MERIT BADGE SERIES

ANIMAL SCIENCE

STEM-Based

BOY SCOUTS OF AMERICA®

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ANIMAL SCIENCE

"Enhancing our youths' competitive edge through merit badges"

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Requirements

Always check www.scouting.org for the latest requirements.

1. Name four breeds of livestock in each of the following classifications: horses, dairy cattle, beef cattle, sheep, hogs, poultry, and goats. Tell their principal uses and merits. Tell where the breeds originated.

2. List five diseases that afflict the animals in each of the classifications in requirement 1. Also list five diseases of poultry. Describe the symptoms of each disease and explain how each is contracted and how it could be prevented.

3. Explain the differences in the digestive systems of ruminants, horses, pigs, and poultry. Explain how the differences in structure and function among these types of digestive tracts affect the nutritional management of these species.

4. Select one type of animal—beef cow, dairy cow, horse, sheep, goat, or hog, or a poultry flock—and tell how you would properly manage it. Include in your discussion nutritional (feeding) concerns, housing, disease prevention, waste control/removal, breeding programs, and biosecurity as appropriate.

5. Explain the importance of setting clear goals for any animal breeding program. Tell how purebred lines of animals are produced. Explain the practice of crossbreeding and the value of this practice.

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6. Complete ONE of the following options:

Beef Cattle Option

a. Visit a farm or ranch where beef cattle are produced under any of these systems:
   (1) Feeding market cattle for harvest
   (2) Cow/calf operation, producing cattle for sale to commercial feeders
   (3) Producing purebred cattle for sale as breeding stock to others

   Talk with the operator to learn how the cattle were handled, fed, weighed, and shipped. Describe what you saw and explain what you learned. If you cannot visit a cattle ranch or farm, view a video from a breed association, or research the internet (with your parent's permission) for information on beef cattle production. Tell about your findings.

b. Sketch a plan of a feedlot to include its forage and grain storage facilities, and loading chute for 30 or more fattening steers; or sketch a corral plan with cutting and loading chutes for handling 50 or more beef cows and their calves at one time.

c. Make a sketch showing the principal wholesale and retail cuts of beef. Tell about the U.S. Department of Agriculture (USDA) dual grading system of beef. Tell the basis of each grade in each system.

d. Define the following terms: bull, steer, bullock, cow, heifer, freemartin, heiferette, calf.

Dairying Option

a. Tell how a cow or a goat converts forage and grain into milk. Explain the differences in feeds typically used for dairy cows versus those fed to beef cows.

b. Make a chart showing the components in cow's milk or goat's milk. Chart the amount of each component.

c. Explain the requirements for producing grade A milk. Tell how and why milk is pasteurized.

d. Tell about the kinds of equipment used for milking and the sanitation standards that must be met on dairy farms.

e. Define the following terms: bull, cow, steer, heifer, springer; buck, doe, kid.

f. Visit a dairy farm or a milk processing plant. Describe what you saw and explain what you learned. If you cannot visit a dairy farm or processing plant, view a video from a breed or dairy association, or research the internet (with your parent's permission) for information on dairying. Tell about your findings.

Horse Option

a. Make a sketch of a useful saddle horse barn and exercise yard.

b. Tell about the history of the horse and the benefits it has brought to people. Using the four breeds of horses you chose in requirement 1, discuss the different special uses of each breed.

c. Define the following terms: mare, stallion, gelding, foal, colt, filly; mustang, quarter horse, draft horse, pacer, trotter; pinto, calico, palomino, roan, overo, tobiano.

d. Visit a horse farm. Describe what you saw and explain what you learned. If you cannot visit a horse farm, view a video from a breed association, or research the internet (with your parent's permission) for information on horses. Tell about your findings.

e. Outline the proper feeding of a horse doing light work. Explain why the amount and kind of feed will change according to the kind of horse and the work it does. Describe what colic is, what can cause it, and its symptoms.

Sheep Option

a. Make a sketch of a live lamb. Show the location of the various wholesale and retail cuts.

b. Discuss how wools are sorted and graded.

c. Do ONE of the following:

(1) Raise a lamb from weaning to market weight. Keep records of feed intake, weight gains, medication, vaccination, and mortality. Present your records to your counselor for review.

(2) Visit a farm or ranch where sheep are raised. Describe what you saw and explain what you learned. If you cannot visit a sheep farm or ranch, view a video from a breed association, or research the internet (with your parent's permission) for information on sheep. Tell about your findings.

d. Describe some differences between the production of purebred and commercial lambs. Then select two breeds that would be appropriate for the production of crossbred market lambs in your region. Identify which breed the ram should be.

e. Define the following terms: wether, ewe, ram, lamb.

Hog Option

a. Make a sketch showing the principal wholesale and retail cuts of pork. Tell about the recommended USDA grades of pork. Tell the basis for each grade.

b. Outline in writing the proper feeding programs used from the breeding of a gilt or sow through the weaning of the litter. Discuss the feeding programs for the growth and finishing periods.

c. Do ONE of the following:

(1) Raise a feeder pig from weaning to market weight. Keep records of feed intake, weight gains, medication, vaccination, and mortality. Present your records to your counselor for review.

(2) Visit a farm where hogs are produced, or visit a packing plant handling hogs. Describe what you saw and explain what you learned. If you cannot visit a hog production unit or packing plant, view a video from a packer or processor, or research the internet (with your parent's permission) for information on hogs. Tell about your findings.

d. Define the following terms: gilt, sow, barrow, boar.

Avian Option

a. Make a sketch of a layer house or broiler house showing nests, roosts, feeders, waterers, and means of ventilation. Explain how insulation, ventilation, temperature controls, automatic lights, and other environmental controls are used to protect birds from heat, cold, and bad weather. Explain the importance of light for egg production.

b. Explain why overcrowding is dangerous for poultry flocks.

c. Tell about the grading of eggs. Describe the classes of chicken meat.

d. Do ONE of the following:

(1) Manage an egg-producing flock for five months. Keep records of feed purchased, eggs sold, medication, vaccination, and mortality. Present your records to your counselor for review.

(2) Raise five chickens from hatching. Keep records of feed intake, weight gains, medication, vaccination, and mortality. Present your records to your counselor for review.

(3) Visit a commercial avian production facility. Describe what you saw and explain what you learned. If you cannot visit a commercial facility, view a video from a poultry association, or research the internet (with your parent's permission) for information on poultry production. Tell about your findings.

e. Define the following terms: chick, pullet, hen, cockerel, cock, capon.

7. Find out about three career opportunities in animal science. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

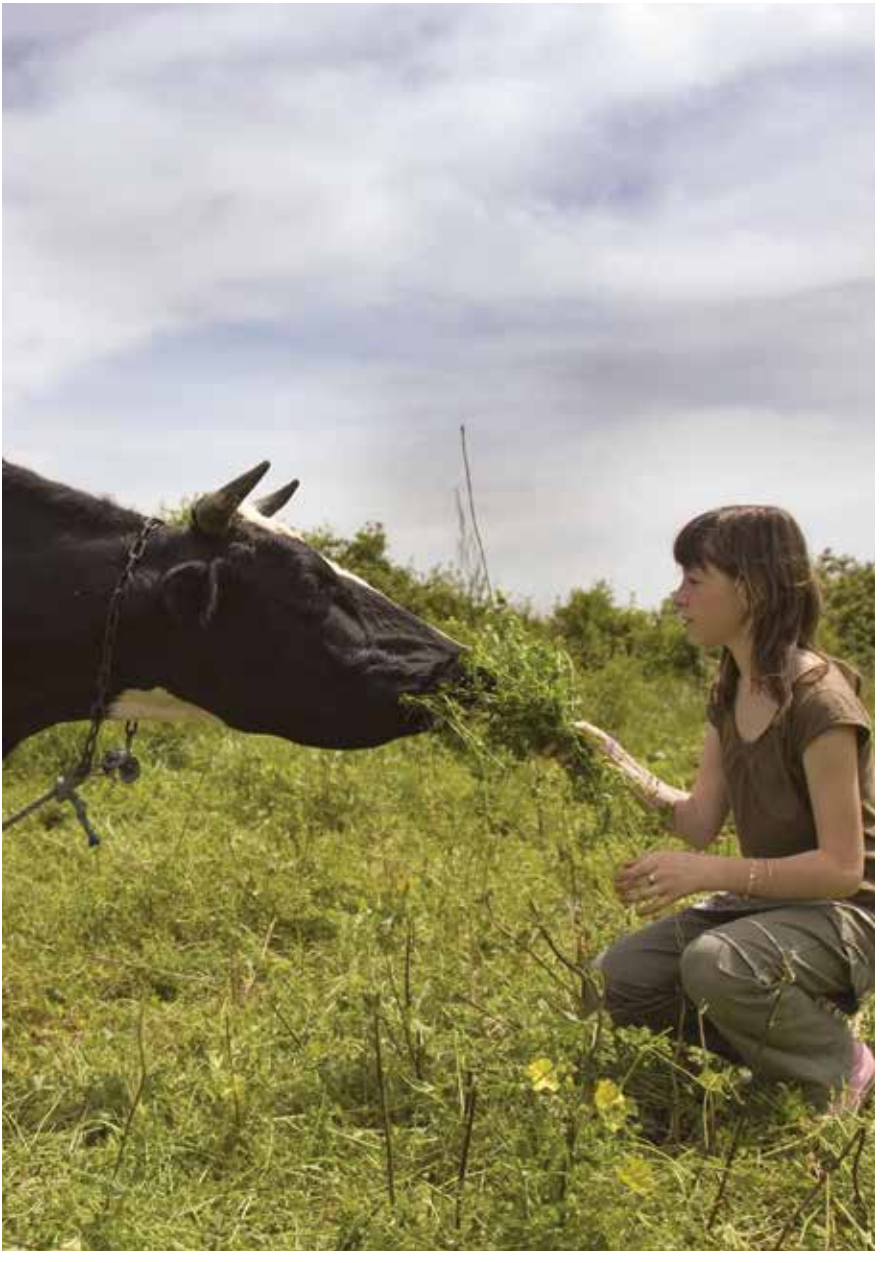
Contents

Animals of Farms and Ranches

Cattle, horses, sheep, goats, hogs, poultry, and other domesticated animals are important to people for many reasons. They supply us with food and clothing, we use them for recreational purposes, they work with and for us.

Farm animals provide us with meat, a basic part of the diet in human cultures the world over. They also supply milk, eggs, wool, and hides, and many valuable by-products ranging from medicines to glue, candles, soap, brushes, fertilizers, and other chemicals. Some animals are used for transportation and work as draft animals. Others are trained for sporting events or kept simply because we enjoy them.

This pamphlet will help you learn about the many kinds of useful animals raised by farmers and will introduce you to principles of livestock selection, breeding, nutrition, health care, and management.



Livestock Breeding and Breeds

A Thoroughbred and a draft horse are bred for different purposes—one for speed, the other for strength. A cow may be a milk cow or a beef animal. A beef cow's purpose is to produce calves that will be raised for meat; a milk cow's purpose is to produce a lot of milk with a fairly low butterfat content or less milk with a high butterfat content.

Butterfat is the natural fat of milk.

Even within a single breed, great differences may exist between animals. For example, a Holstein cow will give more milk on average than a Jersey. But a healthy, well-tended Jersey of superior lineage might produce more milk than a poorly managed Holstein whose parents had inferior genetics.

The same principle of *breed differences* holds true for other livestock. A livestock producer needs to know the advantages and drawbacks of various breeds. The choice of stock to raise will depend on the producer's preference, the breed's characteristics, the area of the country in which the stock will be raised, and the strength of the market for that breed.

Livestock producers constantly try to upgrade their herds or flocks by breeding or buying animals that will improve the herd. They pay close attention to the health, condition, environment, and proper feeding of their stock. These measures—good breeding and good management—are essential for success in livestock production.

Livestock Breeding

Distinct animal breeds are the result of many generations of selective breeding of individuals with specific traits. Animal breeders maintain these breeds by continually selecting individuals that look or perform well, according to the "breed standard."

In many cases, breed standards are kept by *breed associations,* or groups of people who agree on what the characteristics of the breed should include and who help other breeders and producers to meet the standards.

By definition, animals within a breed are more related than animals of different breeds. They have common ancestors and therefore share more genetic similarity and, thus, more similarity in appearance and performance.

Some livestock producers are interested in using *purebred* animals, or animals of a specific breed. But many producers will produce *crossbred* animals by mating two animals of different breeds to get the best characteristics of the two breeds. For example, a beef cattle producer interested in the good milk production of an Angus cow and the size of a larger animal like a Simmental would mate an Angus to a Simmental to produce crossbred offspring that have some characteristics from both breeds.

The most important thing in livestock breeding is for the breeder to establish goals, depending on what the production environment might include.

Think of the cattle producer who uses an Angus-Simmental cross. Both breeds are good choices if the producer wants a large animal with good quality meat. If the cattle lived in a hot, desert environment, a Brahman cross might be better because of its heartiness and ability to withstand harsh conditions.

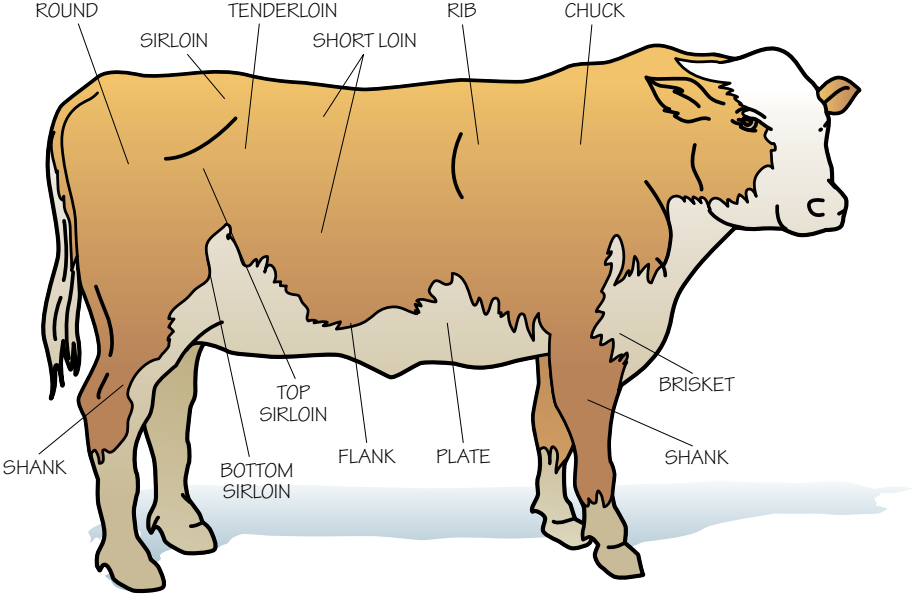
Breeds of Livestock

This section describes the principal breeds of beef cattle, dairy cattle, horses, sheep, dairy goats, hogs, and chickens raised in the United States. To learn more about a breed, check the resources listed at the end of the pamphlet, or ask your merit badge counselor or county agent where you can get more information.

This is a case of the environment *interacting* with genetics, an essential consideration for livestock producers.

Beef Cattle

People do not eat grass or hay or other such roughages (coarse vegetation). Cattle, however, can convert roughages into meat, milk, and usable by-products. Cattle are the most efficient and economical way for people to get food from lands that are wooded, mountainous, or otherwise unsuited for growing crops but that will produce good supplies of grass and forages.



Meat cuts of beef cattle

Terms to Describe Beef and Dairy Cattle

Bull—a sexually intact (uncastrated) adult male.
Bullock—a young bull.
Steer—a male castrated before reaching sexual maturity.
Cow—a mature female.
Calf—a young animal of either sex. Cattle are called *calves* until 1 year of age; from 1 to 2, they are *yearlings.*
Heifer—a young cow that has not produced a calf.
Heiferette—a young cow that has not had more than one calf.
Springer—a heifer or cow that is nearly ready to calve and will, therefore, begin producing milk; the *lactating* period begins as soon as the calf is born.
Freemartin—a female calf that is born as a twin with a male and is sterile.

