MEAT CUTTING AND PROCESSING FOR FOOD SERVICE

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Meat Cutting and Processing for Food Service

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CHAPTER OVERVIEW

1: Meat Science and Nutrition

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1.1: Introduction to Meat Science and Nutrition

Learning Objectives

- Describe the composition and characteristics of meat
- Describe the chemical changes associated with slaughter
- Describe the aging, blooming, and tenderness factors of meat
- Describe diseases associated with meat
- Describe the nutritional value of meat
- Describe the handling and storage of meat and meat products

Introduction

Meat science and the research and studies conducted both independently and in conjunction with many industry stakeholders over the last 40 years have provided a greater understanding of the relationship between animal-handling techniques prior to harvesting (slaughter) and the quality of the meat produced. As well, improved practices during and after the harvesting of animals, especially in large processing plants, have contributed to progress in the meat industry. These include improvements to refrigeration and storage, aging of meats (mainly beef and lamb carcasses), and transportation. Additionally, the slaughter process itself has changed over time, and now beef and veal animals are usually stunned with a captive bolt gun (with a retractable bolt penetrating the brain), rendering the animals unconscious prior to bleeding.

All of these developments have improved the end product, which ultimately ends up at local meat stores and restaurants. However, even today a small amount of product can still be found to be substandard (mainly due to faster processing methods in larger plants). In order to understand some of the factors that can alter the quality of the end product, especially tenderness, colour, flavour, and nutritional value of meat (protein), we must turn to science.

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1.2: Composition of Meat

Meat muscle, which is what we eat, is made of **fibres**, bound together with connective tissue, that are mainly linked to other groups of muscles or directly to the animal's bone structure. Muscle contains 60% to 70% moisture, 10% to 20% protein, 2% to 22% fat, and 1% ash, depending on type and species.

On larger bones (such as the shanks of larger animals), it is easy to see the muscle groups in bundles (if cut on the cross-section) surrounded by **collagen** fibres and a much heavier connective tissue (**elastin**) that forms a thin covering (called **silverskin**) separating muscle groups or a **tendon** at the ends of the muscle group (Figure 1). The tendon is attached to the bone at or near a bone joint (Figure 2).

Figure 1. Crosscut of beef shank showing muscle fibres.

Figure 2. Bone with tendon attached (left) and muscle removed (right).

The muscle fibres are known as **myofibrils**, which are composed of thick and thin filaments arranged in a repeating pattern alongside the other myofibrils (Figure 3). One unit of a bundle is called a **sarcomere**, or little muscle. The thick filaments are the contractile protein **myosin**. The thin filaments, known as **actin**, contain two other proteins called **troponin** and **tropomyosin** that help regulate muscle contraction.

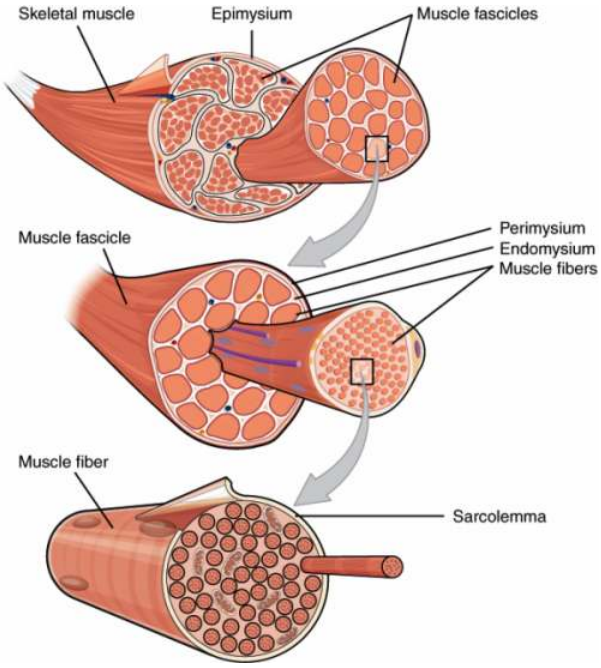

Figure 3. 1007 Muscle Fibres (large) by OpenStax College – Anatomy & Physiology, Connexions Website. June 19, 2013. Licensed under CC BY 3.0 via Wikimedia Commons

The amount of connective tissue in meats and its **solubility** (the degree to which it is dissolved during the cooking process) can directly influence the tenderness of meat muscle. For example, as an animal ages, it has more connective tissue and therefore experiences **cross-linking**, an increase in connective tissue that becomes highly insoluble. This is why older animals are usually tougher and younger animals are more tender.

The most tender cuts from a beef animal, such as tenderloin, strip loin, and top sirloin from the beef hind quarter, can be prepared using a **dry heat cooking method**. In contrast, tougher cuts from the front quarter of beef that have more collagen connective tissue, such as the blade, shoulder, and shank, require a **moist heat** or **combination cooking method**, which breaks down collagen into a **gelatin** form when cooked in water at temperatures of over 80°C (176°F). The collagen dissolves in the water, which is why stocks made from animal bones and connective tissue have body and thicken when cooled. (We discuss cooking potential and tenderness in more detail later in the book.)

Heavy collagen, such as tendons at the ends of muscle groups and the protein elastin, does not break down under this cooking process and is therefore insoluble in water. In addition to silverskin and tendons, there is a specific piece of heavy collagen (also known as the **backstrap)** that is yellow in colour and located along the upper backbone from the base of the skull to the end of the rib cage in all meat animals (Figure 4).

Figure 4. Backstrap location on lamb rack.

Fats are deposited all over certain parts of the animal and contribute to the shelf life, flavour, and colour of dry aged meats. Fat in beef meat muscle is called **intramuscular fat** and appears as a pattern of wavy lines, commonly known as **marbling** (Figure 5).

Figure 5. Poster indicating marbling in USDA Beef grades. [image description]

Well-marbled meat usually indicates that the cooked meat will be juicy and tender, and the amount of marbling is a factor that is used to determine the grade of beef, specifically for the A grades. Beef grading is discussed in detail later in the book.

Image descriptions

Figure 5. Poster indicating marbling in USDA Beef grades.

A guide to understanding the fat content of USDA grades of beef.

- USDA Prime: More marbling—or fine threads of fat—in USDA Prime beef result in more flavor, moisture and tenderness. Marbling also helps keep beef moist during cooking, making USDA Prime ideal for broiling, roasting, grilling and other

high-heat methods. Some cuts. like tenderloin (filet) crd top uade (flat iron). cre often tender regardless of how much marbling they have.

- USDA Choice: USDA Choice beef has less marbling than Prime, but still retains enough fat to stay moist through most high-heat cooking methods like braising, roasting or grilling.
- USDA Select: Beef with less marbling, like USDA Select, should be cooked slowly. Using marinades or moist heat methods like steaming or stewing will help ensure flavor & tenderness.

Return to Figure 5

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1.3: Chemical Changes Associated with Slaughter

Prior to harvesting (slaughter), animals are vulnerable to stresses that can and do alter their **pH (potential hydrogen)**. pH is measured on a scale of 0 to 14 (Figure 6).

- pH above 7 = alkaline
- pH of 7 = neutral
- pH below 7 = acid

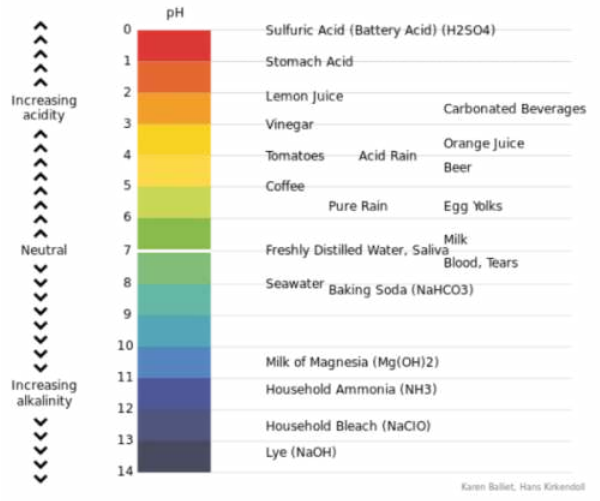

Figure 6. Potential Hydrogen, pH Chart

These changes are most likely to occur with cattle (beef cattle in particular) and pigs, and can cause discolouration that is visible in the finished product. Therefore, it is important to understand how these changes occur and how they may affect product presentation, colour, and flavour.

The amount of stress animals suffer depends on how they are handled before harvesting. For example, when animals are selected for harvesting, they may be separated from the herd, rested overnight, then loaded on a truck to be driven to the harvesting plant. Sometimes the animals have to be transported vast distances, especially in Canada. Once unloaded at the plant, they are rested, hopefully with the same group of animals they have been transported with. All these sudden changes are stressful to the animals, and each step of the process must be carefully handled. Excessive heat, dehydration, cramped conditions, and strange surroundings have a negative effect on most animals, with some finding the process more arduous than others.

At the time of slaughter, animals are moved from their holding pens into a specially designed S-shaped approach chute that helps to keep the animals calm. This then leads the animal into a tight holding box where it is stunned, bled, then winched up for skinning, eviscerating, splitting, and washing followed by rapid cooling in a special holding cooler.

Example: *Grandin Livestock Handling System*

The key to minimizing stress is to handle the animals as quickly and gently as possible to ensure that their pH remains stable prior to death—around 6.5 (neutral) and dropping to about 5.6 to 5.2 **post mortem** (after death) during the first 24 hours of cooling, when the carcass temperature is forced down to 4°C (40°F).

All the factors outlined above have some effect on the animal's pH. As the animal ceases to breathe, and as blood leaves the animal with the heart still pumping, about 50% of the blood is removed. It takes about four to six minutes before the heart ceases to beat. As the pH begins to drop below 6.5, **lactic acid** is produced, increasing the **acidity.** Lactic acid serves as a preservative, lessening deterioration of the carcass until the temperature of the muscles reaches 4°C (40°F).

At this point, **rigor mortis** (the stiffening of the muscles in death) begins to set in. This usually takes between 12 and 24 hours depending on the size of the carcass and amount of exterior fat covering.

