8 Ranch, Wharton, TX; American Brahman Breeders Association

Brahman—Sometimes referred to as Zebu cattle, Brahman cattle were imported into the United States from India in the late 1800s and early 1900s. Brahman cattle are easily distinguished from other breeds: they have a large hump over their shoulders, black pigment, and long droopy ears. They also have excess skin hanging from their neck and throat region. Brahmans may be light gray, dark gray, red, or nearly black in color. Light gray is the most common color. They are typically horned and are used extensively in crossbreeding programs. Brahman cattle are known for their maternal ability and growth rate.



La Muneca Ranch, Linn, TX

Simbrah—Simbrah cattle are a result of crossing Brahman and Simmental breeds. This breed evolved in the 1960s in the Gulf Coast Region of the United States. Simbrahs are typically red with white markings, but there is no set color pattern for this breed. They combine positive traits of the Brahman and Simmental breeds and make excellent mothers, while having high performance and growth with added muscling. The Simbrah registry is housed at the American Simmental Association.



Santa Gertrudis Breeders International, Kingsville, Texas

Santa Gertrudis—Santa Gertrudis cattle were developed on the King Ranch in south Texas. The breed is composed of 3/8 Brahman and 5/8 Shorthorn. Santa Gertrudis cattle are dark cherry red in color and may be horned or polled. This breed was developed to survive in the harsh conditions of South Texas where native grasses are often sparse. Santa Gertrudis are hardy, disease-resistant cattle that easily adapt to different production scenarios.

Lesson 10.1 Review and Assessment

Lesson Summary

- The beef industry is vital to our economy and food supply.
- Beef production systems range from simple, family-owned operations to operations boasting thousands of head of cattle.
- The beef production systems work together to supply a constant and safe supply of beef in the United States and worldwide.
- No two breeds of beef cattle are the same, and each brings its own set of strengths and weaknesses to the industry.
- Through research and development, beef breeds have evolved to fit all climates, terrains, and geographic areas of the world.
- Raising beef cattle is the single largest segment of American agriculture.

Vocabulary Review

Match the vocabulary terms listed in the *Words to Know* to the correct definition.

1. A term to describe young and mature male beef/dairy cattle.
 2. A primal cut of meat from the rear region of beef cattle.
 3. Primal cut from the shoulder and neck of beef cattle; flavorful, but may be tough and fatty and contain excess bone and gristle.
 4. A specific group of cattle that has similar appearance, characteristics, and behaviors that distinguish it from other cattle in the same species.
 5. A beef cattle operation in which young calves are allowed to graze pastures for moderate weight gain before moving to feedlots.
 6. The term used to describe a cow that is in the process of giving birth.
 7. A term to describe young beef/dairy cattle.
 8. A tough, boneless primal cut that lies over the sternum, ribs, and connecting cartilage of beef cattle.
 9. A cattle operation in which large numbers of cattle are grouped based on size, genetics, and consistency to maximize profit; cattle are fed high-grain diets and not allowed to graze.
 10. Usually crossbred beef cattle produced for sale to stocker operations and feedlots.
 11. An operation used to breed and birth beef cattle for sale.
 12. Cattle that lack horns by natural or artificial means.
 13. A term to describe young, female beef/dairy cattle that have not been bred.
 14. The cattle breeds that originated in Europe.
 15. A term to describe mature female beef/dairy cattle.
 16. A group of cattle of a single kind that is kept together for a specific purpose.
 17. The cattle breeds that originated in tropical countries such as Asia, Africa, and India.
 18. The proportion of lean, salable meat yielded by a carcass.
 19. A tender primal cut made from the center section of rib.
 20. A primal cut from the section between the ribs and the round, and above the flank of beef cattle.
- A. backgrounding operation
 - B. *Bos indicus*
 - C. *Bos taurus*
 - D. breed
 - E. brisket
 - F. bull
 - G. calf
 - H. calving
 - I. chuck
 - J. commercial cattle
 - K. cow
 - L. cow-calf operation
 - M. cutability
 - N. feedlot
 - O. flank
 - P. gestation
 - Q. heifer
 - R. herd
 - S. loin
 - T. plate
 - U. polled
 - V. primal cut
 - W. rib
 - X. round
 - Y. seedstock
 - Z. steer

21. The process of carrying young in the womb between conception and birth; pregnancy.
22. Castrated beef/dairy cattle.
23. Term used to describe the large primary pieces into which a beef carcass is divided.
24. Bulls, heifers, and cows that are used in registered breeding herds as well as commercial cattle operations.
25. A tough, fatty primal cut of meat from the front belly of beef cattle, just below the rib cut.
26. A primal cut from the abdominal muscles of beef cattle.

Know and Understand

Answer the following questions using the information provided in this lesson.

1. The beef cattle industry in the United States generates _____ annually.
 - A. \$5.6 billion
 - B. \$22 billion
 - C. \$66.2 billion
 - D. \$87.7 million
2. The average size cowherd in the United States is _____.
 - A. 30 head
 - B. 43 head
 - C. 83 head
 - D. 120 head
3. *True or False?* The US beef industry exports less than 3 billion pounds of beef annually.
4. What is the approximate gestation period for beef cows?
 - A. 120 to 139 days
 - B. 200 days
 - C. 279 to 290 days
 - D. 290 to 305 days
5. At what age are heifers usually bred?
 - A. 15 to 18 months
 - B. 18 to 24 months
 - C. 24 months
 - D. None of the above.
6. Calves are weaned at _____.
 - A. 6 to 8 weeks
 - B. 3 to 4 months
 - C. 6 to 8 months
 - D. 12 to 18 months

7. *True or False?* Cattle graze for their first three months in feedlots and eat high-grain diets for the next 3 to 4 months.
8. *True or False?* Commercial cattle are typically purebred animals that are registered with a breed association.
9. *True or False?* Cattle chew cud to aid in further digestion.
10. *True or False?* A herd of cattle functions as a single entity and may move spontaneously in one direction.
11. The primal cuts of beef include the _____.
 - A. brisket, plate, and flank
 - B. rib and round
 - C. loin and chuck
 - D. All of the above.
12. *True or False?* Subprimal cuts include the edible offal.
13. Which beef cattle breeds are indigenous to the United States?
14. Identify the type of diet beef cattle enjoy while living in feedlot operations. Explain why they are fed this type of diet.
15. List the types of performance data kept on record for purebred cattle.
16. Explain why it is a good idea to maintain some level of human contact with a herd of beef cattle.
17. Explain the differences between *Bos taurus* and *Bos indicus*.

Analyze and Apply

1. How has the beef industry changed since it first began in the United States? Research the development of the beef industry in the United States. Find at least five major events that affected the course of the industry. How were these events significant?
2. The beef industry is strong in many other countries around the world. Aside from the United States, which countries produce and export a significant amount of beef and beef products? Who purchases or imports the most beef from these countries?
3. How large is the organic beef industry in the United States? How are these animals raised? What are they fed? How is it determined whether the cattle have been raised organically?

Thinking Critically

1. What are some of the ethical issues surrounding the beef industry? Research these issues and choose a specific area that interests you. Use your research to write a brief argument for or against a specific issue.
2. The waste from cattle operations produces a considerable amount of methane. Is this methane production detrimental to the environment? How can methane produced from animal waste be used productively?

SAE for ALL Opportunities

1. **Foundational: Career Exploration and Planning SAE**—Are you considering a career in the beef, dairy, or horse industry? Exploring careers in these industries may be easier than you think. One way to explore these career paths would be to research these during your agricultural education class. A hands-on experience could be shadowing a beef cattle producer, a dairy farmer, or an equine expert.
2. **Immersion: Ownership/Entrepreneurship SAE**—Becoming fully immersed in the ownership or production of large animals may not be easy for some students. Many times, this depends on the proper facilities at home or at school. Students can own and produce beef cattle, dairy cattle, and horses with adequate support from family members and their ag teacher. These projects require a significant investment of time and money.
3. **Immersion: Internship/Placement SAE**—Students who are interested in large animal production but lack the facilities or capital to invest in a project may choose a Placement SAE. Students could work for beef, dairy, or equine producers and still learn many of the daily functions of the production system without having the risk of investing their own money. Only time is required for this type of SAE.
4. **Foundational: Agricultural Literacy SAE**—Research the various breeds of beef cattle, dairy cattle, and horses. Determine which breeds are best suited for your region, environment, or climate.
5. **Immersion: School-Based Enterprise SAE**—If your school has a school farm, ask your agriculture teacher(s) if the school/FFA chapter would invest in a breeding animal (beef/dairy heifer, mare) to use to produce offspring. If not, contact a local producer who would be willing to donate an animal to the school/FFA chapter. The proceeds from the offspring could be used to build a school-based enterprise that raises affordable show animals for other students who may not have the means to afford this type of project.
6. **Immersion: Experimental SAE**—Conduct a feed trial with any large animal species using different rations. Using the steps of the scientific method, conduct an experiment and analyze animal rate of gain, cost of feed, and other factors to help recommend a preferred ration.

SAE for ALL Check-In

- How much time have you spent on your SAE this week?
- Have you logged your SAE hours?
- What challenges are you having with your SAE?
- How can your instructor help you?
- Do you have the equipment you need?

LESSON 10.2

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The Dairy Industry

Essential Question

How do producers maximize efficiency in producing milk for dairy products in the United States?

Lesson Objectives

After studying this lesson, you should be able to:

- Understand the size and scope of the US dairy industry.
- Understand common terminology of the dairy industry.
- Identify common dairy products.
- Describe the components of the US dairy industry.
- Understand commonly used production systems in the dairy industry.
- Describe different breeds of dairy cattle in the United States.

Words to Know

blind quarter

butter

buttermilk

cheese

condensed milk

cream

evaporated milk

flash pasteurization

frozen yogurt

heart girth

high-temperature, short-time pasteurization

homogenization

ice cream

lame

mastitis

milk

milking parlor

parturition

pasteurization

sour cream

teat

udder

ultra-heat pasteurization

yogurt

Before You Read

Take a moment to compare and contrast the differences and similarities between dairy cattle and beef cattle. Share the results with your classmates and teacher.

Dairy cattle are cattle raised for their ability to produce large amounts of **milk**. According to the USDA, there are approximately 9.4 million head of dairy cattle in the United States. More than 18% (1.73 million) of those dairy cows are found in the state of California. The top five states (in order) in dairy production are California (18.5%), Wisconsin (14.01%), Idaho (7.16%), New York (6.92%), and Texas (6.34%).

Did You Know?

The first "cows" that were milked were Aurochs some 8000 to 10,000 years ago.

Dairy Industry in the United States

The US dairy industry contributes approximately \$620 billion in total economic impact to our economy. There are more than 34,000 dairies in the United States and more than 95% are family owned and operated. The average herd size for a dairy is 234 fewer cows. Three-fourths of US dairies have less than 100 cows, **Figure 10-10**. Eighty-five percent of milk produced in our country comes from dairies with more than 100 cows. Dairy farms in the United States produce approximately 25.4 billion gallons of milk per year. That is a bathtub of milk for almost every person in North America each year! The average dairy cow will produce almost 7.5 gallons of milk a day, which is more than 2500 gallons per year.



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Figure 10-10. Dairy operations are high-maintenance, labor-intensive operations. *What are some of the jobs or careers involved in dairy cattle production?*

Did You Know?

Bacterial numbers in milk can double within half an hour at a temperature of 95°F (35°C). Within two hours, 1000 bacteria in a milliliter of milk can become 16,000 bacteria.

- **Butter** is a soft yellow or white food churned from milk or cream and used to spread on food, and in cooking and baking.
- **Buttermilk** is the slightly sour liquid left over after butter has been churned. It is used in baking and consumed as a drink.
- **Cheese** is a solid food made from milk curd that is produced in a range of flavors, textures, and forms. The milk curd is pressed together and may be seasoned, or allowed to age or ripen with bacterial cultures, **Figure 10-12**.
- **Condensed milk** is a heavily sweetened milk product made by removing about 60% of the water from ordinary milk. It may be used in baking and desserts.
- **Cream** is the thick white or pale yellow fatty liquid that rises to the top of milk that is left to stand (unless it is homogenized). Homogenization is a process in which the milk's fat droplets are emulsified and the cream does not separate.
- **Evaporated milk** is a milk product made by removing about 60% of the water from ordinary milk. It may be used as a substitute for milk or cream.
- **Frozen yogurt** is a frozen dessert that is lower in fat than ice cream and contains yogurt cultures that may or may not be active.
- **Ice cream** is a sweet, frozen food made from no less than 10% butterfat and made in a myriad of flavors.
- **Sour cream** is cream that has been fermented with certain kinds of bacteria. The bacterial culture sours and thickens the cream.

Milk Fat and Protein by Breed		
Breed	% Fat	% Protein
Ayrshire	3.86	3.18
Brown Swiss	4.04	3.38
Guernsey	4.51	3.37
Holstein	3.65	3.06
Jersey	4.60	3.59

Goodheart-Willcox Publisher

Figure 10-11. The percentage of fat and protein varies by breed of dairy cattle. *What trends can you see in these percentages?*

The main commodity produced from dairy cattle is milk and milk products. However, when dairy cattle are harvested, they may also produce beef and by-products such as leather. Dairy calves account for approximately 14% of beef production in the United States. One in every five pounds of beef consumed in our country comes from dairy cattle.

Milk and Milk Products

Dairy products are used in many of the foods we eat each day, including desserts, breakfast cereals, soups, and as the base for many types of sauces. Most dairy products begin as fluid milk. Milk from a cow averages 3%–4% fat and 3.5% protein, **Figure 10-11**. Some of the most commonly consumed dairy products are types of fluid milk, such as fat-free or skim milk, low-fat (1%) milk, reduced-fat (2%) milk, and whole milk. Common dairy products made from milk include the following:



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Figure 10-12. Cheese is only one of the many dairy products most people consume on a regular basis. *Have you ever made cheese? Was it difficult? Do you think any one kind is more complicated to produce?*

- **Yogurt** is a semisolid food made of milk and milk solids fermented by two added cultures of bacteria (*Lactobacillus bulgaricus* and *Streptococcus thermophilus*).

