

Table 4. Understanding the Food Poisoners

What is food poisoning? Food poisoning, caused by harmful bacteria, normally produces intestinal flu-like symptoms lasting a few hours to several days. But in cases of botulism or when food poisoning strikes infants, the ill, or the elderly, the situation can be serious.

Where do these bacteria come from and how can they be stopped? Food poisoning bacteria, microscopic in size, surround us—in the air, soil, and water, in our own digestive tracts, and in those of many animals. The only way they can effectively be stopped is by careful attention to food handling rules like those outlined below

BACTERIA	HOW IT ATTACKS	SYMPTOMS	PREVENTION
Staphylococcus aureus (Staph)	Staph spreads from someone handling food. It is found on the skin and in boils, pimples, and throat infections. At warm temperatures, staph produces a poison.	2 to 8 hours after eating, you could have vomiting and diarrhea lasting a day or two.	Cooking won't destroy the staph poison so: -Wash hands and utensils before preparing food. -Don't leave food out over 2 hours. Susceptible foods are meat, poultry, meat and poultry salads, cheese, egg products, starchy salads (potato, macaroni, pasta, and tuna), custards, and cream-filled desserts.
Salmonella	You can get salmonella when infected food—such as meat, poultry, eggs, or fish is eaten raw or undercooked. Other causes include cooked food coming into contact with infected raw food or an infected person contaminating food.	In 12 to 36 hours you could have diarrhea, fever, and vomiting lasting 2 to 7 days.	Keep raw food away from cooked food and -Thoroughly cook meat, poultry, and fish. -Be especially careful with poultry, pork, roast beef, and hamburger. -Don't drink unpasteurized milk.
Clostridium perfringens	This “buffet germ” grows rapidly in large portions of food that are cooling slowly. It can also grow in chafing dishes which may not keep food sufficiently hot and even in the refrigerator if food is stored in large portions which do not cool quickly	In 8 to 24 hours you could have diarrhea and gas pains, ending usually in less than a day. But older people and ulcer patients can be badly affected.	Keep food hot (over 140 F) or cold (tinder 40 F) and -Divide bulk cooked foods into smaller portions for serving and cooling. -Be careful with poultry, gravy, stews, and casseroles
Campylobacter jejuni	You drink untreated water on an outing. Your pet becomes infected and spreads it to the whole family, or you eat raw or undercooked meat, poultry, or shellfish.	In 2 to 5 days you could have severe (possibly bloody) diarrhea, cramping, fever, and headache lasting 2 to 7 days.	Don't drink untreated water or unpasteurized milk and -Thoroughly clean hands, utensils, and surfaces that touch raw meats. -Thoroughly cook meat, poultry, and fish.
Clostridium botulinum	Often occurs in home-canned or any canned goods showing warning signs—clear liquids turned milky, cracked jars, loose lids, swollen or dented cans or lids. Beware of any jar or can that spurts liquid or has an off-odor when opened.	In 12 to 48 hours your nervous system could be affected. Other symptoms include double vision, droopy eyelids, and difficulty speaking, swallowing, or breathing. Untreated botulism can be fatal.	Carefully examine home-canned goods before use, and: -Don't use any canned goods showing danger signs. -If you or a family member has botulism symptoms, get medical help immediately. Then call health authorities.

Note: While the chart highlights the preventive measures most important in avoiding each type of bacteria, you should understand that all the rules of prevention should be followed with all food.

THE SKELETAL SYSTEM

The skeletal system is important for the bird for support and has two additional functions which are unique: respiration and calcium transport. The skeletal system of the bird is compact and lightweight, yet strong. The tail and neck vertebrae are movable, and body vertebrae are fused together to give the body sufficient strength to support the wings. There are two special types of bones which make up the birds skeletal system: they are pneumatic bones and medullary bones. The pneumatic bones are important in the bird for respiration. They are hollow bones which are connected to the bird's respiratory system and are important for the bird to breath. Examples of pneumatic bones are the skull, humerus, clavicle, keel (sternum) pelvic girdle, and the lumbar and sacral vertebrae.

The medullary bones are an important source of calcium for the laying hen. Calcium is the primary component of egg shell and a hen mobilizes 47 percent of her body calcium to make the egg shell. Examples of medullary bones are the tibia, pubic bone, ribs ulna, toes and scapula.

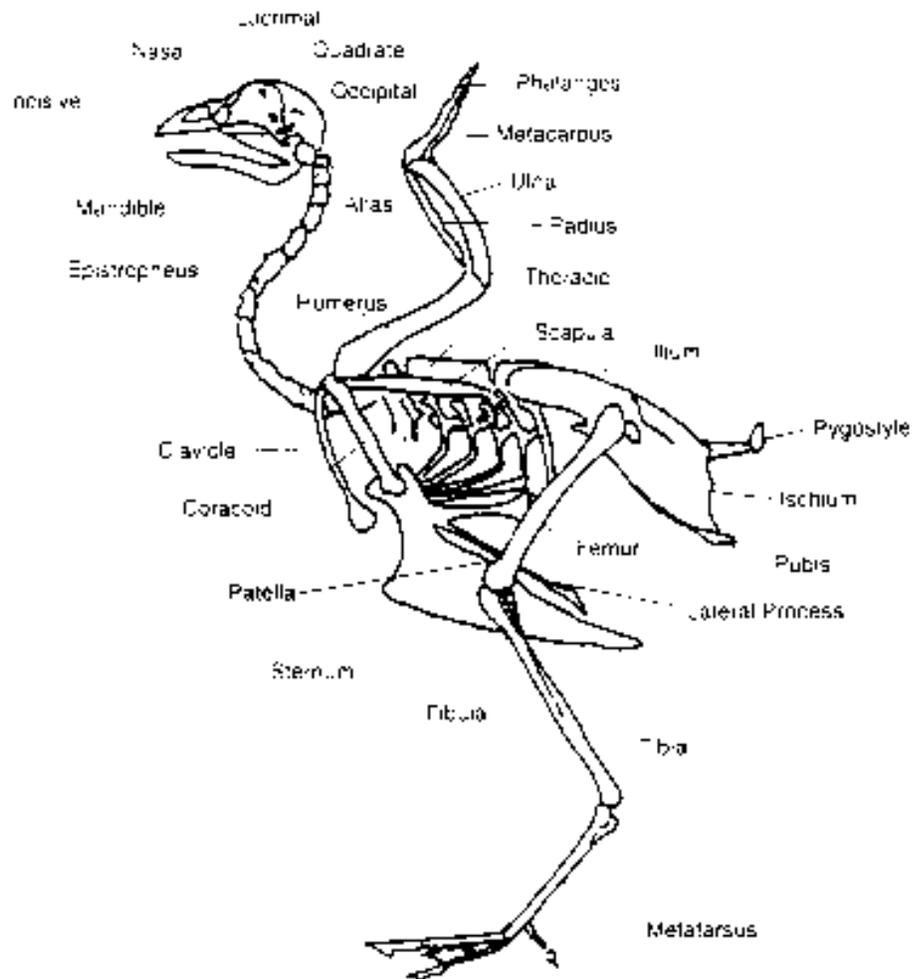


Figure 6. Skeletal System

THE RESPIRATORY SYSTEM

The respiratory system is made up of lungs, pneumatic bones, and air sacs. The lungs of the bird are different from that of a mammal's in that they are rigid. They function in the exchange of blood gases such as CO₂ and O₂. Air sacs are unique to the bird and are flexible. The air sacs open up to the pneumatic bones which aid in the exchange of air throughout the bird's body. There are four pairs of air sacs and one single air sac, two intercostal air sacs, two abdominal air sacs, two anterior thoracic air sacs, two posterior thoracic air sacs, and one cervical air sac. The respiratory system is important for air exchange and also for temperature regulation in the bird.

THE DIGESTIVE SYSTEM

(See Figure 7)

The digestive system functions to utilize food material for the maintenance of all the other systems of the bird's body. The bird's digestive system depends on enzymes (proteins) which chemically break down the food. The digestive system is made up of many different parts. The mouth contains salivary glands that secrete saliva containing enzymes which begin to break down food. A bird does not have teeth to chew its food but does have a tongue which pushes the food to the back of the mouth so that it can begin its passage down the rest of the digestive tract. The esophagus is the tube that connects the mouth with the rest of the digestive tract. The crop is located in the neck region and is used to store food until the bird is ready to digest more food. The proventriculus or true stomach secretes two enzymes: hydrochloric acid (HCl) and pepsin. Another unique part of the bird's digestive tract is the gizzard. The gizzard is made up of two smooth muscles and contains grit or stones and acts as the bird's teeth by grinding the food.

The small intestine is made up of the duodenum and the lower small intestine. The small intestine is important for the absorption of nutrients. The ceca are two blind pouches that, like our appendix, have no real function. The last portion of the digestive tract is the rectum or large intestine where additional absorption of water takes place.

The pancreas, which is in the center of the duodenal loop, secretes pancreatic juice which neutralizes the HCl secreted by the proventriculus and helps break down fat. The liver produces a dark green substance called bile which is necessary for the absorption of fats. The bile is stored in the gall bladder, and when food passes into the duodenum, it causes the gall bladder to empty the bile into the small intestine.

The cloaca is where the digestive tract, the reproductive tract, and the excretory tract all end up. The cloaca is important for absorbing any moisture from foodstuffs which will leave the body. It is also important since it is here that the egg from the female's reproductive tract is flipped in order that it will be laid large end first.

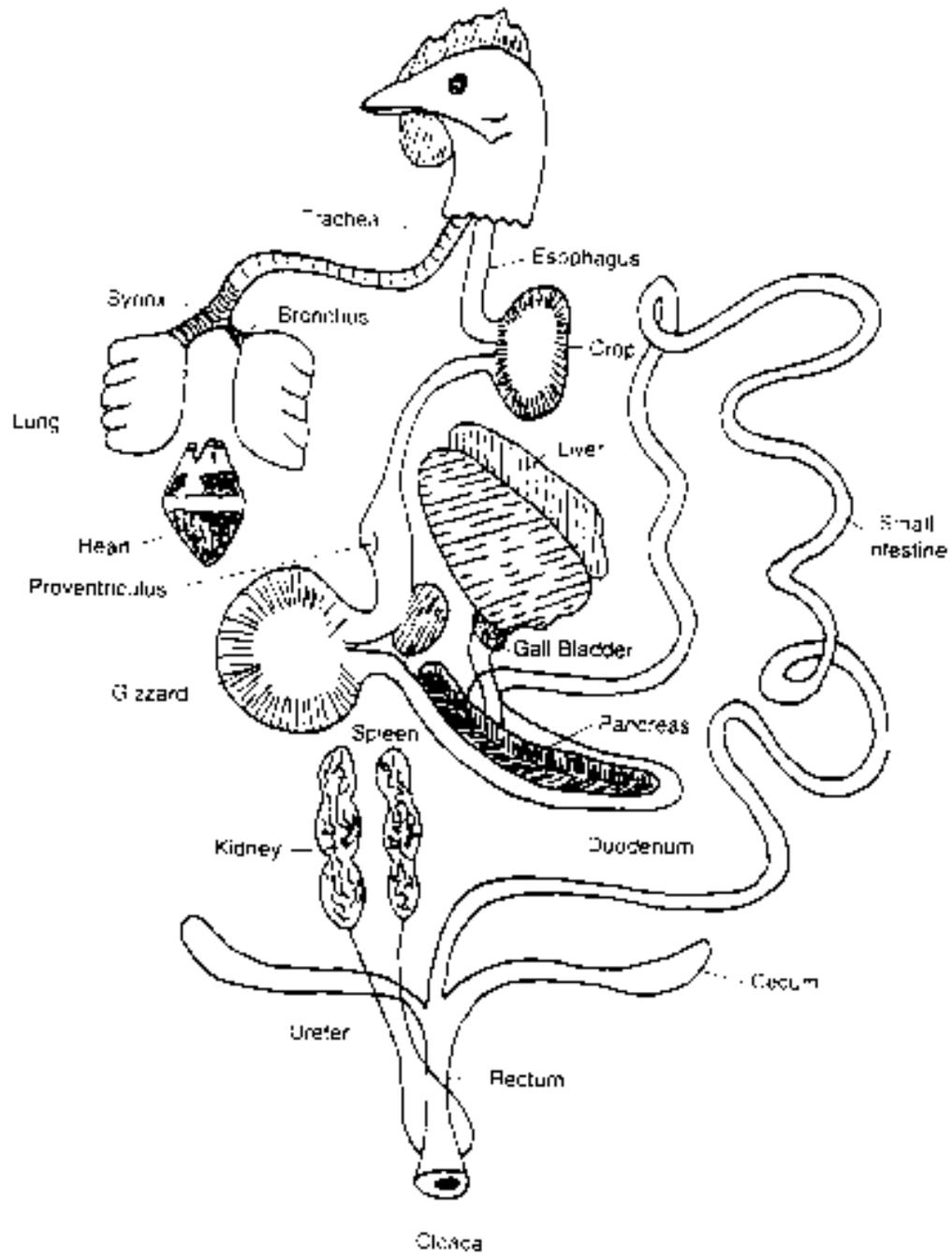


Figure 7. Digestive System and Excretory System

THE FEATHER

Although the feather is not a system of the bird, it is what makes the bird totally unique from all other animals. Figure 8 shows the parts of the feather. The feather is important for flight, protection, and temperature regulation. When a bird rearranges its barbules and barbicels, it is called preening. Birds also lose their feathers once a year during a molt. These feathers are replaced in about 21 days.