Major Breeds of Cattle

Beef cattle:
European breeds: Angus, Devon, Hereford, Red Angus, Shorthorn
Indian breeds: Brahma
U.S.–developed breeds: Beefmaster, Brangus, Polled Hereford, Santa Gertrudis
Exotic breeds: Blonde d'Aquitaine, Charolais, Chianina, Galloway, Gelbvieh, Highland, Limousin, Maine-Anjou, Murray Grey, Piedmontese, Polled Shorthorn, Simmental, White Park
Dairy cattle: Ayrshire, Brown Swiss, Dutch Belted, Guernsey, Holstein, Jersey, Kerry
Dual-purpose cattle (used for both beef and dairy): Milking Shorthorn, Normande, Pinzgauer, Red Poll, Tarentaise

Beef Breeds

Beef cattle are raised throughout the United States in all kinds of climates. Certain breeds are better adapted than others to the local weather and feed supplies and make better choices for certain parts of the country. Ranchers choose a breed based on personal preference and the breed's characteristics such as its adaptability, body size, longevity, ability to efficiently reproduce, mothering and milking abilities, ability to gain weight, and other traits that match the producer's production environment and goals.

Angus. The Angus breed was developed from the native cattle of Scotland and came to the United States in 1873. They tolerate cold climates well. Angus steers average 1,200 pounds at harvest. They are noted for their ability to produce high-quality beef. The breed is popular in the central, southern, and western United States.

Angus, which are polled (hornless) and solid black in color, often are used in crossbreeding programs with Herefords to produce the "black baldy," a black animal with a white face, popular with cattle producers.

Hereford. The Hereford is an old English breed that, until the mid-1700s, was bred mainly as draft animals. The first Herefords in the United States arrived in 1817. Gradually, breeders began improving the Hereford for beef, changing the body structure toward more smoothness and less weight. Herefords are especially popular in the West and Southwest for their ability to graze over a vast range. They take good care of their offspring, making the breed popular under range conditions where good mothering may be vital for the calf's survival.

Polled Hereford. The Polled Hereford developed directly from the American Hereford. In 1898, a young Hereford breeder from Iowa saw some hornless cattle being exhibited at the Trans-Mississippi World Fair in Omaha, Nebraska. By 1901, he established the Polled Hereford breed with naturally hornless whiteface cattle he had obtained. The two breeds look much alike, except the Polled Hereford has no horns.

The Polled Hereford has a red coat with a white face, crest, brisket, belly, and switch (tail) and usually has white below the knees. Its horns curve downward and slightly forward.

Midwesterners discovered in 1870 that hornless cattle sometimes appeared in horned Shorthorn herds. Thus, Polled Shorthorns were developed. Both Shorthorns and Polled Shorthorns will adapt to a wide range of climates, from the heat of the southern states to colder mountain weather.

Shorthorn cattle are combinations of red, white, and *roan* (a mixture of red and white hairs).

Shorthorn. The Shorthorn originated on England's northeastern coast. By 1783, these cattle were found in America. Shorthorns were valued by America's early settlers for their meat and as draft animals for pulling wagons and plows. The cattle are noted for their adaptability, nurturing ability, reproductive performance, good disposition, good feed conversion (pounds of feed needed per pound of weight gain), and longevity.

The Brahman has a large hump above the shoulders and long, narrow, droopy ears. Coat color varies from shades of gray to black, to red and speckled coats, with dark skin coloring, particularly around the eyes, for protection from the sun.

Brahman. The American Brahman was developed from cattle imported from India and Brazil. The first Brahman-type stock arrived in the United States in the late 1800s. The Brahman has a genetic resistance to diseases such as tick fever and pinkeye. These cattle are well-adapted to hot climates and tolerate parasites better than some breeds. Brahman cattle are particularly popular in the hot and humid southern states. The breed does not stand extreme cold as well as breeds that originated in cooler climates.

Santa Gertrudis. The Santa Gertrudis was developed in the early 1900s in South Texas on the King Ranch. Shorthorn cows bred to Brahman bulls produced cattle that could do well in the hot, humid South and also have good-quality carcasses. Mature bulls weigh up to 2,600 pounds; cows average 1,200 to 1,400 pounds. Market weight is about 1,100 pounds. This breed tolerates hot weather as well as colder climates.

The Santa Gertrudis are dark red. Most have horns, but some are polled.

Brangus. Crossbreeding work between Angus and Brahman cattle started in 1912. By 1949, a cross was stabilized at five-eighths Angus and three-eighths Brahman, and the new breed was named the Brangus. Now found in nearly every state in the United States and in Canada, Australia, Mexico, Central America, South America, and Africa, the cattle tolerate hot weather very well.

The Brangus combines the best of the Brahman and the Angus. These cattle are solid black and polled.

Charolais. The Charolais was developed in central France. The King Ranch of Texas is given credit for importing the first Charolais bulls to the United States in 1936. The cattle are noted for their ability to grow rapidly and produce lean, tender beef that is fine-textured and of excellent quality. Bulls weigh as much as 2,600 pounds, and mature cows may weigh 1,700 pounds. The breed is marketed at 1,250 to 1,350 pounds.

The Charolais is large, long-bodied, and heavily muscled. Its coat is white or a light straw color. Charolais generally have horns, but some are polled.

Chianina cattle are off-white in color, with black on the tongue, nose, and switch and around the eyes.

Chianina. One of the world's oldest breeds, the Chianina comes from Italy. Bred as draft and beef animals, the Chianina was introduced in the United States in 1971 and is frequently used in crossbreeding programs. Mature bulls weigh up to 3,500 pounds; females up to 2,400 pounds. These animals grow rapidly and are marketed at 1,350 pounds. The Chianina is a good beef breed, well-muscled with a thin layer of fat.

Limousin cattle are horned and red-gold with a light buckskin color on the underside, legs, and muzzle. Through crossbreeding, there are also polled Limousin and black Limousin.

Limousin. The Limousin breed, developed in France, was introduced into North America in 1968 when a bull arrived in Canada. The first Limousin bulls imported permanently into the United States did not arrive until the fall of 1971. The breed is noted for the extra thickness and muscling typical of the cattle. Mature bulls average 2,400 pounds; cows are about 1,350 pounds.

In Europe, purebred Simmental cattle vary in color from light to dark red, with distinct areas of white. The horns, legs, and tail generally are white, and there may be white patches on the flanks and behind the shoulders.

Simmental. The Simmental has long been a popular breed in Europe. The first purebred Simmental bull arrived in the United States in 1971. Breeders here kept the Simmental's basic color pattern when crossing it with the Hereford. U.S. beef producers have also crossed Simmentals with the Angus and Charolais, and the resulting cattle include red and black individuals. Mature Simmental bulls weigh 2,400 to 2,800 pounds; cows weigh from 1,300 to 1,800 pounds.

Registered Herd or Commercial?

Registered purebred cattle herds usually are smaller than commercial operations. For the breeder to be successful, a market must exist for the animals produced. The advantage of a purebred program is that the breeder can produce a generally superior and more uniform animal that will bring a premium price. A purebred herd can be the best way to get the greatest income from a small acreage.

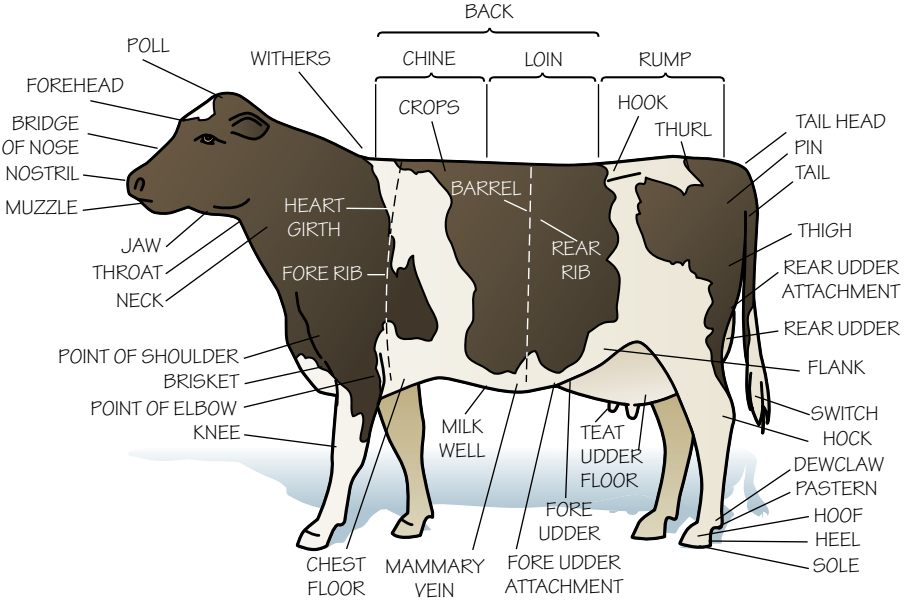
Managing a registered herd takes effort, however. The registration procedures, the paperwork involved in keeping breeding records, and the certification of animals demand careful attention to detail and a large investment of time.

A commercial cattle herd made up of crossbred beef cattle may have recognizable bloodlines—for instance, white-face cattle that are mostly Hereford and black cattle that are mostly Angus—but the animals are not pedigreed. The modern commercial beef herd usually has crossbred cattle for increased productivity and adaptability to various market and production conditions. The herd may be confined on improved pasture or allowed to run on open range. One cow on well-managed, improved pasture may get all of the nutrients she needs for herself and her calf on as few as 1 to 3 acres. In areas of low rainfall and poor plant growth, she may need to graze 100 acres or more.

Ask ranchers and breeders in your area about the most common and popular beef breeds there. Ask about the advantages and disadvantages of breeding purebred animals versus raising a commercial crossbred herd.

Dairy Cattle

Milk is a source of high-quality protein, minerals, and vitamins. All 50 states produce and process milk; California, Wisconsin, New York, Pennsylvania, Minnesota, and Idaho lead the way in milk production. Fluid milk, half-and-half, whipping cream, yogurt, butter, cheese, and ice cream are a few of the products we enjoy thanks to the dairy industry.



Parts of a dairy cow

Holsteins are the dominant breed, especially in fluid milk markets.

Dairy Breeds

In the United States are six commonly recognized dairy breeds: Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, and Milking Shorthorn. Holstein and Brown Swiss produce greater amounts of milk; Jersey and Guernsey give milk with a higher butterfat percentage. More butterfat in milk gives a richer taste.

A dairy farmer should pick the breed that best fits local conditions and markets. In some areas, nearly all of the milk produced is used as fluid milk. In other areas, most of the milk goes to make cheese and other dairy products.

Ayrshire. The Ayrshire originated in Scotland. Today it is found throughout the United States but mostly in the Northeast and Midwest. Ayrshires are well-built, of medium size, strong, and rugged, with symmetrical udders that are well-attached to the body. Almost all Ayrshires are dehorned as calves because their long, curved horns are impractical in dairy operations. Mature cows weigh about 1,200 pounds.

Ayrshires usually are light to deep reddish-brown or mahogany, or a combination of red and white, with distinctive markings.

Brown Swiss. The Brown Swiss, one of the world's oldest dairy breeds, was developed on the mountain slopes and valleys of Switzerland. Brown Swiss are known for their calm dispositions. The first Brown Swiss to be introduced into America came to Massachusetts in 1869 and 1870. Mature cows weigh about 1,500 pounds.

Brown Swiss are solid brown, varying from very light to dark.

Guernsey. This breed originated on the Isle of Guernsey off the northern coast of France. Guernseys are found throughout the United States, mostly in the central states. They are medium-sized cattle, gentle, and easily handled. A mature cow in milk weighs about 1,150 pounds. Heifers mature early. The milk of these cattle is especially yellow.

Guernseys are fawn-colored with white markings. Skin color is golden yellow or pinkish.

Most Holsteins are black and white; some are red and white.

The Jersey is medium-brown to fawn in color.

Holstein. Holsteins descended from cattle developed in the northern part of the Netherlands, especially the province of Friesland, and northern Germany. This is the most popular dairy breed in the United States and is found in all states in great numbers. It is also the largest breed, with mature cows weighing about 1,500 pounds. Holsteins are noted for producing large volumes of milk with low butterfat.

Jersey. The Jersey came from the Isle of Jersey, in the English Channel between Great Britain and France. Jerseys—the smallest of the major U.S. dairy breeds—often were kept aboard sailing ships to supply milk during long sea voyages, and probably came to America with early colonists. The breed's first recorded arrival in America was in 1850. The cows produce a rich milk, high in butterfat and protein. Mature cows weigh 900 to 1,100 pounds. Heifers mature early, calving for the first time at 20 to 24 months of age.

All breeds of dairy cattle have the genes for growing horns, but in U.S. dairy herds nearly all are dehorned soon after birth. Why? Because horns can cause injury to other animals and to those who work with the cattle.

Dual-Purpose Breeds

Cattle originally filled three roles for people: They provided milk, meat, and labor. Eventually, horses and then machinery replaced cattle for labor, so they were often developed for the single purpose of providing either meat or milk. Some breeds, however, still serve a dual purpose and can be raised as either beef or dairy cattle.

Milking Shorthorn. The Milking Shorthorn was an important dual-purpose breed for the pioneers in America, who depended on it for both milk and meat. In early American history, the breed was often called the Durham cow. Modern Milking Shorthorns are raised mainly to produce milk. They are red or white, or a combination (roan), with no black markings. Mature cows weigh about 1,400 pounds.

Horses

In 1920, 27 million horses lived in the United States. Today there are only about 9.2 million. The big drop was caused by the internal combustion engine. With the invention of the truck, tractor, and automobile, horses were no longer needed for heavy farm work and transportation.

In recent times, however, the horse has made a comeback as millions of people have discovered the fun of owning a horse for sport and recreation. Most horses today are kept for riding and racing, but some are still workhorses.

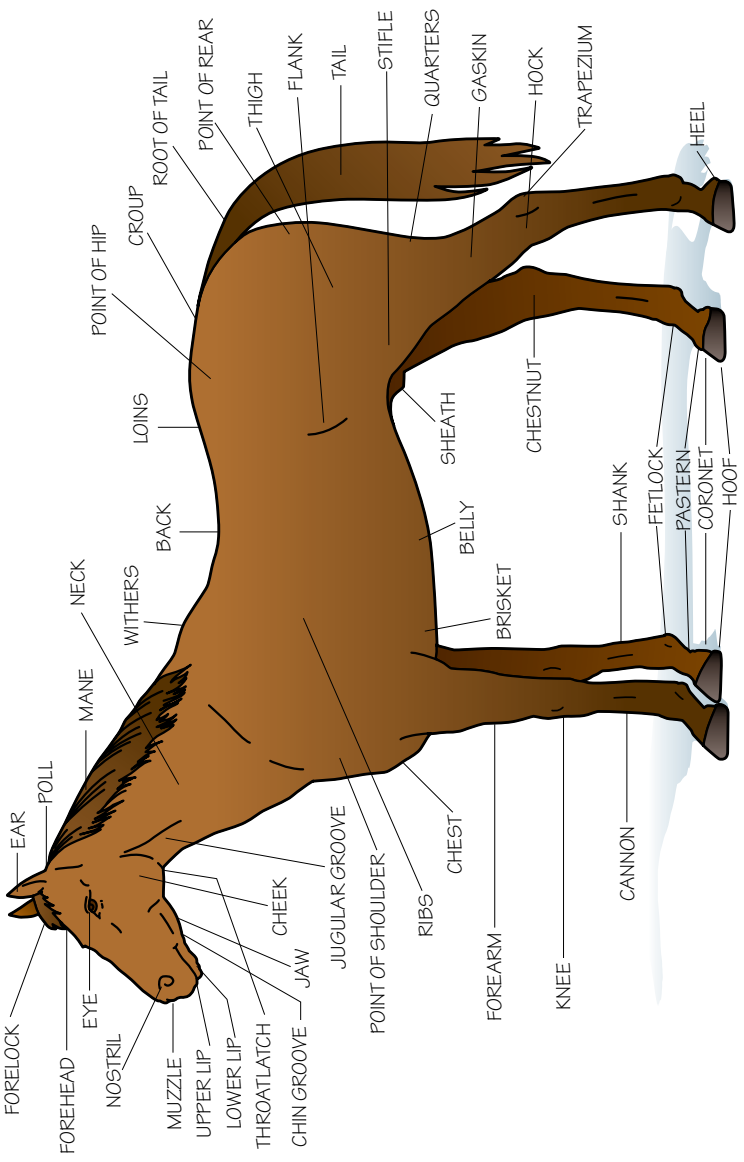
The cow horse is one working horse that is still on the job. A good cow horse is still needed to work cattle in many cattle operations.