There are three stages to rigor mortis:

1. **Pre-rigor:** The muscle fibres begin to shorten due to the depletion of adenosine triphosphate (ATP), causing the muscles to become less extendable while hanging under load. With less oxygen available, the myosin and actin proteins form actomyosin after death occurs. The actomyosin produces a **cross bridge** between the actin and myosin filaments. In the living animal, these cross bridges are broken during the relaxation phase of a normal contraction cycle (e.g., movement such as walking). However, after death (post mortem), cross bridges are formed permanently as the muscles shorten.
2. **Rigor maximum:** The muscle fibres reach maximum shortening, resulting in stiff muscles. The cross bridges are now firmly in place.
3. **Rigor resolution:** The now stiff muscle fibres begin to extend again and stretch out to almost their original length. As this extension occurs, the cross bridges create a tearing effect. This phase results in **tenderization** during **dry aging** (hanging) or **wet aging** (storing in **vacuum packaging**) of carcass meat and is most noticeable in prime meat cuts from the short loin, sirloin, and 7-bone rib (prime rib) of beef. Another chemical process develops during this phase in which the still-living cells begin to produce lactic acid. Lactic acid is normally removed by the circulatory system of living animals; however, in rigor resolution it remains in the muscles, causing the pH to drop until the core temperature of the carcass reaches 4°C (40°F).

Rigor mortis takes different times to activate depending on the size of the animal and, in some cases, the species (Table 1).

Table 1- Length of time required for rigor mortis to activate

Species	Time for Rigor Mortis to Activate
Beef	6 to 12 hours
Lamb	6 to 12 hours
Pork	15 minutes to 3 hours
Turkey	Less than 1 hour
Chicken	Less than half an hour
Fish	Less than 1 hour

To further understand the three stages of rigor mortis in relation to meat tenderness, consider the following example: A beef animal has endured a stressful separation from its home farm and a prolonged road trip to the harvesting plant. During the trip, the animal became very dehydrated, thus arriving at the plant in a weakened and agitated state, and could not be settled down prior to slaughter.

In this example, the animal's pH could be above 7 (neutral) into the alkaline part of the pH scale (8-14) before harvest. This could cause the carcass (post mortem) to never reach rigor resolution, remaining in the rigor maximum stage, where the muscle fibres are at maximum stiffness. Therefore, the carcass would remain tough even after the normal dry or wet aging process.

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1.4: Aging of Meat Carcasses

The overall time for dry aging carcass meats is dictated by the quality and performance of the refrigeration used, the overall condition and handling of the carcass at the time of harvesting, and the hygiene standards of the harvesting plant. For example, while stored at 1°C (33°F), the following species would take varying amounts of time to reach approximately 80% of maximum tenderness:

- Beef: 9 to 14 days
- Lamb: 7 to 14 days
- Pork: 4 to 10 days

Note: Wet-aged (vacuum-packaged) beef can be aged much longer (up to 30 days). Lamb and pork can also be stored longer as a wet-aged product but not quite as long as beef.

Toughness and Age

Both the age of the animal at the time of processing and the post mortem aging affect its toughness. Toughness can be divided into two types:

1. **Background toughness:** More cross links are found in older animals, making the meat tougher. Cross links refer to elastin and collagen rings that hold muscle fibres in place. As animals age, more elastin rings are formed. Also, the more exercised muscles of the animal, such as shanks and shoulders, have more elastin rings regardless of age.
2. **Actomyosin or myofibril toughness:** This toughness is caused by the overlap of thick and thin muscle filaments.

Post mortem aging at the resolution stage of rigor mortis helps eliminate actomyosin toughness, but not background toughness. Table 2 shows the ideal age of animals for processing different types of meat. Animals processed older than the age indicated will have increased levels of background toughness.

Table 2 Approximate processing ages of different animals

Meat type	Approximate age of animal at processing
Beef	1.5 to 2.5 years
Veal	Less than 1 year
Baby veal	3 to 6 months
Pork	6 months
Lamb	3 to 11 months
Poultry	3 to 6 weeks

Use of Electrical Stimulation to Speed Up the Aging Process

Electrical stimulation (ES) is a method of accelerating the normal decline of pH onset post mortem. In Canada, it is used mainly on lamb carcasses to enhance the tenderization process and protect from **cold shortening**. Cold shortening can occur with smaller carcasses and refers to cooling too rapidly, preventing the rigor resolution stage to be reached. ES is used to kick-start the rigor maximum stage to reach the rigor resolution stage, which improves meat tenderness and maintains the bright red colour and muscle firmness.

The standard voltage for ES is 504 volts at 3 amps. If used immediately after stunning, ES can be applied at lower voltage. However, higher voltage is more effective. If ES is delayed for one hour after stunning, a massive 1,600 volts is required to kick-start the process.

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1.5: Meat Fibres and Tenderness Factors

Under cross-sectional inspection, muscles from different parts of the animal's body display bundles of fibres that appear as irregularly shaped polygons. The bundle size and thickness of the **connective tissue septa** determine the texture of the muscles: those with small bundles and thin septa have a fine texture, and those muscles with larger bundles and more connective tissue with thick septa have a coarser texture.

The finer the texture the more precision of movement from the muscle, such as tenderloin (Figure 7). The coarse-textured muscles, such as shanks and shoulders (Figure 8), are the heavy working muscles of the body that support the full weight of the animal and therefore require less precision of movement.

Figure 7 Fine-textured meat shown on beef tenderloin.

Figure 8 Coarse-textured meat shown on beef shoulder pot roast.

Science can help explain why some muscles on a beef animal are more tender than others. There are actually three types of skeletal muscle, known as **twitch fibres**, with differing speeds of movement and with different colours:

1. Fast glycolytic (white): These are fast twitch fibres; they are found in skeletal muscle, such as shanks, shoulders, and hips, and are known as "voluntary muscles." They require no oxygen and they move faster.

2. Fast oxidative (red): These are slow twitch fibres; they are found in the diaphragm, heart, arteries, and veins, and are known as “involuntary muscles.” They require oxygen to operate and they move slowly.
3. Slow oxidative (red/white intermediate): These are slow/fast twitch fibres; they are found in precision muscles, such as the tenderloin and strip loin, that don’t need to move as fast as skeletal muscles.

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1.6: Meat Colour

The post mortem colour development of meat varies greatly from one species to another, with variations in fresh beef being very prominent. Beef shows a range of colour from first being cut to the end of its shelf life (about three days). Typical meat colour for different species is shown in Table 3.

Table 3 Typical colour of meat from different species

Species	Colour
Beef	Bright cherry red
Fish	Pure white to grey-white or pink to dark red
Horse	Dark red
Lamb and mutton	Light red to brick red
Pork	Greyish pink
Poultry	Grey-white to dull red
Veal	Brownish pink

Meat colour is significant to consumer acceptance of products. The bright red colour of good quality beef, sockeye salmon, and young lamb are naturally appealing, whereas the paler colours of veal and other fish species are less appealing to many (although more sought after by some ethnic groups). Dark meats such as horse are more popular in Quebec and European countries. Mutton (sheep over 12 months of age with darker flesh) appeals to an even smaller range of customers.

Factors Affecting Colour

Use of Muscles

Poultry provides a good opportunity to see and learn about the differences in meat colour. Meat cutters and cooks may often be asked why different parts of a chicken have **white meat** and other parts have **dark meat**, or why duck or game birds have mostly dark meat.

The colour of the meat is determined by how the muscle is used. Upland game birds, such as **partridge** and grouse, that fly only for short bursts have white breast meat. In contrast, ducks and geese and most other game birds that fly long distances have exclusively dark meat. In domestic poultry (chickens and turkeys), there is a difference between breasts (white meat) and thighs and drumsticks (dark meat).

Note: Chicken thighs, even when fully cooked, may have a reddish tinge and blood seepage from the thigh bone. This is normal; however, inexperienced customers may interpret this as a sign of not being cooked properly.

Proteins

Meat colour is associated with two proteins: **myoglobin** (in the muscle) and **hemoglobin** (in the blood). When animals are no longer alive and air comes in contact with the meat, myoglobin reacts with oxygen in an attempt to reach a state of equilibrium, at which point no further changes occur. As this process happens, the meat colour goes through three stages and three colours that are easy to see, especially on freshly cut beef meats.

1. Purplish red (myoglobin): occurs immediately after a **steak** is sliced.
2. Cherry red (oxymyoglobin): occurs several minutes after cutting and after exposure to oxygen.
3. Brown (metmyoglobin): occurs when the iron in the myoglobin is oxidized, which usually takes about three days after cutting. (You may see steaks with this colour in the discount bin at a supermarket. The brown colour doesn't mean there is anything wrong with the product; in fact, purchasing meat at this stage is a great way to stock up on cheaper steaks for the freezer.)

Oxygen

Oxygen plays two important roles, which affect the colour in opposite ways. As soon as meat is cut, oxygen reacts with the myoglobin and creates the bright red colour associated with oxymyoglobin. This will continue to develop until the iron in the myoglobin oxidizes to the point of the **metmyoglobin** stage.

Oxidation can also occur when iron in the meat binds with oxygen in the muscle. This can often occur during the processing of round steak from the hip primal and can be identified by the rainbow-like colours that appear from the reflection of light off the meat surface. The condition will remain after the product is cooked and can often be seen on sliced roast beef used in sandwich making. This condition does not alter the quality of the meat; however, it is generally less attractive to consumers.

Age

The pale muscles of veal carcasses indicate an immature animal, which has a lower myoglobin count than those of more mature animals. Young cattle are fed primarily milk products to keep their flesh light in colour. However once a calf is weaned and begins to eat grass, its flesh begins to darken. Intact males such as breeding bulls have muscle that contains more myoglobin than females (heifers) or steers (castrated males) at a comparable age.

Generally, beef and lamb have more myoglobin in their muscles than pork, veal, fish, and poultry. Game animals have muscles that are darker than those of domestic animals, in part due to the higher level of physical activity, and therefore they also have higher myoglobin.

Preventing Discolouration

Maintaining the temperature of fresh meat near the freezing point (0°C/32°F) helps maintain the bright red colour **(bloom)** of beef meats for much longer and prevents discolouration.

Meat should be allowed to bloom completely (the bloom usually reaches its peak about three or four days after cutting) or be wrapped on a meat tray with a **permeable** wrapping film as in supermarket meat displays. If portioned steaks are to be vacuum packed, doing so immediately after cutting (but before the bloom has started) will allow the steaks to bloom naturally when removed from the vacuum packaging.

Certain phases of meat processing can also trigger discolouration. Oxidation browning (metmyoglobin) can develop more rapidly than normal if something occurs to restrict the flow of oxygen once the bloom has started but has not been allowed to run its full course. The two most common examples are:

- Cut meat surfaces stay in contact too long with flat surfaces such as cutting tables, cutting boards, or trays.
- Meat is wrapped in paper (which means there is no further exposure to air and therefore no oxygen, which speeds up the browning effect).

The browning effect will occur naturally once the meat is exposed to oxygen.

There are two other types of discolouration that commonly occur with beef and pig meat. Although the cause of both types occurs before death (**ante mortem**), the actual change does not show up until after death (post mortem). The discolouration is a result of chemical reactions in the animal's body due to stresses, known as **pre-slaughter stress syndrome (PSS)**.

PSS can result in two different types of discolouration: PSE and DFD.

