OKLAHOMA CareerTech

Introduction to Agriscience

Unit 11
The Poultry Industry

Student Edition

CIMC

AG3001

Unit 11
The Poultry Industry

According to the USDA's Economic Research Service, U.S. poultry products hold leading positions in both international and U.S. meat commodity markets, supported by competitive production structures, modern poultry genetics, abundant domestic feed resources, and strong consumer appeal (January 2025). During 2013–22, broiler chickens, which provide virtually all U.S. chicken meat, averaged 67 percent of all poultry sector sales. Chicken eggs, overwhelmingly destined for human consumption, averaged 22 percent, and turkeys averaged 11 percent of poultry sales.

Total poultry sector sales in 2022 were $76.9 billion, an increase of 67 percent from 2021. Broiler sales increased 60 percent, turkey sales increased 21 percent, and egg sales increased 122 percent. Only broilers increased production from 2021.

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OBJECTIVES

1. Discuss the history of the poultry industry and its role today.
2. Distinguish among terms and major species of poultry.
3. Identify common breeds of chickens and their characteristics.
4. Locate the parts of a chicken.
5. Examine the development of an egg.
6. Discuss methods for incubating eggs and chickens.
7. Identify consumer products derived from poultry.

KEY WORDS

albumen
bantams
broilers
brooding
capon
chick
cock
cockerel
cull
debeaking
drake
dual-purpose
duckling
flock
gaggle
gander
giblets
goose
gosling
hen
incubator
layers
offal
oviduct
poult
poultry
pullet
rooster
spent hen
tom

History of the Poultry Industry

Poultry is the term used to describe domesticated birds that are kept for eggs or meat. This includes chickens, turkeys, geese, and ducks, as well as less common birds such as quail, pigeons, peafowl, and even ostriches. However, chickens dominate the United States poultry industry.

Chickens and other poultry have been used by humans since primitive times. Ancient Egyptians are known to have raised poultry for eggs and meat, and they even used clay incubators to hatch eggs. The first chickens in North America were brought by settlers to Jamestown Colony in the early 1600s. Until the mid-1800s, family flocks were the norm with eggs and meat being sold or bartered. As with other livestock, the advent of refrigerated transport, centralized feed mills, and processing plants saw the beginnings of the commercial poultry industry.

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The first commercial hatchery in the United States opened in 1870, and the American Poultry Association was founded in 1873. The following year, the association released the first edition of the *American Standard of Perfection*, which describes the various poultry breeds. The first years of the 20th century saw the introduction of battery raised chickens, a method that has since become standard in many parts of the industry. A *battery* refers to the use of a series of stacked cages to

house the birds. Between 1926 and 1928, the USDA began inspecting poultry products for wholesomeness through the Federal Poultry Inspection Service. In 1940, mechanical poultry dressing was first used. This led to the current large-scale, highly mechanized style of poultry processing used today.

SAE IDEA:
Exploratory
Compete in a poultry Career Development Event.

Colonel Sanders began his first Kentucky Fried Chicken franchise business in 1952. Congress passed the Poultry Products Inspections Act in 1957 and was strengthened by the Wholesome Poultry Products Act of 1968. Since then, virtually all poultry products are processed in federally inspected plants. In the early 1980s, cash receipts for poultry sales began to exceed those for hogs. By the 1990s, chicken consumption increased to the point that it began to equal or exceed that of beef, which until then had been America's most-consumed meat.

Today, chicken is a popular meat because it is relatively inexpensive, easy to prepare, and is perceived as a healthy protein source. The fat and cholesterol contents of chicken are generally lower than that of beef or pork. At the same time, it has very high-quality protein with an excellent balance of all the amino acids. Chicken is also easy to digest, making it a good meat choice for children and invalids.