It is easy to see the dairy industry's influence on our food supply with the wide variety of products made with milk.

Pasteurization and Homogenization

Milk is both pasteurized and homogenized. **Pasteurization** of milk is a process of killing bacteria in the milk. Pasteurization involves heating the milk to 161.6°F (72°C) for 15 seconds and then cooling it quickly. This process is called **flash pasteurization** or **high-temperature, short-time pasteurization**. Flash pasteurization yields milk that lasts in the store for two to three weeks. **Ultra-heat pasteurization** is a pasteurization method in which milk is heated to 280°F (138°C) for two seconds. This results in milk that is shelf-stable for up to nine months.

Homogenization is the process of breaking down fat molecules (cream, butterfat, or milkfat) so they resist separation from the water in milk. It occurs after pasteurization. When raw milk sits without stirring, the cream floats to the top because it is lighter than the water portion of milk. Homogenization is a mechanical process of breaking down fat molecules in the milk to such a small size that they cannot separate.

Production Cycle of Dairy Cattle

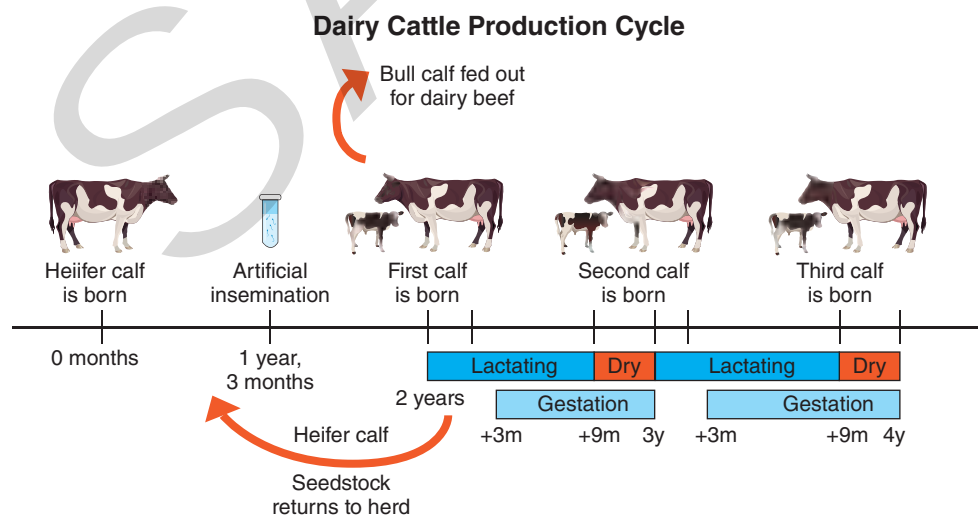
Some aspects of dairy cattle production differ greatly from beef cattle production, **Figure 10-13**. **Parturition**, which is the act of giving birth, causes milk production in cows. When dairy cattle give birth, their calves are only allowed to stay with the cow and nurse for a short period, usually less than 24 hours. The newborn calves are fed milk or milk replacer, a substitute for the cow's milk similar to baby formula in humans, from a bottle until they reach 6 to 8 weeks of age.

Heifers are usually retained and placed into a replacement program where they are grown out to 15 months of age and bred. A replacement program is a plan for how a farm will replace aged cows with new heifers that are high-producing females. They will typically have their first calf at two years of age. Bull calves are usually grown out in similar fashion; most will be castrated and grown for beef production. Only elite bull calves with superior genetics are selected to keep as bulls.

Did You Know?
Opened and unopened milk is still safe for 4–7 days beyond its sell-by date if refrigerated.

Did You Know?
Drinking raw milk, meaning unpasteurized milk, may leave you with some unhealthy results. Raw milk can contain *Salmonella enterica*, *E. coli*, *Listeria monocytogenes*, and *Campylobacter* spp, all of which result in food poisoning.

Dairy Cattle Terminology
bull mature or young male
calf young dairy cattle
calving act of giving birth
cow mature female
heifer young female
steer castrated male



Goodheart-Willcox Publisher; Hennadii_H/Shutterstock.com

Figure 10-13. The production cycle of dairy cattle is similar to that of beef cattle. *What are the main differences of the two cycles?*

STEM Connection

Is It a Dairy Product?

Milk, almond milk, goat's milk, yogurt, custard, ice cream, and Cheese Whiz—many products in your grocery store would have you think they are made from or include dairy. Which of these products and others like them are truly “dairy”? Make a list of as many dairy-type foods found in your local grocery store (hint: you might use the advertisements from the newspaper or online to help trigger your thinking). Categorize them as dairy or nondairy products.

Consider This

1. Why do you think nondairy substitutes have grown in popularity over the past few years? What is the science behind this growth? Is the growth a result of science or marketing? Why do you believe this to be so?
2. Search online for ingredient names used for dairy products in processed foods. Read the labels on foods in your pantry and look for the ingredient names you found online. Which foods include dairy products? Were you surprised by any of the products that did or did not contain a dairy element?
3. Why are so many names used for dairy ingredients?



XiXinXing/Shutterstock.com

Artificial Insemination

Most dairy producers use artificial insemination (A.I.) to breed their cows and do not keep a bull at their farm. Artificial insemination is a process in which sperm is collected from a bull and frozen for storage. Subsequently, the sperm is thawed and placed in the reproductive tract of the cow. A major advantage of A.I. is that producers can breed their cows to the superior genetics of top-performing bulls in the industry without having to ship either of the animals to one farm or the other. Additionally, bulls are expensive to feed and maintain on the farm. The farmer needs the bull only a few days each year, but must feed it year-round if it is kept on the farm. Bulls can also become aggressive and can endanger other animals and people working on the farm.

Culling the Dairy Herd

A dairy cow will usually stay in the production herd about five years. Factors that can lead to cows being culled from the dairy herd include the following:

- **Mastitis** is inflammation of the mammary glands that is usually caused by bacteria. Severe mastitis prevents the cow from producing milk in the future. In addition, all milk from a mastitis cow cannot be consumed by humans and must be dumped.

- Inflammation of the udder is swelling and discoloration of the udder due to infection or injury. The **udder** is the bag-like mammary gland of cattle (and other livestock) that has two or more teats hanging near the hind legs. The **teats** are the nipples of the mammary gland from which the milk is extracted. See **Figure 10-14**.
- When a cow is having trouble moving on its feet and legs, it is said to be **lame**. Lameness becomes a serious issue for dairy cattle because they walk mainly on concrete to enter the milking parlor. Additionally, the cow must walk to eat at the feed bunk or in the pasture.



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Figure 10-14. Dairy farmers pay special attention to the health of their cows' udders. They must be kept clean and free of irritation to maintain maximum milk production efficiency. Udders should have four evenly spaced teats with strong ligaments between the quadrants of the udder. Notice the large mammary veins under the stomach just before the udder.

Milking Parlor

The **milking parlor** is the section of a dairy where the cow is moved to for milking. There are many types of milking parlors. Common milking parlor designs are parallel, tandem, herringbone, and rotary. The most common are rotary and herringbone, **Figure 10-15**. Parallel parlors are similar to herringbone parlors except the cows are not situated at an angle, **Figure 10-16**. Rotary parlors are used on large dairy farms. They are slowly rotating carousels that move while the cows are milked. Some rotary parlors can hold 72 cows. The cow's udders face outward so the farmers can clean and inspect teats and hook the teat cups to the teats.

Dairy cows are typically milked twice a day. Some producers have seen increased production when milking three times a day, but this is time consuming and cost-prohibitive for most dairy operations. The following multistep process occurs prior to and after milking:

1. The cow's udder and teats are cleaned and dried prior to milking.
2. The cow's teats are disinfected with a teat dip to prevent the spread of mastitis and other afflictions.
3. The milking equipment is attached to the udder correctly to ensure maximum production.
4. The cow's teats are disinfected with a teat dip after milking.
5. The milk is cooled to below 45°F (7.2°C) within a two-hour period.
6. The milk is stored in tanks before transport to a processing facility.
7. The milk is tested before processing to ensure it meets health and safety standards.

Dairy farmers are required to meet specific standards and are paid a premium for milk that meets and exceeds the industry standards. The requirements involve bacteria counts, somatic cell (white blood cell) counts, no added water, and no antibiotics present in the milk.

Anatomy of Dairy Cattle

Dairy and beef cattle are all bovine, so they share the same main body structures, **Figure 10-17**. A dairy cow must have good body conformation. This means that she must have sound feet, legs, and a body structure that allows her to stand and walk on either concrete in a high-production free-stall barn or to walk around a pasture grazing.

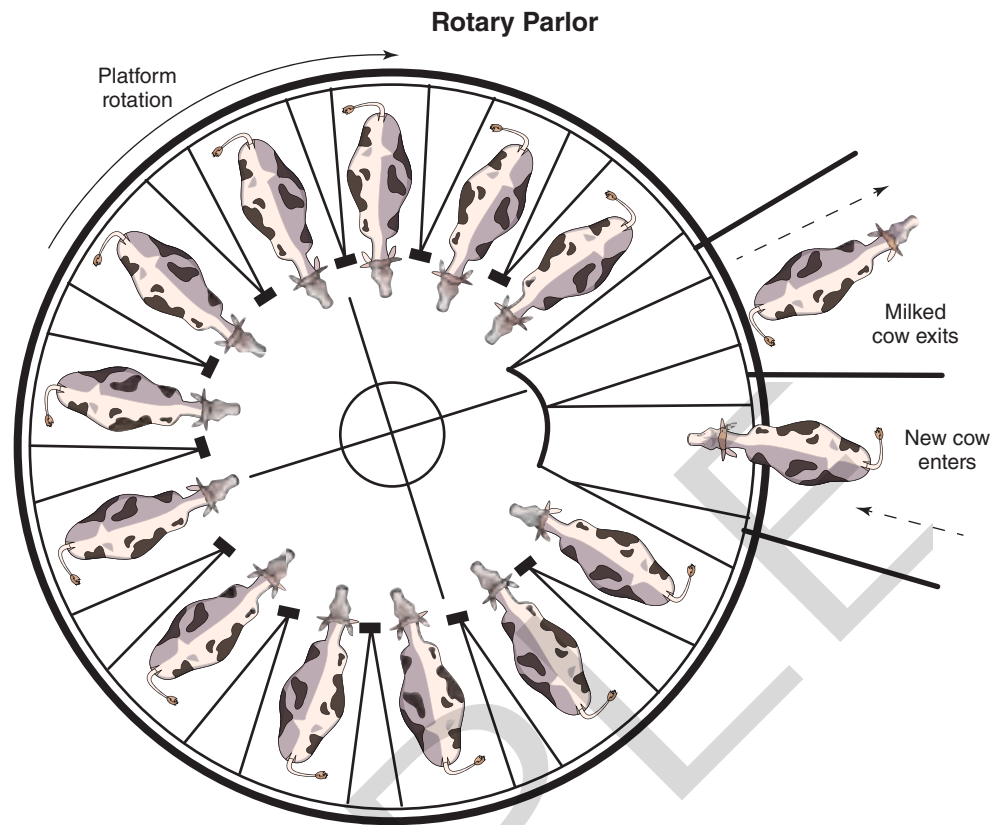
Dairy farmers also prefer cows that are large, especially across their chest floors. This area is called the **heart girth**. A large body capacity and heart girth enables the cow to consume large portions of food and water, which generally translates into greater volumes of milk production.

Did You Know?

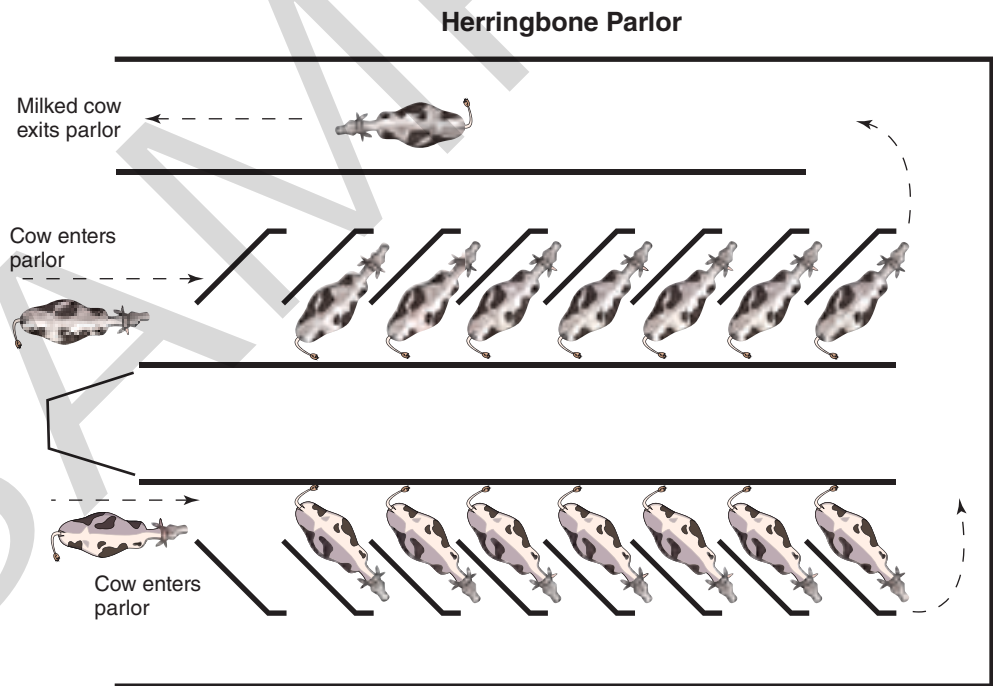
The National FFA Organization has a career development event called Milk Quality and Products. This competition is designed to teach students about milk quality and safety along with manufacturing and marketing of milk and dairy products. Ask your FFA advisor for more information.

Did You Know?

Each gallon of milk requires 500 gallons of blood to be pumped through the udder.