PSE (pale, soft, and exudative) occurs mainly in pigs (and in some cases has been found to be genetic). PSE is brought about by a sudden increase of lactic acid due to the depletion of glycogen before slaughter, which in turn causes a rapid decline in the pH post slaughter. The visible signs of PSE can be detected by the trained eye in the pork loin primal, where the flesh appears much paler than normal. The muscle meat is softer and may be very sloppy and wet to the touch and leaking meat juices, a result of a high proportion of free water in the tissues.

Although product with PSE is safe to eat, its shelf life is limited and it may become tougher sooner if overcooked. Products with PSE have limited use as fresh products but are used to manufacture cooked products such as formed ham and certain sausage varieties with a recommended limit of 10% (i.e., one part PSE to nine parts of regular meat), due to the high water content.

DFD (dark, firm, and dry) occurs mainly in beef carcasses but sometimes in lamb and turkey. In the meat industry, these carcasses are referred to as **dark cutters**. Unlike PSE meat, DFD meat shows little or no drop in the pH after slaughter. Instead, there may be an increase of stress hormones, such as **adrenaline**, released into the bloodstream. Consequently, **glycogen** (muscle sugar) is depleted before slaughter due to stresses. This decreases the lactic acid, which in turn affects the pH, causing it to not drop fast enough after slaughter. Therefore, the muscle meat, typically in the hip area of the carcass, may become very dry and dark.

Even after the carcass is aged and the meat has been processed and displayed, the dark appearance remains and bloom will not occur. In addition, the meat may also feel sticky to the touch, which limits shelf life. DFD meat is generally considered unattractive to the consumer; however, the meat remains edible and is still suitable for use in cooked products and sausage emulsions but should be limited to 10% (one part DFD to nine parts of regular meat).

Listed below are some causes of DFD that should be avoided:

- Transferring animals to strange surroundings (kill plant) and holding them for too long
- Treating animals roughly prior to and during transport (e.g., using cattle prods)
- Overcrowding cattle during shipping
- Mixing cattle with other animals they are not used to
- Preventing animals from having sufficient rest at the slaughterhouse prior to harvesting
- Dehydrating animals (not giving them enough water) prior to slaughter
- Causing over-excitement, pain, hunger, excessive noise, smell of blood
- Exposing animals to temperature extremes during transportation
- Shipping stress-susceptible animals, such as intact males (bulls), during severe weather

Note: DFD can occur anywhere between 12 and 48 hours prior to an animal's slaughter.

Imperfections and Abnormalities in Meat

Even though meats arriving at their final destination (point of sale) have usually been approved and inspected, the product still requires further checks prior to sale and eating in case abnormal meat inconsistencies were missed in the inspection process. Some of these are caused by injuries or disease that occurred while the animal was alive, while others are naturally occurring parts of the animal's body (glands in particular) that are removed prior to or during the cutting process.

Some examples are given here.

- **Abscesses** and **cysts**: infected or non-infected tumours from old injuries that are imbedded in muscles and sometimes close to bones (Figure 9).

Figure 9. Cyst in beef short loin.

- **Blood spots and clots**: usually from more recent injuries and also found imbedded in muscles or between muscle seams or on or near bone joints.
- **Fibrous tissue**: scar tissue, usually from very old injuries, with the appearance of white fatty seams or thin strands tightly bound together, making the muscle tough and unsightly.

- **Lymph nodes** and **glands**: lymph nodes are glands in the throat and back of the tongue that give a good indication of the general health of the animal; these are inspected on the animal carcass at the harvesting plant prior to being sold, but internal or intermuscular glands are not examined unless further inspection is recommended by a veterinarian. Consequently, three major glands are removed from beef, pork, and lamb during processing to ensure the public do not see them. They are the **prescapular gland**, located in the neck and blade sub-primals below the junction of the fifth cervical vertebra (Figure 10); the **prefemoral gland**, located at 90 degrees to the round bone on the hip on the exterior of the sirloin tip imbedded in the cod fat pocket (Figure 11); and the **popliteal gland**, located in the outside round sub-primal in the hip primal between the eye of the round and the outside round flat under the heel of round, imbedded in a fat pocket (Figure 12).

Figure 10. Prescapular gland.

Figure 11. Prefemoral gland.

Figure 12. Popliteal gland.

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1.7: Diseases Associated with Meat

There are several diseases well known to both the industry and the general public that are directly related to all the domestic meat species of beef, pork, lamb, and poultry. These include:

- **E. coli** from ground beef
- **BSE (bovine spongiform encephalitis)** from beef cattle
- **Trichinosis** from pork
- **Salmonella** from poultry
- **Scrapie** from lamb and mutton

In addition, the meat and food industry are vulnerable to a variety of other infectious diseases that can manifest in food processing areas due mainly to poor personal hygiene and processing sanitation practices, which in turn can develop the growth of **bacteria**, **viruses**, **moulds**, and **yeasts**.These can then set the stage for:

- **Foodborne infection**, such as salmonella or trichinosis, caused by ingesting food that is contaminated with bacteria, parasites, and viruses
- **Foodborne intoxication**, either bacterial, such as E. coli, or chemical, where food has been contaminated with toxic chemicals, such as cleaning compounds or pesticides

Two particularly dangerous foodborne bacteria that can cause serious illness require special attention:

- ***Clostridium botulinum***, which can develop in vacuum-packaged and canned foods
- ***Listeria monocytogenes***, which occurs due to poor cleaning of machines, dirty floors, and drains

Following is a brief overview of the major risks – in terms of bacteria and illnesses – associated with meat and the meat industry. Some of the bacteria are known to originate from meat; others can and do develop in food processing areas through unhygienic practices.

BSE (bovine spongiform encephalopathy): commonly known as mad cow disease, a fatal brain-degenerative disease (encephalopathy) in cattle that causes a spongy degeneration in the brain and spinal cord. BSE has a long incubation period, about two-and-a-half to eight years, usually affecting adult cattle at a peak age onset of four to five years. All breeds are equally susceptible. The disease can be easily transmitted to humans who eat food contaminated by the brain, spinal cord, or digestive tract of infected carcasses. In humans, it is known as the variant **Creutzfeldt-Jakob disease**, and as of June 2014 it had killed 177 people in the United Kingdom and 52 elsewhere. Controls on high-risk offal (internal organs) were introduced in 1989. The cause was cattle, which are normally herbivores, being fed the remains of other cattle in the form of meat and bone meal (MBM), which caused the infectious agent to spread. Outbreaks of BSE in Canada severely crippled Canadian beef exports, which have only recently been restored. Under Canadian law, it is now illegal to feed cattle MBM. The **Canadian Food Inspection Agency (CFIA)** strictly controls the slaughter of all beef animals over the age of 30 months.

Safeguards:

- Due to the severity of the disease, the following prevention measures have been implemented at the harvesting point, which has eliminated any possible transmission of the disease to the public. All possible infected parts of these animals are removed at the harvesting plant, kept separate from all other animal waste, and destroyed to safeguard the food supply. The parts removed include the skull, tonsils, a thick slice of the central backbone including the spinal column from the base of the skull to the pelvis, and two sections of the small intestines.

***Clostridium botulinum*:** an **anaerobic** microorganism (it grows without air) which forms spores that exist over a wide range of temperatures. The organism itself does not cause illness, but the toxin it produces is one of the most deadly known to humankind. The spores can survive in frozen, raw, and precooked food. Although it is not a frequent cause of illness, it is considered the most serious to deal with in the food industry. This nasty organism is found in the intestines of humans and animals and in soil and streams. The major source of botulinum is swollen and damaged canned products and/or air-tight packages such as vacuum-sealed products with low acid foods such as beans, fish, and meats.

Safeguards:

- Understand that the spores of the organism are very heat resistant and can survive boiling temperatures.

- During any food packaging process, ensure product is heated to a core temperature of 82°C (180°F) for 20 minutes to kill any toxins.

***Clostridium perfringens*:** an anaerobic organism that produces heat-resistant spores. It also grows in the **danger zone** of 4°C to 60°C (40°F to 140°F) and may double in numbers in 10 minutes. This bacterium is found in intestinal tracts of humans and animals, in sewage, and in manure, and it is considered widespread. Insects and rodents can also become contaminated. Unwashed hands and dirty clothing are major sources and carriers of the disease. The main food sources affected by *C. perfringens* are foods high in proteins such as fresh meat of all types, deli items, and cooked meats like stews and gravies that have cooled too slowly.

Safeguards:

- Only proper hot holding of cooked foods (above 60°C or 140°F) or rapid cooling in shallow trays to below 4°C (40°F) can prevent this disease from taking hold.
- Heat product above 74°C (165°F) to kill most non-heat-resistant strains.

coli: A bacterium found naturally in the intestines of humans or other animals. The strain common to the meat and food industry is E. coli 0157:H7. E. coli does not cause a disease and is not considered parasitic because its source of food is the body waste in the intestinal tract. However, should E. coli gain access to the kidneys, bladder, or other internal organs, it can become parasitic and produce infections that can turn fatal. E. coli outbreaks associated with domestic animals (mainly beef) have strained the meat industry when it has been discovered in ground meat supplies. In addition, E. coli has occurred in milk, cheese, and related foods as well as in plants and plant products irrigated with contaminated groundwater supplies.

Safeguards:

- Understand that E. coli cannot be destroyed by freezing.
- Cook products such as ground meat to a core temperature of 71°C (160°F) to kill E. coli.
- Follow and enforce good personal hygiene (hand washing) after using the toilet.
- Follow industry safeguards to prevent contamination during the harvesting of animals, especially during the removal of the hide, which is often covered in fecal matter. (One large harvesting plant in Alberta has a state-of-the-art hide wash to help eliminate contamination prior to removal of the hide.)
- Take the preventive measure, which should now be a common practice, of carefully trimming meat surfaces on sub-primals that are near the **aitch bone** portion of the pelvis and anal canal. These areas are located on the hip and sirloin, especially on the hindquarters of beef carcasses and pork and lamb legs.

***Listeria monocytogenes*:** Listeria is commonly found in soil, stream water, sewage, plants, foods made from milk, and processed foods such as hot dogs and deli meats. It can also be found in uncooked meat and vegetables and fruit such as apples and cantaloupes. Animals can also be carriers. Contamination may occur after cooking and before packaging. Listeria is responsible for listeriosis, a rare but potentially lethal foodborne infection. Listeria can grow in temperatures from 4°C to 37°C (40°F to 96°F), which is human body temperature. The bacterium is known to cause meningitis, a potentially fatal disease.