Eggs are one of the most nutritionally complete foods. Because the egg supplies all of the needs of the developing embryo, it has to be a nutritionally balanced powerhouse. The protein quality in eggs is considered superior to other protein sources, including cow's milk, fish, and beef. Some common misconceptions about eggs are that eggs with colored shells are more nutritious than white-shell eggs, and that fertile eggs are healthier than unfertilized eggs. Neither of these claims is true.

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Poultry Species

While chickens account for a large percentage of the U.S. poultry industry, chickens are not the only type of poultry raised. Other major species of poultry include turkeys, ducks, and geese. All poultry are closely related and are part of one subdivision classification. The differences in feathers, body structure, land or water inhabitant, or ability to fly separate many of the species of poultry.

Turkeys

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Domestic turkeys are descended from the wild turkey of North America. Turkey meat is growing in popularity because it is low in fat and can be used in a variety of ways. Turkeys, of course, still reign as the centerpiece on the Thanksgiving dinner table. Benjamin Franklin wanted the wild turkey as the national bird because it is highly intelligent, respectable, and courageous.

The most raised breed of turkey for commercial production is the Broad Breasted White. It is marketed at 17 to 30 pounds. The commercially raised turkey is not usually bred naturally. Artificial insemination is used to breed the male turkey to the female. This is largely due to genetic changes such as larger birds with heavier muscling, which leaves the turkey unable to breed naturally. A young turkey is called a ***poult*** no matter if it is male or female. Once a poult matures past one year of age it is either called a ***tom*** (mature male) or a ***hen*** (mature female).

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Ducks

Ducks are the third most important type of commercial poultry. They are raised mostly for their meat, with little demand in the United States for duck eggs. The best breeds for meat production are the Aylesbury, Muscovy, and White Pekin. They are generally marketed as a ***duckling***, a young duck, at six to seven pounds. After a duckling reaches maturity, it is called either a ***drake*** (mature male) or a ***hen*** (mature female).

Geese

Geese are raised in the United States for meat and eggs. They are also popular as farm pets, weeders, and even as guard birds. The most popular breeds for commercial production are the Toulouse, Emden, and African. Weights of these breeds range from 18 to 26 pounds. You may have heard the term, “What’s good for the goose is good for the gander.” A ***goose*** is the term for a female and a ***gander*** is a male goose, while a young goose of either gender is called a ***gosling***. A group of geese is called a ***gaggle***.

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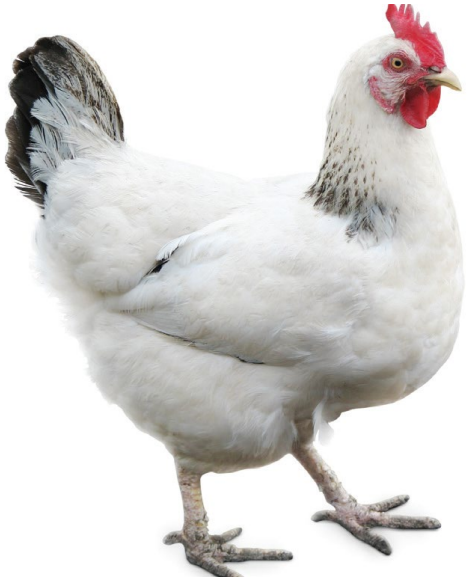
Other Poultry

Other species of poultry that occupy a smaller niche in the industry are swans, peafowl, guinea fowl, quail, and ratites. Ratites are a type of flightless birds. Ostriches, emus, and rheas are all ratites. A few years ago, these became very popular in the United States and sold for high prices. However, the market for products from these birds never developed sufficiently, and their popularity has since declined.

Common Breeds of Chickens

As descendants from wild jungle fowl in Asia and India, chickens occupy the largest portion of the poultry industry. While there are more than 200 breeds of chicken listed in the American Poultry Association's *Standard of Perfection*, most of these breeds are not of importance to the commercial industry. Commercially, chickens are raised as ***broilers*** (young meat chickens) or as ***layers*** (egg-producing chickens).



