

Meat processing

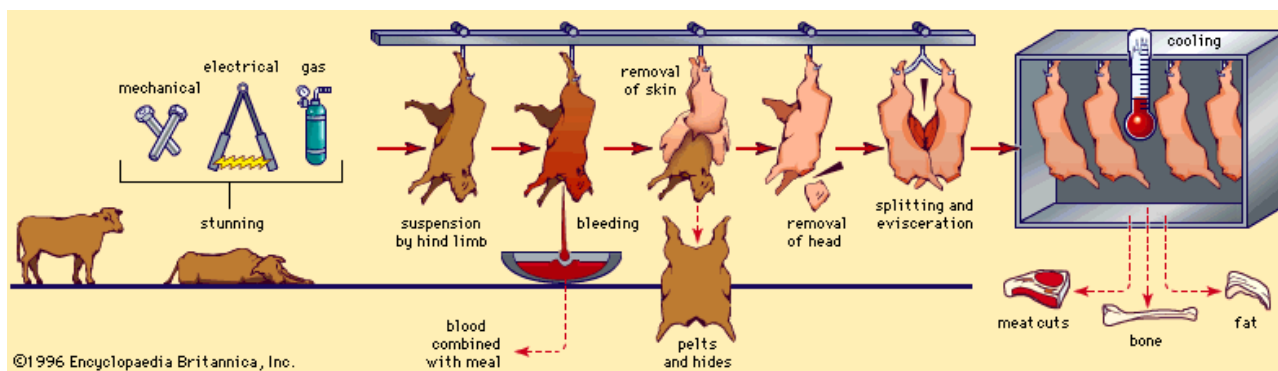
WRITTEN BY:

- H. Russell Cross
- R. Paul Singh

Meat is the common term used to describe the edible portion of animal tissues and any processed or manufactured products prepared from these tissues. Meats are often classified by the type of animal from which they are taken. Red meat refers to the meat taken from mammals, white meat refers to the meat taken from fowl, [seafood](#) refers to the meat taken from fish and shellfish, and [game](#) refers to meat taken from animals that are not commonly domesticated. In addition, most commonly consumed meats are specifically identified by the live animal from which they come. [Beef](#) refers to the meat from cattle, [veal](#) from calves, [pork](#) from hogs, [lamb](#) from young sheep, and [mutton](#) from sheep older than two years. It is with these latter types of red meat that this section is concerned.

Livestock Slaughter Procedures

The slaughter of livestock involves three distinct stages: preslaughter handling, stunning, and slaughtering. In the United States the humane treatment of animals during each of these stages is required by the Humane Slaughter Act.



Preslaughter handling

Preslaughter handling is a major concern to the livestock industry, especially the pork industry. [Stress](#) applied to livestock before slaughter can lead to undesirable effects on the [meat](#) produced from these animals, including both PSE and DFD (see [Postmortem quality problems](#)). Preslaughter stress can be reduced by preventing the mixing of different groups of animals, by keeping livestock cool with adequate ventilation, and by avoiding overcrowding. Before slaughter, animals should be allowed access to water but held off feed for 12 to 24 hours to assure complete bleeding and ease of evisceration (the removal of internal organs).

Stunning

As the slaughter process begins, livestock are restrained in a chute that limits physical movement of the animal. Once restrained, the animal is stunned to ensure a humane end with no pain. Stunning also results in decreased stress of the animal and superior meat quality.

The three most common methods of stunning are mechanical, electrical, and carbon dioxide (CO₂) gas. The end result of each method is to render the animal unconscious. Mechanical stunning involves firing a bolt through the skull of the animal using a [pneumatic device](#) or pistol. Electrical stunning passes a current of electricity through the brain of the animal. CO₂ stunning exposes the animal to a mixture of CO₂ gas, which acts as an anesthetic.

Slaughtering

After stunning, animals are usually suspended by a hind limb and moved down a conveyor line for the slaughter procedures. They are typically bled (a process called sticking or [exsanguination](#)) by the insertion of a knife into the [thoracic cavity](#) and severance of the [carotid artery](#) and [jugular vein](#). This method allows for maximal blood removal from the body. At this point in the process, the slaughtering procedures begin to differ by species.

Hogs

Hogs are usually stunned by electrical means or CO₂ gas. Mechanical stunning is not generally used in hogs because it may cause serious quality problems in the meat, including blood splashing (small, visible hemorrhages in the muscle tissue) in the lean and PSE meat.

Hogs are one of the few domesticated livestock animals in which the skin is left on the [carcass](#) after the slaughter process. Therefore, after bleeding, the carcasses undergo an extensive cleaning procedure. First they are placed for about five minutes in a scalding tank of water that is between 57 and 63 °C (135 and 145 °F) in order to loosen hair and remove dirt and other material (called scurf) from the skin. The carcasses are then placed in a dehairing machine, which uses rubber paddles to remove the loosened hair. After dehairing, the carcasses are suspended from a rail with hooks placed through the gambrel tendons on the hind limbs, and any residual hair is shaved and singed off the skin.