A



B

bsd/Shutterstock.com

Figure 10-15. A—Today’s milking parlors are complex operations requiring daily cleaning and maintenance. On a rotary milking carousel, the cows are milked from below the circular raised platform. The platform on which the cows stand rotates very slowly, allowing milked cows to exit and other cows to step on for milking B—The herringbone parlor, in which the cows are at a 45° angle, is the most common design used on smaller dairy farms. The design allows access for different types of equipment to be used. *How would knowledge of plumbing benefit someone working in a dairy operation?*

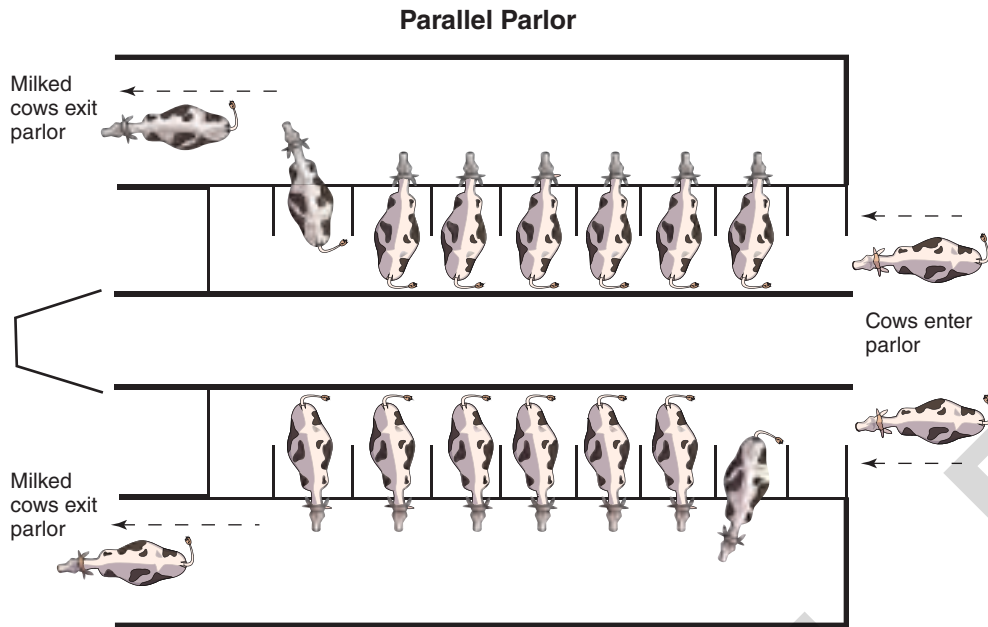


Figure 10-16. The parallel parlor is similar to the herringbone parlor except the cows are parallel to each other. This design only allows access from behind the cow. *What are the advantages and disadvantages for the different milking parlor designs?*

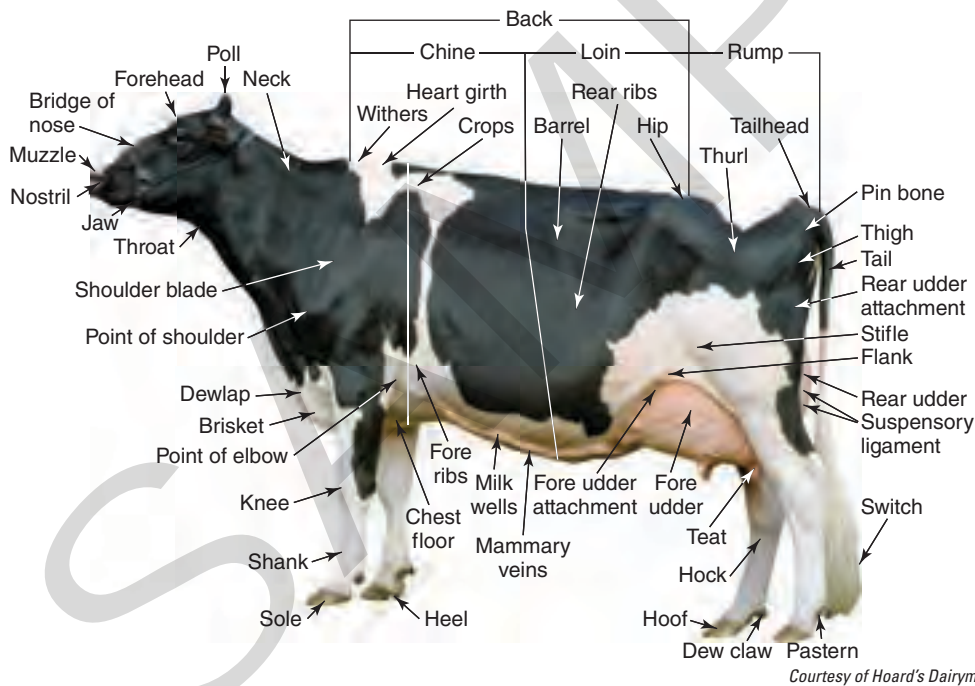


Figure 10-17. Does the dairy cow anatomy differ from the beef cattle anatomy? If so, what are the differences?

Dairy Cattle Build

Dairy cows are much thinner than beef cattle. This difference arises from the end goals of production. Beef cattle are produced for their meat and muscle so they are bred to be bigger and heavier than dairy cows. Dairy cows are raised for milk production. The dairy farmer's goal is that all of the cow's feed energy is used to produce milk with only the necessary amount of muscle and fat to keep the cow healthy. Therefore,

high-producing dairy cows will look thin and you may even see their ribs and hip bones prominently just below their skin. This is one indication of a healthy dairy cow. In fact, heavy dairy cows are low producing and may even be ill.

Udder Care

The udder is the “business end” of the dairy cow. Dairy farmers take good care of their cows’ udders. Before each milking, teats are wiped with a wet cloth to remove any dirt or other debris. Each teat is then dipped in an antibacterial iodine or similar solution to kill any microbes. Hairs on the udder are clipped or singed periodically to prevent dirt build-up. Farmers also check the udders for sores or indications of mastitis.

Lactation Cycle

Dairy cows are milked on a 300-day lactation cycle. Lactation begins at the birth of a calf. The newborn calf nurses for a short time to receive the colostrum from its mother. (The colostrum contains antibodies that help protect the calf until its immune system develops.) The calf is then removed from the cow and she begins providing milk to be sold. The cow will produce milk for the next 300 days. About two months before her next calving, she will stop producing milk. Her body’s energy is focused on the growing calf and preparing her body for the next lactation cycle.

Did You Know?

A dairy cow may lose the ability to produce milk in one of the quarters of her udder and still function at a high level in the herd. The quarter of the udder that lost production is called a **blind quarter**. This has no impact on the cow’s eyesight, however.

Did You Know?

Some of the most extensive genetic records are those of dairy cattle. The oldest known genetic record of a dairy cow dates back to the late 1890s when dairy breed associations began tracking milk production and other cow characteristics.

Maintaining Herd Health

Farmers and their workers know their animals well because of their close daily interactions. Additionally, cattle are herd animals and sickness and disease may easily spread throughout a herd if the animals are not properly vaccinated or if they live in unsanitary conditions. Keep the following points in mind when raising cattle:

- Establish complete herd health records and consistently implement regular vaccination and parasite control programs.
- Maintain clear, complete, and accurate records for calving, breeding, and vaccination.
- Maintain a good working relationship with a large-animal veterinarian to ensure proper herd health management.
- Purchase replacement females and semen only from reputable breeders who maintain high herd health standards.
- Observe new animals for possible diseases and parasites.
- Monitor cows during calving, especially first-calf heifers, to minimize potential harm to or loss of calves and cows. In most cases, the cow intuitively knows how to calve, but sometimes needs some assistance in pushing the calf out of her body.

Feeding Dairy Cattle

Dairy cattle are ruminants. This means that their body can digest grasses and other roughages. A dairy cow must eat about 25 lb of grain and 30 to 35 lb of roughages or

FFA Connection Dairy Cattle Events

Learning the basic parts of dairy cattle is a fundamental step in learning to evaluate and judge dairy cattle. To develop your knowledge and understanding of the confirmation and makeup of dairy cattle, speak with your teacher about the Dairy Cattle Evaluation and Management Career Development Event and the Dairy Handlers event in FFA.

hay per day. Farmers may allow dairy cattle to graze on outdoor pastures or they may feed them roughages in other formats. Roughage can be fed as hay, haylage, or silage, **Figure 10-18**. Haylage and silage are the same kind of roughage except that haylage is made from grass, clover, or alfalfa, and silage is made from corn. Both haylage and silage are harvested from fields when the plants are green and just starting to mature or dry. The entire plant from just above the roots is used. At this point, the haylage or silage has a high moisture content. The haylage or silage is transferred to a silo, bunker, or blown into large agricultural plastic bags. All of these structures are air- and water-proof. In this anaerobic condition, the haylage or silage ferments to become a highly nutritious food for cattle.

The benefit of haylage or silage is that cows can be fed in a feedlot or freestall barn. Additionally, the nutritional content of haylage or silage can be precisely determined much more so than random grasses in a pasture.

Dairy cows require quite a bit of water each day. A cow must drink 30 to 50 gallons of water (over 400 lb of water) each day to produce milk. Water must always be available and of high quality to produce milk, **Figure 10-19**.

Handling Dairy Cattle

There is a great deal more information regarding breeding and handling of dairy cattle than can be included in this chapter. Many of these concepts will be learned in other agricultural classes or in a real-world career setting working on a dairy or in the dairy industry. The following list of tips is not all-inclusive, but each point is significant enough to remember when working with or around dairy cattle:

- Dairy cattle should be selected according to their intended use, the geographical area and environment in which they will be raised, and the breeder's personal preference of the traits he or she wants to produce with the dairy cattle.
- Remain calm and handle dairy cattle with ease when moving them in and out of the milking parlor to avoid slips, falls, and feet and leg injury.
- Extra caution must be exercised if the dairy producer uses bulls rather than artificial insemination. Dairy bulls are large and aggressive animals.
- Provide sufficient access to clean water at all times.
- When possible, provide cattle with shelter from harsh weather conditions.
- Use safe actions when working around dairy cattle.
- Avoid situations that startle or frighten them, especially when approaching them in the milking process.



smereka/Shutterstock.com

Figure 10-18. Silage is a roughage that is the harvested corn plants and includes the stalk, ears, leaves, and tassels. It is fermented in a silo, bunker, or agricultural bag.



Catherine311/Shutterstock.com

Figure 10-19. It is essential for any living organism to have access to a clean and safe water supply. *How would insufficient access to a safe water supply affect a dairy cow's milk production? How would it affect the dairy operation's profits?*

Did You Know?

In the 18th Century, Europeans realized that people who milked cows were immune to smallpox, a deadly disease at the time. The farmers contracted cowpox, a similar but less deadly disease than smallpox. The cowpox was similar enough to smallpox that the farmer developed immunity to smallpox. English physician Edward Jenner experimented with cowpox and developed a vaccination for smallpox, which was introduced to the United States in the early 1800s.

Did You Know?

Some of the top-producing Holstein cows have been known to produce more than 72,000 lb of milk a year! That is under ideal conditions as far as nutrition and milking three times a day versus two.

Dairy Cattle Breeds

The species name for dairy cattle is bovine. Dairy cattle are classified under the subspecies *Bos taurus*—A breed is a specific group of cattle that has similar appearance, characteristics, and behaviors that distinguish it from other cattle in the same species. Let us look at the popular dairy breeds in the United States and their characteristics.



Courtesy of Hoard's Dairyman

Ayrshire—Ayrshire cattle originated in the county of Ayr in Scotland prior to the 1800s. They were first imported into the United States in 1822. Ayrshires are red and white in color and are known for their udder quality, efficiency, and longevity. Ayrshire cattle are moderate in size with mature cows weighing around 1200 lb. They produce high-quality milk, which is popular in manufactured products.



Courtesy of Hoard's Dairyman

Brown Swiss—The Brown Swiss, which originated in Switzerland, is probably the oldest of all dairy breeds. They are known for their ability to adapt to different environments. Brown Swiss were imported into the United States in 1869. The Brown Swiss illustrated here is predominantly brown in color with a black nose encircled by a white ring. Brown Swiss are large-framed cattle. Mature cows will weigh around 1400–1500 lb. They are known for their docile temperament. The high protein content of their milk makes it highly desirable in the cheese industry.



Courtesy of Hoard's Dairyman

Guernsey—Guernsey cattle can be traced back to the Isle of Guernsey off the coast of France. The Guernsey breed was developed by French monks from crossbreeding and can be traced back over 1000 years. They were first imported in the United States in 1831. Guernseys are fawn colored with white markings. Mature cows are smaller to moderate in size, weighing about 1100–1200 lb. They produce milk that is high in fat content and golden in color. Guernsey cattle mature early, adapt well, and are very docile.



Courtesy of Hoard's Dairyman

Holstein—Holstein is the most popular breed of dairy cattle in the United States and is the world's largest dairy breed. They make up more than 90% of the dairy cattle in this country. Holstein cattle originated in the Netherlands over 2000 years ago. One of the provinces they were developed in is called Friesland. In other countries of the world, Holsteins are called Friesians. They are large-framed cattle with mature cows weighing more than 1400 lb. Holsteins are known for their high-volume milk production. The average Holstein cow produces more than 23,000 lb of milk a year.



Courtesy of Hoard's Dairyman

Jersey—Jersey cattle are the second most popular dairy breed in the United States. Jersey cattle originated on the Isle of Jersey in the English Channel off the coast of France. They are one of the oldest dairy breeds. They were imported to the United States in the early 1800s. Jerseys are the smallest breed of dairy cattle in terms of size. Mature cows are usually 1000 lb or lighter. They are cream to fawn color and sometimes almost black. Their points, meaning ears, muzzle, tail switch, and feet, are black and they have a distinctive dished face. Jerseys are known for the exceptionally high fat content in their milk. They rank first among all dairy breeds in fat content, which makes their milk popular for products such as ice cream.



Courtesy of Hoard's Dairyman

Milking Shorthorn—Shorthorns date back to the early 1500s and are probably the oldest breed of cattle. The Milking Shorthorn is a portion of the Shorthorn breed, which was a dual-purpose breed. Milking Shorthorns were developed in Northeastern England in the valley of the Tees River. They were imported into the United States in the late 1700s. Milking Shorthorns come in an array of colors. Milking Shorthorns can range from red, to red and white or roan, much like Shorthorn beef cattle. Cattle are medium in size with mature cows weighing approximately 1400 lb. Milking Shorthorns are known for their versatility and being docile. They are also appreciated for their easy calving and longevity. Milking Shorthorns are also used for beef because of their high muscle content.