Jupiter Images

Broilers can be either male or female chickens, while a layer is strictly a female because it must be able to produce eggs. A young, immature chicken is called a ***chick***. To separate by gender, a young male chicken under one year of age is called a ***cockerel***, and a young female chicken is called a ***pullet***.

A producer may evaluate his/her ***flock*** or group of chickens to choose which males to castrate (caponize), which then gives it the name ***capon***. Others will be allowed to mature into a ***cock*** or ***rooster***, which is a mature male chicken after one year of age. Just as in ducks and turkeys, a mature female chicken over one year of age is called a hen. If a hen is no longer producing eggs, she is known as a ***spent hen***, and a producer may choose to ***cull*** or discard her from the flock.

The modern-day broiler chicken has been developed to grow quickly and efficiently. To produce a desirable broiler, specialty breeders use breed crosses. The two breeds of chicken most used to create this hybrid are the Cornish and the White Plymouth Rock. Usually the genetic strains that result from these crosses are named after the company that developed them, such as Peterson-Cobb.

Egg-laying hens are also bred to lay eggs as efficiently as possible. Most eggs sold in the United States have white shells. Commercial strains of white egg-laying hens are usually developed from the White Leghorn. A popular strain of brown egg-laying hens is called the Production Red and is developed from a breed called the Rhode Island Red.

Non-Commercial Breeds

The idea of commercially breeding beautiful chickens began in the mid-1800s, when exotic breeds were first brought to Europe and the United States from Asia. People greatly admired the new colorful breeds in much the same way that hobby gardeners admire special varieties of plants and flowers.

Chickens have been bred into a wide variety of exotic sizes, shapes, colors, and textures. Some chickens have distinctive feather patterns, while others have puffy “muffs” or beards, feathery feet, large feather crests, striking combs, or long, flowing tails. Chickens also vary in the size and color of eggs they produce. Today, many breeds are still raised in backyard flocks for home meat or egg production, for exhibition, or as ornamental pets. Chicken breeds can be categorized as large breeds and ***bantams***, which are a smaller size.

Large breeds’ mature weights range from about five pounds up to 11 or 12 pounds. Large breeds are further categorized into six classes based on their origins: American, Asiatic, English, Mediterranean, Continental, and other.

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Some large breeds, such as those in the Mediterranean class, are best suited for laying eggs. Others are bigger and make better meat birds, while still other breeds have been developed as excellent ***dual-purpose*** birds (good for both meat and eggs). The Langshan, Plymouth Rock, and Orpington are all considered good dual-purpose breeds. Some breeds of large chickens and all breeds of bantams are considered ornamental breeds, due to unusual plumage or coloring. The White-Crested Black Polish, with its exaggerated crest and striking color, is one of these breeds. The Buff Brahma matures to a very large chicken that is good for meat and beautiful to look at, with its heavy plumage, coloring, and feathered feet.

Bantam breeds generally weigh only one or two pounds when mature. Bantams have subclassifications based on their physical characteristics, such as comb style and feathering. The Black-Tailed Japanese

Bantam is an excellent example of the beauty and style that make raising bantam chickens a popular hobby. Most breeds of chicken, whether large or bantam, have different recognized varieties within the breed based on plumage color. For instance, the Cochin, a leather-footed chicken developed as both large and bantam breeds, is found in more than a dozen color varieties.

The Brown Leghorn is another color variety of the same breed used to develop commercial egg-laying chickens. Purebred chickens, while not commercially important, are enjoyed by poultry breeders, collectors, and other enthusiasts. Sadly, many of these breeds have declined in numbers to the point where the American Livestock Breed Conservancy considers them to be in danger of extinction.