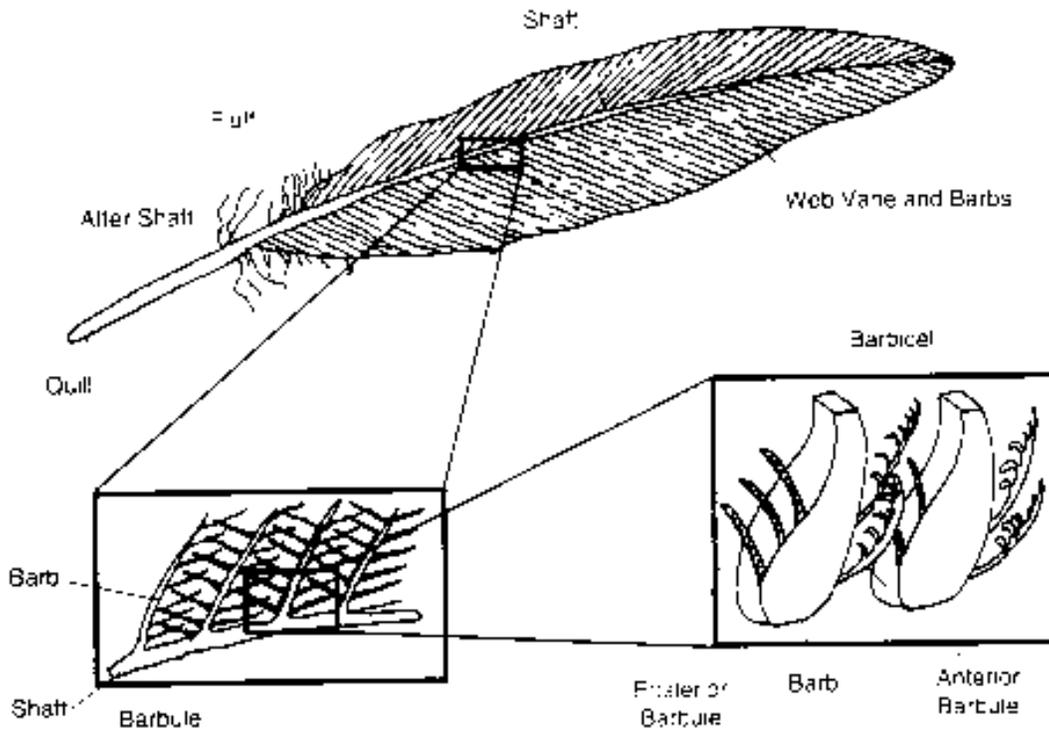


Figure 8. Parts of the Feather

Acknowledgments: Michelle T. Hall, Clemson University Extension Service

Cochins

Varieties: White, Black, Buff, Partridge.

Standard weights: Cock. 11 pounds; hen, 8 1/2 pounds; cockerel, 9 pounds; pullet, 7 pounds.

Skin color: Yellow.

Eggshell color: Brown.

Use: Mainly an ornamental fowl, but their ability as mothers is widely recognized and Cochins are frequently used as foster mothers for game birds and other species.

Origin: Cochins came originally from China but underwent considerable development in the United States and now are found and admired in many parts of the world.

Characteristics: Cochins look like big, t balls of feathers. They are mainly kept as an ornamental fowl and are well-suited to close confinement. The profuse leg and foot feathering makes it desirable to confine Cochins on wet days and where yards become muddy to keep the birds from becoming mired or collecting balls of mud on their feet. They exhibit extremely persistent broodiness, are good mothers, and are intense avers for long periods of time. Because of their feathering, it is necessary to clip some of the feathers or resort to artificial insemination to obtain good rates of fertility.

Langshans

Varieties: Black and White.

Standard weights: Cock. 9 1/2 pounds; hen, 7 1/2 pounds; cockerel, 8 pounds; pullet, 6 1/2 pounds.

Skin color: White.

Eggshell color: Brown.

Use: A general-purpose fowl for the production of meat and eggs. The general shape of the Langshan makes them better suited to roaster and capon use than as fryers.

Origin: Langshans originated in China and are considered one of our oldest breeds.

Characteristics: Langshans enjoyed considerable popularity in the United States during the latter part of the 19th century. Today however, they are primarily an exhibition fowl. They appear to be very tall, with long legs and tails carried at a high angle. They are active and quick. The black variety has a deep greenish sheen when viewed in the proper light. Many other breeds were created using Langshan blood in the foundation matings. They are a good general breed; females go broody and make good mothers. Their feet and legs are feathered but not as fully as the Cochins or Brahmas. Long legs and narrow body conformation leave much to be desired as a meat bird by today's standards.

ENGLISH CLASS

Australorp

Varieties: Black.

Standard weights: Cock, 8 1/2 pounds; hen, 6 1/2 pounds; cockerel, 7 1/2 pounds; pullet, 5 1/2 pounds.

Skin color: White.

Eggshell color: Brown.

Use: Generally a very good egg producer with a fairly meaty body of intermediate size.

Origin: The Australorp was developed in Australia from Black Orpington stock. It is smaller than the Orpington with a trimmer appearance.

Characteristics: Australorps are black, with an intense beetle-green sheen. They have dark eyes and deep bodies and are very active. They are one of the best dual-purpose fowls, having gained attention in the 1930's and '40's by being one side of the successful Austrawhite cross. This cross of Australorp with White Leghorn became the successor to purebred breeds on many Midwestern farms. Broodiness was a problem with the cross and some markets discounted the tinted eggs they laid. Therefore, it soon fell victim to the inbred hybrid crosses of "Flyline" and "DeKaib." Australorps are good egg producers and hold the world's record for egg production, with one hen having laid 364 eggs in 365 days under official Australian trapnest testing.

Cornish

Varieties: White.

Standard weights: Cock, 10 1/2 pounds; hen, 8 pounds; cockerel, 8 1/2 pounds; pullet, 6 1/2 pounds.

Skin color: Yellow.

Eggshell color: Brown.

Use: Developed as the ultimate meat bird, the Cornish has contributed its genes to build the vast broiler industry of the world. Its muscle development and arrangement give excellent carcass shape.

Origin: Cornish were developed in the shire (county) of Cornwall, England, where they were known as Indian Games." They show the obvious influence of Malay and other oriental blood. They were prized for their large proportion of white meat and its fine texture.

Characteristics: The Cornish has a broad, well-muscled body. Its legs are of large diameter and widely spaced. The deep set eyes, projecting brows and strong, slightly curved beak give the Cornish a rather cruel expression. Cornish males are often pugnacious, and the chicks tend to be more cannibalistic than some breeds.

Good Cornish are unique and impressive birds to view. The feathers are short and held closely to the body, and may show exposed areas of skin. Cornish need adequate protection during very cold weather as their feathers offer less insulation than can be found on most other chickens. Because of their short feathers and wide, compact bodies, Cornish are deceptively heavy. Due to their shape, good Cornish often experience poor fertility and artificial insemination is suggested. Cornish are movers and need space to exercise and develop their muscles. The old males get stiff in their legs if they do not

receive sufficient exercise. The females normally go broody but because of their very minimal feathers can cover relatively fewer eggs. They are protective mothers but are almost too active to be good brood hens.

Dorkings

Varieties: Silver Gray, Colored, White.

Standard weights: Cock. 9 pounds: hen, 7 pounds; cockerel. 8 pounds: pullet, 6 pounds.

Skin color White.

Eggshell color: White.

Use: A good, general-purpose fowl for producing meat and eggs. It was developed for its especially fine-quality meat.

Origin: The Dorking is believed to have originated in Italy, having been introduced into Great Britain at an early date by the Romans. Much of its development took place in England, where it gained much acclaim for its table qualities. The Dorking is one of our oldest breeds of chickens.

Characteristics: The Dorking has a rectangular body set on very short legs. It has five toes and has a relatively large comb, thus requiring protection in extremely cold weather.

Dorkings are good layers and are one of the few examples of a bird with red earlobes that lays a white-shelled egg. Most Dorking hens will go broody, make good mothers, and are quite docile. Because of their white skin, Dorkings are not as popular in the United States as in Europe.

Orpingtons

Varieties: Black, White, Buff, Blue.

Standard weights: Cock. 10 pounds: hen. 8 pounds: cockerel, 8½ pounds: pullet, 7 pounds.

Skin color White.

Eggshell color: Brown.

Use: A heavy dual-purpose fowl for the production of both meat and eggs.

Origin: Orpingtons were developed in England in the town of Orpington in County Kent during the 1880's. They were brought to America in the 1890's and gained popularity very rapidly, based on their excellence as a meat bird. As the commercial broiler and roaster market developed, the Orpington lost out partly because of its white skin.

Characteristics: Orpingtons are heavily but loosely feathered, appearing massive. Their feathering allows them to endure cold temperatures better than some other breeds. They are solidly colored. are at home on free range or in relatively confined situations, and are docile. Hens exhibit broodiness and generally make good mothers. Chicks are not very aggressive and are often the underdogs when several breeds are brooded together. They are a good general-use fowl.

Sussex

Varieties: Speckled. Red, Light.

Standard weights: Cock, 9 pounds: hen, 7 pounds: cockerel, 7 1/2 pounds: pullet, 6 pounds.

Skin color: white.

Eggshell color: Brown.

Use: A general-purpose breed for producing meat and eggs. One of the best of the dual-purpose chickens. a good all-round farm fowl.

Origin: Sussex originated in the county of Sussex, England, where they were prized as a table fowl more than 100 years ago. They continue to be a popular fowl in Great Britain, and the light variety has figured prominently in the development of many of their commercial strains. Sussex is one of the oldest breeds that is still with us today in fair numbers.

Characteristics: Sussex are alert, attractive, and good foragers. They have rectangular bodies: the speckled variety is especially attractive with its multicolored plumage. Sussex go broody and make good mothers. They combine both exhibition and utility virtues but are more popular in Canada, England, and other parts of the world than in the United States.

Another Breed in the English Class

Red Caps A rare member of the English class, these are characterized by having a large rose comb. They are one of the few breeds with red earlobes that lay white-shelled eggs.

MEDITERRANEAN CLASS

Anconas

Varieties: Single Comb. Rose Comb.

Standard weights: Cock, 6 pounds: hen, 4½ pounds: cockerel, 5 pounds: pullet, 4 pounds.

Use: A small fowl that lays a fair number of rather small eggs.

Origin: Anconas take their name from the port city of Ancona, Italy, where they are said to have originated.

Characteristics: Anconas resemble Leghorns in shape and size. They are small, active, alert, and black with white tipped feathers evenly distributed. Anconas are noisy, good foragers, and considered non-broody. They were once a prime egg-producing breed, but today they are mainly kept as an ornamental fowl.

Blue Andalusians

Varieties: None.

Standard weights: Cock, 7 pounds; hen, 5 ½ pounds; cockerel, 6 pounds; pullet, 4 ½ pounds.

Skin color White.

Eggshell color: White.

Use: An ornamental fowl with fairly good egg-production potential.

Origin: Developed initially in Spain, the breed has undergone considerable development in England and the United States.

Characteristics: Andalusians are small, active, closely feathered birds that tend to be noisy and rarely go broody. Andalusians are a typical example of the unstable blue color we see in the poultry industry. It is the result of a cross of black and white. When two blues are mated, they produce offspring in the ratio of one black, two blues, and one white. These whites and blacks when mated together will produce mainly blues.

.Andalusians are beautiful when good, but the percentage of really good ones runs low in mans' flocks because of this color segregation. Hence, they are not widely bred and never in large numbers.

Leghorns

Varieties: Single Comb Dark Brown. Single Comb Light Brown, Rose Comb Dark Brown,

Rose Comb Light Brown. Single Comb White. Rose Comb White. Single Comb Buff, Single Comb Black. Single Comb Silver. Single Comb Red, Single Comb Black Tailed Red. Single Comb Columbian.

Standard weights: Cock. 6 pounds; hen. 4 1/2 pounds: cockerel. 5 pounds: pullet. 4 pounds.

Skin color Yellow.

Eggshell color: White.

Use: An egg-type chicken. Leghorns figured in the development of most of our modern egg-type strains.

Origin: Leghorns take their name from the city of Leghorn, Italy, where they are considered to have originated.

Characteristics: A small, spritely, noisy bird with great style, Leghorns like to move about. They are good foragers and can often glean much of their diet from ranging over fields and barnyards. Leghorns are capable of considerable flight and often roost in trees if given the opportunity. Leghorns and their descendants are the most numerous breed we have in America today. The Leghorn has relatively large head furnishings (comb and wattles and is noted for egg production. Leghorns rarely go broody.

Minorcas

Varieties: Single Comb Black, Rose Comb Black. Single Comb White. Rose Comb White. Single Comb Buff.

Standard weights: Single Comb Black: cock, 9 pounds; hen. 7 1/2 pounds: cockerel. 7 1/2 pounds: pullet, 6 1/2 pounds. All others: cock, 8 pounds; hen. 6 1/2 pounds: cockerel, 6 1/2 pounds, pullet, 5 1/2 pounds.

Skin color White.

Eggshell color: White.

Use: Developed for the production of very large chalk-white eggs, the Minorca is today principally an exhibition fowl.

Origin: Developed in the Mediterranean area, they take their name from an island off the coast of Spain. Development may have been as an offshoot of the Spanish breed.

Characteristics: The largest of the Mediterranean breeds. They are long, angular birds that appear larger than they are. They have long tails and large, wide feathers closely held to narrow bodies. Minorcas have relatively large combs and wattles. Good Minorcas are stately, impressive birds and can give a fair return in eggs, although in recent years they have not been intensively selected for that purpose. They are rather poor meat fowl because of their narrow angular bodies and slow growth. Minorcas rarely go broods' and are very alert and fairly good foragers.

White-Faced Black Spanish

Varieties: None.

Standard weight: Cock, 8 pounds; hen, 6 ½ pounds; cockerel, 6 1/2 pounds; pullet, 5 ½ pounds.

Skin color: White.

Eggshell color: White.

Use: An egg-type bird that has, in recent years, had very little selection for that purpose.

Origin: Coming from Spain, this bird arrived in the United States via the Caribbean Islands. Spanish are the oldest breed of chickens that exist in the United States today. At one time known as 'The Fowls of Seville,' they were very popular in the South during the Colonial period.

Characteristics: The large area of snow white skin surrounding the face and wattles makes this breed unique. Actually this is an overdeveloped earlobe. Its color offers a marked contrast with the black plumage and the red comb and wattles. They are considered non-brood and hold their feathers close to their body contours.