Courtesy of Hoard's Dairyman

Red and White Holstein—Red and White dairy cattle are simply red Holsteins. The Red and White Dairy Cattle Association was founded in 1964 in the United States. The breed association is strong and growing. They have the same characteristics as Holsteins except for their variation in color. They are a larger breed in stature, like Holsteins, with mature cows weighing around 1500 lb. They have excellent milk production.

Lesson 10.2 Review and Assessment

Lesson Summary

- The dairy industry is vital to our economy and food supply.
- Dairy production operations range from small, family-owned operations to operations with a couple hundred dairy cattle.
- The main commodity of the dairy industry is fluid milk.
- When dairy cattle are harvested, they also produce beef.
- There are innumerable products made from milk, ranging from cream, yogurt, and butter to cheese and frozen desserts.
- The terminology used to describe dairy cattle is identical to that used to describe beef cattle.
- No two breeds of dairy cattle are the same, and each brings its own set of strengths and weaknesses to the industry.
- Through research and development, dairy breeds have evolved to fit most climates, terrains, and geographic areas of the world.

Vocabulary Review

Match the vocabulary terms listed in the *Words to Know* to the correct definition.

- | | |
|-------------------------|--|
| A. blind quarter | 1. A fluid rich in protein and fat, secreted by female mammals for the nourishment of their young. |
| B. butter | 2. The slightly sour liquid left over after butter has been churned. It is used in baking and consumed as a drink. |
| C. buttermilk | 3. The section of a dairy where the cow is moved to in order for milking to occur. |
| D. cheese | 4. A heavily sweetened milk product made by removing about 60% of the water from ordinary milk. |
| E. condensed milk | 5. A solid food made from milk curd that is produced in a range of flavors, textures, and forms. |
| F. cream | 6. A milk product that has been fermented with certain kinds of bacteria. The bacterial culture sours and thickens the cream. |
| G. evaporated milk | 7. The act of giving birth. |
| H. flash pasteurization | 8. The thick white or pale yellow fatty liquid that rises to the top of milk that is left to stand (unless it is homogenized). |
| I. frozen yogurt | 9. A semisolid food made of milk and milk solids fermented by two added cultures of bacteria. |
| J. heart girth | 10. A milk product made by removing about 60% of the water from ordinary milk. |
| K. homogenization | 11. A soft yellow or white food churned from milk or cream and used to spread on food, and in cooking and baking. |
| L. ice cream | 12. The bag-like mammary gland of cattle that has two or more teats hanging near the hind legs. |
| M. mastitis | 13. A frozen dessert that is lower in fat than ice cream and contains yogurt cultures that may or may not be active. |
| N. milk | 14. A quarter of the udder that has lost production. |
| O. milking parlor | 15. The nipples of the mammary gland from which the milk is extracted. |
| P. parturition | 16. A milk treatment in which milk is heated to 161.6°F (72°C) for 15 seconds and then cooled quickly. |
| Q. pasteurization | 17. A process in which the milk's fat droplets are emulsified and the cream does not separate. |
| R. sour cream | |
| S. teats | |
| T. udder | |
| U. yogurt | |

18. A sweet, frozen food made from no less than 10% butterfat and made in a myriad of flavors.
19. Inflammation of the mammary glands, which is usually caused by bacteria.
20. A process in which bacteria in milk is killed with heat.
21. The measurement of the area across the chest floor of a bovine.

Know and Understand

Answer the following questions using the information provided in this lesson.

1. *True or False?* Less than 65% of dairies in the United States are family owned and operated.
2. What is the main commodity produced from dairy cattle?
 - A. Beef
 - B. Milk
 - C. Cheese
 - D. All of the above.
3. Which is *not* a common product made from cow's milk?
 - A. Butter
 - B. Yogurt
 - C. Almond milk
 - D. Cheese
4. When dairy cattle give birth, the calves _____.
 - A. nurse until they reach 6 to 8 weeks of age
 - B. remain with the cows to nurse for only a few hours
 - C. are placed in a nursery with nursing cows
 - D. None of the above.
5. Why do dairy farmers commonly use artificial insemination to breed their cows?
 - A. A.I. allows the farmer to use superior genetics.
 - B. Bulls are expensive to feed.
 - C. Bulls can become aggressive.
 - D. All of the above.
6. What is one reason that cows are culled from the dairy herd?
 - A. Blind quarters
 - B. Lameness
 - C. Udderitis
 - D. All of the above.
7. Why are a cow's teats disinfected after milking?
 - A. Prevent the spread of mastitis
 - B. Reduce chaffing
 - C. Cool them down
 - D. None of the above.
8. Once the milk leaves the cow, it must be cooled to a temperature below _____ within a two-hour period.
 - A. 45°F (7.2°C)
 - B. 55°F (13°C)
 - C. 65°F (18°C)
 - D. 85°F (29°C)

9. Why do dairy cows look skinnier than beef cattle?
 - A. Most of their feed energy goes toward milk production.
 - B. They are fed less food than beef cattle.
 - C. They are a different species of cattle than beef.
 - D. All of the above.
10. How does a dairy farmer maintain herd health?
 - A. Keeping accurate records
 - B. Working closely with a veterinarian
 - C. Purchasing semen and replacement females from reputable breeders
 - D. All of the above.
11. How much water do dairy cows consume daily?
 - A. Over 400 gallons
 - B. Over 100 gallons
 - C. 30 to 50 gallons
 - D. 25 to 30 gallons
12. What is silage made from?
 - A. Clover
 - B. Alfalfa
 - C. Grass
 - D. Corn
13. What is one practice of proper handling of dairy cows?
 - A. Provide sufficient access to clean food at all times
 - B. Remain calm and handle dairy cattle with ease
 - C. Provide cattle with opportunities to graze in rain and snow
 - D. All of the above.
14. Which is the most common breed of dairy cows?
 - A. Holstein
 - B. Jersey
 - C. Ayrshire
 - D. Guernsey
15. Which is the smallest breed of dairy cows?
 - A. Holstein
 - B. Jersey
 - C. Ayrshire
 - D. Guernsey

Analyze and Apply

1. Conduct a dairy investigation in your home. How many gallons of milk does your family consume in a week? Convert the gallons of milk consumed to pounds of milk. Convert the gallons to glasses of milk. How many dairy cows would your family need to supply your weekly milk needs for just fluid milk?
2. Using USDA reports of milk and milk products, analyze the data about milk and dairy product consumption. What are the trends? How has the invention of nondairy “milk” products affected consumption?
3. Look up the percent fat and percent protein in milk from the breeds of dairy cows. Compare these percentages with the percentages of various dairy food products. Which species produce milk that is suited to the various dairy products? Why?

Thinking Critically

1. Milk is used to make many food products. Develop a list of common foods that have milk as a major ingredient. What percentage of your daily diet includes milk and dairy products? Approximately how many pounds of milk or dairy products do you consume in a day? In a month? In a year?
2. There are many different kinds of fluid milk products, including cream, half-and-half, whole milk, 2% milk, 1% milk, skim milk. Work with a partner to create a chart listing the kinds of milk, what they are used for, how much fat is in each type, and how much price difference there is between each type. Why do you suppose there are differences in price?

SAE for ALL Opportunities

1. **Immersion: Experimental SAE**—Conduct an experiment with types of fluid milk and the impact of using different fluid milk products in a recipe. Find a recipe that calls for fluid milk. Make different versions of the same recipe using the same ingredients, except change the kind of fluid milk or milk product used. Then, research and create a tasting rubric and have your family and/or friends taste the various recipes and rate them. What is the effect of different kinds of fluid milk/milk products on taste, texture, and other food factors?
2. **Immersion: Experimental SAE**—Research how to make cheese from milk. See if you can produce cheese in your home that you can share with friends.

SAE for ALL Check-In

- How much time have you spent on your SAE this week?
- Have you logged your SAE hours?
- What challenges are you having with your SAE?
- How can your instructor help you?
- Do you have the equipment you need?

LESSON 10.3



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The Equine Industry

Essential Question

What is the scope and nature of the equine industry in the United States?

Lesson Objectives

After studying this lesson, you should be able to:

- Understand the size and scope of the equine industry.
- Define common terms used in the equine industry.
- Describe the components of the equine industry in the United States.
- Differentiate types of equine animals based on physical characteristics.
- Identify and describe common breeds of equine animals.

Words to Know

allelomimetic behavior
bars
coldblood
conformation
draft horses
English riding
equine
equine assisted therapy
Equus asinus
Equus caballus
farrier
feral

fight or flight
foaling
frog
hand
herd dominance
hinny
hotblood
imprinting
light horse
long-eared breed
modified monogastric
mule

pony
rodeo
roughstock
sole
stockhorse
stud
topline
warmblood
western riding
white line

Before You Read

Write ten facts you think you already know about the lesson topic. Discuss these facts with a partner. After reading the lesson, revisit your list and add any new information you found about the facts to the list. Have a conversation with your partner about how your knowledge of the topic changed after reading this lesson.

Did You Know?

New Jersey is the state with the most horses per square mile. It is also home to the United States Equestrian Team Olympic Training Center in Gladstone, NJ.

Which livestock animal has historically been used as a food source, a power source, a weapon, a tool, a mode of transportation, a sporting event, a hobby, and even a companion? If you guessed the horse, you are correct. Winston Churchill once said, “The dog may be man’s best friend, but the horse wrote history.” Human history is closely intertwined with horses. Although the advent of the automobile, electric streetcars, and mechanized agricultural machinery once threatened the future need for the horse, the horse industry is still incredibly important to both horse owners and the economy in the United States.

Equine Industry in the United States

Equines are in the family *Equidae*, which includes single-toed hooved animals like horses, asses, and zebras, **Figure 10-20**. Horses make up the largest population of equines in the United States, followed by asses, and less common equines, such as zebras. Although it is difficult to take a census of horses in the United States, the American Horse Council (AHC) estimates there are 7.2 million horses in the country. The top five states by number of horses are Texas, California, Florida, Oklahoma, and Kentucky.

The majority of horses in the United States are kept by private owners for recreational use, including pleasure riding and trail riding. Horses are also used extensively for showing and racing, and more than 0.5 million horses are used for work purposes, including moving livestock and police work. According to the AHC, the equine industry directly employs almost a million Americans and provides \$50 billion in direct economic impact. The equine industry is also a factor in more than \$122 billion of revenue in the United States every year.

Production Cycle of Horses

While production operations exist for all equines, horses are by far the most common equines in production in the United States. Unlike cattle, horses are not bred for meat or milk production in the United States. Horses are bred primarily to continue bloodlines and to produce quality horses for specific uses, such as racing and showing, and to produce good stockhorses for ranch work or roughstock for rodeos.

The production of horses begins through natural breeding or through artificial insemination of the mare. Depending on the breed, a mare will carry the foal for 335 to 370 days. Larger horse breeds have a longer gestation than smaller or pony breeds. Most producers calculate foaling dates at an average of 342 days. **Foaling** is the term for the process of giving birth in all equine animals, **Figure 10-21**. A foal will nurse for 3 to 6 months before being weaned. The continued growth, training, and development of an individual horse depend heavily on the intended use for the horse.

Equine Terminology

- broodmare** mature female kept for breeding
- colt** male two years or younger
- filly** female two years or younger
- foal** young of either gender
- gelding** castrated male
- jack** male ass or donkey
- jenny** or **jennet** female ass or donkey
- mare** mature female horse
- stallion** mature male horse



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Geza_Farkas/Shutterstock.com

Figure 10-20. The equine family includes all horses, asses, donkeys, and even zebras. *What characteristics do these animals have in common?*



R Bar T Quarter Horses

Figure 10-21. This mare has just completed foaling. As a nursing mare, she will have demanding nutritional needs. Ensure you are feeding mares high-protein feed so they do not lose muscle mass when nursing. *What are some of the considerations that the producer should be mindful of to take care of this mare and her new foal?*

Did You Know?

The term *stud* is often misused to describe a mature male horse. The word *stud* is actually used to identify the place a stallion is kept for breeding. For example, if you had a stallion used for breeding purposes your farm or ranch would be the place the stallion was at *stud*.

Did You Know?

An easy way to remember the gestation of a horse is that it is about 11 months and 11 days for most horse breeds.

The Horse Industry

The most common sections of the horse industry in the United States are horse showing, ranch work, rodeos, racing, recreational riding, and other horse employment, **Figure 10-22.**

Horse Showing

Over the course of history, riders have tried to hone and compare their riding and fighting skills through show competitions. Think back to the times of jousting knights in armor where men competed for honor and position, as well as monetary compensation. Today's equestrians compete to show their horse training and handling skills, as well as the quality of their animals. Some equestrians train to reach one of the ultimate competitions, the Olympics.

Horse shows may be breed association championship shows or open to horses of any breed. There are also horse shows for different age and skill levels for both horses and riders. Many different associations sponsor horse shows. Almost anywhere in the country, you are certain to find a show that will match both your own and your horse's skill level and desired discipline.

FFA Connection

Horse Evaluation CDE

Do you think you would be a great horse show judge? Would you like to learn more about the specifics of conformation, equitation, and judged horse show events? The Horse Evaluation CDE through the National FFA Organization allows you the chance to judge both conformation and riding classes. This CDE is a great way to examine breed ideals and test your knowledge of the proper way to evaluate horses at halter and under saddle. You have the opportunity to place classes and then defend your placings through oral reasons.

Horse shows encompass both structural and performance disciplines. Horses are shown at halter based on their conformation to breed standards and based on specific criteria while performing. Some equitation events involve the judging of the rider's ability; other events are based more on the horse's ability. As you can see, there are horse-based events for every level of interest and skill.

The two widely recognized horsemanship disciplines in which horses are shown are English riding and western riding.

English Riding

In **English riding**, horses are ridden in an English saddle, **Figure 10-23.** One of the main differences among English and western riding is the use of the posting trot. This action requires the rider to rise up and down in rhythm with the two-beat gait of the trot. There are also differences in how the reins are held; English riding is completed exclusively with two hands on the reins. Some events in English riding are based on the skills horses and riders used for foxhunting in the English countryside. Horse show events using English riding include: dressage, hunter under saddle, hunt seat equitation, and working hunter.