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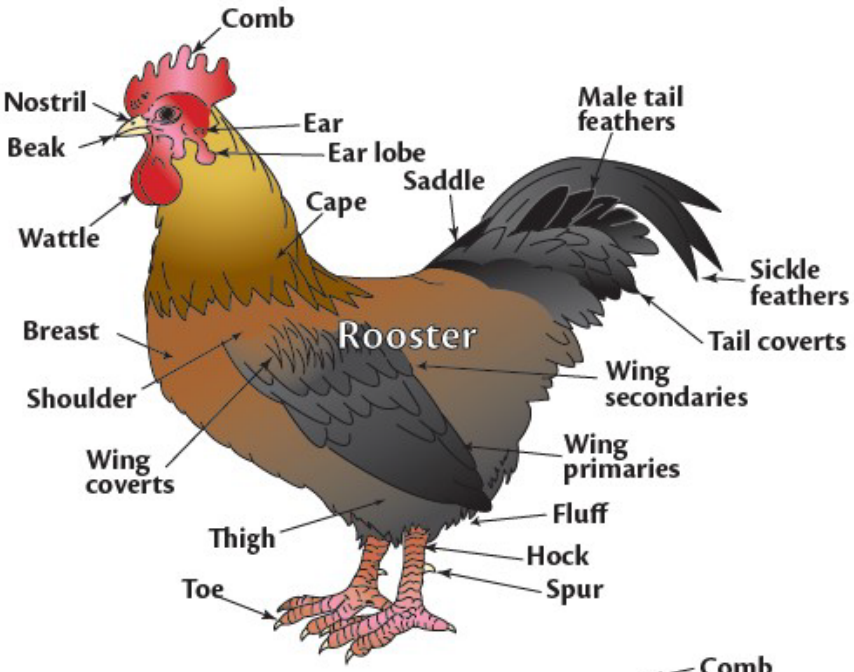
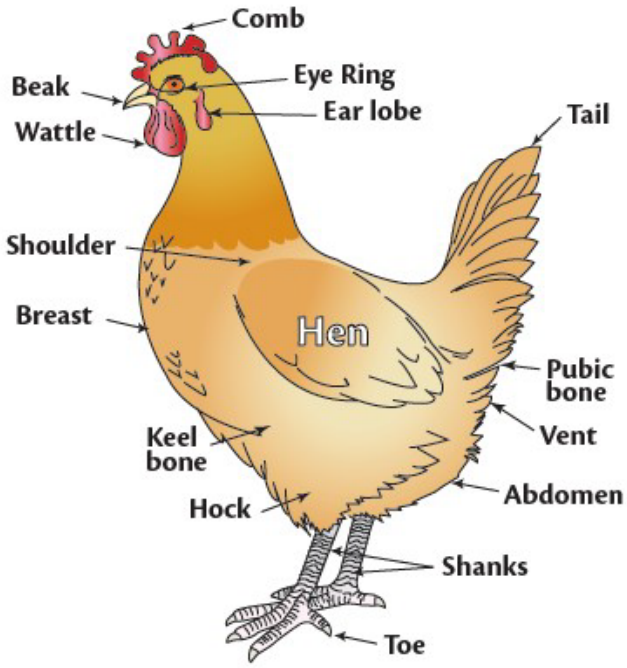
Parts of a Chicken

Chickens are well known for their distinctive head combs and wattles below the beak. However, there are many other important parts a rooster and a hen display that will help you tell them apart. A rooster will generally be larger in size than a hen while displaying a cape of feathers around its neck and spurs on the back of its legs. A hen usually has shorter tail feathers and a smaller wattle. Depending upon the breed, the ear lobes may or may not be apparent. Some breeds also have feathers that cover their eyes and legs.