Terms used to describe the markings on a horse's face or legs include *baldface* (a mostly white face), *blaze* (a large white patch on the face), *star* (any small white patch on the forehead), *snip* (any small white patch near the muzzle), and *sock* (a white patch above the foot).

Descriptive Terms

Horse enthusiasts use several terms to describe the sex, age, or condition of a horse:

- **Stallion**—a sexually intact male horse more than 3 years of age
- **Stud**—a stallion used for breeding
- **Colt**—an intact male up to 3 years of age
- **Gelding**—a castrated male horse of any age
- **Mare**—a mature female
- **Filly**—a female horse age 3 years or younger
- **Foal**—a male or female less than 1 year old
- **Weanling**—a just-weaned young horse of either sex



Parts of a horse

Horses may be various shades of black, brown, *chestnut* (reddish-brown), *dun* (yellowish-gray), gold, gray, *sorrel* (yellowish-brown), and white. *Bay* horses have a brown coat and black *points* (legs, mane, and tail). Chestnut horses may have *flaxen* (pale yellow) or sorrel manes and tails but not black points. Many gray horses are born a dark color and turn a lighter shade with age. Some gray horses turn white by the time they are fully grown. *Roan* horses are yellowish-brown or reddish-brown and sprinkled with white or gray hairs. *Calicoes* are predominantly white with red and black patches.

Palominos have a golden coat and a light blond or silvery mane and tail. Most have no white except on the face and on the legs below the hocks and knees. Almost every horse breed except the Thoroughbred has palominos. The color type was developed by breeders in the United States and Mexico.

Major Breeds of Horses

Light horses: American Saddlebred, Appaloosa, Arabian, Hackney, Morgan, Paint, Quarter Horse, Standardbred, Tennessee Walking Horse, Thoroughbred
Heavy horses: American Cream, Belgian, Clydesdale, Percheron, Shire, Suffolk
Ponies: Connemara, Hackney, Pony of the Americas, Shetland, Welsh

Horse Breeds

This country has more breeds and varieties of horses than anywhere else in the world. Some breeds came from other countries; others were developed here for specific uses.

The Saddlebred may be chestnut, bay, gray, black, or golden in color.

American Saddlebred. The American Saddlebred was developed during Colonial days in Virginia, West Virginia, Kentucky, and Tennessee. Recognized as a distinct breed around 1900, the original stock included Thoroughbreds, Canadian pacers, Morgans, and Standardbreds. It is popular today for its easy, comfortable ride. Most American Saddlebreds are used for recreational riding and are popular in the show ring.

The Appaloosa is noted for the colorful spots on its rear quarters.

Appaloosa. Appaloosas probably came to this continent with Spanish explorers. In the 19th century, most of these horses were owned by the Nez Percé Indians of the Northwest. Later, the breed became widely scattered. Today, Appaloosas are mostly stock and recreation horses.

The Arabian is known for speed, stamina, beauty, and alertness.

Arabian. As the name implies, the Arabian was developed in Arabia. It has been bred in the United States since the Colonial period. George Washington rode a gray Arabian charger. Noted as an "easy keeper," the Arabian can be maintained on less-than-ideal pasture or grain rations, making it an economical horse to own.

The Morgan has a proud carriage, upright graceful neck, and distinctive head.

Morgan. The Morgan was founded by a single outstanding horse. A bay stallion named Justin Morgan, born in 1789, was renowned for his strength, speed, and stamina. He also had the remarkable ability to pass on his likeness and his strengths to his offspring. His descendants, in turn, passed these traits to their offspring. Morgans are popular as saddle horses, trotting racers, carriage horses, and show horses. Some are used as cow horses on cattle ranches.

Paint. From early human cave paintings, Egyptian wall murals, and statues found in ancient Chinese burial mounds, we know the striking paint horse has been around for a long time. Spanish conquistadors brought paints and other horses to the Americas in the 16th century. By the 1800s, paints (also called pintos) were favorite mounts of American Indians and cowboys. Today, paints are popular saddle, show, and stock horses. They are deep-chested, well-muscled, powerful animals that perform well under saddle. A calm disposition and quiet intelligence make the paint a good recreation horse.

Paint horses have two-toned coat markings of white and a darker color. Its two major color patterns are called tobiano (usually red or sorrel on the sides, with white extending over the back), and overo (white on the sides with the color over the back).

The quarter horse gained a reputation in Colonial America as a short-distance runner. Its usual race distance was a quarter mile; hence its name.

Quarter Horse. The quarter horse was the first horse breed established and developed in the Americas. Stallions of Arab, Barb, and Turk breeds shipped to the Americas by Spanish explorers and traders were crossed with a band of mares that arrived from England in 1611. The result was a compact, heavily muscled horse that could run short distances faster than any horse before it.

As settlers moved west and cattle ranches began stretching across the plains, the quarter horse became famous for its "cow sense," which made it invaluable for working cattle on the open ranges of the West. Today, the quarter horse is still used in ranch work and is the most common breed in rodeo events.

Riders find the quarter horse surefooted and intelligent, and a sturdy, dependable mount for weekend trail rides.

Mustangs are descended from horses that Spanish explorers brought to North America in the 1500s. Some of their horses escaped and ran wild. By the mid-1800s, bands of mustangs roamed wide areas of the West. These small, fleet-footed horses make excellent "cow ponies." They have great stamina and seem to sense what a cow might do next. Today, the quick, agile quarter horse has replaced the mustang as the cowboy's favorite mount.

Shetlands come in almost all horse colors.

Standardbreds are known for great stamina and the ability to trot or pace rapidly without breaking into a running gallop.

Shetland. The Shetland pony was developed in the Shetland Islands about 100 miles north of Scotland. Small and rugged, it originally was used in coal mines to pull heavy loads in tight spaces. This pony is widely used today as a child's mount and show pony.

Standardbred. A Thoroughbred stallion named Messenger bred in the 18th century to native mares that were natural trotters or pacers produced the Standardbred. Used mostly in harness racing, the breed has been popular here since the early 1800s.

There are two kinds of harness horses—trotters and pacers. A *trotter* moves the front leg on one side of its body and the hind leg on the other side at the same time. A *pacer* moves the legs on the same side of its body together. Most of the harness-racing horses in the United States are pacers. The two types do not usually race together because pacers generally go faster than trotters.

Tennessee Walking Horse. The smooth and easy gait of the Tennessee walking horse, a breed founded in middle Tennessee, makes this horse a favored mount of park rangers, mounted police officers, field trial enthusiasts, hunters, endurance riders, competitive trail riders, show-ring performers, and riders of all ages and skill levels.

The famous running walk of the Tennessee walking horse is an inherited, natural gait unique to this breed, known for its calm, easy temperament.

Thoroughbred. The Thoroughbred, developed in England for racing, arrived here in the 18th century. Known for its great heart and tremendous speed and stamina in flat racing and jumping, nearly all Thoroughbreds are bred for racing. Some are used as saddle horses and polo mounts. They tend to be somewhat nervous and excitable.

Coat colors in Thoroughbreds may be bay, chestnut, black, or gray; roans are seen rarely.

Draft Horse. The draft horse is a type of horse that includes several breeds that may weigh 2,200 pounds or more. The most popular breeds are the Clydesdale, Belgian, Percheron, Shire, and Suffolk. The tractor and truck of the 19th century and before, few draft horses are work animals today; some are kept for show.

The powerful Belgian *(left)* and Clydesdale *(above)* are favorites for pulling wagons in parades.

Sheep

Sheep are good foragers and can be produced economically on land that is virtually useless for crops. Millions of acres in the United States that cannot be used profitably by other livestock are grazed by sheep. Of the 200 or more sheep breeds scattered throughout the world, more than 35 are found in the United States. Most are of British or European origin.

Sheep breeds have tremendous genetic diversity. Some have fine wool; others have hair. Some breeds at maturity weigh as little as 100 pounds; others may weigh four times as much. Some breeds average one lamb per *ewe* (mature female); others commonly produce three or more lambs at each *lambing* (birth). Various breeds differ in their herding or flocking instincts. Some tend to herd or flock together better than others, making them better adapted to the open range.

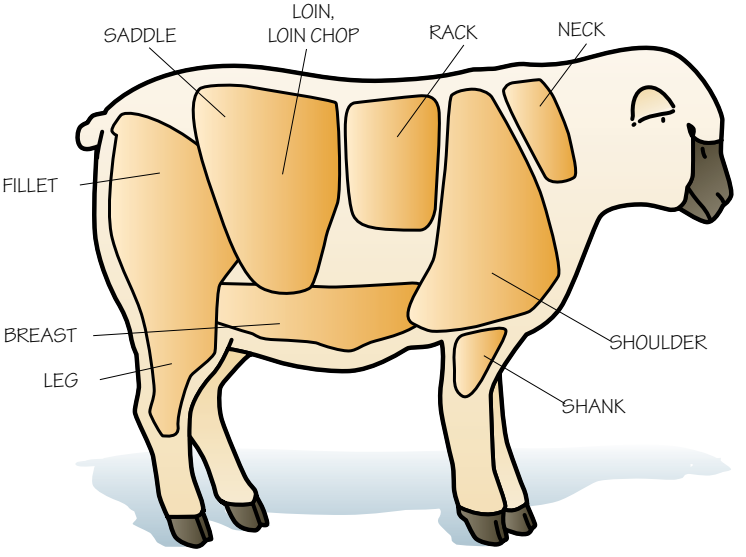
Only about 10 sheep breeds are commercially important today, but the great genetic diversity of sheep allows breeders to make changes rapidly to meet changes in economic conditions and the demands of the market. For successful sheep breeders, the market is an important factor in breed selection. There are three major markets for sheep: raising lambs for meat, producing wool, and raising show lambs.

Other important considerations when choosing a sheep breed include the breed's

- Adaptability to the local environment, taking into account climate and the availability of forage
- Reproductive efficiency, such as number of lambs born and raised per lambing season or year
- Growth rate and carcass quality (faster growth and more lean meat with less fat in the carcass are most economical)
- Wool production

Major Breeds of Sheep

Ewe breeds (fine wool): Debouillet, Finnsheep, Merino, Rambouillet, Romanov
Ram breeds (meat-type): Cheviot, Columbia, Cotswold, Dorset, Hampshire, Leicester, Lincoln, Oxford, Romney, Shropshire, Southdown, Suffolk
Dual-purpose breeds: Cheviot, Columbia, Corriedale, Dorset, Polwarth, Romeldale, Targhee



Meat cuts of a sheep

Terms to Describe Sheep

Ewes—mature females
Rams—mature, sexually intact males
Wethers—male sheep castrated before sexual maturity
Lambs—young sheep

Sheep breeds are classified according to their role in crossbreeding and commercial use. *Ewe breeds* are generally the white-faced breeds of fine-wool type. *Ram breeds* are meat-type sheep used mainly as sires for market lamb production. *Dual-purpose breeds* are used as either ewe or ram breeds depending on the production situation.

Ewe Breeds

Ewe breeds developed mainly from crosses of fine-wool and long-wool types and highly fertile breeds such as the Finnsheep, Booroola Merino, and Romanov. All the fine-wool breeds in the United States trace their ancestry to the Spanish Merino.

Delaine Merinos produce the best-quality wool in the United States.

Merino. The Merino was first imported into the United States in the 18th century. Its three types—types A and B of the American Merino, and type C, the Delaine Merino—differ chiefly in the degree of skin folds or wrinkles. The Delaine Merino has the smoothest skin. Merino are strong, hardy, and herd well. Mature Delaine rams weigh from 150 to 200 pounds; ewes weigh from 110 to 150 pounds. Most rams are horned.

Rambouillets are noted for their high-quality wool, ability to adapt to tough range conditions, and size (they are the largest of the fine-wool breeds).

Rambouillet. The Rambouillet is a good wool producer and also offers acceptable meat. These sheep herd well and are popular in range country. Rams weigh 225 to 275 pounds and ewes 140 to 200 pounds. Most rams have large, spiral horns, but some are polled. The breed was developed from Merino stock imported from Spain into France about 1786, and came to the United States in the 19th century.

Ram Breeds

The ram breeds are selected on the basis of size, growth rate, carcass quality, and ease of lambing. The principal ram breeds in the United States are the Suffolk and Hampshire. The Columbia, Shropshire, Oxford, Southdown, Dorset, and others are used as ram breeds to a lesser extent.

The Suffolk is hornless and has a black face, ears, and legs.

Suffolk. The Suffolk was developed in England and brought to America in the late 1880s. This large, hardy breed tolerates heat well and adapts well to range conditions of the western states. The ewes are excellent mothers. Lambs mature rapidly.

The Hampshire's ears and face are dark and relatively free of wool, as are the legs below the knee and hock.

Hampshire. Originally from southern England, the Hampshire is a large and active breed, with mature rams weighing 275 pounds or more and mature ewes 200 pounds or more in breeding condition. The Hampshire is well-muscled, hornless, and noted for its vigor, strength, and mild disposition. These sheep do well on the range. Ewes lamb easily and have heavy, vigorous lambs.

Columbia. The Columbia originated in Wyoming and Idaho from the crossing of Lincoln rams (a long-wool breed) and Rambouillet ewes. It adapts well to range conditions. Mature Columbia rams weigh 225 to 275 pounds; ewes weigh 125 to 190 pounds. The breed produces a high-quality fleece. Ewes produce a wool *clip* (the wool shorn at shearing) of 12 pounds or more annually.

The Columbia has a white, open-faced, polled head.

Shropshire rams and ewes are polled.

Shropshire. The Shropshire, developed in England, first appeared in the United States about 1855. In size, it ranks between the Hampshire and the Southdown. It is a good meat animal, grows rapidly, and shearing yields about 8 to 12 pounds of wool annually.

Both sexes of the Oxford are polled.

Oxford. Developed in south central England, the Oxford arrived in this country in 1846. Rams weigh 200 to 275 pounds; ewes weigh 150 to 225 pounds. The Oxford shears heavier than many others used as ram breeds, producing 10 to 12 pounds of wool a year.

Southdown. Native to southeastern England, the Southdown had arrived in the United States by the 17th century. An excellent meat breed, the Southdown also produces fine-quality wool but in small amounts. It matures early and is smaller than other ram breeds, with deep, firm flesh. Rams weigh 190 to 230 pounds; ewes weigh 140 to 180 pounds.

Southdown rams and ewes are polled. This breed is a popular choice for 4-H and National FFA Organization market lamb and sheep projects.

Dorset. The Dorset originated in England and is now found in nearly all parts of the United States except the mountain states and the extreme southeast. Multiple births and out-of-season lambs are common, giving these sheep the nickname "the mother breed." The Dorset is a medium-sized sheep, with good body length and muscling and good carcass quality. Rams weigh 225 to 275 pounds; ewes weigh 150 to 200 pounds.

The Dorset breed is noted for mothering ability and milking ability.

Dual-Purpose Breeds

The breeds classified as dual purpose usually are crossed with the ewe breeds to produce crossbred females for market lamb production. Breeds in this category include the Columbia, Dorset, Corriedale, and Cheviot.

Corriedale. The Corriedale was developed in New Zealand from Lincoln rams crossed with Merino ewes. The breed was imported into Wyoming in 1914. These sheep may shear 10 to 12 pounds of wool a year. Mature rams weigh 185 to 225 pounds, and ewes range from 125 to 185 pounds. Both sexes are polled.

Corriedales produce good meat and dense fleece of good quality.

Cheviot. Cheviots originated in the border country between Scotland and England and arrived in the United States in 1838. The breed is noted for its vigor, good milking and nurturing ability, quality meat, and ability to adapt to rugged grazing conditions. Mature rams weigh 160 to 200 pounds; ewes weigh 120 to 160 pounds. Fleece weight usually is light, about 5 to 7 pounds annually. The face and legs have no wool. Both sexes are polled.

The Cheviot is a small, hardy sheep with excellent meat.

Dairy Goats

Goats are grazing animals that can eat a wide variety of plants. Some ranchers use them to clear brush and other unwanted plants from pastures. Goats actively hunt for food and can cover a wide area in search of scarce forage. They thrive in harsh environments such as rocky and mountainous areas and dry or semitropical climates.