Safeguards:

- Implement thorough cleaning practices especially for equipment used to slice or needle meats (tenderize). This includes fully disassembling equipment, then scrubbing, rinsing, sanitizing, and air drying.
- Keep all floors and drains thoroughly cleaned; these areas are often overlooked and are known to be breeding grounds for listeria.
- Institute a deep-cleaning plan for any processing area as part of a sanitation program. This involves committing to extensive cleaning of the whole work area several times throughout the working year, including cleaning floors, walls, and drains and the complete disassembly of all equipment.

Scrapie: a fatal disease that affects the central nervous system of sheep and goats. Scrapie is a transmissible spongiform encephalopathy (TSE). It is similar to BSE, but it is not caused by the animal's feed. While the exact cause of scrapie is still unknown, the disease is associated with the presence of an abnormal form of a protein called a *prion*. According to Health Canada, there is no known link between scrapie and human health. However, the CFIA does have a control program in place. The disease seems to present itself differently in different countries. Wasting and debility (weakness) appear to be more prominent clinical features in North America, while pruritus (intense itching) remains the most noted clinical feature in Europe. Scrapie is spread from

an infected female to her offspring at birth, or to other animals exposed to the birth environment, through fluid and tissue from the placenta.

Safeguards:

- Scrapie is not known to be transmissible to humans, so any measures in place are to safeguard the health of sheep stocks.

Salmonella: Foodborne bacteria with 1,300 types known. One of the most severe infections caused by salmonella is **typhoid fever**. The main sources and carriers of salmonella in the food industry are most poultry, eggs and cracked eggs, shellfish, raw milk, and service workers with unwashed hands. People and animals may be carriers without showing any symptoms.

Safeguards:

- Cook products to an internal temperature over 60°C (140°F) for 12 minutes to kill salmonella.

Staphylococcus: an **aerobic** organism (needs air to grow) that causes food poisoning by releasing toxins into food. It does not form spores. However, it may survive for months in the soil and in a frozen state in food. The most common carrier is the human body, particularly through skin abrasions, wounds, infected sinuses, pimples, etc. Raw poultry is also known to be a carrier. Food poisoning usually occurs when already cooked or easy-to-eat food is re-contaminated with staphylococcus. In the food service industry, susceptible products are those high in protein, such as custards, cream-filled bakery goods, sauces, meat and meat products (especially chopped meats), chicken salads, and cheeses. Staphylococcus can grow to enormous numbers on meat without producing changes in colour, odour, or taste if the infected product has not been stored in the safe temperature zones below 4°C (40°F) or above 60°C (140°F).

Safeguards:

- Wash hands frequently, especially after using the toilet and when coughing and sneezing.
- Always keep foods stored in the safe temperature zones below 4°C (40°F) or above 60°C (140°F).

Trichinosis: a disease caused by *Trichinella* (parasitic nematodes, intestinal worms, and roundworms) that initially enter the body when meat containing the *Trichinella* cysts (roundworm larvae) is eaten. For humans, undercooked or raw pork and raw dry cured pork products, such as pork salami, have been most commonly responsible for transmitting the *Trichinella* parasites.

Trichinosis is a foodborne infection and is not contagious from one human to another unless infected human muscle is eaten. However, almost all carnivores (meat eaters) or omnivores (meat and plant eaters), such as bears, can both become infected and, if eaten, can transmit the disease to other carnivores and omnivores. For example, undercooked or raw bear meat can contain living *Trichinella* cysts. Therefore, if humans, dogs, pigs, rats, or mice eat the meat, they can become infected. In rare instances, larvae in cattle feed can infect cattle. There are six species that are known to infect humans. Today, trichinosis has been virtually eradicated in Canada due to well-managed controls in the Canadian hog industry.

Note: Commercially raised pork in Canada is at low risk of this disease, and it is common now for pork to be cooked to medium instead of well done. Doing so is safe provided the core temperature of 60°C (140°F) is held for at least one minute. Pork can also be cooked as low as a core temperature of 54.4°C (130°F) and held at that temperature for 30 minutes.

Safeguards:

- Eliminate the risk of infection through proper cooking of meat.
- Cook all wild game meat, pork, and horse meat to an internal temperature of at least 71°C (160°F).
- Understand that **curing** (salting), drying, smoking, or microwaving the meat does not consistently kill infective larvae.

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1.8: Human-Introduced Residues in Meat

The two major residues that are or have been used by the meat industry are both well documented and controversial because they are used to manipulate growth and development in animals. These residues are 1) **sub-therapeutic hormones** that produce more lean muscle and less fat and 2) **antibiotics** used to maintain the health of the animals in mass-production operations.

Today the addition of these residues is strictly controlled and monitored by the government. Health Canada sets the standards for levels of hormones and antibiotics that can be left in food, and regulates the use of hormones and antibiotics in Canada so that they do not pose a risk to the public. The CFIA is responsible for the monitoring and testing of food products to ensure that they meet the regulatory requirements.

Hormones

It is important to note that there are naturally occurring hormones in all animals and plants, so when people discuss the use of hormones in food, they are referring to the addition of sub-therapeutic or **growth hormones**. The use of growth hormones is illegal for poultry and pork produced in Canada, as well as for dairy cattle. Growth hormones are still in use by some beef cattle producers, but the residual levels are carefully regulated and monitored.

Antibiotics

Antibiotics are used to treat animals that are sick, manage and prevent disease in animals and fruit crops, and promote the healthy growth of certain animals. In Canada, antibiotics are approved for regulated use in beef, dairy cattle, chicken, laying hens, turkey, pork, and fish.

Should a dairy cow be treated with antibiotics, its milk can be tested for antibiotic residues. Any milk testing positive for antibiotic residue is not sold for human consumption but is discarded. When poultry are treated with antibiotics, the eggs they lay are discarded.

As with hormones, the use of antibiotics is closely regulated, and food products are regularly tested to ensure compliance. In addition, there is a move to reduce the overall use of antibiotics in Canada both in agriculture and for treating human disease due to the increase of antibiotic-resistant bacteria.

Natural, Free Range, and Organic Meats and Poultry

In the last 25 years, there has been an increased consumer demand for meat and poultry products that have been raised in a humane manner with no added growth hormones or antibiotics, and in the case of poultry, with access to the outdoors. Consumers want to know more about the meat they purchase, and many smaller producers and processors now cater to a rapidly growing number of clients who desire meat and poultry that they are confident has come from a “clean” source. Some of the questions these consumers are likely to ask are:

- Which farm did the animal come from?
- Was it given growth hormones or antibiotics?
- Was the farm a clean place for the animal?
- Was the animal treated properly (fed, watered, and sheltered when required)?
- How far did the animal have to be transported prior to slaughter and was it handled humanely?
- Was the animal handled carefully and humanely at the harvesting plant?
- Did the animal have a painless death?

These products may be labelled as natural, **free range**, or **organic**. When promoting products that are free of hormones and antibiotics, the following statement must be used: “No additional hormones or antibiotics.” The word “additional” is required because all animals have natural hormones. Certified organic meats must meet strict requirements of the certifying bodies, such as the Certified Organics Association of BC (COABC), which set standards for feed, pasture, and humane treatment of animals that are certified organic. A list of all certified organic producers can be found on the COABC website.

The following definitions for poultry are provided by the BC Chicken Marketing Board:

- Free Range means that the bird has access to the outdoors. Due to weather in Canada, the free range season is short.

- Free Run means that a bird is able to move freely throughout the barn and is not confined in a cage. All chickens grown in Canada for meat purposes are free run.
- Organic chickens are birds raised using certified organic feed and fresh, untreated drinking water. The COABC also requires growers to allow their birds access to pesticide-free pasture for a minimum of six hours a day, weather permitting.

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1.9: Meat Nutrition

Meat plays a significant role in the Western diet. Meat is almost completely digestible and rates high on the nutritional scale as it contains high levels of **proteins**, consisting of both essential (indispensable) and dispensable **amino acids**. Essential amino acids need to be supplied on a daily basis by diet, while the body is capable of producing dispensable amino acids on its own. Meat and other animal proteins can supply all the essential amino acids required for the human body. Meat is also rich in B complex **vitamins**, such as thiamin, riboflavin, and niacin, but the fat-soluble vitamins are not all found in meat. Minerals essential for the diet, with the exception of calcium, are found in meat, including phosphorus, iron, copper, and trace minerals. Table 4 lists the vitamins and main nutrients found in meat and meat products.

Table 4 – Nutrients in meat and meat products (Canadian Professional Meat Cutters Association)

Vitamins	Sources
A	Certain oils, egg yolk, mammalian liver
D	Fresh liver oils and fatty tissue
E	Green leafy vegetables, animal organs (pituitary gland, adrenals, pancreas, and spleen), milk, butter, and abdominal fat
K	Green vegetables, potatoes, fruits, and liver oils
Thiamin B1	Meat, liver, and kidney
Riboflavin B2	Milk and meat
B6	Red meat, liver, kidney, brain, cod liver, egg yolk, and milk
B12	Liver, kidney, and egg yolk
Niacin	Liver and red meat
Pantothenic acid	Liver, kidney, **muscle meat**, brain, and egg yolk
Biotin	Liver, kidney, muscle meat, egg yolk, and milk
Folic acid	Liver, kidney, muscle meat, milk, and cheese

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1.10: Cholesterol Content in Meat

What is **cholesterol** and why do cooks and meat processors need to know more about it? Cholesterol is essential for the structure and function of every cell in the body. Cholesterol is a waxy, fat-like substance that is found in all cells of the body and similarly in the meat of animals. The body makes all of the cholesterol it needs to function normally, but additional cholesterol enters the body through the consumption of animal products such as meat, eggs, and dairy.

There are two types of cholesterol found in the body. **High-density lipoprotein (HDL)** cholesterol is commonly called “good” cholesterol, as opposed to **low-density-lipoprotein (LDL)** cholesterol (“bad” cholesterol). LDL and HDL travel in the bloodstream, carrying cholesterol to wherever it needs to go within the body. HDL carries cholesterol back to the liver, where the body can process and remove it, while LDL leaves small traces of cholesterol on the walls of arteries as it travels.

Too much cholesterol, high levels of LDL in particular, may cause atherosclerosis, a condition in which plaque (which is made up of cholesterol, fat, calcium, and other substances found in the blood) is deposited in artery walls, blocking the blood flow to vital organs, which can result in high blood pressure or stroke.

Cholesterol levels are measured by the concentration of HDL and LDL in the blood. A blood test will identify the amount of HDL, LDL, and **triglycerides** (the most common type of fat found in the body) present in the blood. A total cholesterol value is calculated by adding the amount of HDL, LDL, and 20% of the triglycerides together. This is represented in either micromoles per litre (mmol/L) or milligrams per deciliter (mg/dL). In Canada, physicians use mmol/L, while in the United States, mg/dL is more common.