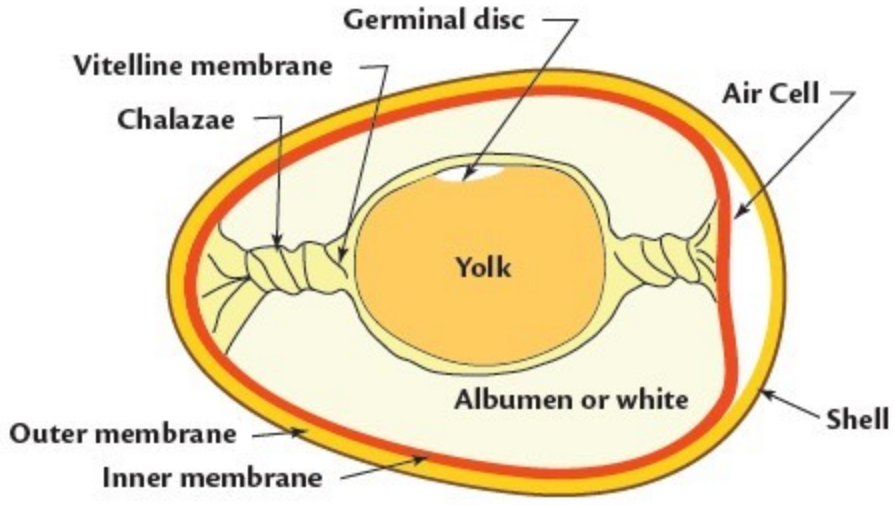


Egg Development

A chicken requires slightly more than 24 hours to complete an egg. Most hens will lay one egg a day for four days, skip a day, then begin laying again. Production layers average about 250 eggs per year. Fertilization is not necessary for hens to lay eggs. The egg begins as a tiny ovum within the hen's body. The ovum matures into a yolk and begins to move down the hen's ***oviduct***, or reproductive tract. As the yolk travels, various layers of ***albumen*** (egg white) and membranes are built up around the yolk. If the yolk had been fertilized, which occurs just as it begins moving through the oviduct, these structures would serve as protection for the developing embryo. The portion of the egg that takes the longest to develop is the shell. The shell is made primarily of the mineral calcium carbonate and takes approximately 21 hours to be completed. Depending on the breed, chicken eggshells may be shades of white, brown, green or blue. Once the shell is complete, the egg passes on through the remainder of the oviduct and is expelled from the hen's vent. Occasionally, an abnormality during this process creates a defect in the egg. Some defects such as blood spots, meat spots, and double yolks can occur.

SAE IDEA:
Placement
Work for a poultry producer.

Blood spots are small spots of blood on the yolk. They occur when a bit of blood is released along with the yolk. Although blood spots are harmless, commercial eggs are screened for this type of abnormality because it is unsightly. Meat spots are like blood spots; this is a brown spot of tissue on the yolk. These are also harmless but unsightly. Double yolks occur when an egg contains two (or more) yolks due to the hen's ovulation cycle not being properly synchronized.



Incubating Eggs and Chickens

Most chickens today are hatched and raised through artificial means. Mechanical incubators and brooders now take the place of the mother hen. Artificial methods for hatching and raising chicks result in greater control and consistency for producers. However, it also increases labor requirements and needs for appropriate facilities. The process begins when breeder hens lay fertile eggs.

Fertile eggs are collected as soon as possible after they are laid to prevent the eggs from getting dirty or broken. Cleanliness is very important because any dirt or bacteria on the eggshell can be drawn into the egg and damage the developing embryo. For this reason, eggs are fumigated with a sanitizing agent before they are placed in the incubator. The ***incubator*** is a device that regulates the environment so embryos can develop properly. The eggs must be kept at the correct temperature, which is about 100°F. The relative humidity must be maintained between 60 and 70 percent. Air must be circulated around the eggs to prevent the build-up of toxic gases. The eggs must be positioned properly in the racks, with the large end up, and turned regularly each day. Eggs remain in the incubator until just prior to hatching, which takes 21 days for a chicken egg.

Once in the optimal environment the incubator provides, embryos develop quite rapidly. Within the first 24 hours, the embryo begins to form a vertebral column, nervous system, head, and eyes. The heart begins to beat by the end of the second day. Legs and wings begin to develop on the third day. Feathering begins to develop on the eighth day. By the end of the second week, scales and claws are present. On the nineteenth day, the yolk is drawn into the almost fully developed chick's body. This will provide nutrition for the newly hatched chick during the first days of life.