Stadium and cross-country jumping are also events considered to be within the English riding discipline, **Figure 10-24.** In addition, there are also classes in which the horses are judged on their ability to pull a carriage, cart, or buggy.

Western Riding

Western riding is the discipline of horse showing in which horses are shown in a western saddle, **Figure 10-25**. Western riding disciplines are designed so that the horse can be shown with the reins in one hand. Traditionally, this allowed the rider's free hand to be used for handling ropes and other tools while working. Most of the western riding events are based on skills required by stockhorses used to move cattle, **Figure 10-26**. Western riding horse showing includes the following events: cutting, reining, trail riding, western pleasure, western riding, and working cow horse.

There are also timed western events that are placed by completing a task in the fastest time such as pole bending, stake race, team penning, and barrel racing.

Ranch Work

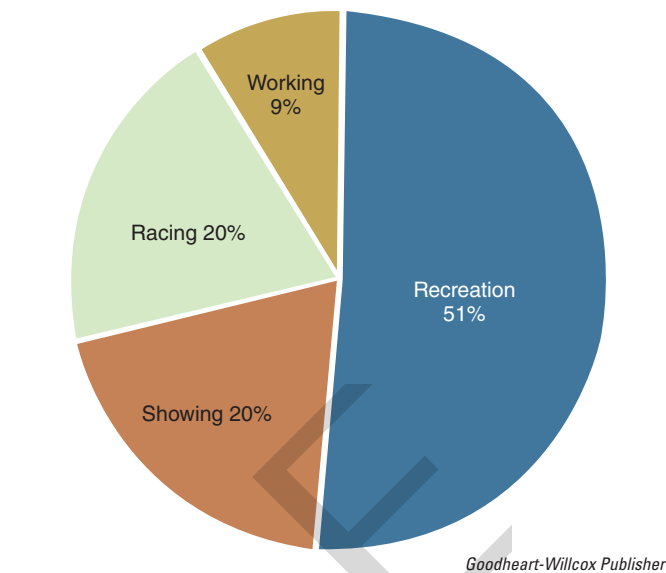
Horses have been a tool used by ranchers since the era of the American West. Even with modern technology and machinery, horses are still used in many beef cattle operations as an efficient way to gather, sort, and work with cattle. Horses are more efficient, less likely to spook cattle, and are able to go into areas where many motorized vehicles are unable to gain access. It requires a specific level of athleticism, speed, and instinctive ability to work with cattle to be a good ranch workhorse. Horses that have been selected for these ranch-working traits are called **stockhorses**. Thousands of horses are used every day to help with ranch work around the country.

Rodeos

Another sector of the horse industry is rodeos. A **rodeo** is a sporting event comprised of events based on ranch skills that cowboys and horses use to work cattle, **Figure 10-27**. The first rodeos began when groups of neighboring ranch hands met to see who had the best ranch skills. Today, horses are used in rodeo events as both roughstock and saddle horses. **Roughstock** animals

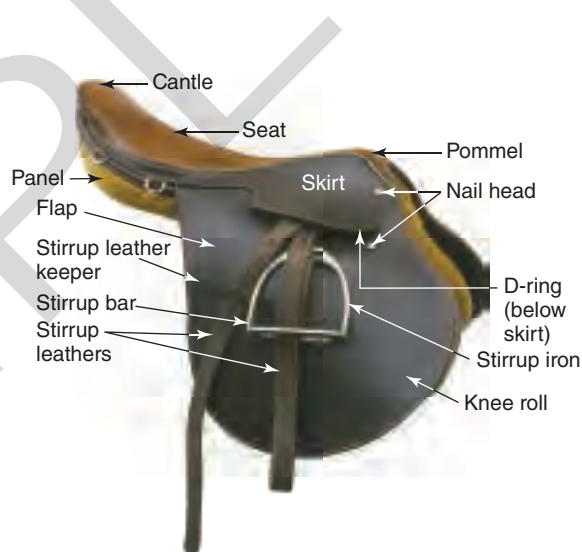


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Figure 10-22. These percentages represent horse use in the United States.



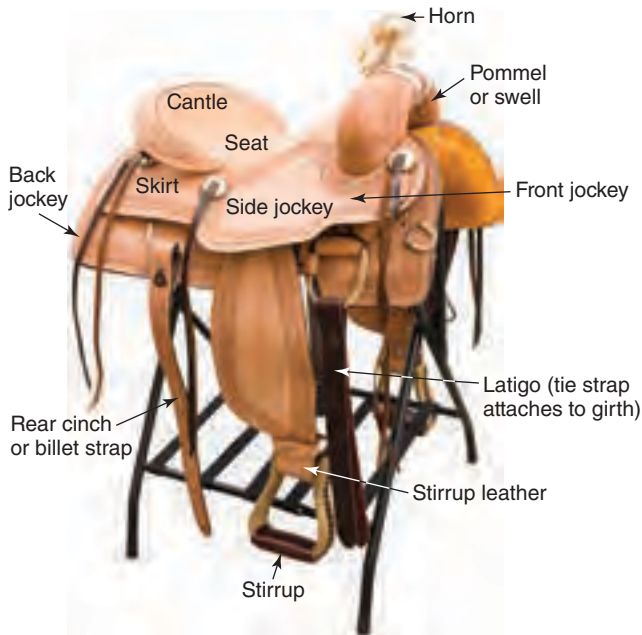
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Figure 10-23. English riding and showing requires an English saddle, such as this one. There are modifications that can be made based on the specific use of the saddle. *Can you think about how a dressage saddle might differ from a saddle used for jumping?*



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Figure 10-24. Stadium jumping is considered an English horse showing event. This event demands careful communication between horse and rider to complete the required tasks.



Gergana Georgieva/iStock/Thinkstock

Figure 10-25. Western riding requires a western saddle, such as this one. Western saddles are designed for specific events, such as roping calves or barrel racing. *How do you think the differences of this saddle and the English saddle help with western riding events?*



Dale A Stork/Shutterstock.com; PROMAI/Shutterstock.com

Figure 10-26. Western horse shows include events such as cutting. Some events require the horse and rider to demonstrate their skills in handling cattle.

are the bucking animals cowboys are scored on riding during rodeo events. Bareback riding and saddle bronc riding are the two roughstock events that use horses.

Horses in rodeos are also used under saddle for rodeo events including: steer wrestling, tie-down roping, steer roping, team roping, breakaway roping, goat tying, pole bending, and barrel racing. Rodeo is a very competitive

industry, with levels of competition ranging from youth rodeos to high school and collegiate rodeos, and adult rodeos for both part-time and full-time cowboys and cowgirls.

Racing

Horse racing, or the “Sport of Kings,” in the United States is a multibillion-dollar industry, **Figure 10-28**. The Thoroughbred breed is often seen as the ultimate racing horse. Consequently, the most notable races in the country, the Kentucky Derby, the Preakness Stakes, and the Belmont Stakes, are all Thoroughbred races. Other breeds are also involved in racing, but not to the scale of the Thoroughbred.

Racehorses undergo a closely monitored exercise and nutrition program to ensure they are in top physical condition before they race. While most horse races occur on a flat track with a single rider called a jockey,



Margo Harrison/Shutterstock.com

Figure 10-27. Skills used to manage and give medical attention to cattle on ranches directly translate to rodeo events.



Mikhail_Pogosov/Shutterstock.com

Figure 10-28. The majority of the horse racing in the United States is done with the Thoroughbred breed. It is called the *Sport of Kings* although sultans, czars, and even Queen Elizabeth have been known to get in on the action.

there are also jumping races called steeplechases, and harness racing where horses pull a small buggy called a sulky, **Figure 10-29**.

Recreational Riding

Many of the horses in the United States are kept for recreational riding. The owner may merely desire to use the horse for personal trail riding or other recreational activities like hunting. Many people join riding clubs so they can ride with other horse enthusiasts and share their love of riding and sometimes the expense of transporting their horses to riding venues across the country. Recreational riding is available in many national parks and forests, with both managed and unmanaged trail opportunities.

Equine Assisted Therapy

Many horse owners use their horses in **equine assisted therapy** programs. These programs use equine activities to improve the physical, occupational, or psychological health of the riders. Studies have found that equine assisted therapy can be helpful for individuals with conditions like ADHD, autism, cerebral palsy, depression, anxiety, developmental delays, and post-traumatic stress disorder, **Figure 10-30**.

Guided Riding Experiences

Many people desire the opportunity to ride horses, even those who do not have the desire to own their own horses. Of these individuals, there are many novice riders who choose to have a guided horseback experience. Dude ranches provide this opportunity for those who want the chance to experience horseback ranch work. Guided trail rides are available for many people who want to experience riding in a particular location, and are very common in vacation destination locations. Horse-oriented day camps are also popular for giving youth an equine experience. Novice riders who want to have a prolonged engagement with horses can sign up for riding lessons that provide a lesson horse for the student to use.

Other Horse Employment

Another section of the equine industry in the United States is the use of horses as tools for completing a specific job. Even though the notion of using horses for our main source of power and transportation is outdated, horses are still used in police and military work, and for pulling wagons and carriages.



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Figure 10-29. Chariot racing began in the Greek coliseums and continues today as an exciting (and dangerous) type of horse racing called harness racing. The small buggies are called sulkies.



Tom Ervin/Getty Images News/Thinkstock

Figure 10-30. Studies have found that there are many benefits to using horses for therapy. This little boy is autistic and suffers from cerebral palsy. *How do you think being involved with horses can enrich his life?*

Did You Know?

Three towns claim to be the site of the first rodeo. The towns are Santa Fe, New Mexico, 1847; Deer Trail, Colorado, July 4, 1869; and Pecos, Texas, 1883. Actually, much of the current rodeo structure is based on the rodeo held in Prescott, Arizona, on July 4, 1888. The Prescott Rodeo is still an annual event.

Did You Know?

The most prestigious title in the Thoroughbred racing industry is the Triple Crown. To win the Triple Crown, a horse must win the Kentucky Derby, the Preakness Stakes, and the Belmont Stakes.

Horses can be effective police officers. Especially in large cities, police officers ride horses to move through crowds. The height of a rider on a horse gives the officer a better vantage point for watching a situation, and the use of a horse provides the maneuverability of being on foot with the speed of having a motorized vehicle. Military cavalry units still exist, although most of their duties now are related to conducting ceremonies, rather than being used in battle.

Anatomy of an Equine

The anatomy and physiology of horses and other equines is essentially the same. Equines come in different sizes. They are measured in four-inch increments called **hands**. The proper way to express a height in hands is the whole number of hands, followed by a decimal and any remaining inches. For example, if a horse were 50", it would be 12.2 hands tall. An equine is measured to the top of its withers.

Conformation

Conformation classes at horse shows are events in which horses are evaluated without a rider based on their structure in comparison to breed ideal anatomy. A horse's **conformation** is the correctness of its bone structure, musculature, and body proportions in relation to each other. Before you can accurately evaluate horses, you must first be acquainted with the external parts of a horse, **Figure 10-31**.

Equine Digestion

The digestion of equines is different from the digestive systems of other livestock animals. Equines are **modified monogastrics**, which means they have a stomach with a single compartment, but also have a special compartment in their intestine called the cecum, which helps them digest roughages, **Figure 10-32**. The cecum is a pouch-like area found at the beginning of the large intestine, where digestive microbes are housed to break down roughages.

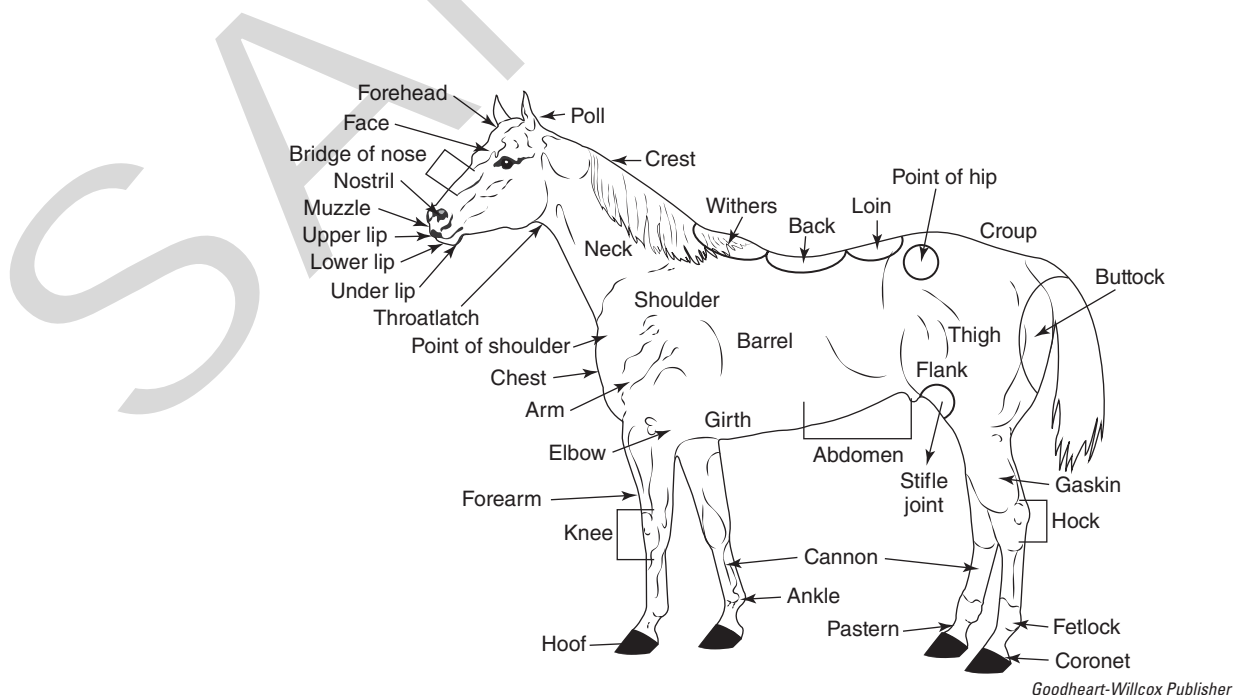


Figure 10-31. Understanding the parts of the external anatomy is an essential part of being able to talk about correct conformation of horses. *Can you name all the parts of this horse?*

Maintaining Herd Health

There are special considerations that equine producers need to take to ensure their equine animals remain in good health. Keep the following things in mind when raising and training horses:

- Maintaining current and complete immunizations is essential for all horses, especially those that will be in contact with other horses at shows and rodeos.
- Some equine diseases are transmitted by flies and mosquitoes. Establish a pest management plan that will reduce these insects in your stable area, and use pest control on your horses during peak fly and mosquito season.
- Internal parasites, such as roundworms and strongyles, can be an issue for grazing animals. Grazing animals ingest the parasite eggs while grazing, especially when they eat roughage to the ground. Monitor your horse to determine the amount of internal parasites they have and deworm as needed.
- The most common cause of death in equines is colic, which is a general term for abdominal pain. Any horse showing signs of colic (i.e., sweating, refusing to eat, kicking at belly) should be carefully monitored and veterinary care sought if symptoms continue.
- Ensure that horses are fed high-quality feeds that are free from both mold and dust, which can cause serious digestive and respiratory complications for horses.
- Traveling with horses has certain health restrictions. Before crossing the state line with your horses, you will likely need a health inspection from a veterinarian and a blood test to ensure they are free from Equine Infectious Anemia.