A total cholesterol level of 5.2 mmol/L (200 mg/dL) or below is recommended for an adult, with a level of 4.65 mmol/L (180 mg/dL) considered optimal. People with higher than recommended cholesterol levels are usually advised to be on a low cholesterol diet; therefore, we need to know more about which foods have less cholesterol so that we can cater to everyone’s dietary needs.

Table 5 lists some high-, moderate-, and low-cholesterol foods that are commonly used in restaurant kitchens and meat operations.

Table 5 – High-, medium-, and low-cholesterol foods

High-Cholesterol Foods	mg per 100 grams
Butter	250
Clarified butter	256
Cream cheese	110
Whole eggs	372
Egg yolks	1,085
Heavy whipping cream	137
Light whipping cream	111
Yellow cheese	108
Lamb kidney	337
Pork liver	301
Lobster	200
Oyster	206
Shrimp	125
Roe	479
Crab meat (Alaskan King)	127
Fish oil, menhaden	521

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1.11: Meat Handling and Storage Procedures

Proper handling and storage are two of the most vital processes undertaken by staff once meat orders arrive at their point of sale. Because foodborne illnesses have not been fully eradicated yet, and food storage is often subject to human error, rigid procedures need to be followed to ensure that all products arriving for sale are checked, refrigerated immediately, and stored correctly. Poor food-handling and storage procedures can prove to be disastrous to a food service company and to customers alike.

In Canada, an estimated 500,000 cases of foodborne illnesses occur annually. Here are some examples of what can happen if a food poisoning outbreak occurs due to mishandling or poor storage procedures:

- Loss of customers and sales
- Illness and even death of clients
- Loss of prestige and reputation
- Costly legal and court costs
- Increased insurance premiums
- Lower employee morale
- Professional embarrassment
- Increased cost to the health care system, such as laboratory analysis, physician time, and hospital care
- CFIA investigation time and possible consequences if charged

Receiving Procedures

Here are several steps to ensure that meat products are handled in a timely and safe manner once they arrive:

- Check to see that the order matches the invoice (number of boxes, etc., and list of product names; have driver and receiver sign off).
- Ensure all packages are still sealed and not damaged.
- Check the temperature of the delivery truck storage area (was it cold on arrival?).
- Sort and move all the meat products immediately to their correct storage coolers.
- Ensure fish, meats, and poultry are kept as far apart as possible and fish containers are kept sealed until ready to use.
- Check cooler temperatures daily and record data according to health department regulations.
- Ensure cooler and freezer doors are kept closed at all times.
- Immediately report any unusual temperature fluctuations to your employer.

Storage Procedures

Meat should be packaged appropriately to prevent drying out, spoilage, or **freezer burn**. Whole sub-primals are often vacuum packed as soon as they are removed from the carcass and will have a long shelf life when kept in the original vacuum packaging. Cut meat products for retail use should be wrapped in permeable film on trays or vacuum packaged after portioning. Cut meat products for food service use may be vacuum packed after cutting or stored in food-grade containers, wrapped appropriately, and stored according to food safety standards. Products for frozen storage should be vacuum packed or wrapped tightly in freezer paper to prevent freezer burn.

Coolers should be maintained at 0°C to 2°C (32°F to 35.6°F). This is considered the safest temperature to hold meats and maintain flavour and moisture. Water freezes at 0°C (32°F); however, meat freezes at about -2°C (29°F).

Today the most common cooling units are the blower coil type, in which cool air is circulated via coils and fans from a ceiling-mounted unit that draws air from the floor up through the cold coils and then drives air back into the cooler area. Floor areas of the cooler must be free of containers that may impede the airflow. This means that all food containers and boxes must be elevated above floor level.

For most modern coolers the **humidity** levels are built into the system and are maintained automatically. For example, lean beef is made up of approximately 70% moisture to optimize its flavour, sales appeal, and value. Moisture content in the air is expressed as relative humidity and is measured as a percentage. To maintain the moisture in meats, coolers need to maintain a humidity level of approximately 75% to 80%. If the moisture level drops below 70%, shrinkage will occur. However, if the humidity level is too high,

moisture will condense onto the meat and appear on the walls of the cooler, creating an excellent medium for bacteria growth and sooner-than-normal meat spoilage.

Modern meat coolers and freezers also have a built in defrost cycle, which is usually timed to activate in the early morning hours when there is less traffic in and out of the units. This important cycle is designed to melt away ice buildup on the blower coils (as they operate at below freezing temperatures) into a drain system. This part of the cycle takes about 20 to 60 minutes. Meat freezer temperatures should be maintained at approximately -23°C to -29°C (-10°F to -20°F).

Handling Procedures

Once processing begins, the following steps must be taken to reduce any additional contamination of the product:

- Do not allow product in any kind of box or container to come into contact with any cutting or work surface or the floors.
- Ensure that all processing tables and cutting boards are already cleaned and sanitized.
- Ensure surfaces are dry with no residue of any **sanitizer** on them (remember that most sanitizers are toxic while wet).
- Maintain separate cutting and processing boards for different species, especially fish, chicken, and pork.
- Clean and sanitize boards immediately after use and elevate to air dry as quickly as possible.
- Have separate cutting boards for cooked meat slicing.
- Thoroughly clean and sanitize meat slicers and tenderizers between uses for different species and between cooked and raw products. These slicing tools and machines pose a very real risk for **cross-contamination** and are always subject to scrutiny by health inspectors.
- If possible, process different species and cooked and raw products on different days. This helps minimize risk of cross-contamination in processing areas, tools, and machines that are used for a variety of products.

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CHAPTER OVERVIEW

2: Inspection and Grading of Meats and Poultry

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2.1: Introduction to Inspection and Grading of Meats and Poultry

Learning Objectives

- Identify meat inspection levels and agencies
- Define the meat inspection process
- Describe grading regulations for meat

Introduction

Meat inspection for the domestic animal market is mandatory for beef, pork, lamb, bison, and poultry and is overseen by the Canadian Food Inspection Agency (CFIA). There are two levels of inspection in Canada: federal and provincial. Federally inspected meats can be sold and transported throughout Canada and also exported or sold internationally. Provincially inspected meats can be sold under the following two categories:

- Intraprovincially, which means the meat can be sold only within the province where the harvesting plant is located
- Interprovincially, which means the meat can be sold in a province or territory other than the one in which the harvesting plant is located

Meat **grading** measures the characteristics of carcasses and classifies them into groups of similar quality, yield, and value, which in turn assists in marketing and merchandizing the products. Grading standards and regulations are set for each species separately through government consultation with each industry. For example, beef grade standards are set by the Canadian Beef Grading Agency, a non-profit organization that relies on recommendations from an industry and government consultative committee to provide data to assist the federal government in setting guidelines. Similar processes are in place for lamb, pork, and poultry.

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2.2: The Meat Inspection Process

Meat inspection is designed to determine the health of animals both prior to death (ante mortem) and after death (post mortem). In federal meat inspection plants, the process is carried out by primary product inspectors (PPIs) from the meat and poultry division of Agriculture and Agri-Foods Canada. The PPIs are overseen by a veterinarian. PPIs also do the inspection in provincial meat plants, but a veterinarian is called in only when a further diagnosis is required.

All domestic animals going into the food chain are inspected prior to harvesting (ante mortem). Some of the inspection methods are:

- Observing the animals' behaviour that may indicate any signs of disease
- Isolating animals that show signs of disease, illness, or injury
- Verifying animal identification records and tags
- Overseeing humane treatment of animals during herding and slaughter

Following harvesting, animals are inspected by either a provincial or federal inspector. In the case of beef, inspectors examine the following:

- Head, an array of lymph nodes near the tongue, and the tongue itself
- Esophagus and spleen
- Lungs and heart
- Bile duct and liver
- Other accessible carcass lymph nodes
- Diaphragm and kidneys
- Carcass internal and external surfaces

Lamb, pork, and poultry carcasses receive similar inspections that focus on the particular species and associated health issues.

Some of the hazards that may occur during the slaughter process are:

- Contamination of the carcass during the removal of the hide and digestive tract
- Cross-contamination during the splitting of the carcass
- Bacterial growth during the chilling and aging of carcasses
- Cross-contamination from specific animal tissue that is high risk for disease, such as BSE **specified risk materials (SRMs)** (e.g., spinal cord, brain)

Once the meat is approved for human consumption, the **inspection stamp** can be made along the length of the carcass. The stamp appears as a blue circle with the word "Canada" inside the circle rim, with a crown in the centre and the plant number at the bottom (Figure 13).

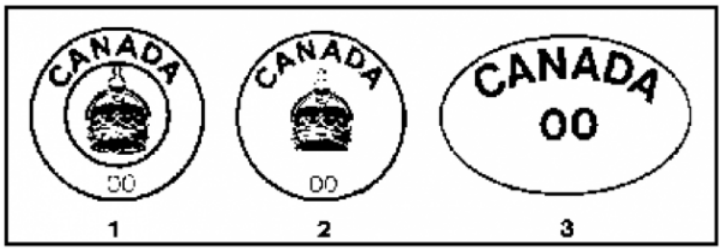

Figure 13. Meat inspection stamps (CFIA)

Media Attributions

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2.3: Grading Regulations for Meat

Meat grading for beef is governed by the Canada Agricultural Products Act and the Livestock and Poultry Carcass Grading Regulations, which also apply to all other domestic species where grading is used. Grading standards and criteria differ somewhat for each species.

Grading is carried out on the animal carcass, which must already be approved for health and safety standards and bear an inspection stamp. Grading categorizes carcasses by quality, yield, and value, and provides producers, wholesalers, retail meat operations, and restaurants the information they need to purchase a grade of meat that suits their particular needs. Grading is also intended to ensure that the consumer has a choice in selecting a consistent and predictable quality of meat.

Beef Grading

The grader assesses several characteristics of a beef carcass to determine quality (Table 6).

Table 6- Beef carcass quality factors

Beef Characteristics	**Beef Carcass Quality Factors**
Maturity (age)	The age of the animal affects tenderness.
Sex (male or female)	Pronounced masculinity in animals (males) affects meat colour and palatability (texture and taste).
Conformation (muscle shape)	Meat yield is influenced by the degree of muscling.
Fat (colour, texture, and cover)	Fat colour and texture (white as opposed to yellow) influence consumer acceptability, whereas fat cover affects meat yield.
Meat (colour, texture, and marbling)	Meat marbling affects quality: juiciness and tenderness. Colour and texture influence consumer acceptability.

Table 7 lists the 13 grades of beef carcasses and the colour of each **roller brand** that is placed along the length of the carcass (Figure 14).