EGGS AND THE FLU VACCINE

Did you know the first step in making influenza vaccines involves chicken eggs? In fact, millions of specially prepared chicken eggs are used to produce our nation's supply of flu vaccine. Each year in the months preceding flu season, hundreds of thousands of 11-day-old fertilized eggs are delivered to drug manufacturing labs where they are cleaned with a disinfectant and injected with a strain of the influenza virus. Once injected, the eggs are incubated for several days to allow the virus to multiply and grow. After incubation, the egg white that contains the virus is collected. The vaccines are then produced in a clean environment where each step of the production process is closely monitored to ensure quality and safety.

Ever wonder why doctors sometimes run out of flu vaccine? The manufacturing of the doses of one season's flu vaccine depends on approximately 90 million eggs. Eggs are ordered a year in advance to ensure a steady supply of eggs for vaccine manufacturing. Once egg orders are in place, there is really no way to buy more fertilized eggs. Grocery store eggs won't work because they are unfertilized. Also, the making of the vaccine is a six- to nine-month process. Even if production could begin immediately, the vaccine produced wouldn't be ready until flu season was over.

USDA-ARS photo

Eggs are candled occasionally to see if they are developing properly. Candling involves shining a bright light through the egg to view the contents. If eggs are found to be developing improperly, they are discarded.

Commercial hatcheries move the eggs from the incubator to a hatching room just prior to hatch. This keeps bacteria from the newly hatched chicks from contaminating the incubating eggs. On the twenty-first day of incubation, the chick breaks open the eggshell by tapping it with the hard egg tooth on the end of its beak. Once the chick is out of the shell and has dried, procedures such as determining the chick's sex, vaccinating, and ***debeaking***, or the removal of the beak tip, are performed. Debeaking is performed to prevent chicks from pecking and harming each other. The chicks are then boxed in special containers and shipped to the customer.

For the first few weeks of life, chicks require special care. This is called ***brooding***, and the cage, pen, or house where the chicks are kept is called a brooder. Like the incubator, environmental conditions in the brooder must be strictly controlled. If the chicks are allowed to get chilled, overheated, hungry, or thirsty, they will experience stress that at best will slow their growth and at worst will kill them. The temperature must be within the range of 90 to 95 degrees for the first week. Each week after that, the temperature can be dropped by five degrees. When the chicks are fully feathered, they can withstand cooler temperatures.

Chicks should be given at least 10 square inches of floor space per chick for the first week. More space is required as the chicks grow. Food and water should always be available, with enough space for all the chicks to eat. The chicks should be protected from drafts, moisture, and fumes with proper ventilation. They should also be kept on dry, clean litter.

SAE IDEA:
Entrepreneurship
Operate a poultry litter cleanout service.

A LESSON IN PARENTING

Many people have all kinds of animals as pets, other than the usual dog or cat. But there is something unique about birds. Those who have watched babies emerge from their shells know that, to a certain extent, these little birds consider their owners to be their parents. All young birds learn by interacting with others of their own species. This process is called *imprinting*. If humans assume the role of the parent, young birds learn to see humans as one of their own kind.

For a wild bird, such as a Bobwhite Quail, this can become a problem. People pose a hazard to birds, especially game birds, yet imprinting removes their fear of humans because they have not learned to take defensive precautions when people are nearby. Imprinting on humans will prevent a bird from being able to live a natural life in the wild. This is why you should never take an egg from a nest in the wild. If you find an egg, leave it alone or put it back on the nest, if possible. Imprinting is also why many people object to the hunting of game birds that were raised and released.

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Consumer Products

Poultry products enrich our lives in many ways. The millions of birds raised by poultry producers each year contribute in the areas of nutrition, industry, arts, medicine, and science. The United States is the world's largest poultry producer and the second-largest egg producer. Exports of poultry products are also a large contributor to the economy, with the United States being the second largest in poultry meat exports.