Domestic goats produce milk, meat, leather, and wool. Babies, the elderly, and people with stomach ailments may find goat's milk easier to digest than cow's milk. People who are allergic to the protein in cow's milk may be able to drink goat's milk safely. However, those who cannot digest the lactose in cow's milk can't drink goat's milk either, because the milk sugar is the same in both kinds of milk.

In the United States and Canada, the most popular milk-producing goat is the Anglo-Nubian, or Nubian. It was developed by breeding British dairy goats with goats imported from Africa and India. Other major breeds of dairy goats are the Saanen, Toggenburg, and Alpine, all developed in Switzerland.

Goat's milk cheeses have a creamy texture and a wide range of flavors. Popular goat's milk cheeses include blue, chèvre, feta, and ricotta.

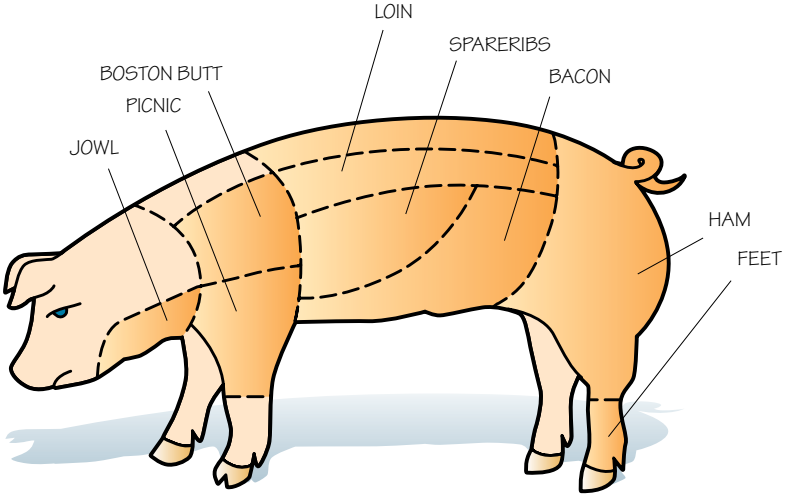
In its composition, goat's milk differs slightly from cow's milk. Both are about 87 percent water, 3 to 4 percent protein, 3 to 5 percent fat (depending on the breed), and 5 percent *lactose* (milk sugar). Both provide similar amounts of calcium and phosphorus. Goat's milk, however, contains more vitamin A than cow's milk but smaller amounts of certain B vitamins including vitamin B_{12}.

An adult male goat is called a *buck* or a *billy goat.* An adult female is a *doe* or a *nanny goat.* A goat less than a year old is a *kid.* The mature weight of modern dairy breeds is between 130 and 200 pounds.

Hogs

Hogs breed rapidly, require little space, and reach market size relatively quickly. These qualities make them a natural choice for small farmers who want to turn home-raised grain into a marketable meat product quickly. Intensive commercial production, however, is rapidly replacing the small pig farmer. Small farmers may typically raise pigs for market from fewer than 50 to 100 *sows* (adult female swine), but intensive commercial producers often have from 500 to 10,000 sows.

Hogs have been in America since explorer Hernando de Soto brought some, and lost them to the wilds, in the early 1500s. Pioneers brought hogs to Jamestown in 1609. Settlers moving westward spread them throughout the United States. By 1840, the center of production had shifted to the Midwest, where it remains today, although swine make important contributions to every state's economy.



Meat cuts of a hog

Swine producers today breed for a meat-type hog with a good yield of the lean cuts—ham, loin, picnic shoulder, and Boston butt. Quality hogs are well-muscled and lean.

Swine Breeds

As is true for other livestock, there is no "best" breed of swine. A hog producer must base breed selection on the growth rate of the breed, the number of pigs in an average litter, and the desirability of the meat, as well as suitability to the producer's goals.

Major Breeds of Hogs

British breeds: Berkshire, Tamworth, Yorkshire
U.S.-developed breeds: American Landrace, Chester White, Duroc, Hampshire, Poland China, Spotted Swine

The American Landrace is white.

American Landrace. The American Landrace was developed from Landrace stock from Denmark and other European countries. Mature *boars* (adult, sexually intact male swine) weigh 700 to 900 pounds, and sows weigh 550 to 750 pounds. The Landrace has a long body and is known for its large litter size.

Berkshires are black with white on the face, tail, and all four feet.

Berkshire. An English breed, the Berkshire is the oldest improved swine breed. It first came to the United States in 1823. A mature Berkshire is of medium size, with boars weighing 700 to 900 pounds and sows 600 to 750 pounds. The breed is long-bodied and produces fine quality meat.

The Chester White originated in Chester County, Pennsylvania.

Chester White. Because of their mothering ability, large litters, durability, and soundness, Chester Whites are popular with pork producers. Chesters mature early and can be marketed at a lighter weight than some breeds. Chester White carcasses are noted for large hams.

Duroc. The Duroc originated in New Jersey and New York in the mid-1800s. A popular and hardy breed, it is noted for an excellent rate of weight gain and feed efficiency (that is, the number of pounds of feed needed to produce one pound of weight gain). Sows have large litters and are good nurturers. Durocs mature early.

The Duroc is all red, the shade varying from light to dark.

Hampshire. The Hampshire was developed from English breeds in Boone County, Kentucky, during the 19th century. Hampshires are noted for leanness, durability, carcass quality, and efficiency. They are large-framed and deep-bodied.

The Hampshire has a black body with a white belt running over the shoulders and front legs.

Poland China. The name of the Poland China is misleading because no swine from Poland or China contributed to its development. It originated in Ohio and was named by a Polish farmer. The breed is known for producing a heavy ham carcass.

The Poland China is black with white feet, snout, and tip of tail.

Spotted Swine. The Spotted swine has changed drastically from the short, fat hog in the early 1900s to a long-sided, fast-growing, large, and hardy breed with excellent carcass quality. The Spot is noted for its mothering ability, litter size, and muscling.

Spotted swine are known as highly productive hogs.

Besides the pure breeds of swine, many *hybrids* (crossbred animals) have been developed to produce pigs that excel in certain characteristics, such as carcass leanness, growth rate, feed efficiency, and reproductive rate. The white breeds have been used extensively as sows for mating to boars of the colored breeds such as the Berkshire, Hampshire, and Poland China.

Poultry

Chickens produce meat and eggs, two of the world's major sources of food. In the United States, many poultry farms are in Georgia, Arkansas, North Carolina, Alabama, Mississippi, Texas, California, Virginia, Pennsylvania, Minnesota, Iowa, and Ohio.

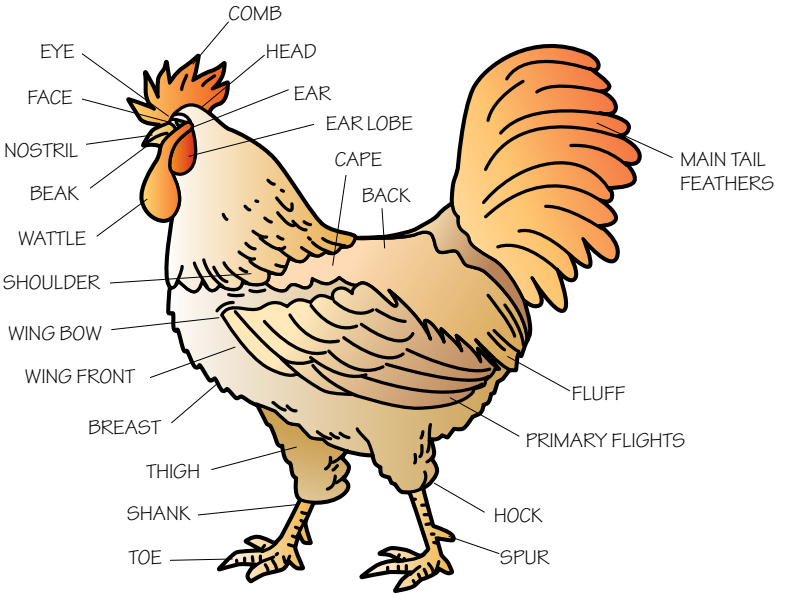
Poultry kept for human use includes turkeys, geese, ducks, guinea fowl, and chickens. People also raise game birds such as chukar partridge, quail, and pheasant. This pamphlet will mention only chickens. To learn more about the others, visit your local library or a poultry producer.

White Leghorn pullets. A *pullet* is a young hen.

Barred Plymouth Rock male

Major Chicken Varieties in the United States

The major chicken varieties include the White Leghorn, White Plymouth Rock, Barred Plymouth Rock, Rhode Island Red, New Hampshire, and Dark Cornish. Most chickens in the United States are hybrids. The high-quality, high-producing birds of commercial egg farms and broiler farms are the results of careful selection and crossbreeding.



Major external parts of a chicken

Broilers. Commercial poultry farms normally buy chicks from companies that specialize in chick production for either meat or egg production. For *broiler* (meat) production, *straight-run* (unsexed) chicks usually are ordered.

Layers. Brown eggs are popular in some areas, but most commercial egg farms use hens that produce white eggs from the White Leghorn breed or from strains of the breed. Commercial producers use high-producing laying hens that have been bred for egg production.

Animals need fresh, clean water available to them at all times.

Management Practices

Livestock animals have certain physical needs that must be met if they are to grow and develop normally, stay healthy, and be productive.

Cattle, horses, sheep, goats, hogs, and poultry have the same basic needs, but the way their needs are met varies. This section will cover these needs in general terms. For more detailed information, talk with your merit badge counselor, a county agent, or a livestock producer.

Feeding and Watering

The nutritional needs of different animals vary, but all require the following.

Water. Fresh, clean water is a must at all times for every animal. A cow, for instance, will drink about 12 gallons of water a day—more in hot weather than in cold. She can live for weeks without food but only a few days without water, which she needs to regulate body temperature, dissolve and carry nutrients, and eliminate wastes.

Carbohydrates. Sugars, starches, and cellulose are carbohydrates that the body "burns" (oxidizes) to provide the energy used for growth, fattening, and reproduction.

Fats. This class of nutrients mainly provides high amounts of energy but also supplies the small amounts of *fatty acids* required for proper growth.

Proteins. These complex compounds provide the *amino acids* essential for an animal's normal growth and functioning. The body uses amino acids mainly to build soft tissues such as muscles.

Without a balanced diet of all these nutrients, animals will not flourish. They will be less productive than healthy specimens, or become infected with disease, and their offspring may be weak or deformed.

Vitamins. These complex substances are vital to normal growth and health. Vitamins are required in small amounts and play specific roles in the body.

Minerals. Normal body functioning requires elements such as iron, copper, phosphorus, potassium, selenium, calcium, and iodine. More than a dozen minerals are known to be essential in an animal's diet.

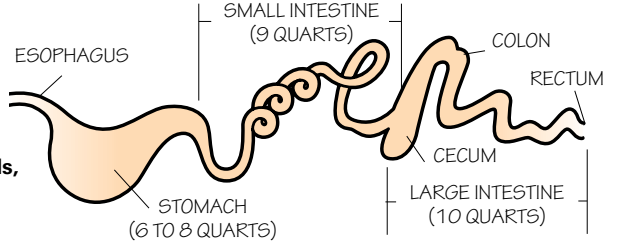
Hay is good feed for cattle because the *ruminant* digestive system contains microorganisms—bacteria and protozoa—that can break hay down into usable forms of energy, protein, vitamins, and minerals.

The main difference between ruminant and nonruminant animals is that the ruminant's "stomach" has four compartments, while the nonruminant's has only one. As a result, the types of feed they can use are quite different.

Digestive Systems of Livestock

Feed is the most important factor in the growth, health, and productivity of all kinds of livestock. For most types of livestock, feed is the producer's biggest expense. Livestock producers must feed their animals well, but they must keep costs down to make a profit. Producers can achieve both good nutrition and good economy if they understand how animals use feed and *convert* it into profitable meat, milk, eggs, wool, or offspring.

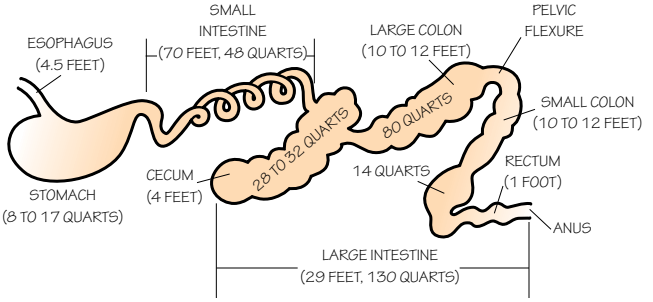
The digestive systems of farm animals are of two kinds. *Ruminants* are cud-chewing, cloven-hoofed animals, including cattle, sheep, and goats. (Deer, bison, antelope, camels, giraffes, and llamas also are ruminants.) All other livestock, including horses, swine, and poultry, are *nonruminants.*



The digestive process of simple-stomached animals, such as the pig, is similar to that of humans.

DIGESTION IN NONRUMINANTS

Let's follow the digestive process of a familiar nonruminant—the horse. The process starts in the mouth, as the horse chews the feed and moistens it with saliva. Chewing causes some physical breakdown of the feed, and saliva eases the feed's passage down the *esophagus* (the tube linking the mouth with the stomach).

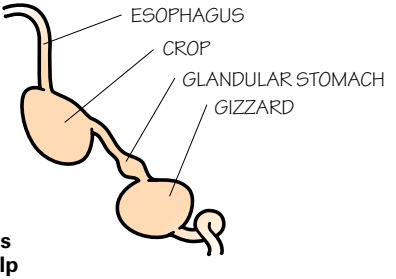


The horse's *cecum* is relatively large, as this drawing of a horse's digestive system shows. Therefore, the horse can use large amounts of forage. Because the cecum of swine and poultry (and people) has a limited capacity, these animals cannot use forage well.

For its size, a horse has a small stomach. This means it must eat relatively small amounts over a long period instead of large amounts quickly. If a horse is not fed, its stomach will be empty within 24 hours.

Once in the horse's stomach, the feed mixes with gastric juices that break down fats and proteins. In the *small intestine*, which is around 70 feet long, enzymes continue to break down proteins, fats, and sugars into simpler substances that can be absorbed into the bloodstream and used by the body.

Digestion and absorption of nutrients continue as food passes through the *cecum* and *colon* (the large intestine). The cecum houses microbes (bacteria and protozoa) that help to break down forages such as hay and grass into nutrients that can be absorbed. Undigested fiber and wastes are expelled through the rectum.



The digestive tract of a chicken, a nonruminant animal, has a pouch, or *crop*, that stores food and slowly passes it to the stomach. After the food has mixed with digestive juices in the stomach, it enters the *gizzard*. This organ's strong muscles grind food. Birds have no teeth to crush their food, so the grinding in the gizzard replaces chewing. The gizzard holds small pieces of gravel that the bird has swallowed, which help to break up and grind the food for better digestion.

DIGESTION IN RUMINANTS

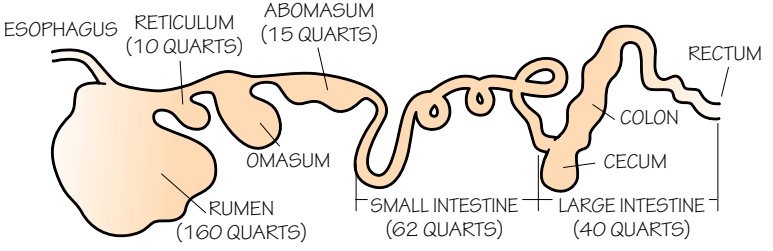
A cow's rumen may have 200 billion microorganisms per teaspoon.

A cow eats by wrapping its tongue around grass and twisting it off. The animal chews its food very little before swallowing it, but does mix the grass with saliva in the mouth to lubricate it and make swallowing easier.

The feed travels down the esophagus to the *rumen,* also called the paunch or fermentation vat. The rumen may hold as much as 50 gallons. This large vat contains microorganisms—bacteria and protozoa—that actively break down the forage the cow eats. These tiny organisms digest the roughage to survive and, in the process, make substances such as fatty acids, B vitamins, and amino acids that the cow needs. When the organisms die, the cow digests them and absorbs the nutrients they release.

Only microbes produce the enzymes that digest forage; the animal itself does not. A calf is not born with the microorganisms needed to digest forages. It must *inoculate* its digestive system by eating or drinking with more mature animals to pick up the necessary microorganisms. Calves start ruminating when they are about 3 months old; they digest only small amounts of roughage at that age. By weaning, a calf's digestive system is functioning completely.