Hoof Care

There is an old saying in equine science: *No hoof, no horse*. Managing equine health rests heavily on caring for hooves and understanding the importance of the structures in a horse's feet, **Figure 10-33**.

Leg Conformation

The lower leg of the horse has many small bones that support the entire weight of the animal. The internal structures of the lower leg are shown in **Figure 10-34**. Proper conformation will ensure that these bones are not put under additional stress. Selective breeding of horses with sound legs can be a huge benefit to offspring. Conformational defects in any of the structures in the lower leg can lead to the horse being unsound and affect the usefulness of the animal.

Hoof Composition

The hoof may appear to be solid, but it is actually made up of several different components, **Figure 10-35**. The outer layer is hard and composed of semihard material similar to your fingernails. It is constantly growing and, like your fingernails, may be

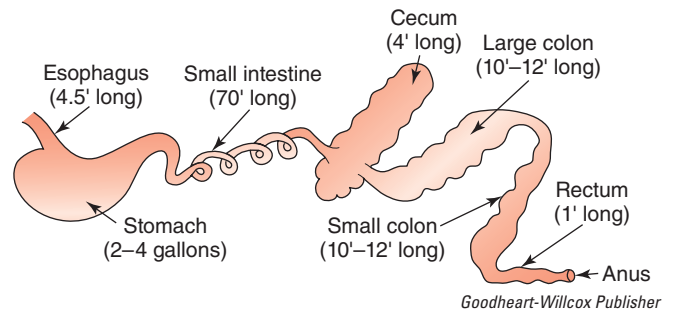


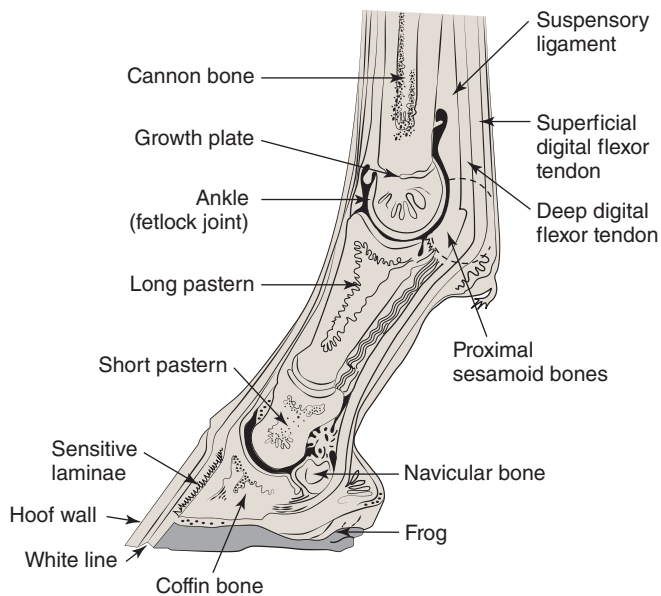
Figure 10-32. Horses only have one compartment to their stomach. To allow them to digest roughages, they have evolved an enlarged cecum. The cecum works similar to the rumen in ruminant animals and is in the same basic place on their digestive system as your appendix is on yours.



Figure 10-33. Daily hoof care is critical to keeping your equine partner healthy. Hooves should be cleaned often to prevent buildup of debris, rocks, and mud near the frog. Stone bruises, thrush, and hoof cracks can all be avoided through attentive hoof care.

Did You Know?

You can determine a horse's age by examining its teeth if you understand how they grow and wear. The permanent teeth replace the juvenile teeth at a specific age and they wear through old age. Hence the phrase, "never look a gift horse in the mouth."



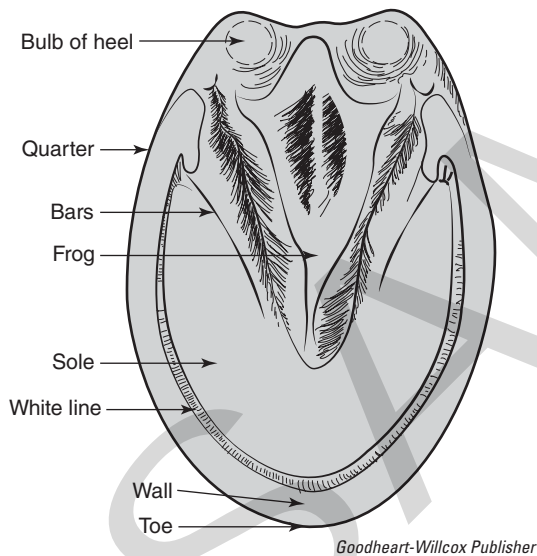
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Figure 10-34. Connective tissue and many small bones make up the internal structure of the leg in horses. Many of these bones are associated with specific problems. For example, navicular disease is caused by inflammation and degeneration of the navicular bone, and laminitis affects the coffin bone.

very thin or very thick. The outer layer attaches to the outer wall of the hoof. The point at which they attach is called the **white line**.

Farriers (craftspeople who trim and shoe horses) use the white line as a guide for trimming and for setting nails. The bottom of the hoof is called the **sole**. The sole is thick, hard, and somewhat flexible and protects the more sensitive part of the sole directly beneath the bones of the foot. The horse's sole protects the horse much as the sole of your shoe protects your foot. The **frog** is a triangular area in the middle of the sole. The frog helps circulate blood in the foot and from the bottom of the leg to the heart. The bars are located on either side of the frog. The **bars** are depressions in the sole of the hoof that provide stability for the walls and allow the frog to expand as the hoof impacts the ground.

A horse's hooves are designed to help absorb impact; however, there are risks from placing too much pressure on a section of the hoof. Placing too much pressure on a section of the hoof can cause bruising to the internal portion of the hoof. Excess pressure may be due to running on extremely hard surfaces or hard objects, such as rocks, affecting the sole. To avoid undue pressure, never run your horse on pavement, and take extra care to remove rocks and other hard objects from arenas and areas where horses are ridden.



Goodheart-Willcox Publisher

Figure 10-35. The bottom of a horse's hoof is designed to protect the internal structures and aid the body in pumping blood back to the horse's heart. *What are some considerations you should be mindful of when caring for hooves?*

Hoof Maintenance

The makeup of the hoof requires horse owners to take special care to ensure that hooves are appropriately maintained. Some of the considerations for hoof care include:

- Ensuring that your horses' hooves are kept trimmed and well maintained. Hooves should be trimmed or reshod every 6 to 8 weeks (**Figure 10-36**).
- Clean hooves with a hoof pick every time you groom your horse. Keeping the bars clean will allow the frog to function properly.
- Proper hoof moisture should be maintained to prevent cracking or fungal growth. Keep stalls clean to prevent ammonia exposure to hooves.

Horse Behavior

The behavior of horses has been studied in depth. Horses are driven by several instincts that guide much of their activities. These behaviors include:

- **Fight or flight**—Horses will naturally try to remove themselves from situations that cause them fear, but will stand and fight if they feel cornered.
- **Allelomimetic behavior**—A range of activities in which the performance of a behavior increases the probability of that behavior being performed by other nearby animals. This instinctive herd mentality was originally developed to help horses stay in large groups to prevent predator animals from singling out individuals.

- **Herd dominance**—In a wild herd, lead animals establish their position and usually maintain it for extended periods. In domestic herds, the herd composition continually changes, as animals are culled or added. This means the social structure changes each time the herd changes, which may lead to more instances of aggressive behavior as horses vie for the lead position. Careful introduction of new horses will help reduce the aggressive behavior and prevent potentially dangerous situations for workers and horses alike.

Handling Horses

Horses are instinctively prey animals that have a natural fear of humans. Most horses receive some training shortly after birth, called **imprinting**, to ensure that they are accustomed to human interaction and will be safer to handle when they are older. Imprinting generally includes the foal learning to be haltered and led, along with tasks like allowing their feet to be picked up and allowing humans to touch their mouth, ears, and girth area, **Figure 10-37**.

Horses are large and often unpredictable animals; to ensure both your own and the horse's safety, keep the following tips in mind when working with or around horses:

- Always approach a horse from a slow and consistent speed; quick movements can startle or spook the horse.
- Work with horses from an early age to help them become more comfortable around humans.
- Remember that horses have a well-developed “fight or flight” instinct. Never put a horse in a situation where it feels cornered.
- Horses have good peripheral vision, but have distinct blind spots, **Figure 10-38**. Avoid standing in these blind spots to prevent spooking the animal.
- It is a well-known fact that horses kick. Do not walk directly behind a horse within reach of its hind legs, and always ensure the horse is aware of your presence.
- When tying a horse, use a quick-release knot. This will prevent yourself and/or the horse from being injured should it be spooked.

Wild Horses and Burros

In the United States, there are still horses that some call wild. These “wild” horses are descendants of animals that escaped from the Spanish explorers in the fifteenth century. These horses are not actually classified as wild by scientific terms because they come from animals that have been domesticated. **Feral** animals are domesticated animals that live in the wild with no human assistance. Careful observation of these feral animals has helped horse behaviorists more accurately understand the instinctive behaviors of horses. The Bureau of Land Management (BLM) is responsible for managing feral horses and burros. The BLM currently estimates there are around 95,000 wild horses and burros in the United States.



3drenderings/Shutterstock.com

Figure 10-36. Do you wear the same pair of shoes for everything? Just like people, horses have a wide variety of shoes that can meet their needs. For example, racehorses wear ultralight shoes made from aluminum, while police horses have shoes with rubberized soles to prevent slipping on pavement. Shoes can also be used to prevent or treat structural issues or injury.



DasyaDasya/Shutterstock.com

Figure 10-37. Working with foals as soon as possible after birth will help them overcome their instinctive fear of humans. Teaching a 100-lb foal to pick up its feet is a lot easier than teaching a 600-lb yearling or 1000-lb 2-year-old to do the same.

Did You Know?

The BLM often works with correctional facilities around the country. Inmates have the opportunity to work training feral horses. Inmates learn horsemanship and life skills, while the horses' value increases with the time and energy the inmates invest. Horses are later adopted as riding animals.

Did You Know

The current claim for the tallest horse in the world belongs to a Belgian gelding named Big Jake. Big Jake weighed 240 lb at birth and he stands almost 20.3 hands. He currently weighs more than 2600 lb and consumes about 80 lb of hay and 40 qt of oats every day.

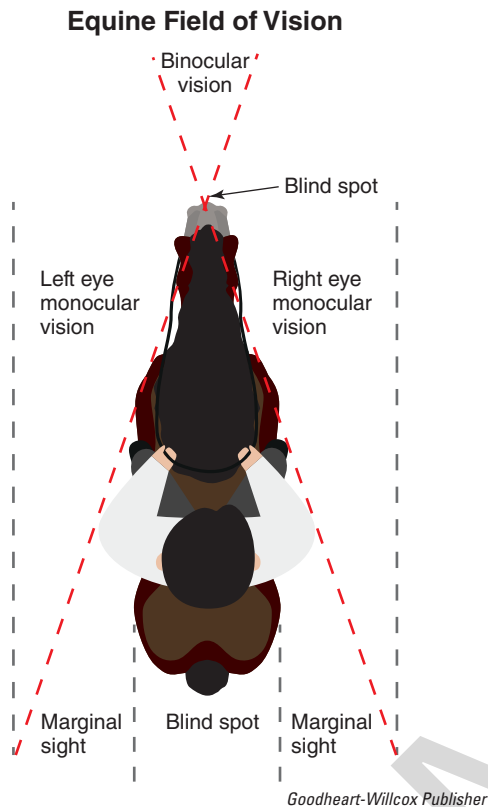


Figure 10-38. Horses have broad peripheral vision. They can see with both eyes out in front of them and to both their left and right sides with each respective eye. They also have a large blind spot behind them.

Feral Horses and Burros in Western States

Prior to 1971, the feral horse herds were allowed to roam largely across Western states without human interaction. The 1971 Wild Free-Roaming Horses and Burros Act set forth regulations and policies for the management of these herds. Managing feral horses and burros is often a source of contention in the states where these animals roam. Herd numbers often exceed the number of animals that ranges can adequately support, and ranchers are concerned with cattle having to compete for grazing.

To reduce the number of animals on the rangeland, the BLM periodically conducts roundups of the animals and sorts out some horses and burros for public adoption. Many of these horses are also kept on feedlots or private ranches. Populations are also managed by treating mares with fertility control injections.

East Coast Feral Horses

When most people think of wild horses in the United States, they picture those running across Western states, not running free on an island on the East Coast. The Assateague horses are said to be descendants of horses owned by seventeenth century owners seeking to avoid fencing laws and livestock taxation. Others paint a more romantic story of the horses as descendants of shipwreck survivors. Feral horse herds can also be found on the Outer Banks of North Carolina. Populations in these areas are controlled through roundup and adoption operations, much like their Western counterparts.