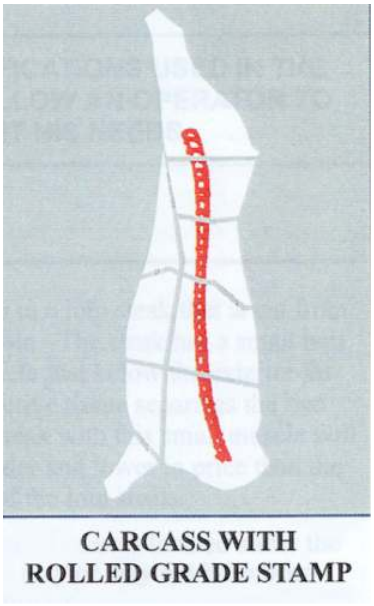

Figure 14. Rolled grade stamp on beef carcass.

Table 7- Beef grades

Red	Blue	Brown	Brown
Canada A	Canada B1	Canada D1	Canada E
Canada AA	Canada B2	Canada D2	
Canada AAA	Canada B3	Canada D3	
Canada Prime	Canada B4	Canada D4	

Beef carcasses are graded in the A category using the following determinations:

- The age of the carcass is assessed (must be youthful).
- Fat levels are assessed by measuring with a special ruler on the left side of the carcass between the 12th and 13th ribs across the ribeye muscle at the 12th rib (the front quarter of beef).
- An additional assessment of the external fat cover of both sides is made. Grade A beef has a fat covering that is firm and white or slightly tinged with a reddish or amber colour and is not more than 2 mm in thickness at the measurement site.
- A muscle score is determined from a grid depending on the width and length of the ribeye muscle. Grade A beef has muscling that ranges from good with some deficiencies to excellent.
- Ten minutes after having been exposed, the ribeye muscle shows firm and bright red in colour (bloom).

In addition, only A grade carcasses are assessed for the three lean meat yield classes. **Yield grading** is determined by measuring exterior fat thickness as well as the length and the width of the ribeye muscle at the 12th rib (Figure 15). The yield classes are indicated by a triangular-shaped stamp in red ink placed on the short-loin and rib sections of each side of the carcass. Yield classes are shown in Table 8.

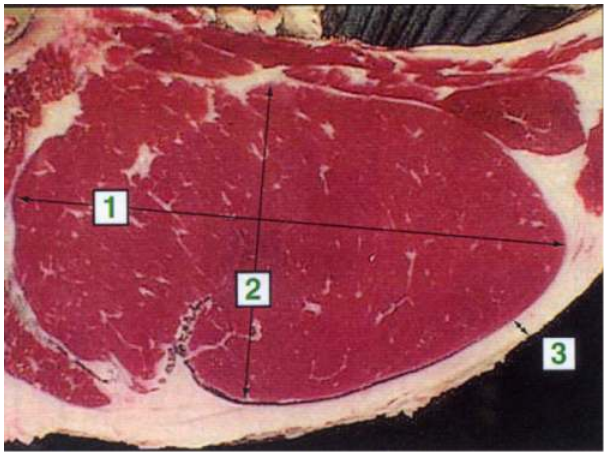

Figure 15. Measuring yield for grading showing length (1), width (2), and fat thickness (3).

Table 8 – Yield classes and percentages

Yield class stamp	Meat yield
Canada 1	59% or higher
Canada 2	54% to 58%
Canada 3	53% or lower

The A grades are assessed further to determine the marbling (intramuscular fat content), as shown in Table 9 and illustrated in Figure 16.

Table 9- Required marbling content of A grades

Grade	Marbling content
Canada A	At the least, traces, but less than a slight amount
Canada AA	At the least, a slight amount, but less than a small amount
Canada AAA	At the least, a small amount
Canada Prime	At the least, slightly abundant

Figure 16. A grade marbling chart. Courtesy Beef Grading Centre

These marbling assessments offer the purchaser different levels of fat content to market. For example, some stores promote only AAA beef. A custom processor may want to dry age beef carcasses longer for his customers, but if he doesn't want to have too high a waste factor (with fat), he may prefer to purchase AA or A beef. Restaurants may choose Canada Prime that shows a lot of marbling, has longer aging ability (wet aging, vacuum sealed), and therefore, in the long term, is more tender.

B grade beef (blue) is still good-quality meat for eating but doesn't have the same consumer appeal as A grade. B grade beef is usually cheaper and doesn't dry age as well as A grade. Table 10 provides B grade characteristics.

Table 10- Characteristics of B grade beef

Grade	Age	Muscling	Ribeye muscle	Marbling	Fat colour and texture	Fat measurement
B1	Youthful	Firm, bright, and red	Devoid	Firm white or amber	Firm white or amber	Less than 2 mm
B2	Youthful	Bright red	Bright red	Yellow	Yellow	No requirement
B3	Youthful	Bright red	Bright red	White or amber	White or amber	No requirement
B4	Youthful	Dark red	Bright red	No requirement	No requirement	No requirement

D grade beef (brown) characteristics are shown in Table 11. D2 to D4 animals are used extensively in ground meat and in the manufacturing of sausage products.

Table 11- Characteristics of D grade beef

Grade	Age	Muscling	Ribeye muscle	Marbling	Fat colour and texture	Fat measurement
D1	Mature (old)	Excellent	No requirement	No requirement	Firm white or amber	Less than 15 mm
D2	Mature (old)	No requirement	No requirement	No requirement	White to Yellow	Less than 15 mm
D3	Mature (old)	No requirement	No requirement	No requirement	No requirement	Less than 15 mm
D4	Mature (old)	No requirement	No requirement	No requirement	No requirement	More than 15 mm

E grade beef (brown) comes from youthful or mature (older) animals with pronounced masculinity, heavy shoulders, and lean and darker meat. These animals, often bulls and stags (unsuccessfully castrated bulls), are used extensively in the manufacturing of sausage products and ground meat.

Bison Grading

A new system for bison grading was developed in the 1990s. It is based on the beef grading system but takes into account the natural differences of the bison carcass. The official grading began in 1995, and on the basis of these standards the European Community (EC) approved bison sales to Europe. There are nine bison grades, which are evaluated for maturity, muscling, meat quality, and fat measurement. The grades are A1, A2, A3, B1, B2, C1, C2, D1, and D2.

Bison traditionally live longer than beef, and their bones and joints harden (ossify) more slowly. Furthermore, they are more heavily muscled in the shoulders and less muscled in the hindquarters than beef. These differences must be taken into account by the grader. Bison is now farmed in some provinces, including British Columbia and Alberta, and in several states in the United States. The product has become a popular alternative protein source, particularly with specialty meat markets and high-end restaurants.

Table 12 compares bison and beef grading.

Table 12- Differences between bison and beef grading

Bison	Beef
9 grades	13 grades
Knife ribbed between 11th and 12th ribs	Knife ribbed between the 12th and 13th ribs
1 mm minimum fat cover for A grades	4 mm minimum fat cover for A grades
Heavily muscled fronts	Heavily muscled hinds
3 maturity divisions	2 maturity divisions
More age in A grades than beef	Less age in A grades than bison
Grade stamped brown	Grade stamped red
5 stamps per carcass side	2 stamps per carcass side
Not ribbon branded	Ribbon branded
No marbling assessment	Marble assessed
3 meat yield grades	3 meat yield % for A grades

Veal Grading

Veal is meat from the young bovine born into the dairy industry. Most veal is sold through restaurants. However, today very few retail markets sell veal due to the low consumer demand.

Veal grading assesses both fat (creamy white) and good muscling as is done on beef, but it focuses even more on the colour of the flesh to determine the eventual grade. Veal is generally very tender due to its age and has a mild (some might even say bland) flavour, with little fat cover and marbling. There are several types of veal (Table 13).

Table 13- Veal types and descriptions

Veal Types	Age	Characteristics	Carcass Weight
Baby veal (Bob veal)	3-30 days	Males, classified as “light,” sold whole for festive occasions and roasted whole	9-27 kg (20-60 lb)
Vealers (light)	1-3 months	Raised on milk with no restrictions on other types of feeds such as hay or grains	36-68 kg (80-150 lb)
Nature (white veal)	Up to 5 months	Very expensive, white-pinkish flesh, no iron in diet, raised in pens, limited movement permitted	82-109 kg (180-240 lb)
Calves (heavy)	Up to 5 months	Raised on milk and fed on grain-hay combinations; physically beginning to change from veal to beef	68-136 kg (150-300 lb)

Youthful bovine carcasses weighing less than 160 kg (32.2 lb) (hide off) are classified as veal by the Canadian beef grading program and are graded as shown in Table 14.

Table 14- Muscling requirements for veal grades

Grade	Requirements
Canada A1 to A4	Carcasses with at least good muscling and some creamy white fat
Canada B1 to B4	Carcasses with low to medium muscling and an excess of fat cover
Canada C1 and C2	Carcasses failing to meet the requirements of Canada B

All veal carcasses are then graded for meat colour. The veal grader uses a Minolta colour reflectance meter to do this. The carcasses are assigned a numerical value based on the objective measurement of meat colour. Then the carcasses are segregated into four colour classifications, based on the meter reading values. The most pale white colour range is given a grade of 1 and is assigned an A grade provided the kidney fat and muscling meet the A standard. As meat colour becomes more pink, grades of 2, 3, and 4 are assigned.

This scientific method of assessing meat colour is being continually refined. Research is now underway to develop a meat probe that will directly measure the level of meat pigment, which is the basis of all colour analysis. Should this method of colour determination be judged superior to the current methods, this new technology will be adopted. This process of muscle and colour grading ensures that purchasers of Canadian veal can specify their exact quality requirements.

Table 15 shows how the colour ranges are assigned the correct grade.

Table 15- Colour requirements for veal

grading

Veal Grades	Veal Flesh Colour
Canada A1	White 50 +
Canada A2	Pink 40-49
Canada A3	Pale red 30-39
Canada A4	Red 0-29
Canada B1	Bright pink 50+
Canada B2	Pink 40-49
Canada B3	Pale red 30-39
Canada B4	Red 0-29
Canada C1	Pink or lighter 40 +
Canada C2	Pale or dark red 39 or less

Table 16 shows the criteria used to establish veal grades.

Table 16- Veal grading criteria

Grade	Kidney Fat	Muscling
A1-A4	Covered with fat that is not excessive and is creamy white or pink tinged	At least good and free of depressions; 3 out of 4 of: 1. At least a straight profile for upper portion of leg 2. Loins wide and thick 3. Racks well covered 4. Shoulder points well covered
B1-B4	Covered with fat deposits ranging from small to large	At least low to medium, some depressions; 3 out of 4 of: 1. Hip joints noticeable but not prominent 2. Loins with depressions 3. Racks sparsely covered with flesh 4. Shoulder points noticeable but not prominent
C1 and C2	Extremely small deposits of fat on kidneys	Deficient to excellent

Lamb Grading

Lamb has become an increasingly popular protein in restaurants, local markets, and high-end stores in recent years. In addition, there is a growing need to supply the diverse ethnic trade market, which includes a growing Muslim community.