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Meat

All poultry can be consumed as meat, but only chickens, turkeys, geese, and ducks are commonly eaten in the United States. Other species of poultry are considered specialty meats. Along with the meat, some of the organs are also edible. These are called ***giblets*** and consist of the heart, liver and gizzard. Poultry's popularity has increased among health-conscious consumers over the years because it is lower in fat and cholesterol than beef or pork. Since 1970, per capita consumption of chicken and turkey has more than doubled.

Eggs

Most of the eggs sold for consumption in the United States are chicken eggs. Eggs are given a grade or are evaluated and sorted according to specific qualities. Grades include A, AA, and B, with AA being the highest. Eggs are sold as fresh, in-the-shell eggs. Some eggs are processed through an egg-breaking operation and are marketed as a liquid, frozen, or dried product. Consumer concerns about the cholesterol levels in eggs caused per capita consumption to drop about 25 percent between 1970 and 1990. Since then, these concerns have eased somewhat, and egg consumption has increased slightly in the last few decades. Eggs are also used for artwork using painting, dying, and other techniques. Ostrich and emu eggs can even be carved to make beautiful decorations.

SAE IDEA:
Research
Conduct feed trials for growing broiler chickens

Feathers and Down

Feathers are used in a variety of ways, from fly-tying and craft-making to insulation and feather dusters. Goose or duck down, which are small, fluffy feathers that grow under the outer feathering, is highly regarded as a soft, insulating filling for pillows, comforters, and outdoor clothing. The feathers of peacocks, ostriches, and game birds are often used as decoration.

Offal and Manure

The ***offal***, or parts inedible by humans, from slaughtering operations and the manure from production operations are used as fertilizer and animal feed. Broiler litter is the subject of much research to determine how it can be utilized as a portion of the feed for different species of livestock.

Skin

Ostrich skin is used to make fine-quality leather. Visit any rodeo and you will find those fashion-conscious cowboys and cowgirls wearing boots made of leather from ostrich skin.

USDA-ARS photo

Drugs

Many medications use eggs in the manufacturing process. Eggs and their components are used to prepare ointments, antidotes, vaccines, and culture media. Another poultry product used for medical purposes is emu oil. Research indicates that emu oil is a natural anti-inflammatory agent. It is used to treat such problems as burns, wounds, and muscle or joint pain.

Scientific Research

Poultry is an invaluable resource for a multitude of research projects. Eggs and chicks were the basis of nutritional studies that taught us how many vitamins and minerals are used by living organisms. Fertile eggs are also used to study various types of disease-causing organisms. Chickens, ducks, and geese have been instrumental in behavioral research. Our understanding of social phenomena such as pecking order (a group's social organization) and imprinting was developed from studying these birds.

UNIT SUMMARY

Poultry of all species have provided humans with food for centuries through the consumption of meat and eggs. Chicken is especially popular for its ease in preparation and perceived health benefits. As close relatives to the chicken, turkeys, ducks, and geese are also raised for consumption. Depending upon the use, some chicken breeds are chosen over others. The Cornish and White Plymouth Rock are popular for meat production while the White Leghorn is widely used for egg production. Chickens can produce many eggs each year, which will either be fertilized for chick production or left unfertilized for human use. Poultry have proved to be useful past food production. The feathers, offal, manure, and skin can be used for many other products. The various uses of poultry make it an essential animal to humans.

UNIT REVIEW

1. Who brought the first chickens to North America?
2. What is the *American Standard of Perfection?*
3. Why is chicken a popular meat?
4. What are three other species of poultry besides chickens?
5. Why are turkeys not typically bred naturally?
6. What is the difference between a broiler and a layer?
7. How do a hen and a rooster differ in their parts?
8. Describe the process of egg development.
9. What are egg blood spots?
10. Why are most chickens hatched and raised artificially?
11. What are the optimal conditions for eggs in an incubator?
12. Why is debeaking performed on chicks?
13. What are some non-food uses for chicken products?
14. How have poultry contributed to scientific research?