Career Connection

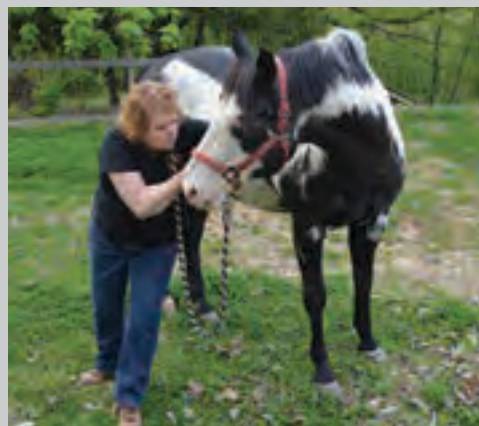
Equine Chiropractor

Equine chiropractors diagnose and treat muscular and skeletal ailments in horses. Generally, they work with performance horses that need to be in top physical condition. Much like a human chiropractor, equine chiropractors perform massage, rehabilitation therapy, and spinal manipulation—they just do it with much larger patients.

Education—The completion of a training program with a one-year or two-year certification in equine chiropractic services is required. Some specialized chiropractors are also licensed veterinarians.

Salary—The annual salary range for this position is \$40,000 to \$80,000.

Job fit—This job may be for you if you enjoy working with horses and their owners and you do not mind putting all your weight into the job, literally.



Leslie Trimble

Equine Breeds

The species name given to all horses, donkeys, and asses is equine. Within the equine species, there are two subcategories, *Equus caballus* and *Equus asinus*. *Equus caballus* is the scientific name for wild and domesticated horses, and *Equus asinus* is the scientific name for donkeys and asses.

The *Equus asinus* equines are often called the **long-eared breeds**. These asses and donkeys are characterized by their long ears, larger heads in proportion to their bodies, and flatter backs and croups. Horses, the subcategory *Equus caballus*, are divided into three categories based on size:

- **Pony** is the classification typically given to horses under 14.2 hands and weighing up to 900 lb. They are the smallest recognized breeds of horses and include miniature horses.
- **Light horses** are around 14 to 16 hands and weigh 900 to 1400 lb at maturity. These horses are most commonly used as saddle horses. There are hundreds of breeds of light horses.
- **Draft horses** are typically 16 to 18 hands and may weigh upward of 2000 lb. They are characterized by their heavy bone and muscular build. Draft horses are the historical powerhouses of the horse world. These animals have primarily been used to pull carts and farm equipment. Their large size belies their general calm disposition.

Note that height alone is not the only indicator of a horse's subcategory. For example, in cases where a light breed horse matures at under 14.2 hands tall, it is not necessarily considered a pony.

The term **warmblood** is used to define horses that are a combination of larger draft horses, which are considered **coldbloods**, and high-spirited light breeds, such as the Arabian and Thoroughbred, which are considered **hotbloods**. The result is a horse that is large in stature, but retains the athleticism of a light horse.

You may wonder where mules fit into all of this equine stuff. Mules are a hybrid animal, combined by crossing a horse with an animal from the ass family. When a mare is bred to a jack, the offspring is called a **mule**. You can also breed to get a **hinny**, the product of a female donkey and a stallion. Even though they have a distinct male or female gender, all mules and hinnies are sterile, meaning they cannot produce offspring. This is because of some very specific things that happen in the creation of their DNA. During meiosis, sperm and egg cells are created. These cells have half the regular number of chromosomes for that species. For example, horses have 64 chromosomes, meaning that a horse egg or sperm cell only has 32 chromosomes. In donkeys, there are 62 total chromosomes, leading to sperm and egg cells that have 31 chromosomes. When donkeys and horses mate, the result is a zygote (newly fertilized egg) with 63 chromosomes. Because the DNA structure of horses and donkeys is so closely related, this zygote grows into a complete organism with 63 chromosomes. Mules function well until it comes time for them to create sex cells of their own. In meiosis, there is no way to split an uneven number of chromosomes, leaving mules and hinnies unable to create viable sperm or egg cells.

Long-Eared Breeds (*Equus asinus*)



kubais/Shutterstock.com

American Mammoth Jack—The American Mammoth Jack originated from a combination of breeds of donkey imported into the United States. These animals may be solid or have large white patches throughout their coat. They are not large enough to be considered a draft breed, with typical heights of 13.5 hands for jennets and 14 hands for jacks.



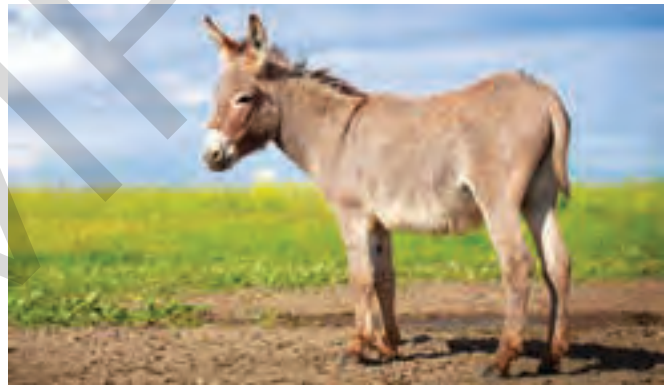
Dennis W Donohue/Shutterstock.com

Miniature Donkey—Miniature donkeys originated in the Italian islands of Sardinia and Sicily. These donkeys are small in stature, gray or grayish-tan in color, and typically under 9 hands at the withers. They are most frequently kept as companion animals and used for weed control.



Critter Haven Pandemonium, photo provided courtesy of Diane Hildebrand/Critter Haven Farms

Spotted Ass—The spotted ass is a color-based breed association incorporating any ass or donkey having a coat with spots of color and white. These asses may come in a variety of sizes and varied colors.



DragoNika/Shutterstock.com

Standard Donkey/Burro—The standard donkey is gray and stands approximately 10 to 12 hands with a slender build. Burro is the name for a Standard Donkey that originated in North America. Burros exist in both domesticated and feral groups. Standard Donkeys and Burros are still used for transportation and as cart animals in many parts of Mexico and Latin America.

Pony Breeds



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American Miniature Horse—The miniature horse is the smallest horse breed. To be considered a miniature horse, the animal must stand less than 8.2 hands at the withers. The breed standard requires these horses to have the same proportional conformation as their larger light breed counterparts. These horses originated from the Argentine Falabella horses, that were crossbred beginning in the fifteenth century to create a distinctly small breed of horse.



Photo courtesy of Pony of the Americas Club, Inc./Impulse Photography



S.M/Shutterstock.com

Pony of the Americas (POA)—The Pony of the Americas (POA) breed originated in the mid-1950s in Iowa. These ponies were developed as a combination of Shetland ponies and Arabian and Appaloosa breeds. Today, the breed also incorporates Quarter Horse and Welsh Pony genetics. Characteristics of the breed include heights of 11.2 to 14 hands, muscular builds with slightly dished heads, and white sclera (the white outer layer of the eyeball) around their eyes. They are most commonly found with a spotted coat pattern.



Vera Zinkova/Shutterstock.com



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Shetland—The Shetland Pony originated from the cart ponies used in the Shetland Isles to haul peat and coal. Their small size allowed the ponies to easily enter mines and pull coal carts. Shetlands range from 7 hands to a maximum height of 10.2 hands. They are heavy boned, muscular in build, and have thick necks and strong **toplines** (the muscles going over the haunches, back, and neck of a horse). Today, they are used primarily for youth riders, but are also shown in harness driving classes and used for pleasure driving.



Zuzule/Shutterstock.com



Christian Mueller/Shutterstock.com

Welsh Pony and Welsh Cob—The Welsh mountain pony originated in the rough terrain of Wales. These equines, which were once used in coal mines, have sound, well-balanced bodies, great endurance, and a high degree of intelligence. The Welsh breed is divided into four sections: Welsh Mountain pony (under 12.2 hands), Welsh pony (under 14.2 hands), Welsh pony of Cob type (under 13.2 hands), and the Welsh Cob (exceeds 13.2 hands). These ponies have a gentle nature and are ideal for a growing child. The Welsh ponies can be used in most disciplines.

Light Horse Breeds



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HTurner/Shutterstock.com

American Mustang—American Mustangs come from the feral horses in the American West. To be considered part of this breed, the horse must have come directly from the range or have parents that have come directly from the range. They are typically 14.2 to 15.2 hands and have heavy bone and large heads. Conformation varies greatly, depending on the genetics in the area where individual horses are found.



Courtesy of APHA/Paint Horse Journal



Thampitakkull_Jakkree/Shutterstock.com

American Paint Horse—The American Paint Horse breed originated in the United States as a registry for horses that have a coat pattern with large sections of white coloring. They have muscular hindquarters and strong topline, combined with athletic ability and a willing disposition. They typically range from 14.2 to 16 hands. There are bloodline restrictions and horses must have a distinctive stockhorse body type. Offspring of American Paint Horses that do not meet the coloring requirements may also be registered in this breed.



Telasecret, AQHA World Champion Producer, Courtesy Clark Rassi Quarter Horses

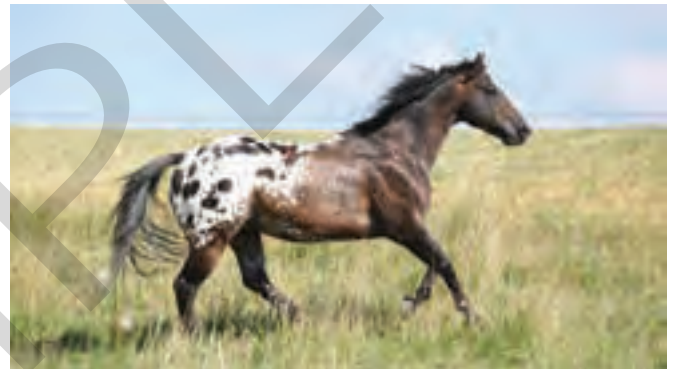


jacotakepics/Shutterstock.com

American Quarter Horse—The American Quarter Horse Association is the largest breed registry in the United States, and the Quarter Horse is the most popular breed in the nation. These horses are 14.2 to 16 hands. They typically have a blending of an attractive head with a refined throatlatch and trim neck. Conformation standards include a long shoulder; deep girth; strong back, loin, and hip; and uniform muscularity in their hip, gaskin, forearm, and chest. Quarter Horses are considered one of the most versatile breeds. They excel at ranch work, both English and western showing, racing, and pleasure riding.



Darrell Dodds, courtesy of the Appaloosa Horse Club



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Appaloosa—The Appaloosa breed originated from the horses of the Nez Perce Native Americans in the Pacific Northwest. This breed is characteristically 14.1 to 15.3 hands. Coloring often includes a spotted coat pattern on either their entire body or over their hindquarters. They are often seen with mottled or spotted colored skin, white sclera around their eyes, and striped hooves. Horses without spotted coloring can still be registered in this breed if their parentage is verified. Appaloosas are used for general riding, showing, and ranch work.



Original breed standard painting by Gladys Brown Edwards; printed with permission by Arabian Horse Association



arthorse/Shutterstock.com

Arabian—Arabian horses are descendants of the horses ridden in ancient Arabia. These horses have been carefully bred over thousands of years to create a horse that is refined in nature and exhibits the distinct characteristics of the breed. Arabians have a characteristic dished profile, large wide-set eyes, a broad forehead, small curved ears, and large nostrils. They also have a long arched neck, short back, refined bone structure, and high tailset. Ranging from 14.1 to 16.1 hands, Arabians are used in a variety of events including showing, endurance racing, and pleasure riding.



Sunrise Tradition, Courtesy of P Bar T Fox Trotters, Independence, MN

Missouri Fox Trotter—Missouri Fox Trotters were developed in the Ozark Mountains to haul logs and work cattle. They are a combination of Arabian, Morgan, Standardbred, and Saddlebred horses. Missouri Fox Trotters range from 14 to 16 hands and weigh 900–1200 lb. They should have symmetrical features with large bright eyes and a tapered muzzle. Their body should have a deep girth and well sprung ribs. Fox trotters have a distinct foxtrot gait. In this gait, the horse walks on its front legs while trotting on its hind legs.



Breed standard painting courtesy of the American Morgan Horse Association/Jeanne Mellin

Morgan—The Morgan horse originated in the late eighteenth century when a man named Justin Morgan began promoting his stallion, that eventually became the foundation of the breed. The ideal Morgan stands from 14.2 to 16 hands, has a straight face, well-rounded jowls, and a deeper throatlatch. Morgans should also have an angular shoulder, a compact body, and correctly angled hocks. Some Morgans are gaited, meaning they have a specific way of moving different from non-gaited breeds.



Courtesy of The Jockey Club/Susan Martin



Cheryl Ann Quigley/Shutterstock.com

Thoroughbred—The Thoroughbred breed originated in England from two types of Arabian horses and Turkish horses. The horses were bred in an effort to create a horse that could carry weight with sustained speed over extended distances. These horses range from 15.2 to 17 hands, and are most often a solid dark color or gray. Thoroughbreds have a well-chiseled head, long neck, high withers, deep chest and hindquarters, lean body, and long legs. In the United States, Thoroughbreds are widely used in racing, as well as in English horse showing and pleasure riding.

Warmbloods



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Dutch Warmblood—Dutch Warmbloods are at least 15.3 hands at the withers, and are often found in heights up to 17.2 hands. These horses are most commonly used for show jumping, dressage, cross-country jumping, or the combination of all those events, called Three Day Eventing.



Abramova_Kseniya/Shutterstock.com



Bildagentur_Zoonar_GmbH/Shutterstock.com

Hanoverian—The Hanoverian originated in Germany where it was bred and raised for farming and military use. Today, these horses are highly desirable for dressage, eventing, and show hunters and commonly compete at the Olympic level. They are intelligent, sensible animals that are easy to train. These sturdy and hardy horses have a plain head, long strong neck, powerful body with deep girth, and strong hindquarters. Standing 15.3 to 17.2 hands, the Hanoverian may be chestnut, bay, black, brown, or gray.