The rumen of a mature cow acts as a storage vat. After feeding, the cow *regurgitates* (casts up) a cud of partially chewed feed and fluid. Forcing the cud up the esophagus from the rumen to the mouth, the cow chews it more thoroughly and then reswallows it. Digestion by the microbes continues until the particles of feed are small enough to flow down the digestive tract through the small opening of the rumen and *reticulum.*



A cow's digestive system has a "stomach" with four compartments: rumen, reticulum, omasum, and abomasum. A limited amount of microbial digestion continues in its cecum.

Next comes the *omasum,* which removes most of the water. Most microbial digestion is completed by the time the food reaches the next stop, the *abomasum*. Often called the *true stomach* because it performs much like the simple stomach of the horse and pig, the abomasum uses digestive juices to break down food into its nutrient building blocks, which are then absorbed through the wall of the small intestine. Undigested material moves through the cecum and large intestine and is expelled as manure through the rectum.

Ruminants can go for longer periods without food than nonruminants, provided they have adequate rations when they are fed. They can also use more roughages such as grass and hay, which are more difficult to digest than feeds such as grains.

A ruminant's stomach takes 72 hours to empty.

Feeding Cattle

The rations fed to cattle depend on the intended goal—fattening a steer for market, feeding dairy cows to increase milk production, feeding show animals, or wintering cattle, for instance. Rations often are prepared with computers and complicated nutritional data, but you can use some general guidelines to plan basic rations.

- Any sign of *unthriftiness* (lack of vigor or health) in cattle should prompt a change in the ration if parasites and disease can be ruled out as the cause of the problem.

- Two percent of the body weight of cattle may be fed daily as hay (roughage), or three times this amount for silage. (*Silage* is a fermented, moist feed.)
- For protein, feed 1½ to 2 pounds of oil meals, or three times this amount of alfalfa or other leguminous hay. Leguminous hays include vetch, clovers, and alfalfa.
- To fatten cattle, feed a ration of at least 60 percent concentrates (grains) and 40 percent roughages (hay, silage), in amounts equal to 3 percent of the body weight.
- With any ration, also provide needed mineral supplements. Many areas of the country have mineral deficiencies in their soils. To balance a feed, stockraisers may need to supplement with various extra minerals that are deficient in their area.

Suggested Beef Cattle Rations

The table shows some suggestions for basic rations in pounds per day.

	Supplementing a 1,000-pound cow	Fattening a 600-pound calf
1. Nonleguminous hay	20	10
Oil meal	2	2
Grain (shelled corn or ground grain sorghum)	—	6
2. Nonleguminous hay	—	3
Silage	60	20
Oil meal	2	1.5
Grain (corn or grain sorghum)	—	6
3. Nonleguminous hay	16	8
Leguminous hay	6	2
Oil meal	—	1.5
Grain (corn or grain sorghum)	—	6
4. Leguminous hay	6	10
Silage	48	—
Oil meal	—	1
Grain (corn or grain sorghum)	—	7

Feeding Horses

A horse's dietary needs depend on its age and how it is used. Working and race horses need more energy than idle ones. Mares with foals at their side need more protein than unbred mares. Young horses generally need a more nutritious diet than older horses.

Linseed oil meal is a popular protein feed for horses. It promotes a shiny coat. Grains—especially oats, and to a lesser degree corn, barley, and wheat—provide energy. An iodized, trace-mineral, free-choice salt block will prevent mineral deficiencies. Lush pastures will provide a horse with the necessary vitamins. If no pasture is available, green, leafy forages may be substituted.

Horses can use high-energy concentrate feeds but require some bulk (forage) to keep the food from becoming compacted in the digestive tract. Compaction can cause dangerous disorders such as *colic.* Oats are excellent grains for horses. They are high in nutrition, somewhat bulky, and horses like to eat them.

A horse kept for recreational riding should do well on a simple ration of 95 percent oats and 5 percent linseed meal, or half oats and half sweet feed (premixed corn, soybeans, linseed, wheat, and vitamin-mineral supplements), plus a bright, clean, leafy hay for roughage.

Feeding horses with rations that are too low in roughages can cause *colic*—acute abdominal pain.

Suggested Horse Rations

The table gives sample daily rations for horses doing light work and for stallions and mares used for breeding.

	1,000-pound saddle horse	1,200-pound broodmare and stallion in service
1. Alfalfa hay	10 pounds	14 to 16 pounds
Oats	4 pounds	10 pounds
Mineral supplement	—	2 ounces
2. Alfalfa hay	—	10 pounds
Grass hay	14 pounds	4 pounds
Oats	5 pounds	5 pounds
Corn	—	3 pounds
Barley	—	2 pounds
Wheat bran	—	2 pounds
3. Alfalfa hay	10 pounds	5 pounds
Grass hay	—	8 pounds
Oats	3 pounds	12 pounds
Barley	1 pound	—
Wheat germ oil	—	1 ounce
Mineral supplement	—	2 ounces

Do not feed livestock hay on the ground. That can lead to worm infestations and may cause "sand colic," a common digestive disorder in horses. Feed hay in bunks or hay nets. Keep feed boxes free of moldy feed, which often causes chronic coughing.

Points to remember: Feed and water horses at least twice a day. Do not let a horse drink its fill of water after vigorous exercise. Always walk a horse to cool it off before letting it drink.

Feeding Sheep

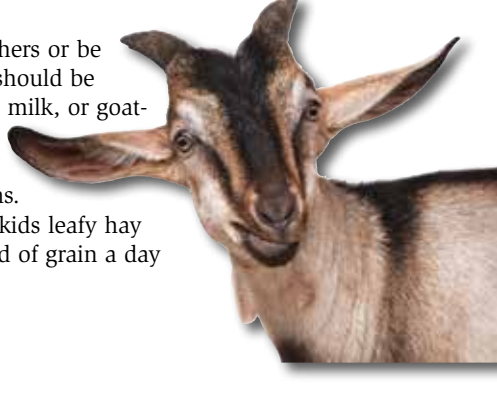
Rations for sheep are often mostly roughages. Sheep thrive on good pastures. Generally, ewes need 4½ to 5 pounds of dry feed or its equivalent each day. This may be made up of legume hay, grass hay, and silage, or merely a good pasture.

Often, ½ to 1½ pounds of grain are added to the daily diet of ewes during pregnancy, after lambing, and just before breeding. *Finishing* lambs (putting on weight) normally will require 3 to 4 pounds daily of a ration containing at least 70 percent grain.

Feeding Dairy Goats

Feed adult dairy goats good-quality hay and grain. Make plenty of clean water and salt available to them at all times.

Kids can either get milk from their mothers or be raised by hand using a bottle or pan. They should be fed 1 to 2 quarts a day of goat's milk, cow's milk, or goat- or sheep-milk replacer. They need milk three to four times daily the first week of life, then twice daily for three or four months. Starting when they are 1 week of age, offer kids leafy hay and grain. After weaning, they need 1 pound of grain a day and all the hay they will eat.



Feeding Hogs

Hogs are easy to feed if you use commercially available premixed, balanced feeds that contain all the necessary nutrients. It is possible to simply fill a self-feeding hopper once or twice a week, and check daily to see that the hopper is not clogged and to ensure that the hogs have fresh water available at all times.

Swine rations normally will contain only concentrates. The fiber content must be less than 5 percent. If you feed hogs roughages, feed only those of high quality, such as alfalfa leaf meal, legumes, or grazing cereal grains.

Three basic commercial premixed rations are available for feeder pigs. Weaned piglets younger than 5 weeks of age may be fed *prestarter rations,* which have 20 to 22 percent protein. Slowly switch the pigs, by the time they are 5 weeks old, to *starter rations,* which are up to 20 percent protein. At 65 to 70 pounds, switch them to a *grower ration* that provides about 16 percent protein. Continue this ration until slaughter, or put hogs weighing 120 pounds on *finisher rations* containing 14 percent protein.

Some swine producers use these rules:

- Give 1 pound of feed for each 30 pounds of body weight from 120 pounds to market weight.
- Feed only the amount eaten in 20 to 30 minutes.
- Finishing hogs (120 to 245 pounds), while on full feed, will eat 4 to 6 pounds of feed each day per 100 pounds of live weight.

A diet that is good for market hogs will not be nutritious enough for *gilts* (young females) that will grow up to rear litters of piglets. Breeding females need extra nutrients. Pregnant gilts and sows should receive 4 to 6 pounds a day of a special *gestation* diet. Females housed outside may need an extra pound or two of feed daily but should not be overfed during gestation to avoid gaining too much weight and fat.

After *farrowing* (giving birth), females require a nutrient-rich *lactation* diet of 16 to 17 percent protein. A lactating sow that is nursing produces 15 to 30 pounds of milk daily, making her nutrient requirements three times higher than during gestation. The average sow requires 4 to 6 pounds of feed per day plus 1 pound daily for each nursing piglet.

When the piglets are weaned at the end of the three-week lactation period, a sow's daily feed intake falls off dramatically as she stops producing milk. At this time, the "dry" sow goes back on a prebreeding or gestation diet containing 12 to 14 percent protein.

Feeding Chickens

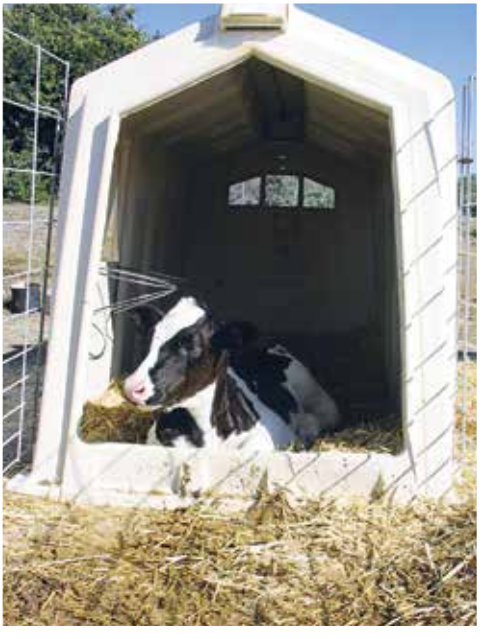
Corn is the most important grain used in poultry rations, followed by sorghum (milo) and wheat. Soybean oil meal often is used as a protein supplement. Common calcium supplements include crushed oyster shells and ground limestone.

The science of feeding chickens has become highly technical as our knowledge of nutrient requirements grows. Today, almost all commercial growers purchase their feed rather than mix their own.

The high water content of the eggs and meat makes fresh, clean water doubly important for poultry. It should be available at all times.

Housing

Every kind of livestock needs protection against severe weather and predators, shelter for times of illness, and protection for its young. The type of shelter needed depends on the type of livestock, its size and feeding habits, and the climate.



Make sure barns or other living quarters for animals are clean and dry, with no sharp edges or nails that might cause injury. Good drainage is important. See that all waste material is removed regularly.

For range cattle in most areas, open shelters are adequate. Beef cattle on pastures with some natural windbreaks such as treelines or cliffs may not need buildings for shelter.

Sheep are hardy but should have shelter to protect them from cold or rain. A plain, open shed facing away from the wind will be enough in most areas.

An open shed facing away from the wind provides adequate shelter for hardy farm animals like sheep and goats.

Dairy goats need an exercise area and a sturdy shelter free of drafts. Goats are curious, active creatures and will try to escape from enclosures. The best way to keep them in is to use solid board fencing or electric fences.

Hogs do best in sanitary, cool, well-kept quarters. People should wear clean footwear when working in farrowing houses or other buildings where hogs are kept because small pigs are highly susceptible to disease. Sanitation is especially important in swine management because hogs normally are kept in large numbers in close confinement.

Contrary to popular belief, a hog does not prefer to live in a mud wallow. Swine actually are quite clean.

The landscape of farming continues to evolve. While the average size of a farm has more than doubled in the last 20 years—creating larger, industrialized operations—*smaller specialty farms* that produce goods from animals such as free-range chickens and turkeys, alpacas, and farm-raised fish have become profitable options.

Layer and broiler houses protect birds from the elements. Most houses today, such as this layer house, are well-ventilated and well-insulated and have controlled temperature and automatic lights, feeders, and waterers.

Layer houses provide nests, roosts, feeders, and waterers. Broiler chickens are housed in broiler houses, 30 to 40 feet wide and as long as necessary to hold the number of birds desired. Adequate space is important. Birds need enough room at the feeders so that all can comfortably eat at the same time. Overcrowding is dangerous for poultry flocks. Diseases can pass more easily between birds, and the stress of overcrowding makes birds more vulnerable to disease. Good housing reduces stress on the birds.

Grooming

Grooming helps keep animals clean, stimulates blood circulation, and helps prevent skin disease. A groomer may see blemishes that should be addressed. Clean, well-groomed animals are more comfortable and less likely to spread infections or parasites to other animals.

While the horse has only one hoof per foot, cattle, pigs, sheep, and goats have two toes (or claws) covered by a hoof on each foot. Trimming the feet of dairy cattle may be necessary to help keep them from growing abnormally. Abnormal claw growth can affect how a cow stands on its feet, causing pain that can affect eating habits—and thus affect the cow's milk production and body flesh.

Shoes protect a horse's feet and keep the hooves from cracking and splitting. To stay healthy, horses need their hooves trimmed regularly by an experienced *farrier* (a person who shoes horses). Cleaning a horse's hooves is part of regular care. A hoof pick is used to remove dirt, stones, and other debris.

Except for horses, most farm livestock are not groomed regularly unless they are show animals, such as this heifer.

Livestock Diseases and Prevention

Each time you buy an animal, ask for its vaccination record. Because mixing animals can spread diseases, always try to isolate incoming animals for one month to determine whether they are carrying a disease.

Ranchers and stockfarmers must be familiar with the diseases, parasites, and disorders that may afflict domestic stock, and constantly guard against them. This section describes some common diseases of livestock. Talk with your merit badge counselor, county agent, or veterinarian about the diseases common in your area. Study these and learn the most effective means of prevention.

Each year, losses from diseases and parasites run into the millions of dollars. Timely measures of prevention and control could probably avert many of these losses. The old saying that "an ounce of prevention is worth a pound of cure" certainly applies to the livestock industry.

Plan a health program for your animals. Find out what vaccines are given routinely in your area. Use a calendar to remind you of the best times to vaccinate against disease and to control parasites. Coordinate a year-round health plan for your herd or flock with your other management practices.

Diseases of Cattle

Dairy and beef cattle get the same types of diseases. A few diseases that affect the udder are, of course, especially serious in dairy cattle.

The first sign of illness in cattle often is high temperature. Normal temperature is 100.4 to 102.8 degrees Fahrenheit. An animal thermometer inserted into the rectum is used to take the temperature of cattle. Get instruction from an expert before trying to take an animal's temperature.

Some common or serious diseases of cattle, and their causes, symptoms, and methods of prevention, are described below. For treatments, consult a veterinarian.

Blackleg. Blackleg, caused by a microorganism, is contagious and often fatal. Most outbreaks occur in the warmer months of spring and autumn. The first symptom is lameness, and the upper parts of the leg swell. Temperature usually is high and the animal loses its appetite. Death occurs quickly; a cattle producer might not notice signs of a problem until one or more calves have died. Blackleg can be prevented through vaccination.

Blackleg most often strikes cattle between 6 months and 2 years of age.

Bloat. Bloat is not a disease but a painful and unhealthy condition that can kill cattle. It shows up as abnormal swelling of the left side of the animal that, in severe cases, puts pressure on the diaphragm and lungs and causes the animal to gasp for breath. To help prevent bloat, feed cattle dry hay before turning them out to graze legume pastures.

Bloat occurs when gas builds up in the first two compartments (rumen and reticulum) of the digestive tract of cattle and other ruminants. Legume pastures, alfalfa hay, and high-concentrate feeds can bring it on.

The Scoop About BSE, or Mad Cow Disease

You probably have heard a lot about bovine spongiform encephalopathy (BSE, also known as mad cow disease), a fatal disease of adult cattle that kills an animal's brain cells. BSE is caused by a class of infectious agents called *prions,* which are neither viruses nor bacteria. Symptoms of the disease may include skittishness or aggression, weight loss, abnormal posture, difficulty standing up, and paralysis. The infection may lie quiet in an animal's brain for years. Once the disease flares up, the animal dies quickly—usually in less than six months. No treatment is known.