Spanish are active and noisy. Many birds are below recommended weight, and at this time, most of the population is highly inbred.

Other Breeds in the Mediterranean Class

Buttercups: A small, spirited breed from Sicily, their chief distinguishing feature is their cup-shaped comb. Buttercups are non-broody. Lay fair number of small eggs, and are kept strictly as ornamental fowl.

Catalanas: The Buff Catalana is a medium-sized bird noted for its hardiness. It is not well-known in the United States but is widely distributed through South America. Catalanas come closer to being a dual-purpose breed than any of the other Mediterranean breeds.

CONTINENTAL CLASS

Northern European

Hamburg s

Varieties: Golden Spangled. Silver Spangled, Golden Penciled, Silver Penciled, Black, White.

Standard weights: Cock, 5 pounds; hen, 4 pounds: cockerel, 4 pounds: pullet, 3 ½ pounds.

Skin color: White.

Eggshell color: White.

Use: An ornamental fowl capable of laying fair numbers of relatively small eggs.

Origin: Hamburgs carry a German name but are generally considered to have originated in Holland.

Characteristics: Hamburgs are active, flighty birds. They are trim and stylish with delicate features and are wild in nature. They forage well and are capable of living long distances. Although good egg producers. their eggs are often very small.

Campines

There are two varieties of campines, Golden and Silver. Campines are a fairly small, closely feathered breed with solid-colored hackles and barred bodies. They are chiefly an ornamental breed but will lay a fair number of white-shelled eggs and are non-broody. They are thought to have originated in Belgium.

Lakenvelders

An old German breed best known for its color pattern (black hackle and tail on a white body). They are quite small, non-broody, lay white-shelled eggs. and are rather wild and flighty.

RAISING GAME BIRDS

There are many reasons for participating in game bird farming. It can be an enjoyable hobby, a way to fulfill a 4-H project requirement, a means of establishing or increasing game bird populations, or a business venture.

Stocking game birds to establish or increase a resident population for hunting has long been practiced by professional wildlife managers, landowners, and sportsmen. Since public lands available for hunting upland game birds have diminished considerably, many sportsmen are turning to licensed shooting clubs for hunting. Most clubs operate on a put-and-take basis and attempt to harvest a high percentage of stocked game birds.

Whatever your reasons for entering game bird farming, consider these three important factors:

- Game birds must be regarded as a wildlife crop. Proven methods exist to help you raise and harvest a good crop. Game birds are not incidental products that grow without cultivation. You will need to devote enough time to provide the intensive care they require.
- If your motive is to establish or increase local game bird populations, make sure the habitat is suitable for the species being stocked. No animal can survive for long in an unfavorable habitat. Because conditions vary between locations, and game birds differ in their requirements, contact your state Department of Fish and Game or your county Cooperative Extension office for habitat information.
- Every business operates on the principle of supply and demand. If you are considering game bird farming as a business venture, do so only after determining:
 - Present and potential markets and demand
 - Total costs, including initial investment, labor, transportation, and taxes
 - Pricing
 - Competition
 - Contract and supply arrangements

Certain management practices will take most of the guesswork out of planning a successful game bird farming operation, whatever its size or purpose.

RULES AND REGULATIONS

The state Department of Fish and Game is responsible for management of all game birds. Consequently, the rules and regulations are designed to encourage native and certain exotic species while discouraging others. States usually require that a person acquire a game breeder's license before obtaining and keeping game birds. Therefore, direct all questions about legal requirements for any phase of the game bird raising and release to the State Department of Fish and Game.

HATCHING

We strongly recommend that beginners start with day-old chicks or eggs purchased from a reputable game bird breeder who can guarantee a product is reasonably free of disease.

A list of game bird breeders is usually available from the State Department of Fish and Game.

Hatchery Equipment

Your need for a hatchery will depend on the size of the operation. Hatcheries should have concrete floors sloped to large drains in every room to facilitate cleaning. Walls and ceilings should be constructed of water-impervious materials.

Hatcheries should be well-ventilated with a system designed to provide a uniform supply of clean air in all areas. The temperature should be maintained between 65 and 80 °F (18.3 and 26.7 °C). In the summer, especially in dry areas, evaporative cooling is preferred, because it increases the humidity of the incoming air. Some heat will need to be provided in most locations during the colder months.

Adequate oxygen levels and carbon dioxide removal are necessary for embryo development, but the main function of ventilation is to control the temperature and to dilute airborne microorganisms during the hatch. In a commercial game bird hatchery, the hatcher and equipment-cleaning area should be in a separate room with its own ventilation system so that the fluff and dust from the hatch are kept away from the incubators, clean eggs, and clean equipment. For small operations, separation of incubator and hatcher may not be feasible.

Some machines are designed to operate better with two or three ages of eggs in one incubator. This makes cleaning more difficult, but you can still clean the interior surfaces of the machine before adding new eggs by removing a few trays at a time, and you can clean the hatcher after each use.

Some incubators have hatchers attached. In these cases, the room should be ventilated so as to keep as much of the dirty air as possible away from the incubator.

When you purchase an incubator or hatcher, select one that is well-constructed. The machine must have automatic temperature control within a narrow range (within +1- 25 °F or 0.15 °C is best). Other essential features for a commercial operation are automatic turning of the eggs, humidity control, and forced air movement.

Another important consideration is the ease of washing and sanitizing the cabinet. Metal or fiberglass surfaces are best. Wood is durable and a good insulator, but it is difficult to clean and nearly impossible to sterilize. Many wooden machines can be improved by coating the interior surfaces with epoxy resin. Do not use lead-based paints; lead is toxic to chicks.

Also consider the reliability of the mechanical systems, the ease of repair, and the availability of spare parts.

Care of Eggs

Always wash your hands thoroughly, preferably with disinfectant soap, before handling eggs. If eggs sweat when removed from the holding room, reduce the humidity or temperature of the room where eggs are stored. The egg-holding-room temperature may need to be varied as shown in Table 14, depending on the length of egg storage.

Table 14. Holding Room Temperature as Affected by Storage Time

Duration of Storage	Maximum Storage	Temperature
Days	°F	°C
1	70	21.1
2-4	65	18.3
5-10	60	15.6
Over10	55	12.8

Set only nest-clean eggs. Cracked, thin-shelled, misshapen, or abnormal-size eggs should not be set, because they hatch very poorly and are likely to contaminate other eggs or chicks. Eggs that have been stored do not hatch as early as fresh eggs and therefore should be preset or allowed more time to hatch. Eggs stored for 2 weeks should be preset for 10 hours: those stored for 3 weeks, 18 hours.

Fumigation

Fumigate clean eggs soon after collection and again after traying, if desired, but never between 24 and 96 hours of incubation. Hydrogen peroxide (H₂O₂) is an effective fumigant.

Incubation

Proper incubation is not difficult, but certain procedures should be followed to ensure success. First, clean the equipment. Wash incubators and hatchers with detergent solution, then rinse and fumigate them. Soak trays in detergent solution and then scrub, rinse, and fumigate them with the incubator.

After the incubator is clean, it should be started, tested, and adjusted as necessary before any eggs are set. Operate the machine for 24 hours before setting eggs. Put a record sheet on each machine, and record the wet and dry bulb temperatures at least twice a day. Table 14 specifies conditions for incubation of pheasant, partridge, and quail eggs.

Table 15. Conditions for Incubation of Pheasant, Partridge, and Quail Eggs

Machine Type	Incubation Temperature		Hatching Temperature	
	Dry Bulb	Wet Bulb	Dry Bulb	Wet Bulb
Fan Ventilated	99.5-100°F	82-86 °F	98.5 °F	90-92 °F
	(37.5-37.8 °C)	(27.8-28.3 °C)	(37 °C)	(32.2-33.4 °C)
Still Air	102-103 °F	88-90 °F	100-101°F	88-92 °F
	(38.9-39.4 °C)	(31.1-33.3 °C)	(37.8-38.3 °C)	(31.1-33.3 °C)

Wet bulb temperature is not an accurate measure of relative humidity in still-air incubators.

Always follow the manufacturer's instructions for adjusting the air vents in the incubator, but remember that some ventilation is necessary at all times to ensure proper levels of oxygen and carbon dioxide.

Eggs can be set either large end up or horizontally, but never small end up. They should be turned every 2 to 4 hours during the first two-thirds of incubation or until transfer to the hatcher, but never during the hatching period. If mechanical turning is not available, turn eggs three or more times per day (starting as early and finishing as late as possible).

When eggs are set, record the date, egg source, number set, and expected transfer and hatch dates. Attach a card with this information to the setting trays, so that each set can always be easily identified.

Examination of Eggs

Game bird eggs should be candled after 7 to 10 days of incubation and again at transfer (3 to 4 days before hatch). A strong candling light is advisable, because most species have pigmented shells that obstruct light transmission. Remove and count all eggs that are clear or contain blood rings. The eggs that are candled out (or a sample of at least 50) should be opened, examined, and classified before they are discarded.

Egg examination is most conveniently performed in a well-lighted area equipped with a sink and garbage disposal. Open eggs by breaking the large end and removing the shell and shell membranes on this end with the thumb and forefinger. Carefully open eggs that have blood rings to avoid loss of any embryo that might be present near the air cell. As the types are identified, they should be recorded.

The early candling will reveal the following types:

Clears

- True infertiles
- Fertile no development (FND): fertiles that failed to develop
- Positive development (PD): showing cellular development but not blood

Blood Rings

- Blastoderm without embryo (BWE): a blood ring appears but no embryo
- Early dead embryos

After the second candling, the eggs removed should also be examined. Most of these will be dead embryos, but you may occasionally find a live embryo, which should be dropped from the sample count, or one of the previously described types that was missed on the first candling. Record the latter on the record from the earlier candling and examination.

Transfer to Hatcher

Table 16 gives incubation periods of several game birds. Transfer eggs to the hatcher 3 or 4 days before hatch—just before pipping (breaking through the shell) starts. Lower the dry bulb temperature by 1 °F (0.3-0.5 °C) and increase the wet bulb temperature to 88-92 °F (31.1-33.3 °C); this will provide optimum hatching conditions. You may need to vary these wet bulb settings to get the correct moisture content of the eggs. Fumigation in the hatcher is not recommended unless there is a disease problem.

Table 16. Incubation Periods for Several Popular Game Birds

Bird	Days
Chinese Ring-necked Pheasant	23-24
Mongolian Ring-necked Pheasant	24-25
Red-legged Partridge	23-24
Hungarian Partridge	24-25
Bobwhite Quail	23-24
California Quail	23-24
Japanese Quail	17-18
Wild Turkey	28

When the hatch is completed, sort, count, and place the chicks in new chick boxes or plastic boxes that have been cleaned, sanitized, and equipped with new pads. Be sure that you have allowed enough time for the hatch to be completed and the chicks to dry, but don't keep the chicks in the hatcher longer than necessary, because they will become dehydrated. When 1 to 5 percent of the chicks are still wet, it is time to remove the hatch.

Record and break out all unhatched eggs as previously described. Give particular attention to the moisture (dry-down) condition and the embryo position (normal is head under right wing). There are usually some abnormal embryos with missing parts, duplications, or abnormal parts in this group. If there are significant numbers with the same abnormality, be sure to note this.

Keep a record of the results of each hatch, including the information from candling and egg examination as well as the number of chicks obtained. These records are useful in pinpointing problems when hatches are poor. Reasonable goals for most game birds are 96 percent true fertility, 93 percent candled fertility, 87 percent hatch of eggs set, and less than 3 percent cracked and unsettable eggs.

Sanitation

After removing the chicks, thoroughly clean the hatcher and trays. The hatching trays can then be returned to the hatcher and the entire unit fumigated by using the procedure described earlier.

Sanitation is always 90 percent cleaning. Disinfectants are valuable in maintaining a sanitary hatchery, but they will not compensate for a poor cleaning job. Following is a good washing procedure:

1. Empty refuse.
2. Soak in detergent solution, if necessary, to loosen dirt.
3. Wash with hot water and detergent.
4. Rinse.
5. Disinfect (steps 4 and 5 may be combined if disinfectant is nontoxic).

An equipment washing area should be provided near the hatcher(s). A reasonable arrangement for a small hatchery would be as follows:

- Room A: egg processing and traying area, egg holding room, egg fumigation cabinet, incubators, clean equipment storage area.
- Room B: hatcher(s), chick holding area, equipment washing area, outside door to refuse collection area.

BROODING

Artificial brooding of domestic poultry and game birds has been so successful that natural brooding has become obsolete. There are basically two types of brooding in common use: cool-room brooding and warm-room brooding. In the former, birds are provided with a heat source with an adjacent area held at a lower temperature. This system has several advantages including faster feathering in the chicks and easier temperature regulation. With warm-room brooding, a heating system maintains the entire house or room at the desired temperature.

Heat Sources

Many types of heat sources can be used successfully for brooding. These include heat lamps; hot water or steam pipes; or stoves that use natural gas, liquid petroleum (LP) gas, fuel oil, coal, wood, or electricity. Stoves using LP gas or natural gas are the most popular because of their economy and convenience. We recommend the hover-type gas brooder, because it is more economical to operate than the pancake type. With a hover brooder, which has more depth, less heat is lost into the room, and the cooler room temperature stimulates fast feathering in chicks.

With cool-room brooding, the temperature of the hover area is usually adjusted to 95 F (35 °C) during the first week, and then the temperature is decreased approximately 5 °F (2.8 C) per week until the room temperature is reached. Measure these temperatures at bird height near the edge of the brooding stove.

The best guide to temperature adjustment is to watch the chicks' behavior. If the temperature is too low, they will huddle under the stove, If they avoid the heated area completely, the temperature is too high.

With warm-room brooding, chicks can be started at a room temperature of approximately 90 °F'; this temperature should be decreased as they become older.

Light and Ventilation

It is important that brooding pens be properly lighted during the first week so that young chicks will learn to eat and drink. Use continuous light with an intensity of 2 or more foot-candles during the first week: after that, the light may be reduced to 12 hours per day or natural daylight.