The lamb grading service is delivered by the Canadian Sheep Federation, which has been accredited by the CFIA to perform this function. The current system is voluntary and is designed to provide more information to producers and consumers. However, new technology is currently being developed to improve and speed up the current system at federal plants.

The seven lamb carcass grades are shown in Table 17, and the five mutton carcass grades are shown in Table 18.

Table 17- Lamb grades

Grades	Lamb Ribbon Brand Colour
Canada A1, A2, A3, A4	Red
Canada B	Blue
Canada C1, C2	Brown

Table 18- Mutton grades

Grades	Mutton Ribbon Brand Colour
Canada D1, D2, D3, D4	Black
Canada E	Black

Currently in Canada, lamb (sheep under 12 months of age) and mutton (sheep 12 months of age or older) are graded by a generic system used in all regions. The measures to assess the grade are:

- Age, determined by the colour of the **break joint** on the front leg
- Weight
- Lean meat content and colour
- Fat content and colour
- Conformation or external shape of the carcass

These factors are further classified to determine a final grade using a formula integrating all the data collected, as noted in Table 19.

Table 19- Lamb grading criteria

Factors	Determining characteristics
Break joint colour	Purple, red (young), or white (old)
Meat colour	Designated a C only when the carcass exhibits extremely dark meat (old)
Sex	Male or female
Fat cover	● + (plus sign) for excessive covering ● N for normal covering ● — (minus sign) for deficient covering
Conformation (shape), which then determines a muscle score of 1 to 5	● + (plus sign) for good to excellent ● N for medium to good ● — (minus sign) for marked deficiencies ● 1 indicates extreme deficiencies ● 5 indicates excellent muscling
Exterior fat depth (EFD)	Actual fat depth as measured by a ruler over the 12th rib 11 cm from carcass back midline
Fat colour	Designated with a Y when a carcass exhibits yellow fat
Weight	Indicated by warm carcass weight (WCW)

Pork Grading

Requirements for pork grading are established under the authority of the Canada Agricultural Products Act and the Livestock and Poultry Carcass Grading Regulations. In commercial agriculture, pigs raised for food (pork) are usually referred to as hogs. Once the carcasses have been graded, the meat is always referred to as pork.

Hogs are popular farm animals because they mature more quickly than other animals and are ready for slaughter at approximately six months of age. Hogs must be handled very carefully during the harvesting process as they are easily stressed. To offset some of the stress they are electrically stunned (which is faster and requires quicker bleeding time) or gassed in federal plants in a special chamber that gradually removes the oxygen and then introduces carbon dioxide to ensure a painless death and means less rush prior to bleeding.

Pork from youthful hogs is very tender due to the absence of heavy connective tissue. Unlike beef, pork does not need to be aged very long. The flesh has a pinkish colour, a fine texture, and very greasy white fat that enhances the flavour of the meat. Pork is very popular in North America and other Western and European countries and is a popular item on restaurant menus; in addition, it is considered a diverse and profitable product that is increasingly in demand in manufactured products, such as the many varieties of sausages and cured products available today.

Canada has several major pork marketing agencies, such as the Canadian Pork Council and Canada Pork International, as well as provincial organizations, such as Alberta Pork and BC Pork, that promote and monitor the industry. All commercial hog carcasses are either federally or provincially inspected.

There are 12 grades of hog carcasses with criteria outlined in Table 20.

Table 20- Hog (pork) grades

Hog Grade Classes	# of Grades	Hog Criteria
Canada Yield with 7 classes	1	Weight must be 40 kg (88 lb) or more
Canada Emaciated	1	Weight must be 40 kg (88 lb) or less
Canada Ridgling	1	Has one or two undescended testicles or has both male and female sex organs
Canada Sow 1-6	6	Must be a sow with the required back fat levels, good muscling, straight to convex profile, and barely visible shoulder joints
Canada Sow 7	1	Must be a sow deficient in muscling and finish
Canada Stag	1	A mature porcine animal, castrated before slaughter, and exhibiting pronounced masculinity at time of slaughter
Canada Boar	1	Must be a male carcass with one or more testicles but not a carcass of a ridgling

Modern technology provides a quick and accurate method for grading hogs at federally inspected plants:

- An **electronic probe** is inserted between the third and fourth **ribs** on the left side of the carcass. The needle has a sensor light on the end.
- As the needle is withdrawn from the probe site, it measures meat thickness and fat levels.
- These measurements are fed into a computer, which generates a yield class estimating percentage of lean meat.

This method of grading hogs is used to establish producer payments, which are automatically sent to the farmer's bank account.

An overview of the grading process using an electronic probe can be found at https://www.westernhogexchange.com/about/marketing/GradingGrids.aspx

Poultry Grading

All commercial poultry for sale must be inspected at federally or provincially designated poultry harvesting plants and show proof of inspection with a stamp similar to what is shown on beef carcasses: a round stamp with a crown in the centre, the word “Canada” above, and the plant registration number below.

Poultry harvesting includes electrical stunning, with the bird’s head touching either a charged wand or a charged water bath prior to bleeding. The carcasses are then scalded to loosen the feathers, after which they pass through a fast-rotating automatic feather-plucking drum. This is followed by the evisceration process and meat inspection. The carcass is then passed through a rapid air-chilling system to cool the carcass as quickly as possible. Air-cooled poultry has a much longer shelf life (approximately 5 to 10 days) compared to the shelf life of a poultry carcass that has just been allowed to cool naturally after harvesting and processing.

Poultry graders assess the carcasses for several criteria. Those for A grade poultry are shown in Table 21.

Table 21- A grade poultry

Poultry Grading Factors	**Criteria for A Grade Poultry**
Conformation (shape)	● Refers to the physical points on the outside of the bird ● A grade birds must have normal conformation, including a plump body, stocky legs, and a well-**dressed** body ● NO missing parts such as wings ● NO crooked keel bone ● NO broken bones, bruises, or cysts
Fleshing (desired quality)	● Refers to the amount and distribution of meat ● A grade birds must have moderately long and broad plump and firm breast meat ● Short, plump legs
Fat covering	● A grade birds have an even covering of fat under the skin ● Good fat cover indicates yellowish or cream-coloured skin ● A blemish or reddish tinge beneath the skin indicates poor fat covering
Bones	● A grade birds must have a soft and pliable keel bone cartilage ● Joints are loose but not springy
Carcass dressing	● A grade birds are free of pin feathers ● Pin feathers will lower carcass saleability

There are three grades of processed poultry. The grade stamp is a maple leaf with the grade’s respective colour and the appropriate grade in the centre (Table 22). These grades are used for chickens but are also used for:

- **Capons**
- Rock **Cornish hen**
- Mature chicken
- Old **rooster**
- Young and mature turkey
- Young and mature **duck**
- Young and mature goose

Table 22- Poultry grades

Poultry Grades	Poultry Grade Colour	Poultry Criteria
Canada A	Red	See Table 21

Canada Utility	Blue	• Insufficient fat
		• Not more than the following missing parts:
		  ◦ wings, tail, one leg (including the thigh or both drumsticks)
		  ◦ small areas of flesh from the carcass
		  ◦ skin not more than half of the area of the breast
		• No dislocated or broken bones other than wings or legs
		• No prominent discolourations exceeding a certain size on breast or elsewhere on carcass

Canada C	Brown	Mature or older poultry requiring moist heat cooking

Types of Chicken and Turkey

Chickens are also categorized according to age and size, the most common being frying chicken (also called **fryers** or **broilers**). These are usually 6 to 8 weeks old and weigh approximately 1.1 to 1.6 kg (2 1/2 to 3 1/2 lb). Roasting chickens or **roasters** are young birds over 8 weeks, but usually between 12 and 20 weeks old, that weigh over 2.2 kg (5 lb). Rock Cornish hens are small chickens that weigh between 500 g and 900 kg (1 to 2 lb). Very young chickens, called **poussin**, are less than 500 g (1 lb). A Capon is a large castrated male that weighs 2.7 to 3.6 kg (6 to 8 lb), and a stewing hen or **fowl** is an older bird, usually female, over 10 months of age and weighing 2.2 to 3.2 kg (5 to 7 lb).

Turkeys are classified by age only. Young turkeys are approximately 24 weeks of age. Mature turkeys are over 24 months of age.

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- Yield Measuring
- figure16

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2.4: Game Processing, Inspection, and Grading

The domestic market for game meats in British Columbia and elsewhere in Canada is still developing. Consumers seeking natural meats such as elk and deer (the most sought after commercially available game meats in the country) usually have to access them through farm operations that promote and harvest their own animals, or through meat shops that specialize in retailing game.

Other specialty species that are sold commercially are goat (particularly for the ethnic market) and **ratites**, such as **ostrich** and **emu**, which have tried to secure a portion of the market but have been slow to catch on. Muskox is harvested in the Northwest Territories and Nunavut, and game birds, such as **pheasant**, **squab**, **Guinea fowl**, and **quail**, are commercially available through specialty retailers and wholesalers. Rabbit and **hare** are also available, with the majority of commercial production in Quebec and Ontario.

All game meats to be sold at the retail level and in restaurants must be either federally or provincially inspected. Grading of game meats is not available in Canada at this time.

Venison

The domestication of deer species for meat and hunting has been taking place for an estimated 2,000 years. The New Zealand venison industry is currently the largest in the world, but deer farming for meat production has grown in Canada, Ireland, Great Britain, the United States, South Africa, and Germany over the last few decades. Currently there is no grading system in place for fallow deer and elk meats in Canada.

Meats from the deer species (fallow, mule, whitetail, and red deer) as well as elk, moose, caribou (reindeer), and sometimes antelope are all considered **venison**.

Table 23 provides a short list of venison muscle meats and processed products available, mainly from elk and deer.

Table 23 Venison products available for sale

Venison Muscle Meats for Wholesale and Retail	Venison Processed Products
Leg cuts (from the hip), Denver style	Sausage patties (pre-prepared)
Back loins (strip loins)	Ground meat burgers (pre-prepared)
Tenderloins (whole)	Snack sticks
Racks (10 rib)	Jerky
Sirloin steaks	Hard or dry cured sausage
Shoulder roasts (boneless)	Fresh sausage
Ground meats (mince)	Cooked and smoked sausage

Recently the number of restaurants serving venison and the number of stores selling the processed products have increased. There are approximately 14 licensed farm operations in B.C. and more in Alberta that cater to both domestic and export markets.

Fallow deer are one of the smaller deer species and are the main species used for commercial farming. These deer were originally imported live as breeding stock from New Zealand. They adjust well to farm life, are easy to handle, are a relatively gentle species, and can be grown to a very consistent size that suits marketing purposes. Prior to 1990, the bulk of venison sold in British Columbia was imported from New Zealand. Today, approximately 80% of the B.C. venison market is being served by B.C. fallow deer producers.