Since BSE was first diagnosed in Great Britain in 1986, Europe has had more than 180,000 cases of infected cattle. BSE is not contagious and does not spread from one cow to another. Cattle become infected by eating contaminated feed.

However, people who eat meat containing the nervous tissues from BSE-infected cattle may die of a human brain disorder, a variation of a rare disease called Creutzfeldt-Jakob disease (CJD or, the variation, vCJD).

Strict rules in the United States keep the risk of contracting the disease extremely low here. Cattle can no longer be imported from Europe.

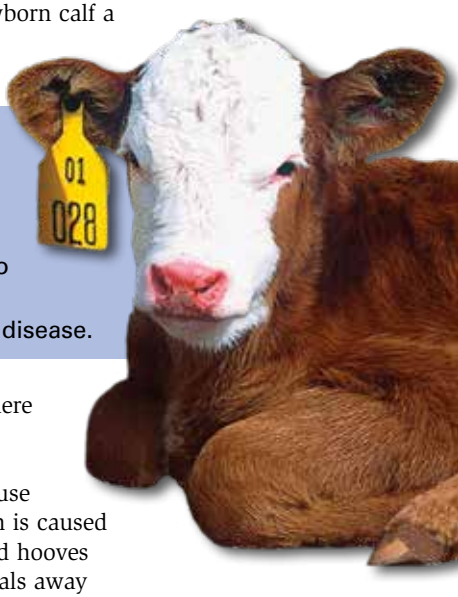
A strict government program of eradication requires carriers of Bang's disease to be destroyed, reducing the incidence of brucellosis from 30 percent of the cattle herds in the United States years ago to less than 2 percent today.

Brucellosis (Bang's Disease). The key sign of brucellosis is a cow that aborts after the fifth month of pregnancy. A microscopic organism is the cause. Testing involves checking a blood sample for signs of the organism's presence. All cattle that react positively to the test must be slaughtered to prevent the spread of the disease. Herds in which brucellosis is suspected are quarantined until they are tested and certified clean.

Through direct contact with infected cattle or contaminated grass, ground, or water, brucellosis easily spreads from one cow to another. It is not transmitted by marketing the meat or the by-products of an infected animal. It is spread through contact with unpasteurized milk—causing a condition in humans known as *undulant fever.*

Calf Scours (White Scours). Many newborn calves die from calf scours, or diarrhea, in the first month of their lives. Those that recover are often stunted for life. Scours kills through dehydration. Calves pass watery manure and lose weight. If 15 percent of the body weight is lost because of dehydration, the calf goes into a coma and dies.

Scours may be caused by bacteria and viruses and made worse by poor management. Overcrowding, overfeeding, vitamin A deficiency, and parasites may all contribute. To prevent scours, make sure cows have enough of vitamins A and D before calving. Keep calves in clean quarters, disinfect stalls, isolate infected calves, and give each newborn calf a full feed (about 2 quarts) of *colostrum* milk within one hour after birth.



To survive, the newborn needs *colostrum,* a special milk the cow produces during the first three days after calving. Colostrum contains high levels of energy, vitamins, and minerals, and also supplies antibodies (immunoglobulins) to protect the newborn against infection and disease.

Foot Rot. Foot rot is common in feedlots or where cattle are confined in muddy areas. The skin between the toes becomes swollen and red and sometimes breaks open. Cattle stop eating because of the pain and may run a fever. Foot rot, which is caused by an organism in the soil, can lead to deformed hooves and lameness. Prevent foot rot by keeping animals away from wet areas.

There are many more ailments that strike cattle than we can include here. For more about diseases of cattle, see the resources section at the back of this pamphlet or visit your local library. With your parent's permission, search the web. Some other diseases of interest include anaplasmosis, founder, grass tetany, ketosis, lumpy jaw, malignant edema, pneumonia, and red water disease.

Leptospirosis is transmitted mainly through water and can affect people as well as cattle and deer.

Leptospirosis. Leptospirosis affects the kidneys and may bring on various conditions including abortion, mastitis (an infection in the udder), high temperature, jaundice, wine-colored urine, and anemia. Although very young animals commonly die from the disease, older cattle may survive. The cause is a microorganism, and the disease can be diagnosed only through laboratory testing. Vaccinations are recommended for all cattle herds. Deer carry the disease and may infect cattle if herds are not immunized.

On dairy farms, milking parlors must be properly sanitized to prevent mastitis. Cleanliness is essential.

Mastitis. Mastitis, caused by a bacterial infection in the udder, results in milk that is lumpy and sometimes streaked with blood. The udder may become hot and hard; milk production is affected. Left untreated, the infection can spread through the cow's body, leading to fever and other signs of general sickness. A routine monthly test will detect the disease before symptoms become apparent. To prevent mastitis, keep milking machines well-maintained and take care during milking to avoid injury to the udder.

Milk Fever. Milk fever is a nutritionally related condition brought on by a calcium deficiency. It may occur at or shortly after calving. The cow is weak and wild-eyed, and often loses consciousness. Her body temperature will generally be below normal. A veterinarian can treat the condition. Untreated cows will likely die.

Pinkeye. A cow with pinkeye is sensitive to bright light, is teary eyed, and has reddened eye membranes. A milky film may cover the eyeballs, and an affected animal may be blinded. This bacterial infection seldom kills cattle but is economically serious because of the weight loss and decreased milk production in afflicted animals.

Pinkeye is more likely to develop when cattle's eyes are irritated by bright sunlight, dust, wind, flies, pollen, and weed and grass seeds. This disease is more common in pastured cattle than in feedlots. Prevention practices include controlling flies and dust, and clipping or mowing pastures to reduce weed-seed irritation.

Pinkeye spreads rapidly, carried by face flies from animal to animal.

Shipping Fever. Shipping fever is caused by a combination of stress, bacteria, and viruses. It may occur after a calf has been stressed by castration; vaccination; dehorning; weaning; exposure to cold, wet, or drafty conditions; or especially if it has traveled a long way to a new location. Stress can bring on the illness, but the actual cause is any number of various microorganisms. Symptoms include fever of 104 to 106 degrees Fahrenheit, not eating, difficulty breathing, coughing, runny eyes and nose, and diarrhea.

Stress is the major contributor to this disease, so avoid doing all of the tasks of weaning, dehorning, castrating, and vaccinating at one time. Work cattle gently over a period of time. As a precaution, vaccinate cattle for shipping fever before they are shipped.

Diseases of Horses

Horse owners can help prevent disease by keeping stables and horses clean. Clean feed boxes and change bedding regularly.

A healthy horse always wants to eat; a poor appetite or a refusal to eat is a first sign of illness. A rectal temperature above or below the average range of 99 to 100.8 degrees Fahrenheit (100.5 degrees average) will confirm the presence of a problem.

Call a veterinarian when a horse shows signs of illness. Some common diseases, injuries, and parasites of horses are described below.

A horse with colic will be greatly agitated, constantly moving, sweating, and trying to roll. Rolling may lead to a twisted gut, which is fatal.

Colic. A digestive problem, colic may be brought on by a horse's overeating, drinking too much water while hot, or eating moldy feeds. The intestine is blocked or impacted, causing the horse much pain. Halter an afflicted horse to prevent rolling, and walk it until a veterinarian arrives. The veterinarian may give mineral oils by stomach tube to relieve the compaction in the intestine.

Equine Encephalomyelitis (Sleeping Sickness). This disease causes inflammation of the brain and spinal cord. The two most common forms found in the United States are Eastern and Western equine encephalomyelitis. A third form, Venezuelan, has not occurred here for decades but is found in other countries. The cause of all forms is a virus transmitted by infected mosquitoes. Outbreaks are most common during the summer.

A collapsed colt suffering from equine encephalomyelitis

An infected horse generally has a fever and rapid heart rate, loses its appetite, and acts depressed. As the illness progresses, the animal may show muscle weakness, wall leaning, compulsive circling, and blindness, followed by convulsions and coma. Up to 90 percent of horses infected with EEE die. The mortality rate for WEE approaches 50 percent. Annual vaccination is highly recommended. Vaccines for horses may come in a "three-way shot" that includes vaccination for EEE, WEE, and tetanus.

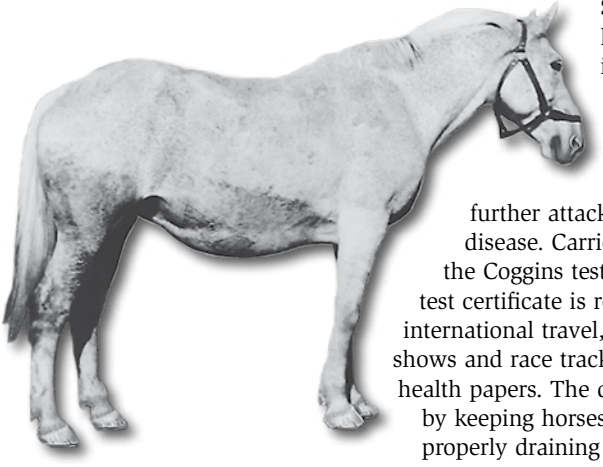
Humans also can contract equine encephalomyelitis from the bites of infected mosquitoes. Healthy adults who get the virus may show flulike symptoms such as high fever and headache. The young, the elderly, and people with weakened immune systems can become severely ill or die from this disease.

Influenza. Symptoms of equine influenza, a respiratory disease much like the flu in humans, include coughing, nasal discharge, and high fever. A variety of different viruses may cause it, and vaccines that will give immunity are available for some of them.

Horses are susceptible to many different types of afflictions. Some others not discussed here include founder, horse bots, Monday morning disease, West Nile virus, and worms. For more information, use the resources section in this pamphlet, visit your local library, and search the web (with your parent's permission).

Strangles (Equine Distemper). Strangles may strike horses between 6 months and 5 years of age. It is caused by a microorganism and is contagious. Symptoms include high fever, coughing, discharge of pus from the nose, and swelling of glands under the jaw. Eventually, the glands break open and discharge pus. Isolate an afflicted horse in a clean, well-ventilated stall, allow it to rest, and follow a veterinarian's orders. Strangles is seldom fatal, and once a horse has recovered, it usually is immune from further attacks.

Swamp Fever (Infectious Equine Anemia). The virus that causes swamp fever is carried by flies and mosquitoes. Symptoms are high fever, labored breathing, pounding heartbeat, and exhaustion. Most afflicted horses die within 30 days; those that recover are immune from further attacks but can spread the disease. Carriers can be identified by the Coggins test. A negative Coggins test certificate is required for interstate and international travel, and at most larger horse shows and race tracks as a part of the horse's health papers. The disease may be controlled by keeping horses out of low places and by properly draining land.



Swellings on the abdomen can indicate swamp fever.

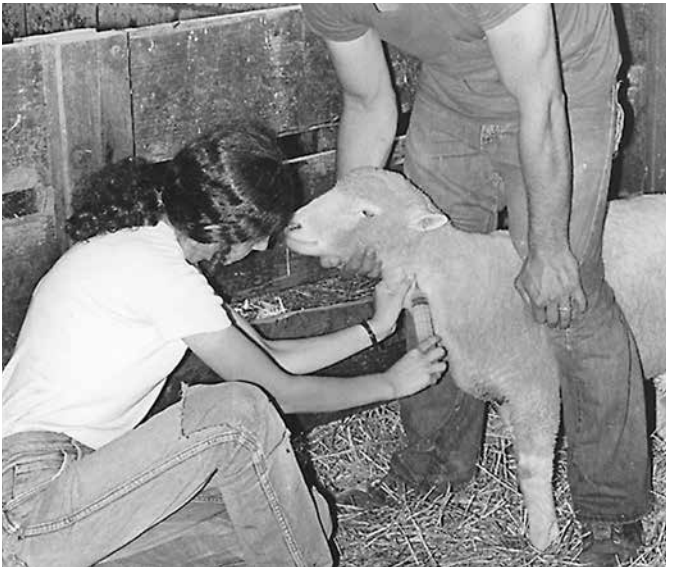
Tetanus (Lockjaw). Puncture wounds may be infected by the tetanus organism, which produces a powerful poison that causes muscle contractions. Stiff legs, noise sensitivity, and folding of the inner eyelid over the eye are the symptoms of a horse with lockjaw. Death may occur within 24 hours. A vaccine will prevent the disease.

Diseases of Sheep

As with other classes of livestock, body temperature often is the first sign of disease in sheep. The normal temperature range is from 100.9 to 103.8 degrees Fahrenheit, with an average of 102.3 degrees. For blackleg, bloat, foot rot, and pinkeye, the signs and prevention are the same as for cattle. **Bluebag** in sheep is the same disease as mastitis in cattle. Other common diseases of sheep are described below.

Bluetongue. Symptoms of bluetongue are depressed appetite, an inflamed nose and mouth lining that may turn blue, frothing at the mouth, and labored breathing. A red band may appear at the top of the hoof. Bluetongue is of most concern to sheep ranchers in the southwestern United States. It is caused by a virus transmitted by insects. A vaccine is recommended for prevention.

Sheep should be treated gently at all times, and especially when they are ill. Ill or injured sheep can easily slip into shock, followed by death.



Taking a blood sample for testing

Circling Disease (Encephalitis). An animal afflicted with encephalitis walks in circles, staggers, and may be paralyzed. The disease usually is fatal. It is caused by a bacterial infection of the brain. Prevention is through good sanitation.

Enterotoxemia (Overeating Disease). Enterotoxemia is a serious problem in feedlots. A high level of concentrate feeding can bring on a condition afflicting feedlot lambs with staggering and convulsions, which may lead to death. Toxins produced by bacteria in the digestive tract cause enterotoxemia. Vaccines for prevention are available.

Lamb Dysentery (Scours). Good sanitation and well-protected, dry shelters help prevent lamb dysentery, which can cause high death losses among lambs during the first few days after birth. Diarrhea and fever are the main symptoms. The cause is a microorganism. Lamb dysentery usually is a problem where sheep are in close confinement, seldom on open range.

Other ailments that can strike sheep include pregnancy disease, soremouth (contagious ecthyma), stiff lamb disease (white muscle disease), tetanus (lockjaw), wool maggots, ticks, mites, and worms. You can learn more about these by using the resources listed at the end of this pamphlet, visiting your local library, and searching the web (with your parent's permission).

Scrapie. Sheep with scrapie will scrape off wool by rubbing against fences and other objects because of the unbearable itching. They usually have no fever but will walk with an unsteady, uncoordinated gait. Paralysis and death follow. Scrapie is caused by the same class of infectious agents called *prions,* which are neither viruses nor bacteria, that cause BSE in cattle. No treatment is known. To prevent the spread of this highly fatal disease, government regulations often require that infected flocks be destroyed.

Diseases of Goats

Soremouth, a highly contagious disease, causes sores on the mouths of goats. The virus **caprine arthritic encephalitis** causes arthritis in goats, can cause paralysis in goat kids, and may reduce milk production in does. Some three-quarters of goats tested in one herd had CAE, although many showed no symptoms. Check with a veterinarian for tips on prevention and treatment.

Most goatkeepers vaccinate their herds against two serious diseases—**tetanus,** which affects the muscles, and **enterotoxemia,** which affects the intestines. Goats should receive selenium shots in areas where this mineral is lacking. **Worms** are often a problem in goat herds, so regular deworming usually is necessary.

Diseases of Swine

Good sanitation of buildings and equipment and a planned immunization program go a long way toward keeping a swine herd free of disease and parasites. Sanitation is extremely important in swine management because hogs usually are kept in close confinement. Some common or serious illnesses of hogs are described below.

Injecting baby pigs at 1 to 3 days of age with an iron solution may easily prevent anemia. Providing fresh soil for pigs to root around in and swabbing the sow's udder with an iron sulfate solution may also be effective.

The normal rectal temperature of swine is 102 to 103.6 degrees Fahrenheit, with an average of 102.6 degrees. As with other livestock, any deviation from the normal temperature could be a sign of illness.

Anemia. A lack of iron causes anemia and is most common among hogs in confinement. Hogs kept outdoors are able to root around in the soil and pick up the needed iron. Anemia is particularly a problem of rapidly growing piglets. Sow's milk supplies only a fraction of a baby pig's daily iron requirement. Symptoms of a deficiency include rough hair coat, listlessness, and pale eye and mouth membranes. In the advanced stages, labored breathing and rapid heartbeat also appear.