Brooder houses or rooms containing starting batteries need to be well-ventilated to remove moisture and ammonia. If you smell ammonia or observe wet litter in the pen, ventilation is marginal or inadequate. Fans and uniform slot air intakes provide good ventilation in houses with high bird density.

Brooding Methods

Battery brooding has attractive features for some growers. Batteries are particularly suited to small groups of chicks that need to be raised separately. They are easily cleaned, and the chicks are easy to inspect. With larger hatches, battery brooding requires more labor than floor brooding, and chicks must be moved to other pens after 2 or 3 weeks.

For floor brooding, the first step in preparing a pen for new chicks is to clean the area thoroughly, including the walls and ceilings, and clean all of the equipment that will be used in the brooding pen. Then disinfect the brooding area and the equipment using an effective disinfectant. After the pen is disinfected and thoroughly dry, place 3 or 4 inches of clean litter in the pen. Shavings, peanut hulls, rice hulls, sugar cane fiber, ground corn cobs, or chopped straw are excellent litter materials. Sawdust and sand, although sometimes used, are less desirable. Litter should be free of molds and toxic materials.

Place the heating unit in position and cover the floor in this area with rough paper so that chicks can walk on it easily. A brooder ring 15 to 20 inches (37.5 to 50 cm) high, made of corrugated cardboard or 1/2-inch (1.25 cm) mesh hardware cloth, should be placed around the heat stove to form a circle approximately 18 inches (45 cm) from the edge of the stove. (For quail, finer mesh hardware cloth would be needed.) The solid corrugated cardboard ring is preferred, because it protects chicks from drafts.

Start the stove and adjust it to the correct temperature at least 1 day before chicks are to be placed under the heating unit. Place feed troughs and water fountains in the brooder ring, and fill them before chicks arrive. Allow at least 20 inches (50 cm) of eating space per 100 chicks. Some feed should also be placed in egg flats or box covers during the first 3 to 5 days to encourage chicks to eat.

Be sure to provide plenty of waterers—at least two 1-gallon (3.78-liter) fountains per 100 chicks—so that chicks will be able to find water quickly. Use watering devices of the right size to prevent chicks from falling into the water reservoir. For quail, it may be necessary to cover the water trough with hardware cloth or to place pebbles in the trough so that chicks can escape when they fall into the water.

Most healthy chicks that die during the first week do so because they fail to learn to drink. It is a good practice to dip the beak of each chick into the water as you remove it from the box and place it in the pen.

Always check young chicks after dark to be certain that none are huddled away from the heat. A light under the stove can help keep chicks under the stove at night.

GROWING GAME BIRDS

The basic principles and techniques for growing birds apply equally to most species of game birds. The successful breeder innovates to fit the needs of the specific operation.

Cages and Pens

Chukars and quail can be grown successfully in all-wire cages kept inside a building. About 1 square foot (0.023 square meter) per bird is adequate for chukars and 2 square feet (0.046 square meter) for quail.

Outside pens for growing or holding breeder stock should be constructed to permit good drainage of water from sprinklers or storms. Pens for growing birds may be of several different sizes, but their actual construction is much the same. Pens used in large commercial production are usually arranged side by side with the ends opening into a central service aisle, which is also covered to prevent escape. The support posts are 4 by 4 inches (10 by 10-cm) of redwood or treated wood placed on 8- or 10-foot (2.4 or 3.0-meter) centers. Occasionally 2 by 4-inch (5 by 10-cm) support posts are used alternately with the 4 by 4-inch (10 by 10-cm) posts.

To provide protection from the wind, the lower walls of pens should be boarded to a height of 20 to 24 inches (50 or 60 cm). The outside perimeter is made predator- and rodent-proof by burying a piece of wire netting 12 inches (30 cm) wide to a depth of 8 inches (20 cm) with the remaining 4 inches (10 cm) turning outward. Pens are commonly enclosed on the top and outsides with 2-inch (5-centimeter) wire mesh. The same size wire mesh can be used for partition between pens.

Commercial game bird growers use pens of various sizes. The number of birds put into the pen depends on pen size and on ground cover (vegetation) available. Twice as many birds can be grown in pens with adequate ground cover as in pens without any ground cover (Table 17).

Table 17. Suggested Pen Size and Bird Density

Species	Width ft	Length ft	Bird Density sq ft/bird
Pheasant	50 or 100	150	15*
	(15 or 30 m)	(45 m)	(1.35 sq m)
Chukar	50 or 100	150	10
	(15 or 30 m)	(45 m)	(0.93 sq m)
Quail	50	150	4
150 (45 m)	(15 m)	(45 m)	(0.37 sq m)

* Double the space required for each species if growing pens do not have adequate vegetative cover.

The space requirements for growing ornamental pheasants are greater than for other pheasants because of their timid behavior and elaborate feathering. More protection is provided for exotic pheasants, such as the Firebacks, Argus, Peacock pheasants, and Long-tailed pheasants. One arrangement used for exotics is a shed-type house with inside partitions that are continuous with outside runs of 10 by 20 feet (3 by 5 meters).

Cover Crop

A good cover crop helps in obtaining optimum growth and good feathering in game birds; a ground cover or herbaceous growth provides shade and protection. For many ornamental pheasants and some grouse, a selection of different conifer species placed throughout the pens is desirable.

For large or small operations, a number of wild annual grasses serve as excellent ground cover. Some annual weeds, such as pigweed, lambsquarter, millet, mustard, or vetch, grow as volunteer crops and, if properly watered and maintained, can provide excellent cover. Perennials, such as alfalfa, sweet clover, or fescue, require more attention than do most annuals and support fewer birds.

Waterers and Feeders

Waterers must provide a continuous supply of fresh, cool drinking water. Range and bowl founts are popular types used on commercial game farms. It is desirable to have a screened platform or dry well filled with rock beneath the fount to prevent puddling.

Feeders of many designs are used successfully on game farms: the size and type used depend on the farming operation. A good management practice is to keep all feeds covered. Many range feeders are designed with a sloping cover that keeps the feed or grain dry during bad weather. Open trough feeders can be used for grit and shell.

MANAGEMENT OF BREEDER STOCK

To establish a good foundation stock, it is important that the original eggs or stock come from a pullorum-free source. The potential breeder stock should be free of abnormalities (blindness, crooked toes, or malformed beak, neck, or leg bones). The birds should have good body conformation and the size and color pattern characteristic of the species.

Cages and Pens

Pheasants perform satisfactorily when housed in wire colony cages. A mating ratio of 10 hens to 1 cock is recommended in a colony pen measuring 2 feet (0.6 m) wide by 6 feet (1.8 m) long by 1½ feet (0.45 m) high.

Equipment

The same types of feeders and waterers used in the growing pens can be used for the breeders. Adequate covers on the feeders are highly recommended, especially during the wet spring months.

Nest boxes placed in protected areas within the pen greatly reduce the incidence of dirty eggs and prevent bacterial contamination. A wooden nest box 2 feet (0.6 m) wide by 6 feet (1.8 m) long by 1 foot (0.3 m) high, either subdivided into three compartments or constructed as one single walk-through unit, will serve about 24 hens. Place artificial eggs in the nests well in advance of the laying season to encourage the hens to use the nest rather than to lay eggs randomly on the ground. Low shelters placed about the pen serve as shades and escape sites for hens chased by over-aggressive males.

Care of Eggs

Proper handling and care of eggs are extremely important in maintaining hatchability. Store hatching eggs in a cool room maintained at about 50 to 60 °F (10 to 15.6 C) and 70 percent relative humidity (see Table 1). Following are recommendations for proper care of potential hatching eggs:

- Keep nest areas dry.
- Collect eggs a minimum of three times daily.

- Avoid over-filling the basket when gathering eggs.
- Don't spray insecticides or larvicides around breeder pens or the egg holding room.
- Clean eggs with slightly soiled shells with a light abrasive (sandpaper) material and fumigate soon after gathering. Don't use heavily soiled eggs for hatching. Lightly soiled eggs can also be washed.
- Store eggs to be set within 14 days large end up in open flats. Eggs to be held longer than 14 days should be placed in flats, sealed in new plastic bags after a 24-hour cool down, and turned at least twice a day.

Lighting

Game birds can be induced to lay at any time of the year provided they have been exposed to day-lengths of less than 12 hours for a minimum of 6 weeks before they are given stimulatory light. A series of incandescent lights placed above the breeder pens or pole-mounted outdoor lamps (for example, quartz iodide) can furnish the light necessary to stimulate early egg production. A time clock can be used to control the duration of light.

Some growers use a step-up lighting program: The light-day is increased to 14 hours per day, and once the birds reach peak production, the light increment is increased by 15 minutes per week until a maximum of 17 hours of light per day is attained. Never decrease the light intensity or the number of light-hours per day when egg production is desired.

Hens can be recycled to lay by first restricting the light to hours per day following the regular season. Eight weeks later, expose the birds to a stimulatory light regime of 14 or more hours per day. Hens begin to lay about 18 to 21 days after stimulatory light. Always light males 2 weeks before females to ensure good, early fertility, because males respond more slowly to a stimulatory light regime.

FEEDING GAME BIRDS

It is not essential to buy special game bird diets. Game birds thrive on poultry diets that are properly balanced in energy, amino acids, vitamins, and minerals, similar to the diets given in Table 18. Game bird or poultry diets are usually available in 50- or 100-pound (22.7- or 55.4- kg) sacks.

Game birds can be fed diets in the form of mash, crumbles, or pellets. Pellets and crumbles are made from mash and are more expensive. Pellets are usually fed to adult birds. There is little advantage in feeding pelleted diets to game birds, but they z're less dusty to handle.

Never feed laying rations to day-old game birds, because such diets cont high levels of calcium, which can be harmful to the growing chicks. Also, do not feed grain to day-old chicks. After the birds are about 4 weeks old, a part of the diet can be in the form of grain if grit is made available.

Table 18. Composition of Game Bird Diets

Item	Starter	Grower	Breeder
Alfalfa meal	7.5	5.0	5.0
Corn, ground	28.0	52.0	56.7
Meat and bone meal	8.0	0.0	0.0
Sorghum, ground	10.0	0.0	0.0
Soybean meal (45% protein)	28.0	27.5	14.7
Wheat, ground	15.0	0.0	0.0
Wheat middlings	2.0	0.0	0.0
Wheat bran	0.0	12.0	16.8
Limestone, ground	0.0	1.0	4.1
CaHPO 2H ₂ O	0.0	1.5	1.5
Salt, iodized	0.7	0.4	0.5
DL-methionine	0.3	0.1	0.2
Premix*	0.5	0.5	0.5
<u>Calculated analysis</u>			
Protein, %	23.4	19.8	15.1
Metabolizable energy (kcal/kg) (or kcal/2.2 lb)	2,720	2,660	2,570
Ca, %	1.0	0.94	2.15
Total P. %	0.76	0.76	0.74
Available P, %	0.52	0.45	0.44

* Premix should contain:

- In mg per kg (or per 2.2 lb) diet: MnSO₄ H₂O 40; ZnO, 60; vitamin B. 0.005; menadione sodium bisulfite, 2; riboflavin, 6; niacin, 40; calcium pantothenate, 20; folacin, 0.5; antioxidant, 100; antibiotic, 10

- In U—vitamin A, 5000; vitamin D₃ 1500; vitamin E, 20. An equivalent commercial premix can be used, but follow the directions of the supplier.

The simplest way to feed game birds is to buy a game bird or turkey starter ration containing about 26 to 28 percent protein and feed it for the first 6 weeks. When the birds are 7 to 14 weeks old, feed a game bird or turkey grower diet or a chicken starter diet containing about 20 percent protein. From the age of 15 weeks until market, feed a game

bird, chicken, or turkey growing diet containing about 15 percent dietary protein. When fed such diets, most game birds grow at the rate indicated in Table 19.

A turkey starter mash with 28 percent protein can be used as a diet for small flocks of game birds as shown in Table 20. Breeding birds need a good breeder ration containing about 15 to 16 percent protein. To mix your own game bird diets, use the formulas given in Table 18.

Place grit and mash in separate containers. The size of grit depends upon the size of the bird. The grit should be insoluble in dilute hydrochloric acid. Fine gravel is an acceptable substitute for purchased grit.

Do not store feed for more than 6 weeks at any time, especially in the summer. Protect the feed from rodents and insects. We suggest storing small amounts in metal garbage cans with tight lids. Growers of large flocks will need bulk feed tanks. Keep feeders clean and dry to prevent any mold growth.

Table 19. Growth Rate and Feed Consumption of Some Game Birds (mixed sexes)

	Ring-necked pheasant		Chukar partridge		Japanese quail	
Age	Cumulative weight	Cumulative feed consumed	Cumulative weight	Cumulative feed consumed	Cumulative weight	Cumulative feed consumed
wk	grams *	grams	grams	grams	grams	grams
1	41	59	32	32	23	32
2	82	154	54	90	45	65
3	136	286	100	220	73	114
4	195	450	159	368	95	180
5	264	614	210	527	109	255
6	360	865	250	730	118	335
7	436	1160	320	970	127	445
8	523	1455	370	1200	132	570
9	591	1750	504	1430	136	715
10	690	2090	435	1660	136	860
11	775	2520	480	1910	136	1020
12	840	2955	515	2200	141	1195
13	920	3385	527	2490	141	1365
14	1000	3860	545	2720	145	1480
15	1065	4320	550	2945	145	1605
16	1100	4820	568	3135	145	1735

17	1135	5320	577	3325	150	1865
18	1140	5820	590	3520	150	2020

*454 grams = 1 pound.

Table 20. Diets for Small Flocks of Game Birds *

Age	Ratio of turkey starter mash to grain
0-4 weeks	Mash only
5-8 weeks	4 to 1 (80 lb or kg mash to 20 lb or kg grain)
9-12 weeks	3 to 2(60 lb or kg mash to 40 lb or kg grain)
13-16 weeks	2 to 3(40 lb or kg mash to 60 lb or kg grain)
17 weeks to market	1 to 3(25 lb or kg mash to 75 lb or kg grain)

* Feed pasture or green chop free choice, if available, from 4 weeks to market. Feed grit free choice to all birds. For breeders, feed one part mash to one part grain plus free-choice oyster shell, grit, and green chop (if available).