Abramova_Kseniya/Shutterstock.com



Julie Remezova/Shutterstock.com

Trakehner—The Trakehner is a light, warmblood breed that originated in Trakehner, Prussia in the 1700s. They were bred for working on the farm, cavalry mounts, fox hunting, driving, and racing. Today, these horses are valued for their athleticism and performance in dressage, eventing, and show jumping, and they have often competed in the Olympics. The Trakehner can be any color but they are most commonly chestnut, bay, gray, or black and stand 15.1 to 16.2 hands. In addition to their athletic talent, Trakehners are intelligent, calm, and friendly with a natural desire to please their riders.

Draft Breeds



Hyjak Legacy Lady – Hyjak—Legacy's Supreme Lady, M124671, Registered Belgian mare shown by Oak Haven Belfians, DOB: 3/10/2001

Belgian—Belgian horses originated in Belgium in the 1800s. These horses are bred for thicker bodies and heavier boned. They stand 16 to 17.3 hands and have thick muscular chests, heavy bone, and strong loins and hindquarters. They are most commonly seen with a reddish brown (sorrel) body and a gold or tan (flaxen) mane and tail. These horses are often used for pulling carts and wagons and horse weight-pulling competitions.



Muskoka Stock Photos/Shutterstock.com

Clydesdale—Clydesdales originated in Scotland where they were used as farm horses. These horses are generally brown with a black mane and tail (bay), and have white markings on their legs and face. They are also known for having excess hair, or feathering, on their lower legs. Clydesdales typically mature at a height of 17 to 18 hands, and weigh 1600 to 2400 lb. They are used for pulling carts and wagons and in horse-pulling competitions, although some people use them for pleasure riding as well.



On Behalf of Horse Photos

Percheron—Percheron horses originated in France, where they were used as warhorses, for farm work, and for carriage pulling. They are usually black or gray, although they may be found in other colors. They typically stand 16.2 to 17.3 hands and weigh an average of 1900 lb. These horses are known for exceptional muscling in their lower thighs, allowing them to pull heavy loads over long distances. These horses are still used in farming applications in some areas, as well as being used as cart and wagon horses.



2014 National Grand Champion Shire Mare, courtesy of Jenson Shires, Blair, NE

Shire—Shire horses are a minimum of 16.2 hands and average 17.1 hands. The ideal Shire should have a broad head, sloping shoulders, deep girth, and a strong, short back. They should have heavy bone and large feet. Shires are most desirable in brown, bay, black, or gray. These horses are especially known for their ability to move large amounts of weight over short distances and are commonly used in horse-pulling competitions.

Lesson 10.3 Review and Assessment

Lesson Summary

- The equine industry in the United States includes more than 9 million animals and contributes more than \$100 billion in revenue annually.
- Horses are selectively bred to have characteristics that meet their desired discipline.
- Horses are used for showing, ranch work, rodeo, racing, recreational riding, and other highly specialized uses.
- Behavior plays a major role in handling and managing horses. Using caution around horses can prevent injuries to you or the horses you are working with.
- Feral horses still exist in the United States. Hundreds of breeds of domestic horses have been developed to suit the needs of humans.

Vocabulary Review

Match the vocabulary terms listed in the *Words to Know* to the correct definition.

- | | |
|--------------------------|--|
| A. colt | 1. The scientific name for wild and domesticated horses. |
| B. conformation | 2. A female horse two years or younger. |
| C. draft horse | 3. A young equine of either gender. |
| D. equine | 4. The scientific name for donkeys and asses. |
| E. <i>Equus asinus</i> | 5. The correctness of an animal's bone structure, musculature, and body proportions in relation to each other. |
| F. <i>Equus caballus</i> | 6. The process of when an equine is giving birth. |
| G. feral | 7. A castrated male equine. |
| H. filly | 8. Training given to newborn equines to ensure they are accustomed to human interaction and will be safer to handle when they are older. |
| I. foal | 9. A mature female horse. |
| J. foaling | 10. The species name given to all horses, donkeys, and asses. |
| K. gelding | 11. The bucking animals that cowboys attempt to ride in rodeos. |
| L. hinny | 12. The equine offspring of a female donkey and a stallion. |
| M. imprinting | 13. A male horse two years or younger. |
| N. jack | 14. A female ass or donkey. |
| O. jenny | 15. The classification given to horses measuring 16 to 18 hands tall and weighing upward of 2000 lb. |
| P. light horse | 16. A mature male horse. |
| Q. mare | 17. The classification typically given to horses around 14 to 16 hands tall and weighing 900 to 1400 lb at maturity. |
| R. modified monogastric | 18. Animals that have historically been domesticated and now live in the wild with no human assistance. |
| S. mule | 19. A male ass or donkey. |
| T. pony | 20. A horse that has been selected for ranch working traits such as a specific level of athleticism, speed, and instinctive ability to work with cattle. |
| U. rodeo | 21. The equine offspring of a mare bred to a jack. |
| V. roughstock | 22. A type of digestive system with a stomach that has a single compartment and a special compartment in the intestine called the cecum. |
| W. stallion | 23. The classification typically given to horses under 14.2 hands tall and weighing up to 900 lb. |
| X. stockhorse | 24. A sporting event comprised of events based on ranch skills that cowboys and horses needed to have to work cattle. |

Know and Understand

Answer the following questions using the information provided in this lesson.

1. The estimated number of horses in the United States is _____.
 - A. 4.3 million
 - B. 5.7 million
 - C. 6.8 million
 - D. 7.2 million
2. What is the estimated direct economic impact of the equine industry in the United States?
 - A. \$40 billion
 - B. \$50 billion
 - C. \$60 billion
 - D. \$70 billion
3. What is the most common use of horses in the United States?
 - A. Recreation
 - B. Racing
 - C. Showing
 - D. Working (ranch work, police work)
4. What is the average gestation length for horses?
 - A. 330 days
 - B. 342 days
 - C. 356 days
 - D. 370 days
5. *True or False?* A foal will typically nurse for 3 to 6 months before being weaned.
6. What are the two main disciplines of horse showing?
 - A. Dressage and Stadium Jumping
 - B. English and western
 - C. European and Asian
 - D. Open and Youth
7. Which of the following horse show events are considered within the western discipline?
 - A. Cutting
 - B. Dressage
 - C. Stadium Jumping
 - D. Working Hunter
8. The bucking animals used in rodeo events are referred to as _____ animals.
 - A. cutting stock
 - B. roughstock
 - C. working stock
 - D. heavy stock
9. Rodeo events are based on _____ skills cowboys and horses used in the American West.
 - A. blacksmith
 - B. horsemanship
 - C. ranch
 - D. roping
10. Which breed is responsible for most of the horse racing income in the United States?
 - A. Arabian
 - B. Paso Fino
 - C. Quarter Horse
 - D. Thoroughbred

11. *True or False?* Equine activities are often used in therapy to improve the physical, occupational, or psychological health of the riders.
12. *True or False?* An equine is measured in feet to the top of its withers.
13. How big is a “hand,” the unit used to measure horse height?
 - A. 4”
 - B. 6”
 - C. 8”
 - D. 10”
14. Horses have a(n) _____ digestive system.
 - A. avian
 - B. modified monogastric
 - C. monogastric
 - D. ruminant
15. What is the most common cause of death in horses?
 - A. Colic
 - B. Founder
 - C. Injury
 - D. Old age
16. Which of the following statements about the horse’s hoof is *false*?
 - A. The hooves are continually growing.
 - B. The frog helps pump blood from the hoof back to the heart.
 - C. The sole of a horses’ hoof is not flexible at all.
 - D. The white line serves as a guide for farriers when shoeing or trimming.
17. Approximately how many *wild* horses are there in the United States?
 - A. 80,000
 - B. 85,000
 - C. 90,000
 - D. 95,000
18. What is the maximum height for an equine to be considered a pony?
 - A. 13.2 hands
 - B. 14.2 hands
 - C. 15.2 hands
 - D. 16.2 hands
19. Explain why it is sometimes preferable to use horses instead of motorized vehicles in cattle operations.
20. Explain the fight or flight behavior common to horses.

Analyze and Apply

1. Horses are measured in hands (4” each). Calculate the following horse heights in hands. (Remember that you express the hands in whole numbers, then the number of remaining inches, i.e., 12.3 hands.)
 - A. 48”
 - B. 56”
 - C. 62”
 - D. 5’
 - E. 6’-1”
 - F. 6’-7”

2. Horses are driven by a combination of their instincts and training, and managing horses is a very intense industry. Imagine you are the owner of a horse boarding facility. Using the information from this lesson and your previous knowledge, write a list of 10 “Barn Rules” that you would post in your facility and require all horse owners to follow.

Thinking Critically

1. There is a lot of controversy about feral horse populations in the United States. Conduct research online to find out why some organizations oppose the current management plan being used by the Bureau of Land Management (BLM). Compile a list of five arguments that opposition to the BLM has for the current Wild Horse Management Plan.
2. Horse slaughter is another controversial issue in the United States. Conduct research on horse slaughter in the United States and write 2 to 4 paragraphs explaining your personal opinion on whether horse slaughter should be legal in the United States. Use factual statements to back your opinion and cite your references.
3. Think about the wide difference in breeds of horses. Why do you think there is the need for so many different breeds?
4. What steps should be taken when introducing a new horse onto your ranch or farm?

SAE for **ALL** Opportunities

1. **Foundational: Career Exploration and Planning SAE**—Would you like a career in the equine industry? Select a career related to horses and complete an internet search to find someone in your area who has that career. Write a list of interview questions about the career, including likes/dislikes, training required, and tips for someone who would like to go into that career area. Make contact and complete your interview. Journal your findings.
2. **Immersion: Internship/Placement SAE**—Contact a local equine facility and inquire if they have any internship opportunities available. It can take years to become a reputable horse trainer, and often trainers are willing to mentor young people as interns to clean stalls, groom horses, or exercise horses in training.

SAE for **ALL** Check-In

- How much time have you spent on your SAE this week?
- Have you logged your SAE hours?
- What challenges are you having with your SAE?
- How can your instructor help you?
- Do you have the equipment you need?

Chapter 10 Skill Development

STEM and Academic Activities

- Science**—Cheese is made from a chemical process that alters the milk protein using enzymes. What makes different varieties of cheese different? Choose three types of cheese to research and write a paragraph on each, describing the specific process for making that type of cheese. Then, compare and contrast your three cheese types so that you can explain how they are different. Be prepared to share your findings with the class.
- Technology**—Milking machines are incredibly fascinating machinery. To find out how the milking machine mirrors the actual suckling of a calf, conduct some research or ask a local dairyman. Draw a diagram that shows the parts of the milking machine that are required to ensure that dairy cows are milked efficiently.
- Engineering**—Cattle-handling facilities are incredibly diverse. Imagine that you are the owner of a cow-calf operation and need to design a cattle-handling area. In groups of two or three, research the common components of a cattle-handling area, and design your layout. Make sure you include a squeeze chute or calf table, holding pen, and any other pens or structures that you think would be significant.
- Math**—Working with a partner, measure the stalls in an equine stable. Calculate the number of square feet for each stall. Obtain prices for various types of bedding used for equines. Using the total square footage of the stalls, calculate how much bedding will be needed to provide adequate bedding for each stall. Calculate the cost of each type of bedding. Determine the cost for one month's bedding for all the stalls. Use your local tax rate to calculate taxes and add shipping and delivery to your total.
- Social Science**—Why are businesses, homes, and livestock facilities usually in separate areas of a community? Are there instances where livestock may be kept on property that is not zoned as agricultural land? Interview the person in your community who is in charge of planning or zoning. Find out why zoning is important for the community and how a property owner can seek a zoning change. Obtain a copy of the community's zoning map and use it for a visual aid as you report your findings to the class.
- Language Arts**—Many stories, books, and poems have been written about horses. Choose one of the following titles, or one of your own favorites, to read and write a detailed book report. Use a standard format from your agriculture or English teacher. Create a diorama of your favorite or most memorable scene. Books to consider: *Black Beauty* by Anna Sewell, *The Black Stallion* by Walter Farley, *The Horse Whisperer* by Nicholas Evans, and *A Horse Called Wonder* by Joanna Campbell.



Communicating about Agriculture

1. **Reading and Speaking**—Research the products and services available for raising either cattle or equines. Collect promotional materials for a variety of products and services from product manufacturers and service providers. Analyze the data in these materials based on the knowledge gained from this chapter. With your group, review the list for words that can be used in the subject area of raising livestock. Practice pronouncing the word, and discuss its meaning. As a fun challenge, work together to compose a creative narrative using as many words as you can from your new list.
2. **Speaking and Listening**—Divide into groups of four or five students. Each group should choose one of the following types of beef cattle operations: backgrounding operation, cow-calf operation, and stocker operation. Using your textbook as a starting point, research your topic and prepare a report on the operation. Include topics such as costs, land needs, structural needs, and employees, as well as the types of challenges the operation faces. As a group, deliver your presentation to the rest of the class. Take notes while other students give their reports. Ask questions about any details that you would like clarified.
3. **Reading and Writing**—The ability to read and interpret information is a requisite workplace skill. Presume you work for a local, well known dairy operation. Your employer is considering upgrading the milking parlor with new milking equipment. Your supervisor wants you to evaluate and interpret some research on several new milking systems. Locate at least three reliable resources for the most current information on new milking systems. If possible, contact representatives from the manufacturers and (after explaining your project) ask them about their products and additional costs, such as delivery and installation and employee training on the new equipment. Write a report summarizing your findings in an organized manner.

Extending Your Knowledge

1. Buying a horse is a huge financial responsibility. Even if you already have the horse and the equipment needed, there are additional costs such as entry fees for shows or rodeos, and medical fees. Calculate the operating costs to keep a horse for one year. Research the cost for horse-related expenses in your area, and find the total. You will need to provide:
2. **Housing**—Contact a local boarding facility to determine the cost per month for stall, paddock, or pasture rent.
3. **Horse shoeing**—Calculate the number of trimmings or shoeings your horse will require per year (once every 6 to 8 weeks).
4. **Feed**—Light breed horses will eat on average one ton of hay every three months. Find this cost plus the cost of any feed additives.
5. **Vaccinations**—Most horses will receive annual and semiannual vaccinations. Contact an animal health provider to calculate this cost. Remember that this cost does not include other common costs like additional veterinary bills or paperwork for out-of-state travel.