Brucellosis. Similar to brucellosis in cattle but caused by different bacteria, this disease causes sows to abort. To prevent the spread of brucellosis, herds should be tested annually and hogs that carry it destroyed.

Cholera. Hog cholera is a highly contagious disease caused by a virus. The usual symptoms are lack of appetite, high temperature, diarrhea, and weight loss. There may be discharge from the eyes. Afflicted animals suffer dehydration and drink much water. They may walk with a wobbly gait. Infected herds are quarantined and destroyed.

Hog cholera is among the most serious diseases of swine. It was eradicated from the United States in 1978 but remains a problem elsewhere. To ensure pigs are free of the disease, swine from countries affected by hog cholera can enter the United States only after a 90-day quarantine.

Erysipelas. Pigs with the acute form of swine erysipelas may have fever, lose their appetite, develop sore muscles or tender feet, have an arched back, and walk with a shuffling gait or remain lying down. Red patches may appear on the skin. Some pigs die suddenly. Pigs affected with the chronic form may suffer from arthritis and swollen joints, and the tips of their ears or tail may blacken and fall off. The disease is caused by bacteria. Sanitation and vaccination are effective in prevention.

Mycoplasma Pneumonia. A dry, rasping, persistent cough is the most common sign of this pneumonia, which is caused by bacteria. Affected pigs grow slowly. Although the original infection is mild, secondary infections (those that happen as a result or consequence of the original infection) can cause severe losses. Swine producers should stock herds from sources free of this disease.

Transmissible Gastroenteritis (TGE). An infectious disease that causes many deaths among young pigs, TGE is signaled by poor appetite, vomiting, scours, and weight loss. Afflicted pigs pass whitish, yellowish, or greenish feces and soon die from dehydration. TGE is caused by a virus usually passed through the manure and the respiratory tract of infected swine. Prevention requires strict sanitation, disinfection, and vaccination.

To learn more about other ailments of swine such as atrophic rhinitis, dysentery, leptospirosis, and pseudorabies (mad itch), search the web (with your parent's permission), visit your local library, and use the resources listed at the end of this pamphlet.

Diseases of Chickens

Modern confinement methods of raising broilers and layers make disease outbreaks particularly serious. As always, think prevention rather than treatment. Good poultry management emphasizes sanitation, immunization, quarantine of sick birds, and proper housing that avoids overcrowding and other stresses on the birds.

A bird that eats and drinks little may be sick. Diarrhea, paralysis, breathing difficulties, skin conditions, and bloody or unusually wet droppings are other signs that something is wrong.

Each year, inspectors reject millions of pounds of poultry for human consumption because of diseased birds. In a laying flock, a 10 to 12 percent annual death rate may be expected. The normal annual death loss for broiler flocks is 4 percent or less. Losses greater than these signal a serious threat that demands prompt attention.

Some of the more common or serious problems are described below.

Some 80 separate diseases or parasite problems of poultry are recognized, among them avian tumor diseases, coccidiosis, infectious bursal disease, infectious coryza, and parasites. To learn more, visit your local library, explore the web (with your parent's permission), and use the resources section of this pamphlet.

Chronic Respiratory Disease. Microorganisms cause chronic respiratory disease, which affects the air sacs. The sacs fill with fluid, the lungs harden, and breathing becomes difficult. The death rate may be high. Broilers that recover may be rejected at carcass inspection. Isolating sick birds and practicing proper sanitation help prevent its spread.

Fowl Pox. Birds with fowl pox show black, raised scabs on the comb, wattles, face, shanks (legs), and feet. Egg production drops, growth slows, and egg fertility is reduced. The cause is a virus spread by infected birds and mosquitoes. Vaccinating against fowl pox gives chickens lifelong immunity.

Vaccinating for fowl pox

Hysteria. Birds subjected to loud noises, rapid light changes, or quick movements may panic. Broilers in open houses fly into a corner, and many may suffocate. Caged layers may try to fly and break their wings or necks. To prevent hysteria, take care not to frighten birds. Some poultry managers play a radio in houses to get the birds used to the sound of human voices and noise. Some knock before opening a door to the poultry house to draw the birds' attention so they won't be startled when humans enter.

Hysteria is a behavioral problem rather than a disease.

Infectious Bronchitis. Coughing, sneezing, and difficult breathing are common signs of infectious bronchitis, an extremely contagious viral infection of chickens. Young birds often die, and hens stop laying or lay defective eggs. A vaccine can provide control.

Newcastle Disease. Death losses can be high among broilers with Newcastle disease, and a laying flock that has it can fail to produce eggs. Symptoms include difficult breathing, gasping, and sneezing. This highly contagious disease is caused by a virus. Vaccination is recommended for prevention.

Salmonella bacteria attack many animals and can be a serious health threat. In chickens, these organisms cause pullorum disease and fowl typhoid.

Salmonelloses. Baby chicks with **pullorum disease** huddle together, lose their appetites, may show labored breathing, and often develop a whitish diarrhea. Although they do not show signs of it, adult birds that have recovered from pullorum carry the disease and may lay infected eggs. A poultry manager who suspects pullorum will commonly fumigate the incubator and eggs. Strict sanitation is important. Infected breeder birds should be eliminated from the flock.

Fowl typhoid, another salmonella-induced disease, has signs similar to those of pullorum. Good hatchery sanitation and elimination of infected birds are the recommended control methods.

What's Up With Bird Flu?

Avian influenza, or bird flu, has attracted a lot of attention lately. Bird flu viruses, which rarely infect people, strike domesticated birds, including chickens, ducks, and turkeys. Infected birds act depressed and stop laying eggs. Watery diarrhea is common. Chickens' heads may be darkened, and fluid may build up around the eyes and in the *wattle* and *comb* (fleshy areas around the neck and head).

Birds exposed to infected poultry, contaminated cages or dust, or soiled feed or water can catch the highly contagious virus. As of early 2006, highly pathogenic avian influenza (HPAI) had become a significant problem in Asia and was spreading into the Middle East and Europe. Proper biosecurity measures will help keep HPAI from spreading in those areas already affected and from entering North America.

HPAI can wipe out an entire flock. Milder strains of bird flu, however, are responsible for most outbreaks in poultry. Infected birds shed flu virus in their saliva, nasal secretions, and droppings. To control an outbreak of bird flu, a flock is quarantined (or isolated), sick birds are destroyed, and the houses or cages are thoroughly cleaned and disinfected.

Low pathogenic avian influenza A outbreaks occur among poultry from time to time in North America. Based on a report from the World Organization for Animal Health, since 1997 the United States has experienced only one outbreak of highly pathogenic avian influenza A (or H5N2) virus in poultry. It was restricted to one poultry farm.

The practice of being extremely careful not to spread disease between animals is called biosecurity. It is the key to keeping a healthy flock.

Production Notes

When livestock producers speak of *production,* they are talking about an animal's growth, fattening, milk or egg production, reproduction, or work. By choosing stock carefully; by managing the herd or flock properly to ensure that the animals have adequate food, water, shelter, and exercise; and by attending to the health-care needs of their animals, livestock producers can enhance their animals' productive ability.

This section gives a few guidelines to help you judge how well a herd or flock is doing. To better understand the level of production to be expected in your area, talk with your merit badge counselor, a local livestock producer, or your county agent.

Length of Estrous Cycle and Pregnancy in Farm Animals

Animal	Length of Estrous Cycle (Heat Period)	Length of Pregnancy
Cow	21 days	282 days
Sow	20 to 21 days	114 days
Ewe	16 to 17 days	150 days
Goat	19 to 20 days	150 days
Mare	19 to 23 days	336 days

Knowing the fertility (estrous) and pregnancy cycles of animals and length of pregnancy is basic to being able to judge their productivity potential.

Beef Cattle Performance

A cow's economic value is judged by its reproductive efficiency, mothering ability, rate and economy of gain, longevity, and carcass merit. High-producing cows should be fertile and have a record of regular pregnancies, live births, and good milk production. Their calves should be efficient in using feed to gain weight rapidly. A calf's growth from birth to weaning is a good reflection of a cow's milk production and the calf's inherited ability to gain.

Reproductive efficiency and mothering ability are two traits in cattle that contribute to high economic value.

Fattening Cattle

Cattle may be expected to gain weight over the winter on roughage. Calves weighing about 400 pounds when purchased in October or November can be expected to gain about 1½ pounds per day over winter. In the spring and summer, they can be *finished,* or fattened to their best weight, on a combination of roughage and a high level of grain.

Cattle also can be finished quickly in a feedlot. Cattle weighing 750 pounds can be finished in 150 days or fewer in a feedlot on a full-feed program with high-concentrate rations. In a feedlot, cattle can be expected to gain about 1 pound of weight per 7 pounds of feed.

Carcass Grading

Beef carcass grades are based on the quality of the meat (USDA quality grades) and the quantity or yield of trimmed, boneless, major retail cuts of beef (USDA yield grades). Both grades are assigned to a beef carcass.

USDA quality grades are prime, choice, good, standard, commercial, utility, cutter, and canner, with prime being the "best." Quality grade is a prediction of the expected palatability (taste qualities) of the meat. It is based mostly on animal maturity and *marbling* (the amount of fat visible in a cross section of the rib muscle).

Yield grade measures the amount of salable meat on a carcass. It is based on the amount of external or back fat, the carcass weight immediately after slaughter (also known as hot carcass weight), the amount of fat surrounding the kidney and heart or in the pelvic area, and the area of a cross section of the rib muscle. USDA yield grades are expressed by a number, 1 through 5, with yield grade 1 having the highest yield of retail cuts, and yield grade 5 the lowest.

Performance Characteristics

Weight is just one of several factors considered when farm animals are judged for their economic value. There are other important traits.

Carcass Merit. The fineness of a dressed meat animal, based on the *quality* of the meat (its taste, tenderness, and "eating" characteristics) and on the *yield* (the percentage of lean meat obtained from the carcass).

Feed Efficiency (or Feed Conversion). The number of pounds of feed needed to produce 1 pound of weight gain or product. For example, it takes about 9 pounds of feed to produce 1 pound of weight gain on a live cow and 4 pounds of feed to produce a pound of pork, but only 1.11 pounds of feed to produce 1 pound of milk.

Fertility (Reproductive Efficiency). An animal's ability to reproduce regularly; to produce vigorous, fast-growing offspring; and to produce multiple births (depending on the animal).

Longevity. How long the animal lives and can reproduce.

Mothering and Nursing Ability. A breeding female's ability to feed, protect, and care for her young. The survival of young animals and their weight at weaning depend largely on the mother's maternal and milking abilities.

Rate of Gain. How quickly the animal gains weight. *Rate of gain* and *economy of gain* in meat animals are related. For example, some cattle may gain only 1 pound a day, while others (in the same feedlot and on the same ration) may gain more than 3 pounds daily. Those that put on weight the fastest also show the most economical gains.

Milk cows must be cleaned and milked two or three times a day.

Milk production is fairly high immediately after calving and increases until the cow reaches her maximum production. Daily lactation peaks 45 to 60 days after calving. Then the amount of milk produced declines gradually until the cow is dried up, to give her time to prepare to deliver her next calf.

Dairy Cow Performance

A dairy cow normally will produce milk for 305 days, with a 60-day dry period. This may vary from a 270-day milking period or less, to a *lactation* of more than 400 days. Shorter periods normally are caused by the cow being bred again soon after calving, or because of illness. Longer periods are mainly due to breeding problems.

The average cow commonly produces 15,000 to 25,000 pounds of milk in a year or 50 or 100 pounds of milk per day. Many top cows produce more than 40,000 pounds per year. Producing such large amounts of milk places enormous demands on the cow's metabolism and requires careful nutritional management. A lactating dairy cow's diet is carefully formulated, often with the help of computer programs and specialized dairy nutrition consultants.

It is virtually impossible for a high-producing dairy cow to eat enough to satisfy her energy needs during the peak of her lactation period. As a result, a good dairy cow is expected to lose weight, or "condition," during peak production. This weight is replaced later in the lactation period.

The points of conformation judged ideal for various breeds of horses are beyond the scope of this pamphlet. Check with the appropriate breed association to find out more about a specific breed. (See the resources section.) Most associations have a list of standards available at no cost.

A horse, such as this jumper, must be built for the job it is to do.

Horse Performance

A direct relationship exists between a horse's conformation (build) and its type, and the work it is to do.

A quarter horse, for example, should have a well-balanced, well-muscled body, firmly supported by strong, straight legs. A quarter horse viewed from the side should have a short back and long underline. This gives the horse the ability to stretch out underneath. It should have short, erect ears that often point forward. This indicates a horse that is in good condition, alert, and paying attention to its surroundings—essential qualities in a cutting horse, roping horse, or stock horse. The eyes should be prominent and set well apart so that the horse can see forward and backward without moving its head. This allows the horse to react quickly. The nostrils should be large to allow the intake of air necessary for a hard-working horse (horses do not breathe through the mouth).

Sheep Performance

Ewes of most sheep breeds can conceive (become pregnant) only during the fall. Unlike cattle that can be managed to calve in the spring, the fall, or all year round, sheep normally lamb in the spring. A few breeds do not follow this pattern and may produce out-of-season lambs. The Dorset is an example.

Ewes normally lamb in the spring.

Feeding extra grain or grazing ewes on lush pasture two or three weeks before the breeding season is recommended to make ewes more fertile and increase the chances of twins being conceived. A 110 to 150 percent lamb crop (an average of one or more lambs per ewe) in a flock is desirable. Feeding a half pound of oats or corn per head per day in the weeks before the breeding season may produce an increase in the lamb crop of 10 to 20 percent.

Producers judge individual ewes according to the birth weight of their lambs, how often they have lambs, how often they have twins, the weaning weight, weight gain, feed efficiency, fleece weight, and carcass merit.

Meat

Sheep produce meat and wool. In meat-type breeds, the emphasis is on carcass traits; wool generally is a minor concern. Sheep destined for slaughter should be well-muscled.

The carcass of a slaughtered sheep is classified as *lamb* for a young animal or *mutton* for a mature animal. A carcass will generally yield from 46 to 53 percent meat. The rest of the carcass produces by-products such as glue, soap, and fertilizer.

One by-product, chamois skins, is unique to sheep. Cleaned of wool and tanned, sheepskins once were used for college diplomas. Now, chamois skins are most likely to be seen in gas stations and car washes.

Wool

With sheep kept for wool production, producers put less emphasis on body traits and pay more attention to the weight and quality of the fleece. As a rule, wool-type sheep are larger, more angular, and less muscular but have heavier fleeces than meat breeds. Sheep are sheared for wool once a year, usually in the spring.

The fleece is examined, and undesirable wool (with stains or clumps of plant matter, for example) is removed. Wool that is shorter, coarser, or otherwise different from most of the fleece (such as the wool from the belly and hindquarters) is sorted out and bagged separately to keep from mixing wools of varying qualities within the same fleece.

Shearing is a skill that can be learned only through practice. A skilled shearer, using electric clippers, can shear a sheep in about five minutes, taking care to remove the fleece in one piece as if it were a blanket being unwrapped from the animal. If you want to learn, check into the possibility of attending a sheepshearing school or training with professional shearers.

Fleeces are graded according to their fineness—the thickness (diameter) of individual wool fibers. The American or "blood" system of grading wool is based on comparing the quality with that of Merino wool. The grades, ranging from finest to coarsest, are *fine* (for full-blooded Merino), *half blood, three-eighths blood, quarter blood, low quarter blood, common,* and *braid.* Fineness is the main factor that determines the market value of raw wool. Fine wools are used to make lightweight fabrics for clothing, while coarser wools are used in blankets and carpets.

Another grading system, which is used internationally and is replacing the American blood system, is the micron system that measures individual fiber diameters in *microns* (a length equal to 1/25,400 of an inch). A wool graded half blood under the American blood system would have a fiber diameter of 22 to nearly 25 microns. The micron system is the most accurate measure for determining the grade of wools.

Dairy Goat Performance

Good dairy goats can produce up to 8 quarts of milk a day, averaging about 2 quarts a day over 10 months. A doe should be milked twice daily on a regular schedule.

The mating season of a goat depends on where it lives. In tropical areas near the equator, goats mate throughout the year, but in the temperate regions they breed only from late summer to late winter. They begin breeding as the days grow shorter. A doe gives birth to two or three kids about five months after mating.