DISEASE CONTROL

Most diseases affecting game birds are caused by microorganisms or viruses spread from bird to bird directly or indirectly. Some infections are airborne; others are transmitted by insects, rodents, free-tiving birds, and other animals. Diseases can also be spread by mechanical means, such as tools, beak trimmers, chick boxes, and motor vehicles. Droppings or litter from a previous flock of birds can be a reservoir of disease-producing organisms. The greatest threat to any game bird operation is disease. For this reason, you should enforce the following good management practices at all times:

- Avoid introducing live birds. Live birds are a principal means of bringing disease organisms to susceptible birds. Even though a bird may appear perfectly healthy, it may have had a disease, recovered, and then become a carrier of the disease. If new stock must be introduced, the only relatively safe way is by means of hatching eggs or day-old baby chicks.
- Buy chicks from known sources. Purchase day-old chicks from a breeder with a reputation for producing disease-free stock.
- Separate age groups. Ideally, each species of game bird should be raised separately to eliminate disease and parasite problems. When raising two or more age groups on the same premises is unavoidable, separate the groups as far as possible. During the work day, care for the youngest birds first. Chicks are more susceptible to diseases than older birds.

Vaccination

There is no general rule for vaccination of game birds for specific diseases. Generally, the need for vaccination is determined by the kinds of diseases prevalent in your area. The purpose of a vaccine is to introduce a mild form of a disease into the bird and allow the

body to produce antibodies against the organisms, thus building up an immunity. Bacterins (bacterial vaccines) do not produce infections, but will stimulate antibody production.

Sanitation

Preventative disease control is a crucial part of a successful game bird program. Many problems can be avoided if certain management practices are enforced:

- Keep brooder houses and growing pens off-limits to all visitors.
- Train employees to recognize the danger of spreading diseases from farm to farm.
- Thoroughly clean and disinfect all equipment and housing between groups of birds.
- Control predators and rodents, because they may be carriers of disease and external parasites.
- Test breeder stock annually for pullorum as a safeguard against future chick mortality.

Treatment of Disease

Should the birds appear unhealthy and mortality occur, isolate the sick birds immediately. Send a representative sample of sick live birds and some dead birds to the diagnostic laboratory closest to you. Most laboratories charge a small fee for the examination. Treat the sick birds as prescribed by the veterinarian. In acute outbreaks of disease, water medication is preferred over medication in the feed, because sick birds will often drink when they will not eat.

Understanding Diseases

Recognizing common groups of diseases and knowing how they can be prevented or controlled is an important part of a good disease management program.

Parasitic Diseases

Coccidiosis is a destructive protozoan disease that can occur in all species of game birds. It is predominantly a disease of young chicks and is characterized by symptoms of weakness, ruffled feathers, and unthriftiness. Droppings may be bloody. Affected birds are listless and show little interest in feed or water. As the disease advances, moderate to high mortality can be expected. Maintain dry litter and use a good coccidiostat in the feed or water to permit development of immunity in young growing chicks.

Blackhead is a destructive protozoan disease of pheasants, chukars, and grouse. It may spread directly through contact with contaminated feces or indirectly through the infected egg of the cecal worm, *Heterakis*. Infected birds appear droopy, stop feeding, and have a yellowish-brown stool that is watery and foamy. Acutely involved chukars may die very quickly without developing the blackhead syndrome. Several effective drugs are available to prevent or control blackhead.

Worms are often found in game birds at necropsy. Earthworms, slugs, snails, beetles, and other insects are involved in the spread of many parasitic diseases. The best protection against worms is to avoid wet spots around waterers and feeders and to provide well-drained, sloping pens. Phenothiazine and piperazine effectively control some worms.

Acute Infectious Diseases

Erysipelas is a bacterial disease that occurs most often in adult pheasants during the fall. Many deaths may occur before any symptoms are seen. Most affected birds are visibly sick for only a short period before death. General symptoms include weakness, listlessness, loss of appetite, and sometimes a yellowish or greenish diarrhea. Avoid the use of areas previously occupied by swine, sheep, or turkeys.

Fowl cholera generally strikes during the laying season or in mature birds late in winter, and causes very high death loss. It can be introduced onto the farm by wild birds, rodents, and other animals. Treatment consists of prompt cleanup of dead birds and use of antibiotics.

Viral Diseases

Newcastle is a very contagious viral disease, primarily of avian species, including most game birds. Among game birds, Newcastle is transmitted via fecal contamination, eggs, and offal of infected birds. In infected birds, the disease may be manifested by coughing and hoarseness followed by degrees of leg and wing paralysis, tremors, and twisting of the neck. There is no known effective treatment for Newcastle.

Marble spleen disease is a viral disease commonly found in pen-raised pheasants and is characterized by deaths with or without noticeable signs of illness. The most consistent internal symptoms are severe edema (fluid in tissues), enlarged grayish-tan mottled spleens, and inflammation of the lungs. There is no known treatment for this disease.

Quail bronchitis is a severe respiratory disease of quail caused by a virus-like agent. The disease affects young quail and is characterized by rapidly spreading respiratory signs (wheezing, coughing, and sneezing) and mortality ranging from 10 to 100 percent over a period of several weeks.

Fowl pox is a viral infection of most game birds characterized by many lesions (sores) on the skin and mucous membranes of the mouth and upper respiratory tract. Captive pheasants are probably similar to chickens with regard to severity and course of pox infections.

When exposure to these viruses is likely, for example, in areas of high chicken populations, vaccination is recommended. It is advisable to consult a veterinarian or poultry farm advisor before planning a vaccination program.

CONTROLLING CANNIBALISM

Cannibalism is found frequently in most chicken-like species of birds kept in captivity. This vicious habit may start as a mild form of feather or toe picking and develop into a full-scale attack on the flesh of other birds. As a consequence, the game bird industry suffers major economic losses. Birds of all breeds and ages are subject to outbreaks of cannibalism. The pheasant is more prone to cannibalize than are other species of game birds. Some factors contributing to cannibalism include:

Overcrowding. High-density housing brings the birds in close contact with one another. Picking may start as a result of boredom, idleness, and lack of adequate feeder space.

Temperature. Too high a brooding temperature may cause birds to become irate and pick one another.

Light. Bright brooder light increases activity and picking. Less picking occurs when chicks are brooded under natural daylight or artificial light of low intensity (0.5 foot-candle or less at the feed troughs).

Age. Cannibalism occurs in all age groups. Toe, beak, and feather picking are more common among baby chicks; vent, wing, and head picking are forms usually found in older birds.

Sanitation. Poor brooder-house ventilation and sanitation may induce certain irritations of the eyes and nostrils, which become prime targets for picking. Keep litter dry to prevent fecal buildup on the toes of young birds: such buildup can result in loss of toes.

Equipment. Poorly designed feeders and waterers with sharp edges can cause injuries that serve as picking points.

External parasites. Lice or mite infestations can cause itching, irritation, and picking of feathers.

Territorial aggression. Most males become very aggressive during courtship and mating. Conditions of overcrowding in range or small mating pens intensify picking.

Nutrition. The incidence of cannibalism is usually higher in flocks fed rations high in energy and low in fiber. Adding fiber in the form of oats may help reduce picking.

Cannibalism can occur under the most favorable management conditions, so daily observation of the birds' behavior is essential to detect a problem. The following management practices will help minimize problems with cannibalism:

- Provide adequate shelter and ground cover.
- Provide adequate floor or pen space for the birds.
- Provide adequate feeder space and waterers.
- Eliminate obstacles from floor or pen that may cause injury.
- Remove dead, sick, or weak birds from the flock.
- Don't introduce a few new birds into an established population.
- Avoid frightening the birds.
- Don't make sudden changes in texture of feed.
- Avoid sudden changes in temperature when moving young birds from brooder house to range.
- Use proper mechanical devices or methods for control of cannibalism:

Lighting: Use dim red or white light in brooder house.

Specs: Reduce picking and egg eating.

Hoods: Several types of hoods can be used during the growing, holding, and breeding period.

Bits: Reduce picking by preventing closure of beak.

Beak trimming: Proper removal of no more than one-third of the upper bill can greatly reduce injury due to picking. Commercial hot-blade beak trimmers used for chickens work equally well for game birds. Finger nail clippers can be used to cut and shape the bill.

RODENT AND PREDATOR CONTROL

Norway rats and house mice are universal pests. They are best controlled by exclusion rather than removal, but they seem to be able to invade even the best and tightest of brooder houses and feed storage rooms in time.

Control of rats and mice by poison baits can be difficult because of the competition offered by an abundance of attractive feeds. In such cases, traps must be used, and this can be slow, never-ending work. Because of their great differences in living and eating habits, rats and mice are controlled by different techniques and even different poisons. A common error is to consider rats and mice as one problem and try to solve it with one control effort. This usually fails.

There are many poisons that, if properly used, can control rat and mice populations. Contact your local agricultural commissioner, Cooperative Extension farm advisor, the State Department of Fish and Game, or the State Department of Food and Agriculture to find out which poisons and poisoning techniques are recommended.

Trapping rats or mice is more an art of where than how. There are many good baits: almost any food that can be placed on the trigger is effective. Runway setting without bait is sometimes more effective. For both rat and mouse traps, an enlarged bait pan made from cardboard or light screen wire greatly improves results. It is important to set traps across the paths used by rats and mice—next to walls and between obstacles. Boxes or sacks may be used to form obstacles to force the rodent to pass over the trigger. Two or more traps set close together work well where there are many rats and mice or where there are trap-shy individuals. Use plenty of traps if you are going to trap at all. If travel is overhead, rat or mouse traps can be fastened to pipes, walls, or rafters. It is not necessary to clean or boil the traps or handle them with gloves; rats and mice are accustomed to human odors.

In dealing with predators, exclusion is perhaps even more important than in protection against rodents, because even one visit by a fox, mink, racoon, bobcat, or skunk can be very costly in birds killed. Enclosed flight pens, if properly constructed, should do the job. However, the mesh ordinarily will not exclude weasels or snakes and certainly not rats and mice.

Damage to birds can result from fright if a predator outside the wire panics them, even if no entrance is made for direct killing. Therefore, some reduction of predators in the surrounding area may be necessary.

Skunks seem to be everywhere and are an important nuisance. In attacking bird flocks, skunks usually kill only one victim, and the predator can usually be identified by its clumsy mauling of the bird.

Opossums also maul their victims and also do a messy job of smashing eggs in pens if they get at them.

Weasels are very neat killers, usually biting the bird through the skull, the back of the neck, or under the wing. They don't stop with one, though: they may kill many birds in one night and place them in a neat pile.

Rats, too, are ruthless killers and, like the weasel, often pile their victims in a corner. They usually kill by slitting the bird's throat and are very slick at not disturbing the entire flock. Rats usually eat more from the carcass than do weasels, often pulling the bird partly into their burrows. Young birds and eggs will disappear completely.

Foxes don't usually kill a great number of birds at one time, and they carry off their victims.

Raccoons eat the heads off as many birds as possible. and they are persistent. Raccoons are clever, very strong, and excellent hunters.

Feral (wild) dogs and cats are a menace to any ground-dwelling wild birds. The cats are more likely to be a problem if there is sufficient heavy cover in which they can hide.

For all these predators, if control is deemed necessary, the selective method is shooting. Trapping with steel traps is effective if it can be done without endangering bird dogs or other nontarget animals, and if the operator has the right trap and knows how to use them. In many cases, a live trap is easier for an inexperienced trapper to use, and it is safer. Animals accidentally caught can be released unharmed.

PROCESSING GAME BIRDS

The procedures used to process fowl can be modified and used for most game birds. The size of equipment and degree of mechanization will depend upon the number of birds to be processed. Following is a procedure for processing game birds:

Slaughter

Hang the bird by its feet on the killing rack, sever the jugular vein behind the lower jaw. and allow the blood to drain. This method removes from 34 to 50 percent of the total blood of the body.

Picking

To remove the feathers, immerse the bird for 60 to 90 seconds in water heated to sub-scalding about 140 F (60 C). Test ease of feather removal by pulling a few tail or wing feathers. Remove feathers by hand or machine immediately after sub-scalding. A tub-type of picking machine equipped with rubber fingers on the side and bottom of the drum is preferred over the reel type of picker that requires the operator to hold each bird when removing the feathers. After the feathers are removed, scrub the carcass thoroughly to remove soiled areas and also to reduce the number of surface microorganisms.

Evisceration

Remove feet at the hock joint. Remove the oil gland on the tail: start 1 inch (2.5 cm) forward of the gland, then cut to the end of the tail. Cut the head off. Split the neck skin, starting from the shoulders and going to the end of the neck, and pull skin from the neck. Remove the trachea (windpipe) and esophagus (gullet) with the crop, and cut off the neck. Cut around the vent and gently pull until a few inches of the intestines are out. About half-way between the tip of the breast and vent make a crosswise cut about 3 inches (7.6 cm) long. Pull the vent and intestine through the cut and remove the viscera. Remove the heart, liver, and gizzard (giblets) and place them in a clean container for further processing. Remove all other organs, especially the lungs, making sure the body cavity is clean.

Packaging

Wash the carcass and giblets thoroughly. Chill in ice water kept at 40 F 4 C) for several hours. Remove from the water and drain. Place giblets in a small plastic bag, or wrap them in wax paper and place them inside the carcass. Tuck the legs of the carcass under the strip of skin left by the crosswise cut below the breast. Place the carcass in a plastic bag, draw out as much air as possible, and tie the bag with a wire tie. Air can be forced out of the plastic bag with a vacuum pump or by submerging the bag in water until it covers the carcass without entering the bag.

The dressed bird can be placed in containers and covered with crushed ice or dry-packed with CO₂ snow (dry ice) for shipment to market. (Caution: Do not handle dry ice with your bare hands, it freezes the skin quickly.)