An exception to this procedure occurs in certain specialized hog slaughter facilities, such as “whole hog” sausage slaughter plants. In whole hog sausage production all the skeletal meat is trimmed off the carcass, and therefore the carcass is routinely skinned following exsanguination.

After cleaning and dehairing, heads are removed and carcasses are opened by a straight cut in the centre of the belly to remove the viscera (the digestive system

including liver, stomach, bladder, and intestines and the reproductive organs), pluck (thoracic contents including heart and lungs), kidneys, and associated fat (called leaf fat). The intestines are washed and cleaned to serve as natural casings for sausage products. The carcasses are then split down the centre of the backbone into two “sides,” which are placed in a cooler (called a “hot box”) for approximately 24 hours before fabrication into meat cuts.

Cattle, calves, and sheep

These animals are usually stunned mechanically, but some sheep slaughter facilities also use electrical stunning. The feet are removed from the carcasses before they are suspended by the Achilles tendon of a hind leg for exsanguination. The carcasses are then skinned with the aid of mechanical skinners called “hide pullers.” Sheep pelts are often removed by hand in a process called “fisting.” (In older operations, hides and pelts are removed by knife.) The hides (cattle and calves) or pelts (sheep) are usually preserved by salting so that they can be tanned for leather products. Heads are removed at the first cervical vertebra, called the atlas joint. Evisceration and splitting are similar to hog procedures, except that kidney, pelvic, and heart fat are typically left in beef carcasses for grading. Carcasses are then placed in a cooler for 24 hours (often 48 hours for beef) prior to fabrication into meat cuts.

By-products

By-products are the nonmeat materials collected during the slaughter process, commonly called offal. Variety meats include livers, brains, hearts, sweetbreads (thymus and pancreas), fries (testicles), kidneys, oxtails, tripe (stomach of cattle), and tongue. Bones and rendered meat are used as bone and meat meal in animal feeds and fertilizers. Gelatin, obtained from high-collagen products such as pork snouts, pork skin, and dried rendered bone, is used in confections, jellies, and pharmaceuticals. Intestines are used as sausage casings. Hormones and other pharmaceutical products such as insulin, heparin, and cortisone are obtained from various glands and tissues. Edible fats are used as lard (from hogs), tallow (from cattle), shortenings, and cooking oils. Inedible fats are used in soap and candle manufacturing and in various industrial grease formulations. Lanolin from sheep wool is used in cosmetics. Finally, hides and pelts are used in the manufacture of leather.

Meat Inspection

Meat inspection is mandatory and has the mission of assuring wholesomeness, safety, and accurate labeling of the meat supply. Although inspection procedures vary from country to country, they are centred around the same basic principles and may be performed by government officials, veterinarians, or plant personnel. For example, in the United States meat inspection is administered through the Food Safety and Inspection Service of the United States Department of Agriculture (USDA-FSIS) and is composed of several distinct programs. In general, these programs are representative of the basic inspection procedures used throughout the world and include antemortem

inspection, postmortem inspection, reinspection during processing, sanitation, facilities and equipment, labels and standards, compliance, pathology and epidemiology, residue monitoring and evaluation, federal-state relations, and foreign programs.

Antemortem and postmortem inspection

Antemortem inspection identifies animals not fit for human consumption. Here animals that are down, disabled, diseased, or dead (known as 4D animals) are removed from the food chain and labeled “condemned.” Other animals showing signs of being sick are labeled “suspect” and are segregated from healthy animals for more thorough inspection during processing procedures.

Postmortem inspection of the head, viscera, and carcasses helps to identify whole carcasses, individual parts, or organs that are not wholesome or safe for human consumption.

Reinspection during processing

Although previously inspected meat is used in the preparation of processed meat products, additional ingredients are added to processed meats. Reinspection during processing assures that only wholesome and safe ingredients are used in the manufacture of processed meat products (e.g., sausage and ham).

Sanitation

Sanitation is maintained at all meat-packing and processing facilities by mandatory inspection both before and during the production process. This includes floors, walls, ceilings, personnel, clothing, coolers, drains, equipment, and other items that come in contact with food products. In addition, all water used in the production process must be potable (reasonably free of contamination).

Facilities and equipment

Facilities and equipment are inspected to ensure that they meet safety requirements. Facilities must have sufficient cooling and lighting, and rails from which carcasses are suspended must be high enough to assure that the carcasses never come in contact with the floor. Equipment must be able to be properly cleaned and must not adversely affect the wholesomeness of the products.