Hog Production

Litter size and weight at birth, litter size and weight at weaning, conformation, rate and efficiency of weight gain, and carcass value are the traits that determine swine productivity. Sows have large litters at short intervals, making it possible to market large numbers of animals. An outstanding sow can produce more than two litters of 10 market pigs, or nearly 5,000 pounds of pigs for market, per year.

The usual litter size is eight or nine piglets. Gilts (young female hogs) usually are bred when they are 8 months old or on their third heat period, which allows them to farrow (give birth) at about 1 year of age.

Sows have large litters at short intervals, sometimes producing more than two litters of 10 market pigs each year.

Pork and Carcass Grades

Market hogs are classified and sold in four market classes based on sex, the use to which the animal is best suited, and weight.

- Most finished market hogs are **barrows** and **gilts**—castrated male hogs and young females. They reach market weight at 200 to 250 pounds. Most pork for human consumption comes from this market class.
- **Sows,** usually weighing upward of 220 pounds, make up the second market class of swine. Pork from sows marketed for human consumption is mainly in the form of cured pork.
- **Stags** (castrated males that show some sexual development) and **boars** (intact males) are low in market value because little of the carcass is suitable for human consumption. Lubricants, fertilizers, hides, and other by-products are the main uses of these classes.

Carcass grades indicate the quality of an animal in its specific market class. The U.S. carcass grades for pork are U.S. No. 1, U.S. No. 2, U.S. No. 3, U.S. No. 4, and U.S. Utility. These grades are determined by inspecting the fat and the lean for quality, including firmness, color, backfat thickness, belly fatness, and loin marbling (the intermixture of fat and lean), and by the percentage of the four major wholesale cuts—hams, loins, picnics, and Boston butts. U.S. No. 1 carcasses have a high-quality lean, a high yield of lean cuts, and a low percentage of backfat. The poorest quality carcasses—those with unacceptable belly thickness and those that are soft or oily—are graded U.S. Utility.

Poultry Production

Commercial high-laying hens will produce 20 eggs a month. Layers are seldom kept for more than 19 months because production begins to drop by this age. With good management, it should take less than 4½ pounds of feed to produce a dozen eggs.

Eggs are graded according to weight and quality for three markets.

- **Consumer grades**—Grade AA or Fresh Fancy, Grade A; and Jumbo, Extra Large, Large, Medium, Small, and Peewee
- **Wholesale grades**—U.S. Specials, U.S. Extras, U.S. Standards, U.S. Trades, U.S. Dirties, and U.S. Checks (used in wholesale trade; may be re-sorted to conform to consumer grades)
- **U.S. procurement grades**—Special designations for institutions and the armed forces

Broilers

A broiler should weigh about 5½ pounds at 50 days of age. Feed conversion should average 2 pounds of feed or less per pound of gain.

The U.S. Department of Agriculture has established the grades for broilers (dressed birds are Grade A). The grades are based on conformation, fleshing, fat covering, and presence or absence of defects.

Eggs should be collected frequently, cleaned immediately, and refrigerated.

Other classes of chicken meat include these.

- **Roaster**—a young chicken more mature than is acceptable for broilers
- **Capon**—a castrated male younger than 8 months of age
- **Stag**—a male chicken younger than 10 months but showing developing sex characteristics
- **Cock** or **rooster**—a mature male
- **Hen** or **stewing chicken**—a mature hen, usually older than 10 months, often culled from laying operations

The Rock Cornish or Cornish game hen is a female less than 4 weeks of age and weighing no more than one pound ready to cook, selected from Cornish or Cornish-cross matings. These are popular at convention banquets and similar affairs.

Careers in Animal Science

Few professions are more important to American society than that of agricultural producer. Farmers and ranchers grow the crops and raise the livestock that provide the food we eat and the natural fibers we need for clothing and other items.

Agricultural producers are the first link in the vast chain that includes the raising, processing, transporting, and marketing of food and fiber. The whole chain is called *agribusiness*. People who are interested in animal science may pursue careers in livestock production or in many related fields in agribusiness, research, education, or veterinary medicine.

Stockraisers are involved in genetics, business and economics, advertising and merchandising, nutrition, animal health, and agronomy and range science. Many ranchers and stockfarmers raise crops as well as livestock, growing nearly all of the grains and forages their animals need.

Advances in agricultural production mean that fewer people are needed on farms and ranches than in years past. A hundred years ago, a farmer produced enough food and fiber for five people. Now, each farm worker supplies enough for more than 100 people.

Farm and Ranch Managers. The manager—whether the farm or ranch owner or an employee hired to oversee the business—plans the operation of the farm or ranch, supervises the work, sees that animals are properly cared for, and that barns, pens, and other farm buildings are kept clean and in good repair. Farm and ranch managers also make the business decisions, such as securing loans to finance the purchase of livestock, feed, and equipment. The financial records of the operation and the production records of the herd or flock are the manager's responsibility.

Ranch managers of small operations may do much of the work themselves. Those who oversee large spreads often have several employees. Large farms and ranches may have dozens of full-time workers.

Many farm laborers learn their responsibilities on the farm and need little or no outside training.

Farm Workers. Members of farm families and hired employees do most of the routine work required of modern farming and ranching. They maintain the facilities. They feed and water the animals, check stock regularly for signs of infection or disease, and often vaccinate livestock against diseases or spray them with insecticides for protection against parasites.

For many of their tasks, farm workers use machinery, such as tractors, hay balers, and milking machines. Farm workers must have basic skills as mechanics and be able to set up, operate, maintain, clean, and repair farm equipment. They also maintain and repair barns, fences, and other structures.

The greatest career opportunities in today's agriculture often lie in off-farm positions. However, don't overlook the many opportunities in the related fields of animal health, genetics, the meat industry, and agricultural education.

Off-Farm Occupations

Modern agriculture indirectly employs millions of people. The number and variety of off-farm positions have grown as the business and technical sides of agriculture have become more complex.

Two- and four-year colleges and universities in every state offer degree programs in the agricultural sciences, including animal science.

Animal science research is conducted by many universities and private industries and by the U.S. Department of Agriculture.

Researcher. Animal scientists study breeding, feeding, and marketing problems and develop improved methods of housing, sanitation, and disease control. Research technicians generally help scientists with their experimental work. Technicians have the training and skills needed to prepare animals for tests, use specialized equipment, and conduct experiments under a scientist's supervision.

Educator. Teachers are a vital link between researchers and those who use the knowledge gained in the laboratory or from the test herd. Vocational educators teach secondary school and adult education classes in farm and ranch management; agricultural production; agricultural supplies, services, and sales; and related areas.

This parasitologist checks water sources used by livestock and wild animals for signs of harmful organisms.

County Extension Agent. County extension agents are community teachers and provide information to individuals, families, and communities. They offer educational programs in agriculture, natural resources, youth groups, community development, and other areas of interest to local residents. They help improve people's lives, the local economy, and the environment.

This is a people career. Agents give educational workshops and seminars and spread information through radio programs, web pages, printed materials, and other communications tools. Agricultural agents work mainly with farmers, ranchers, and agribusinesses. Youth development agents train adults, recruit volunteers, and work with young people through 4-H clubs, special projects, and school programs.

To be a county extension agent, you need a bachelor's or master's degree in agriculture or natural resources, education, science/technology, or related field, along with the desire to work with people of many backgrounds and contribute to the local community.

Production Services and Specialists. As farms and ranches become larger and agriculture grows more complex, producers increasingly rely on specialists for livestock and crop services. Veterinarians, for example, test animals for disease, supervise programs to eradicate certain diseases, and conduct research to develop vaccines. Ranchers may hire technicians to artificially inseminate cows.

Testers employed by dairy herd improvement associations travel from farm to farm to test the milk from each cow for acidity and butterfat content. Sheep shearers shear wool. Poultry hatcheries employ animal caretakers to vaccinate birds, place eggs on trays in incubators, and care for baby chicks.

The number and variety of off-farm positions have grown as the technical aspects of agriculture have become more complex.

Inspectors. Meat and poultry inspectors work for the U.S. Department of Agriculture and for many state departments of agriculture. Working under the supervision of a veterinarian, they inspect meat and poultry slaughtering, processing, and packaging operations to ensure that proper sanitation is maintained. They also inspect meat additives and make sure that processed meats are correctly labeled.

Agricultural Commodity Graders. Graders inspect agricultural products to determine their quality and grade, and issue grading certificates. They generally specialize in a particular commodity, such as eggs or dairy products.

If you love animals and the outdoors, stockraising could suit you perfectly—but it is challenging. Animals must be fed and watered every day. Because of the demands of their work, farmers and ranchers rarely take vacation.

For off-farm occupations, working conditions vary. Researchers and educators generally work in offices and laboratories and have fairly regular hours. Veterinarians, however, may have to work in uncomfortable surroundings, and outdoors in all kinds of weather.

Preparing for a Career

Growing up on a family farm or ranch and taking part in programs for young people such as the National FFA Organization or 4-H is important training for prospective livestock producers. However, because of the scientific and business complexities of modern farming and ranching and the need to keep up with advances in farming methods, many young people who grow up on farms and ranches also attend a two- or four-year college of agriculture before launching their own careers in livestock production.

Colleges of agriculture offer four-year degree programs in general agriculture, agronomy (field crops), soil science, animal science, agricultural economics, agricultural business, food science, agricultural education, agricultural engineering, and related fields. Although a bachelor's degree usually is enough for a livestock producer, related positions in animal science, breeding, and research may require an advanced degree.

Colleges of veterinary medicine offer professional training leading to the doctor of veterinary medicine degree.

Many technical schools or junior colleges offer programs in agricultural production, agricultural supply and service, agricultural mechanics, and other specialties. The training may last only a few weeks, or students may enroll in a two-year degree program, depending on the subject.

Animal Science Resources

The **county extension office** is home base for your county agent. If possible, visit the county extension office before you start on requirement 6. High school **vocational agriculture teachers** are also good resources.

On the internet (with your parent's permission) visit www.nifa.usda.gov.

Scouting Literature

Mammals pocket guide; *Bird Study, Environmental Science, Farm Mechanics, Horsemanship, Mammal Study, Plant Science, Public Health, Soil and Water Conservation,* and *Veterinary Medicine* merit badge pamphlets

With your parent's permission, visit the Boy Scouts of America's official retail website, www.scoutshop.org, for a complete listing of all merit badge pamphlets and other helpful Scouting materials and supplies.

Books

Belanger, Jerry. *Storey's Guide to Raising Dairy Goats*. Storey Publishing, 2018.

Damerow, Gail. *Barnyard in Your Backyard: A Beginner's Guide to Raising Chickens, Ducks, Geese, Rabbits, Goats, Sheep, and Cattle*. Storey Publishing, 2002.

Dutson, Judith. *Getting Your First Horse*. Storey Publishing, 2003.

Ekarius, Carol, and Ken Ekarius. *How to Build Animal Housing: 60 Plans for Coops, Hutches, Barns, Sheds, Pens, Nestboxes, Feeders, Stanchions, and Much More*. Storey Publishing, 2004.

Haynes, N. Bruce. *Keeping Livestock Healthy: A Veterinary Guide to Horses, Cattle, Pigs, Goats, and Sheep*. Storey Publishing, 2001.

Klober, Kelly. *Storey's Guide to Raising Pigs*. Storey Publishing, 2018.

Peck-Whiting, Jeanie. *Farm Animals: Your Guide to Raising Livestock*. On the Farm Press, 2003.

Simmons, Paula, and Carol Ekarius. *Storey's Guide to Raising Sheep*. Storey Publishing, 2019.

Thomas, Heather Smith. *Getting Started With Beef and Dairy Cattle*. Storey Publishing, 2005.

Vogel, Colin. *Complete Horse Care Manual.* DK Publishing, 2011.

Organizations and Websites

AgNIC (Agriculture Network Information Collaborative)
Telephone: 301-504-6999
www.agnic.org

AGRICOLA (National Agricultural Library)
Telephone: 301-504-5755
agricola.nal.usda.gov

Agriculture in the Classroom
www.agclassroom.org

American Delaine and Merino Record Association
Telephone: 785-456-8500
admra.net

American Angus Association
Telephone: 816-383-5100
www.angus.org

American Bantam Association
www.bantamclub.com

American Berkshire Association
Telephone: 765-497-3618
www.americanberkshire.com

American Brahman Breeders Association
Telephone: 713-349-0854
www.brahman.org

American Cheviot Sheep Society
www.cheviots.org

American Chianina Association
Telephone: 816-431-2808
www.chicattle.org

American Corriedale Association
Telephone: 618-676-1046
www.americancorriedale.com

American Dairy Goat Association
Telephone: 828-286-3801
www.adga.org

American Farm Bureau Federation
600 Maryland Ave. SW, Suite 1000W
Washington, DC 20024
Telephone: 202-406-3600
www.fb.org

American Goat Society
Telephone: 830-535-4247
www.americangoatsociety.com

American Guernsey Association
Telephone: 614-864-2409
www.usguernsey.com

American Hampshire Sheep Association
Telephone: 785-456-8500
www.hampshires.org

American Hereford Association
Telephone: 816-842-3757
www.hereford.org

American-International Charolais Association
Telephone: 816-464-5977
www.charolaisusa.com

American Jersey Cattle Association
Telephone: 614-861-3636
www.usjersey.com

American Milking Shorthorn Society
Telephone: 608-365-3332
www.milkingshorthorn.com

American Morgan Horse Association
Telephone: 802-985-4944
www.morganhorse.com

American Paint Horse Association
Telephone: 817-834-2742
www.apha.com

American Poultry Association
www.amerpoultryassn.com

American Quarter Horse Association
Telephone: 806-376-4811
www.aqha.com

American Rambouillet Sheep Breeders Association
Telephone: 785-456-8500
www.countrylovin.com/ARSBA/index.htm

American Saddlebred Horse Association
Telephone: 859-259-2742
www.asha.net

American Sheep Industry Association
Telephone: 303-771-3500
www.sheepusa.org

American Shetland Pony Club
Telephone: 309-263-4044
www.shetlandminiature.com

American Shorthorn Association
Telephone: 402-393-7200
www.shorthorn.org

American Simmental Association
Telephone: 816-599-7777
www.simmental.org

American Southdown Breeders' Association
Telephone: 325-429-6226
www.southdownsheep.org

Appaloosa Horse Club
Telephone: 208-882-5578
www.appaloosa.com

Arabian Horse Association
Telephone: 303-696-4500
www.arabianhorses.org

Breeders World
www.breedersworld.com

Brown Swiss Association
Telephone: 608-365-4474
www.brownswissusa.com

Certified Pedigreed Swine
(Chester White, Hereford, Poland China, and Spotted Swine breed associations)
Telephone: 309-691-0151
www.cpsswine.com

Columbia Sheep Breeders Association of America
Telephone: 507-360-2160
www.columbiasheep.org

Continental Dorset Club
Telephone: 401-647-4676
continentaldorsetclub.com

The Coop
www.the-coop.org

Holstein Association USA Inc.
Toll-free telephone: 800-952-5200
www.holsteinusa.com

National Cattlemen's Beef Association
Telephone: 303-694-0305
www.ncba.org

National 4-H Council
Telephone: 301-961-2800
www.4-h.org

National FFA Organization
Toll-free telephone: 888-332-2668
www.ffa.org

National Pork Producers Council
Telephone: 202-347-3600
www.nppc.org

National Swine Registry
(American Landrace Association, American Yorkshire Club, Hampshire Swine Registry, and United Duroc Swine Registry)
Telephone: 765-463-3594
www.nationalswine.com

NetVet—Veterinary Resources
netvet.wustl.edu

North American Limousin Foundation
Telephone: 303-220-1693
www.nalf.org

Pony of the Americas Club Inc.
Telephone: 317-788-0107
www.poac.org

Tennessee Walking Horse Breeders' and Exhibitors' Association
Telephone: 931-359-1574
www.twhbea.com

U.S. Ayrshire Breeders Association
Telephone: 614-335-0020
www.usayrshire.com

U.S. Department of Agriculture (USDA)
1400 Independence Ave. SW
Washington, DC 20250
Telephone: 202-720-2791
www.usda.gov

United Suffolk Sheep Association
Telephone: 641-684-5291
www.suffolks.org

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