Meat Quality

The quality of game bird meat may mean different things to different people. The present-day consumer judges quality on the basis of tenderness, moisture, and flavor. The old method of developing a “gamey” taste in game birds was to allow the bird to hang with feathers and viscera intact for several days. Federal and state regulations no longer permit birds to be “aged” in this manner, if the operation comes under the conditions where inspection is required.

Two factors affecting the quality of game bird meat are scalding and aging temperatures. The freshly cleaned carcass should be placed for several hours in slush ice (for chilling) and refrigerated. Aging time for adequate tenderization of the meat should be about 18 to 24 hours. Thereafter the meat can be cooked or frozen.

Spoilage

The processor must produce a wholesome product through proper handling and storage. Spoilage of game bird meat is due mainly to the development of microorganisms. Only a few species of psychrophilic (cold-loving) organisms cause spoilage in the meat. Freshly killed poultry contains approximately 1 to 10,000 microorganisms per square centimeter (1 square inch = 6.45 square cm). Spoilage in poultry usually occurs when the number of bacteria reaches 1 to 10 million per square centimeter. The first sign of spoilage is off-odor. Certain organisms also cause flavor changes as their numbers exceed the safe level. To help sanitize processing plants, some processors use chlorinated water to clean equipment and chill the birds.

Laws

Laws regulating the processing and sale of game bird meats differ among states. Therefore, you should check with your State Department of Agriculture (food inspection) and local agencies for requirements on the processing of game bird meats.

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“From eggyclopedia”

Cooking Functions

While eggs are widely known as breakfast entrees, they also perform in many other ways for the knowledgeable cook. Their cooking properties are so varied, in fact, that they have been called “the cement that holds the castle of cuisine together.”

Eggs can bind ingredients as in meatloaves or croquettes. They can also leaven such baked high rises as souffles and sponge cakes. Their thickening talent is seen in custards and sauces. They emulsify mayonnaise, salad dressings, and hollandaise sauce and are frequently used to coat or glaze breads and cookies. They clarify soups and coffee. In boiled candies and frostings, they retard crystallization. As a finishing touch, they can be hard cooked and used as a garnish.

Cooking Methods

There are five basic methods for cooking eggs. The basic principle of egg cooking is to use a medium to low temperature and time carefully. When eggs are cooked at too high a temperature or for too long at a low temperature, whites shrink and become tough and rubbery: yolks become tough and their surface may turn gray-green.

Eggs, other than hard-cooked, should be cooked until the whites are completely coagulated and the yolks begin to thicken.

Recipes

Baked (also known as shirred): For each serving, break and slip two eggs into a greased ramekin, shallow baking dish, or 10-ounce custard cup. Spoon 1 tablespoon half and half, light cream, or milk over eggs. Bake in preheated 325 F oven until whites are completely set and yolks begin to thicken but are not hard, about 12 to 18 minutes, depending on number of servings being baked.

Cooked in the shell (eggs in their shells cooked in water): Place eggs in single layer in a sauce and add enough water to cover at least 1 inch above eggs. Cover and quick bring just to boiling. Turn off heat. If necessary, remove the pan from the burn to prevent further boiling. Let the eggs stand, covered, in the hot water, the proper amount of time.

Hard-cooked: Let stand in hot water about 15 minutes for Large eggs. (Adjust the time up or down by about 3 minutes for each size larger or smaller.) To help prevent dark surface on the yolks, immediately run cold water over the eggs or place them in ice water until completely cooled. (Unfortunately, it is almost impossible to cook eggs to this stage at altitudes above 10,000 feet.) —see Peeling

Soft-cooked: Let stand in hot water about 4 to 5 minutes, depending on desired doneness. Immediately run cold water over the eggs or place them in ice water until cool enough to handle. To serve out of the shell, break the shell through the middle with a knife. With a teaspoon, scoop the egg out of each shell half into a serving dish. To serve in an egg cup, place the egg in the cup small-end down, slice off the large end of the egg with a knife or egg scissors, and eat from the shell with a spoon.

Fried (cooked in a small amount of fat in a pan): In a 7- to 8-inch omelet pan or skillet over medium-high heat, heat 1 to 2 tablespoons butter until just hot enough to sizzle a drop of water. (If you use a very large pan, more butter will be needed.) Break and slip two eggs into the pan. Immediately reduce the heat to low. Cook slowly until whites are completely set and yolks begin to thicken but are not hard, covering with lid, spooning butter over the eggs to baste them, or turning the eggs to cook both sides.

Steam-basted variation (a lower-fat version of fried eggs): Use just enough butter to grease a 7- to 8-inch omelet pan or skillet or substitute a light coating of vegetable pan spray and/or a nonstick pan. Over medium-high heat, heat the butter or the coated pan until just hot enough to sizzle a drop of water. Break and slip the eggs into the pan. Immediately reduce the heat to low. Cook until the edges turn white, about 1 minute. Add about 1 teaspoon water for each two eggs. (Decrease the proportion slightly for each additional egg being fried.) Cover the pan tightly to hold in steam. Cook until the whites are completely set and the yolks begin to thicken but are not hard.

Poached (eggs cooked out of the shell in hot water, milk, broth or other liquid): In a saucepan or deep omelet pan, bring to 3 inches of water or other liquid to boiling. Reduce the heat to keep the water gently simmering. Break cold eggs, one at a time, into a custard cup or saucer or break several into a bowl. Holding the dish close to the water's surface, slip the eggs, one by one, into the water. Cook until the whites are completely set and the yolks begin to thicken but are not hard, about 3 to 5 minutes. With a slotted spoon, lift out the eggs. Drain them in a spoon or on paper towels and trim any rough edges, if desired.

Scrambled (yolks and whites beaten together before cooking in a greased pan): For each serving, beat together two eggs, 2 tablespoons milk, and salt and pepper to taste until blended. In a 7- to 8-inch omelet pan or skillet over medium heat, heat 2 teaspoons butter until just hot enough to sizzle a drop of water. Pour in the egg mixture. As the mixture begins to set, gently draw an inverted pancake turner completely across the bottom and sides of the pan, forming large soft curds. Continue until the eggs are thickened and no visible liquid egg remains. Do not stir constantly.

Cooking Terms

Certain terms or phrases occur with regularity in egg recipes. Here are many of them along with an explanation.

Cook until knife inserted near center comes out clean: Baked custard mixtures are done when a metal knife inserted off-center comes out clean. The very center still may not be quite done, but the heat retained in the mixture will continue to cook it after removal from the oven. Cooking longer may result in a curdled and/or weeping custard. Cooking a shorter period may result in a thickened but not set custard.

Cook until just coats a metal spoon: For stirred custard mixtures, the eggs are cooked to the proper doneness when a thin film adheres to a metal spoon dipped into the custard. This point of coating a metal spoon is 20 to 30 degrees below boiling. Stirred custards should not boil. The finished product should be soft and thickened but not set. Stirred custards will thicken slightly after refrigeration.

Slightly beaten: Use a fork or whisk to beat eggs just until the yolks and whites are blended.

Well-beaten: Use a mixer, blender, beater, or whisk to beat eggs until they are light, frothy, and evenly colored.

Thick and lemon-colored: Beat yolks at high speed with an electric mixer until they become a pastel yellow and form ribbons when the beater is lifted or they are dropped from a spoon, about 3 to 5 minutes. Although yolks can't incorporate as much air as whites, this beating does create a foam and is important to airy concoctions such as sponge cakes.

Add a small amount of hot mixture to eggs/egg yolks: When eggs or egg yolks are added to a hot mixture all at once, they may begin to coagulate too rapidly and form lumps. Therefore, stir a small amount of the hot mixture into the yolks to warm them and then stir the warmed egg yolk mixture into the remaining hot mixture. This is called tempering.

Room temperature: Some recipes call for eggs to be at room temperature before eggs are to be combined with a fat and sugar. Cold eggs could harden the fat in such a recipe and the batter might become curdled. This could affect the texture of the finished product. Remove eggs from the refrigerator about 30 minutes before using them or put them in a bowl of warm water while assembling other ingredients. For all other recipes, however, use eggs straight from the refrigerator. —see Separated

The following cooking terms apply specifically to egg whites.

Separated: Fat inhibits the foaming of egg whites. Since egg yolks contain fat, they are often separated from the whites and the whites beaten separately to allow them to reach their fullest possible volume. Eggs are easiest to separate when cold, but whites reach their fullest volume if allowed to stand at room temperature for about 30 minutes before beating.

Many inexpensive egg separators are available. To separate, tap the midpoint of the egg sharply against a hard surface. Holding the egg over the bowl in which you want the whites, pull the halves apart gently. Let the yolk nestle into the cuplike center of the separator and the white will drop through the slots into the bowl beneath.

Drop one egg white at a time into a cup or small bowl and then transfer it to the mixing bowl before separating another egg. This avoids the possibility of yolk from the last egg getting into several whites. Drop the yolk into another mixing bowl if needed in the recipe or into a storage container if not.

Add cream of tartar: Egg whites heat to greater volume than most other foods including whipping cream, but the air beaten into them can be lost quite easily. A stabilizing agent such as cream of tartar is added to the whites to make the foam more stable. Lemon juice works much the same way. —see Cream of Tartar

Add sugar, 1 to 2 tablespoons at a time: When making meringues and some cakes, sugar is slowly added to beaten egg whites. This serves to increase the stability of the foam. Sugar, however, can retard the foaming of the whites and must be added slowly so as not

to decrease the volume. Beat the whites until foamy, then slowly beat in the sugar. —see Meringue

Stiff but not dry: Beat whites with a mixer, beater, or whisk just until they no longer slip when the bowl is tilted. (A blender or food processor will not aerate them properly.) If egg whites are underbeaten, the finished product may be heavier and less puffy than desired. If egg whites are overbeaten, they may form clumps which are difficult to blend into other foods in the mixture and the finished product may lack volume.

Stiff peaks form: Stiff but not dry.

Soft peaks or piles softly: Whites that have been beaten until high in volume but not beaten to the stiff peak stage. When beater is lifted, peaks will form and curl over slightly.

Gently folded: When combining beaten egg whites with other heavier mixtures, handle carefully so that the air beaten into the whites is not lost. It's best to pour the heavier mixture onto the beaten egg whites. Then gradually combine the ingredients with a downward stroke into the bowl, across, up and over the mixture motion, using a spoon or rubber spatula. Come up through the center of the mixture about every three strokes and rotate the bowl as you are folding. Fold just until there are no streaks remaining in the mixture. Don't stir because this will force air out of the egg whites. If you have a stand mixer, put the mixing bowl on the turntable for easier turning as you fold.

Copper Bowl

—see Cooking Equipment, bowls

Cream of Tartar

An acid ingredient which stabilizes beaten egg whites. As a rule of thumb, use ¼ teaspoon cream of tartar per egg white or 1 teaspoon per cup of egg whites. For meringues, use ¼ teaspoon cream of tartar for each two egg whites. —see Cooking Terms

Cream Puff

A light, but rich, hollow pastry puff which may be filled with a sweet filling for dessert or with a savory one such as chicken salad for a main dish.

Called choux pastry after the French word for cabbage, cream puffs do come out of the oven looking like little cabbages.

A high proportion of egg is necessary to form the structure of the cream puff. The egg yolk helps to emulsify the fat.

Crepe

A light, thin, egg-rich pancake. The word is French, but the crepe is so versatile that you'll find it in many other languages. It's a Russian blini, a Jewish blintz, a Chinese egg roll, a Greek krep, or a Hungarian palascinta. Depending on the filling, it can be an appetizer, a main dish, or a dessert. Crepe batter should be the consistency of heavy cream. Letting it rest for an hour or so after mixing allows the flour to absorb moisture and lets the air bubbles dissipate so that the crepe does not have tiny holes. Crepes can be

made in advance, stacked, wrapped, and refrigerated for a few days, then reheated to serve. For longer storage, double wrap and freeze.

Curdling

Also known as syneresis or weeping. When egg mixtures such as custards or sauces are cooked too rapidly, the protein becomes over-coagulated and separates from the liquid leaving a mixture resembling fine curds and whey. If curdling has not progressed too far, it may some times be reversed by removing the mixture from the heat and stirring or beating vigorously.

To prevent syneresis or curdling, use a low temperature, stir—if appropriate for the recipe—and cool quickly by setting the pan in a bowl of ice or cold water and stirring for a few minutes.

The term curdling is usually used in connection with a stirred mixture such as custard sauce, while weeping or syneresis are more often used with reference to pie meringues or baked custards. —see Meringue, soft meringue

Custard

A cooked mixture of eggs and milk with sugar and flavoring sometimes added. There are two basic kinds of custard—stirred and baked.

Stirred custard, also known as soft custard, custard sauce or, erroneously, boiled custard, is cooked on top of the range to a creamy, but pourable, consistency. Although some cooks like to cook the mixture in a double boiler over hot water, a heavy saucepan over low heat works as well. Stirred custard is eaten as a pudding or served over cake or fruit.

Baked custard is cooked in a water bath in the oven and has a firm, but delicate, gel-like consistency. It is a dessert in itself or it may serve as a base for toppings and sauces. Unsweetened baked custard can become a quiche or timbale.

The usual custard proportions are one egg plus 2 tablespoons sugar for each cup of milk. This is the minimum ratio of eggs to milk which will produce a properly thickened custard, although as many as four eggs may be used and the sugar may be increased to 4 tablespoons. Increasing the sugar makes the custard less firm and lengthens the cooking time. Increasing the egg makes the custard more firm and shortens the cooking time.

Two egg yolks may be substituted for one whole egg. Two egg whites will also thicken the custard as much as one whole egg, but the characteristic color and flavor will be missing.

Recipes

Soft (Stirred) Custard Sauce

(Makes about 3 ½ cups)

4 eggs OR 8 egg yolks

1/2 cup sugar

1/4 teaspoon salt

2½ cups milk

1 1/7 teaspoons vanilla

In large saucepan, beat together eggs, sugar, and salt. Stir in milk. Cook over low heat, stirring constantly, until mixture is thick enough to coat a metal spoon with a thin film or reaches at least 160 F, about 15 to 20 minutes. Remove from heat. Stir in vanilla. Cool quickly by setting pan in bowl of ice or cold water and stirring for a few minutes. (Over cooking will cause the custard to curdle.) Cover and chill thoroughly.

Baked Custard

(Makes 6 servings)

4 eggs

1/2 cup sugar

1 1/2 teaspoons vanilla

1/8

1/4 teaspoon salt

3 cups milk, heated until very hot

Ground nutmeg or cinnamon, optional

In medium bowl, beat together eggs, sugar, vanilla, and salt until well blended. Stir in milk. Place six (6-ounce) custard cups or 1 1/2-quart casserole in large baking pan. Pour egg mixture into custard cups. Sprinkle with nutmeg, if desired. Place pan on rack in preheated 350 °F oven. Pour very hot water into pan to within 1/2 inch of top of custards. (The water bath, also called a bain marie, promotes even cooking.) Bake until knife inserted near center comes out clean, about 25 to 30 minutes for custard cups or about 35 to 40 minutes for casserole. (Time bake carefully. Too long a baking time will curdle the custard. Too short a time will prevent the custard from setting.) Remove promptly from hot water. Cool on wire rack about 5 to 10 minutes. Serve warm or chilled.

Daily Reference Values (DRVs)

A new term similar to RDIs for food components not covered by RDIs. Some DRVs are based on reference calorie intakes of 2,000 (average needed by postmenopausal women, women who exercise moderately, teenage girls, and sedentary men) and 2,500 calories (adequate for young men) and others on dietary recommendations suggested by some health and nutrition groups. Daily Reference Values are intended to serve as a yardstick for food comparisons, not as a strict dietary prescription. Based on your own calorie intake and activity level, your needs may be more or less than the DRVs. There is no DRV for sugars. Other DRVs are:

- Calorie Intake: 2,000*: 2,500 calories,
- Total Fat: No more than 30 percent of total calories (less than 65; 80 grams),
- Saturated Fat: No more than 10 percent of total calories (less than 20; 25 grams),
- Unsaturated Fat**. No more than 20 percent of total calories (less than 40; 50 grams),

- Cholesterol: Less than 300 milligrams,
- Total Carbohydrate: At least 55 percent of total calories (300: 375 grams),
- Dietary Fiber: 11.5 grams per 1,000 calories (25; 30 grams),
- Protein**: 10 percent of calories for those over 4 (50 grams; 63 grams),
- Sodium: Less than 2,400 milligrams, and
- Potassium**: 3,500 milligrams.

*Due to space limitations, food labels will show percentages of DRVs based on a 2,000-calorie diet. Some large labels may also show DRVs (but not percentages) for a 2,500-calorie diet.

**Listing percentages of DRVs for this nutrient on food labels is optional. —see Daily Values (DVs), Reference Daily Intakes (RDIs), Recommended Dietary Allowances (RDAs), U.S. Recommended Daily Allowances (US. RDAs)

Daily Values (DVs)

A term on new food labels that represents age-adjusted average levels of protein, fat, cholesterol, carbohydrate (including dietary fiber and sugars), vitamins, and minerals recommended for various groups of people of different ages and sexes as established by the National Academy of Sciences.

Since they are averages, many Daily Value figures are lower than the familiar U.S. RDAs which represented the highest values for each nutrient. In some cases, DVs are also lower due to new nutritional evidence considered by the National Academy. DVs serve as a yardstick for food comparisons and not as a strict dietary prescription. —see Daily Reference Values (DRVs), Reference Daily Intakes (RDIs), Recommended Dietary Allowances (RDAs), U.S. Recommended Daily Allowances (US. RDAs)

Decorating Eggs

The egg's shape has often inspired artists. It has been the palette for one of the most intriguing of folk arts in many cultures.

There is literally no end to the creative possibilities for individual expression on an eggshell. Eggs can be painted or colored with crayons or felt-tipped pens, turned into funny faces, topped with fantastic hats, trimmed with feathers or sequins, or simply dyed in an endless variety of hues. However you decide to do it, decorating eggs is fun for grown-ups as well as for kids.

Eggs to be decorated may be either hard-cooked eggs or empty eggshells. The hard-cooked variety is a bit more sturdy for children to use, while empty shells are best if you're making an egg tree or want to keep the eggs on display for a considerable time.

If eggs are to be dyed, washing in a mild detergent solution helps to remove the oil coating so that the color adheres more evenly.

Commercial egg dyes are available, especially at the Easter season. Food coloring works, too, but some craftsmen prefer to experiment with their own colors from nature. Eggs simmered in water to cover for 15 minutes with 1 tablespoon of white vinegar for each cup of water and your choice of one of the materials below will produce a shade of the color

shown. You'll have to use your own judgment about quantities. This is an art—not a science!

Material	Color
Fresh beets, cranberries, radishes, or frozen raspberries	Pinkish red
Yellow onion skins	Orange
Orange or lemon peels, carrot tops, celery seed, or ground cumin	Delicate yellow
Ground turmeric	Yellow
Spinach leaves	Pale green
Yellow Delicious apple peels	Green-gold
Canned blueberries or red cabbage leaves	Blue
Strong brewed coffee	Beige to brown
Dill seeds	Brown-gold
Chili powder	Brown-orange
Purple or red grape juice or beet juice	Grey

However you decide to color your hard-cooked eggs, follow these tips if you'd like to eat them later: Wash your hands thoroughly before handling the eggs at every step including cooking, cooling, dyeing, and hiding. If you won't be coloring your eggs right after cooking them, store them in their cartons in the refrigerator. Don't color or hide cracked eggs.

When coloring the eggs, use water warmer than the eggs and refrigerate them in their cartons right after coloring them. Refrigerate them again after they've been hidden and found and don't eat cracked eggs or eggs that have been out of refrigeration for more than 2 hours. If you plan to use hard-cooked eggs as a centerpiece or other decoration and they will be out of refrigeration for many hours or several days, cook extra eggs to refrigerate for eating and discard the eggs that have been left out as a decoration. —see *Cooking Methods, hard-cooked.* Blown-out Eggshells; Easter Eggs

Deviled Eggs

Also known as stuffed eggs. Hard-cooked eggs are peeled and cut in half. The yolks are removed, mixed with a moistener such as mayonnaise and seasonings, and then piled back into the whites. The word 'devil' originally referred to the combination of spices, including dry mustard, with which the eggs were highly seasoned.

Dried Eggs

—see *Egg Products*

Easter Eggs

Eggs were colored, blessed, exchanged, and eaten as part of the rites of spring long before Christian times. Even the earliest civilizations held springtime festivals to welcome the sun's rising from its long winter sleep. They thought of the sun's return from darkness as an annual miracle and regarded the egg as a natural wonder and a proof of the renewal of life. As Christianity spread, the egg was adopted as a symbol of Christ's Resurrection from the tomb.

For centuries, eggs were among the foods forbidden by the church during Lent, so it was a special treat to have them again at Easter. In Slavic countries, baskets of food including eggs are traditionally taken to church to be blessed on Holy Saturday or before the Easter midnight Mass, then taken home for a part of Easter breakfast.

People in central European countries have a long tradition of elaborately decorated Easter eggs. Polish, Slavic, and Ukrainian people create amazingly intricate designs on the eggs. They draw lines with a wax pencil or stylus, dip the egg in color and repeat the process many times to make true works of art. Every dot and line in the pattern has a meaning. Yugoslavian Easter eggs bear the initials XV" for "Christ is Risen," a traditional Easter greeting.

The Russians, during the reign of the tsars, celebrated Easter much more elaborately than Christmas, with Easter breads and other special foods and quantities of decorated eggs given as gifts. The Russian royal family carried the custom to great lengths, giving exquisitely detailed jeweled eggs made by goldsmith Carl Fabergé from the 1880's until 1917.

In Germany and other countries of central Europe, eggs that go into Easter foods are not broken, but emptied out. The empty shells are painted and decorated with bits of lace, cloth, or ribbon, then hung with ribbons on an evergreen or small leafless tree. On the third Sunday before Easter, Moravian village girls used to carry a tree decorated with eggshells and flowers from house to house for good luck. The eggshell tree is one of several Easter traditions carried to America by German settlers especially those who became known as Pennsylvania Dutch. They also brought the fable that the Easter bunny delivered colored eggs for good children.

Easter is an especially happy time for children and many Easter customs are for their enjoyment. Hunting Easter eggs hidden around the house or yard is a universal custom and so are egg-rolling contests. —see Blown-Out Eggshells, Decorating Eggs, Games

Egghead

A highbrow or one with intellectual interests or pretensions. The name is probably related to the idea that a high forehead is a sign of intelligence.

Egg Money

Before World War II, most eggs were produced by small flocks that scratched their way around the barnyard. The farmer's wife usually supervised the operation. The money received from the sale of the eggs was considered hers.

Eggnog

A beverage of eggs, milk, sugar, and flavoring. Rich cream may take the place of part or all of the milk. Spirits are often added at holiday time. Eggnog may be served hot or cold, but it should be prepared as a stirred custard. The name may come from the noggin or small cup in which it was served in earlier days. —see Custard, Raw Egg

Egg Nutrition Center

The nutrition organization for the egg industry. ENC was created in 1984 to provide scientifically correct information on egg nutrition and accompanying health issues. The Center is a cooperative project of the American Egg Board and the United Egg Producers. Located in Washington, D.C., the Egg Nutrition Center communicates regularly with industry, government, the media, and health and nutrition communities. Since cholesterol is an important public health and nutrition concern, much of the Center's activity focuses on this complicated issue. A panel of independent scientists advises the Egg Nutrition Center and provides interpretation of current scientific literature. The Center is dedicated to providing balanced, accurate information on the complex issues surrounding cholesterol and heart disease.

Egg Products

Processed and convenience forms of eggs for commercial, foodservice, and home use. These are refrigerated liquid, frozen, dried, and specialty products. Many egg products are comparable in flavor, nutritional value, and most functional properties to shell eggs. Convenience foods such as cake and pudding mixes, pasta, ice cream, mayonnaise, candies, and bakery goods utilize egg products. Egg products are frequently preferred to shell eggs by commercial bakers, food manufacturers, and the foodservice industry because they have many advantages including convenience: labor savings; minimal storage requirements; ease of portion control; and product quality, stability, and uniformity.

Surplus shell eggs, as well as those produced particularly for the purpose, are used in making egg products. In 1992, about 20 percent of the total U.S. egg production went into egg products. About 1/4 billion pounds of all types of egg products are produced each year in the U.S.

Since passage of the Egg Product Inspection Act (EPIA) in 1970, all plants that make egg products operate under continuous USDA inspection. Under this Act, pasteurization of all egg products is mandatory.

Shell eggs used for egg products must be clean and of edible interior quality.

Processing egg products: When shell eggs are delivered to the breaking plant, they are put into refrigerated holding rooms. Before breaking, they are washed in water at least 20 degrees warmer than that of the egg and spray-rinsed with a sanitizing agent. They may be moist, but not wet, when they are broken.

Refrigerated liquid products: Eggs are broken and separated, if necessary, by machines and the liquid egg put into covered containers. At this point, they may be shipped to bakeries or other outlets for immediate use or to other plants for further processing. Shipment is in sanitary tank trucks maintaining temperatures

low enough to assure that the liquid egg arrives at its destination at 40 °F (4 °C) or less. Whole sale and foodservice refrigerated products are also available in 30-pound cans and 4-, 5-, 8- and 10-pound cartons.

Retail consumer refrigerated products are generally available in one- or two-pack cartons containing 8 to 16 ounces each.

Keep liquid egg products under refrigeration. Shelf life can vary, so check the label of the products you are using. Once opened, use immediately.

Frozen egg products: These include separated whites and yolks; whole eggs; blends of whole eggs and yolks or whole eggs and milk; and these same blends with sugar, corn syrup, or salt added. Salt or carbohydrates are sometimes added to yolks and whole eggs to prevent gelation during freezing. Frozen egg products are generally packed in 30-pound cans and in 4-, 5-, 8- and 10-pound pouches or waxed or plastic cartons. Some retail consumer products are available frozen in one- or two- pack cartons containing 8 to 16 ounces each.

Frozen egg products should be kept frozen or refrigerated until used. They should be thawed under refrigeration or under cold running water in unopened containers. After defrosting, they should be refrigerated and used within 3 days.

Dried or dehydrated egg products: Known also as egg solids, these have been produced in the United States since 1930, but demand was minimal until World War II when production reached peak levels to meet military and lend-lease requirements. While quality of the early product was poor, it has now been greatly improved. Dried egg products are used in a wide number of convenience foods and in the foodservice industry. With the exception of some camping supply stores, dried eggs are not available at present on the retail market. Dried eggs for foodservice use are sold in 6-ounce pouches, number 10 cans, and 3-pound and 25-pound poly-packs. For commercial use, 25- and 50-pound boxes and 150-, 175-, and 200-pound drums are available.

Unopened dried egg products should be stored in a cool (below 70 °F). dry place away from light. Opened containers should be tightly sealed and refrigerated.

Specialty egg products: Egg specialties processed for the foodservice industry include wet- pack and dry-pack pre-peeled hard-cooked eggs—either whole, wedged, sliced, chopped or pickled; long rolls of hard-cooked eggs; frozen omelets; egg patties; quiche and quiche mix; frozen French toast; frozen scrambled egg mix in boilable pouches; frozen fried eggs; frozen pre-cooked scrambled eggs; freeze-dried scrambled eggs; and other convenience menu items.

In the near future, innovative egg products such as ultra-pasteurized liquid egg, free-flowing frozen egg pellets, and modified atmosphere packaging for hard-cooked eggs are expected to become available.

Many specialty egg items are reaching the retail market as well, including frozen omelets and mixes; frozen scrambled eggs, French toast, and quiche; and specially coated shelf-

stable hard-cooked eggs. —see Breakers, Egg Products Inspection Act, Egg Roll, Restricted Eggs

Egg Products Inspection Act

A program to assure wholesome shell eggs and egg products in the marketplace. Passed by Congress in December, 1970, the Egg Products Inspection Act is administered by the USDA and imposes specific inspection requirements for two categories of eggs—egg products and shell eggs. The Act gives enforcement authority to the USDA and to the Food and Drug Administration. Federal agriculture officials or state officials acting on behalf of USDA visit egg packers and hatcheries at least every 3 months to see that they are in compliance with the law. Firms which transport, ship, or receive shell eggs and egg products may also be checked periodically. Under the Egg Products Inspection Act, plants that break, dry, and process shell eggs into liquid, frozen, or dried egg products must operate under the continuous inspection program of the USDA. An official inspector must be present at all times when eggs are being processed. The law applies to all egg-breaking plants, regardless of size, and to those selling products locally, across state lines, and through foreign commerce. Disposition of undesirable shell eggs is controlled to prevent their entering consumer food channels. —see Egg Products, Grading, Restricted Eggs

Egg Roll

1. An elongated hard-cooked egg processed for the foodservice industry. When sliced, every piece is a center cut for attractive service.
2. An Asian specialty made by wrapping an egg-rich dough around a savory filling and deep-fat frying. In this country, egg rolls are often served as appetizers.
3. The annual Easter event on the White House lawn.

Egg Salad

A popular combination of chopped hard-cooked eggs, a moistener such as mayonnaise, and seasonings, often served as a sandwich filling or in scooped-out tomatoes or lettuce cups.

Egg Substitutes

Liquid egg products formulated as substitutes for whole eggs. Such products contain egg white. The yolk is replaced with other ingredients such as nonfat milk, tofu, vegetable oils, emulsifiers, stabilizers, antioxidants, gum, artificial color, minerals, and vitamins.

Equinox

Either of the two times each year when the sun crosses the equator and day and night are of equal length everywhere. During the spring (vernal) equinox (about March 21), it is said that an egg will stand on its small end. Although some people have reported success, it is not known whether such results were due to the equinox or to the peculiarities of that particular egg. Others insist that some eggs will stand on their small ends at any time of the year.

Expiration Date

A date on an egg carton beyond which the eggs should not be sold. —see Carton Dates

Fat

A concentrated source of food energy containing 9 calories per gram. In addition to supplying energy, fat aids in the absorption of certain vitamins, enhances flavor, aroma, and mouthfeel of food, and adds satiety to the diet.

Fatty acids, the basic chemical units of fat, are either saturated, monounsaturated, or polyunsaturated.

Saturated fatty acids are found primarily in fats of animal origin (meat and dairy products) and are usually solids at room temperature. Exceptions are some vegetable oils (palm, palm kernel, and coconut) which contain large amounts of saturated fatty acids. Saturated fat increases blood cholesterol.

Monounsaturated fatty acids are found in fats of both plant and animal origin. They tend to decrease blood cholesterol levels. Polyunsaturated fatty acids are found primarily in fats of plant origin and in fats of fatty fish. They also tend to decrease blood cholesterol levels.

An increasing number of nutrition professionals are recommending the reduction of total dietary fat to 30 percent or less of total calories and that dietary fat be distributed equally among saturated, monounsaturated, and polyunsaturated fats.

A Large egg contains only about 5 grams of fat—about 1.5 grams saturated and 2.5 grams unsaturated. Egg recipes which are high in fat and/or saturated fat can often be significantly lowered in fat content by making changes in “traditional” recipe ingredients and cooking methods. —see Cholesterol

Fertile Eggs

Eggs which can be incubated and developed into chicks. Fertile eggs are not more nutritious than nonfertile eggs, do not keep as well as nonfertile eggs, and are more expensive to produce. Fertile eggs may contain a small amount of male hormone, but there are no known advantages. —see Germinal Disc

Foam

Air bubbles trapped in liquid albumen when egg white is beaten. When egg white is beaten, it becomes foamy, increases six to eight times in volume and stands in peaks. When the foam is heated, the tiny air cells expand, and the egg protein coagulates around them, giving permanence to the foam. Egg white foam is responsible for the structure of souffles, angel food cake, puffy omelets, and meringue.

Egg whites reach their greatest volume if allowed to stand at room temperature for about 30 minutes before beating.

Fat inhibits the foaming of egg whites, so be sure beaters and bowls are clean and that there is no trace of yolk in the whites. Use only metal or glass bowls because plastic bowls tend to absorb fat.

If egg whites are underbeaten, the volume of the finished product will be less than desired. Overbeaten whites form clumps which are difficult to blend with other ingredients, and because overbeaten egg whites lack elasticity, they cannot expand properly when heated. The finished product may be dry, of poor volume, or may even collapse.

The addition of an acid ingredient helps to stabilize the foam. The most commonly used acid ingredient is cream of tartar (½ teaspoon for each one to two whites), although some recipes call for lemon juice or vinegar.

Since salt decreases foam stability, it is best to add it to other recipe ingredients.

Egg white foams should be combined with other ingredients immediately, before they have time to drain or shrink.

Egg yolk and whole egg will also form foams, but the volume is much less than the foam of beaten white. —see Angel Food Cake. Cooking Terms, Meringue

Food Guide Pyramid

Based on nutrition research, the USDA has grouped all of the foods we eat according to the nutritional contributions they make. For a balanced diet that includes all the food groups in good proportions, follow these daily recommendations:

Breads, grains, and cereals: 6 to 11 servings

Vegetables: 3 to 5 servings

Fruits: 2 to 4 servings

Meat and meat alternates: 5 to 7 ounces

Milk and milk products: 2 to 3 servings

Fats, oils, and sweets: 53 to 93 grams (4½ to 7½ tablespoons) fat at most:

2 to 6 tablespoons added sugar at most.

Eggs are included in the meat and meat alternates group because, after mother's milk, they provide the highest quality protein available. One egg = 1 ounce of lean meat, fish, or poultry. —see Biological Value, Daily Reference Values (DRVs), Nutrient, Protein

Formation

A hen requires about 24 to 26 hours to produce an egg. Thirty minutes later, she starts all over again.

The reproductive system of the hen consists of the ovary, the organ where the yolk develops, and the oviduct, where the egg is completed. The ovary is attached to the back about halfway between the neck and the tail. The oviduct, a tubelike organ approximately 26 inches long, is loosely attached to the backbone between the ovary and the tail. Most female animals have two functioning ovaries, but the hen uses only one, the left. The right ovary and oviduct remain dormant.

Ovary: A female chick is born with a fully formed ovary containing several thousand tiny ova, or future yolks. These begin to develop, one at a time, when the pullet reaches sexual maturity. Each yolk is enclosed in its own sac or follicle.

The follicle contains a highly developed system of blood vessels which carry nourishment to the developing yolk. At ovulation, the follicle ruptures to release the yolk into the oviduct. A double-yolked egg is the result of two yolks being released at the same time. Rupture occurs at the stigma line, an area of the follicle which has no blood vessels. —see Blood Spots

Oviduct: The infundibulum, also known as the funnel, captures the ovulated yolk. This is where fertilization, if it occurred, would take place. After about 15 minutes, the yolk passes along to the magnum. Here, in approximately 3 hours, the albumen is deposited around the yolk. As the albumen is formed, the yolk rotates, twisting the albuminous fibers to form the chalazae.

The next sight of activity is the isthmus where the two shell membranes are formed in about 1 1/4 hours. The egg has now reached its full size and shape. It next passes into the shell gland and after 19 hours, the shell, shell color, and bloom are laid down. The next stop for the egg is the vagina. In the vagina, the egg is flipped so the large or round end of the egg enters into the cloaca (the junction of the digestive, urinary, and reproductive tracts), and the egg is expelled from the vent. Laying of the egg is known as oviposition.

During formation, the egg moves through the oviduct small end first. Just before laying, it is rotated and laid large end first. A young hen lays small eggs. The size increases as she gets older. —see Composition

Free-range Eggs

True free-range eggs are those produced by hens raised outdoors or that have daily access to the outdoors. Due to seasonal conditions, however, few hens are actually raised outdoors. Some egg farms are indoor floor operations and these are sometimes erroneously referred to as free-range operations. Due to higher production costs and lower volume per farm, free-range eggs are generally more expensive. The nutrient content of eggs is not affected by whether hens are raised free-range or in floor or cage operations. —see Production

Freezing Eggs

If you receive a windfall of eggs far beyond your capacity to use within a few weeks, they can be frozen—not in the shell, of course. Freeze only clean, fresh eggs.

Whites: Break and separate the eggs, one at a time, making sure that no yolk gets in the whites. Pour them into freezer containers, seal tightly, label with the number of egg whites and the date, and freeze. For faster thawing and easier measuring, first freeze each white in an ice cube tray and then transfer to a freezer container.

Yolks: Egg yolks require special treatment. The gelation property of yolk causes it to thicken or gel when frozen. If frozen as is, egg yolk will eventually become so gelatinous it will be almost impossible to use in a recipe. To help retard this gelation, beat in either 1/2 teaspoon salt or 1 1/2 teaspoons sugar or corn syrup per 1/4 cup egg yolks (four yolks). Label the container with the number of yolks, the date, and whether you've added salt (for main dishes) or sweetener (for baking or desserts).

Whole eggs: Beat until just blended, pour into freezer containers, seal tightly, label with the number of eggs and the date, and freeze.

Hard-cooked: 1-lard-cooked yolks can be frozen to use later for toppings or garnishes. Carefully place the yolks in a single layer in a saucepan and add enough water to come at least 1 inch above the yolks. Cover and quickly bring just to boiling. Remove from the heat and let stand, covered, in the hot water about 15 minutes. Remove with a slotted spoon, drain well, and package for freezing. 1-lard-cooked whole eggs and whites become tough and watery when frozen, so don't freeze them.

To use frozen eggs: Thaw frozen eggs overnight in the refrigerator or under running cold water. Use yolks or whole eggs as soon as they're thawed. Once thawed, whites will beat to better volume if allowed to sit at room temperature for about 30 minutes.

- Substitute 2 tablespoons thawed egg white for one Large fresh white.
- Substitute 1 tablespoon thawed egg yolk for one Large fresh yolk.
- Substitute 3 tablespoons thawed whole egg for one Large fresh egg.

Use thawed frozen eggs only in dishes that are thoroughly cooked.

French Toast

Egg-soaked bread, sauteed in butter. Another name for this breakfast specialty is pain perda, French for lost bread. Thrifty cooks of the 15th century developed this trick for using nearly stale bread which would otherwise be lost.

Freshness

How recently an egg was laid has a bearing on its freshness but is only one of many factors. The temperature at which it is held, the humidity, and the handling all play a part. These variables are so important that an egg one week old, held under ideal conditions, can be fresher than an egg left at room temperature for one day. The ideal conditions are temperatures that don't go above 40 °F (4 C) and a relative humidity of 70 to 80 percent.

Proper handling means prompt gathering, washing, and oiling of the eggs within a few hours after laying. Most commercially produced eggs reach supermarkets within a few days of leaving the laying house. If the market and the buyer handle them properly, they will still be fresh when they reach the table.

It is not true that freshness can be judged by placing an egg in salt water. A carefully controlled brine test is sometimes used to judge shell thickness of eggs for hatching purposes but has no application to freshness of table eggs.

How important is "freshness"? As an egg ages, the white becomes thinner and the yolk becomes flatter. These changes do not have any great effect on the nutritional quality of the egg or its functional cooking properties in recipes. Appearance may be affected, though. When poached or fried, the fresher the egg, the more it will hold its shape rather than spread out in the pan. On the other hand, if you hard cook eggs that are at least a week old, you'll find them easier to peel after cooking and cooling than fresher eggs. — see Storing

Fried Egg

—see Cooking Methods, fried

Frittata

An unfolded Italian version of the omelet. A frittata cooks on top of the stove until almost set. It is finished off under the broiler or turned over or the pan may be removed from the heat, covered and allowed to stand until the top of the omelet is completely cooked.

A frittata may contain any combination of cooked vegetables, seafood, meat, poultry, grain, or cheese you like.

Games

The egg's fragility probably accounts for its popularity in games down through the centuries.

Egg Hunt: Hiding colored or decorated eggs around the house or garden for youngsters to find has long been an Easter morning tradition.

Egg Toss: Whenever groups gather for picnic games, an egg toss is as predictable as a sack race. Partners line up in two rows facing each other. Every member on one side tosses a raw egg across. After each successful catch, the players step backward, adding to the difficulty of the next catch. This is repeated until all but one egg is broken. The couple with the last unbroken egg wins.

Egg Rolling: Many variations of egg rolling contests and games can be played. The egg rolling that takes place on the lawn of the White House or Capitol building has become an American tradition started, according to legend, by Dalley Madison in the early 1800's. Similar events are held in many other locations throughout the country.

The United States, however, can hardly take credit for inventing the custom—egg rolling was mentioned in a Latin treatise in 1684. In England and Scotland, children roll eggs downhill and the last child with an unbroken egg is the winner. In another version of egg rolling, the players push the egg to the finish line using only their noses. Very similar are egg races in which the players try to send emptied eggshells across the finish line by fanning them with a piece of cardboard or by blowing them. Since eggs are not round, winning is not as easy as it might seem!

Egg Tapping: Many countries continue the age-old ritual of egg-tapping or egg-shackling. For example, Greeks form a circle and tap scarlet eggs, one against the other. The one finishing with an unbroken egg may claim all the other eggs. (The trick is protecting as much of the egg as possible with your fingers.)

Pace Egging: In English villages until modern times, children carried on an old sport called pace-egging. The name comes from Pasch, the word that means Easter in most European countries. This derives from Pesach, the Hebrew Passover, which falls at the same time of the year. Pace-eggers are much like Halloween trick-or-treaters. They go from house to house in costume or with paper streamers and bright ribbons attached to their clothes. Faces blackened or masked, they sing or perform skits and demand pace-eggs, either colored hard-cooked eggs or substitutes such as candy and small coins.

—see Decorating Eggs, Easter Eggs