Game-farmed venison has been proven to have a lower fat and cholesterol content than most red meats. The demand for venison has increased greatly in the last few years and continues to grow rapidly. Ranched elk is a culinary treat and is a naturally tender and healthy meat with a mild, distinctive flavour, although some people refer to wild elk meat as the queen of game meats. It can be included in many cooking styles. Elk is very low in cholesterol, and although low in calories it provides the same amount of protein as most other livestock. Studies at the Agriculture and Agri-Food Canada Research Station in Lacombe, Alberta, have shown that elk is generally more tender than beef.

Currently there are two federally inspected plants in Alberta that accept elk and deer for processing.

Wild deer species in B.C., Alberta, and other parts of Canada are not used for farm and meat production. However, some of Canada's deer species are susceptible to **chronic wasting disease (CWD)**, which is a progressive, fatal disease of the nervous system. It is known as a transmissible spongiform encephalopathy (TSE). Other TSEs include scrapie in sheep, bovine spongiform encephalopathy (BSE) in cattle, and Creutzfeldt-Jakob disease (CJD) in humans. In Canada, CWD is a serious concern for deer and elk farmers and is a **reportable disease** under the Health of Animals Act. All cases must be reported to the CFIA.

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CHAPTER OVERVIEW

3: Cutting and Processing Meats

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3.1: Introduction to Cutting and Processing Meats

Learning Objectives

- Describe the muscle and bone structure of meat
- Identify suitable cuts of meat for various cooking methods
- Identify primal cuts of beef, lamb, pork, and veal
- Identify secondary cuts of beef, lamb, pork, and veal
- Describe variety meats and offal
- Describe cuts of game

Introduction

You will remember from the first chapter of this book that meat is muscle made up of fibres. These muscle fibres are held together by connective tissue such as collagen and elastin. The amount of connective tissue contained in the muscle (or meat) has to be acknowledged before choosing the appropriate way to prepare the product.

A highly exercised muscle, such as a shank or shoulder area, will develop much more connective tissue and more coarse muscle fibres. This means they require a moist heat cooking method. If cooked with liquid, collagen breaks down at 80°C (176°F) into gelatin. This gelatin provides not only body to the cooking liquid but also, more importantly, moisture to the cooked meat and rich flavour.

A lightly exercised muscle will contain less connective tissue and more fine muscle fibres, allowing it to be prepared using dry heat cooking methods. Beef tenderloin is a perfect example of this type of meat.

Generally, four-legged animals use their shoulder and leg muscles the most; therefore, the cuts from these areas contain more connective tissues and are less tender. The back, rib, and loin sections contain muscles that are used less frequently, and they tend to be the source of the more tender, or choicer, cuts of meat. It is not surprising, therefore, that cuts from these sections tend to be higher priced and are featured more often on restaurant menus. Although the physical structure and names of the muscles in the three main species (cattle, sheep, and hogs) are similar, the cuts are named differently and regulated by the Canadian Food Inspection Agency (CFIA).

To further confuse the issue, meat cutters and cooks in the United States, the United Kingdom, Australia, and other parts of the world may use different names for the same cuts of meat.

It is important to understand that meat cuts to be sold at a retail level must be labelled according to CFIA standards. The same rules do *not* apply to sale of whole muscles or restaurant cuts to be advertised on a menu. For a complete breakdown of retail labelling requirements, visit the CFIA website.

General cutting procedures and terms

Meat animals are generally broken down from large carcasses into **primal** and **sub-primal** cuts. These are large parts of the animal that are then further broken down into retail or restaurant cuts. In some cases, primals and sub-primals are cooked whole, but for the most part they are broken down into a number of different types of smaller portion cuts or **fabricated cuts**. These include:

- Roasts – boneless or bone-in large cuts that are meant to be cooked whole and then sliced after cooking into portions
- Racks – most common with lamb and pork, these are a special type of roast that contains the rib bones and has been trimmed to show the white portion of the bone. Bones which have been trimmed using this process are called **frenched**.
- Steaks and chops – boneless and bone-in individual portion cuts that are cooked and generally served whole or sliced. Chops always have a bone, while steaks can be bone-in (such as a beef T-bone or pork shoulder blade steak) or boneless (such as a tenderloin or sirloin).
- Cutlets – thin slices of boneless meat, usually from the leg, which can be mechanically tenderized or pounded. Small round cutlets from the loin or tenderloin are also called **medallions** or **noisettes**.

- Stew or cubed meat – cubes of meat used for stews and other similar dishes
- Thinly sliced or **emincé** – used for stir-fry and similar dishes
- Ground – usually made from trim, ground meat is a mixture of lean and fatty trim that has been passed through a grinder. It can be graded depending on fat content, and can be finely or coarsely ground.
- Cured and **smoked** – most common with pork, meat cuts that are cured using a dry or wet cure (brine) and then may be smoked

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3.2: Primal, Sub-primal, and Secondary Cuts

Beef

The beef animal is broken down into sides. A side is one-half of a **dressed carcass** that has been split lengthwise from the neck to the tail. The side can then be split into the front quarter and hind quarter. This cut is made between the 12th and 13th ribs counting from the front of the animal. The beef front quarter is heavily exercised, resulting in an abundance of connective tissue. Moist heat cooking is required on the majority of the sub-primals from the front quarter, with the major exception being the 7-bone rib (prime rib). The hind quarter of beef contains mostly sub-primals that can be prepared using dry heat.

Figure 17 illustrates the primal, sub-primal, and retail cuts of beef.

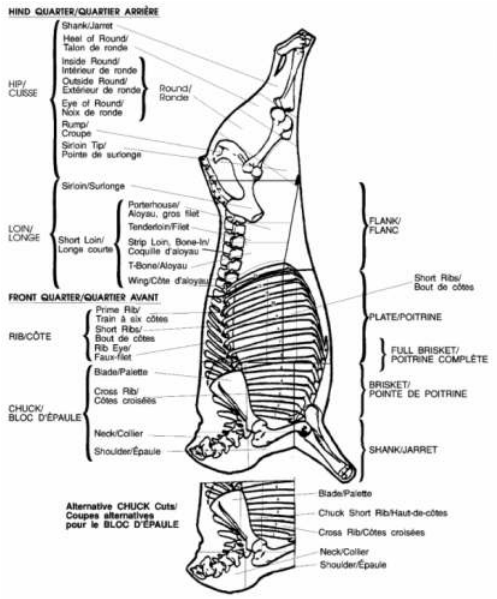

Figure 17. Beef carcass showing primal, sub-primal, and retail cuts.

Beef Front Quarter: The beef front quarter contains four primal cuts, the brisket, foreshank, rib, and chuck (square chuck). The chuck is separated by first cutting across the carcass between the 5th and 6th ribs, which separates the chuck, brisket, and shank from the rib and plate. The second cut passes at a point slightly above the elbow joint and through the cartilage below the first (1st) rib and sternum, and separates the chuck from the brisket and shank. The brisket is further separated from the shank by following the natural contour of the elbow bone. The rib is separated from the plate by a straight cut passing across the ribs at right angles to the first cut at a point slightly below the centre of the rib cage.

The primals are then processed into sub-primals by following the cutting lines as shown in Figure 18 and Table 24.

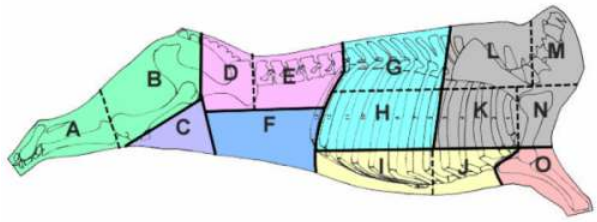

Figure 18. Beef primals and sub-primals.

Table 24- Beef primals and sub-primals from the front quarter

Primal	Sub-Primal
Rib	Short rib (H) 7-bone rib (G)
Square chuck	Neck (M) Blade (L) Shoulder (N) Cross rib (K)
Brisket	Brisket point (J) Brisket plate (I)
Fore shank	No further break down required (O)

From these sub-primals, further usable portions are processed and retail cuts prepared for the consumer.

Beef Hind Quarter: The beef hind quarter is broken down into four primal cuts, the flank, the long loin, the hip, and the sirloin tip. The flank is separated by a straight cut passing approximately parallel to the lumbar backbone (lumbar vertebrae), beginning in close proximity to or through the flank lymph node (prefemoral), and from the plate by a cut passing between the 12th and 13th ribs and cartilage. The hip is separated from the long loin by a straight cut that passes in front of the rump knuckle bone, thereby cutting the pelvic bone into approximately two equal parts. The sirloin tip is then separated from the hip by a “V-shaped” cut beginning approximately at the knee cap, following the full length of the leg bone up to the rump knuckle bone, then towards the flank lymph node.

The primals are then processed into sub-primals as shown in Figure 18 and Table 25.

Table 25- Beef primals and sub-primals from the hind quarter

Primal	Sub-Primal
Flank	No further break down required (F)
Long loin	Short loin (E) Sirloin butt (D)
Hip	Inside round (B) Outside round (B-opposite side of bone) Hind shank (A)
Sirloin tip	No further break down (C)

Breakdown of sub-primals into retail and wholesale cuts

From the sub-primals, secondary or portion cuts are obtained. In most cases, there are a number of different **secondary cuts** that can be obtained from each sub-primal. In addition, there are often different names for the same cut used in the retail, wholesale, or restaurant industry. Table 26 shows the retail and restaurant cuts that come from each of the beef sub-primals.

Table 26- Retail and restaurant cuts of beef (Front Quarter)

Sub-Primal	Retail Meat Sales Cuts	Restaurant Cuts	Alternate Names
Short rb	Short ribs simmering (bone in or boneless)	Short ribs	
7-bone rib	Prime rib over roast Standing rib oven roast	Prime rib	
	Prime rib grillings steak	Rib steak	Côte de boeuf
	Ribeye grilling steak	Ribeye	Delmonico
	Beef ribs(cut from prime rib)	Finger bones	Beef back ribs
Blade	Bottom blade		Chuckeye roll
	Top blade	Flat iron	Mock tender
Cross rib	Cross rib (pot roast or marinating steak)	Short ribs, boneless short ribs	Chuck short rib
	Beef ribs(cut from the cross rib)		Shoulder clod
			Bolo
			Deluxe 4-bone rib
			Flat rib
Brisket point	Brisket pot roast	Corned beef	
	Stew beef		
	Medium ground beef		
Neck	Lean ground beef		
Fore shank	Stew beef	Shin meat for consommé	

Table 26- Retail and restaurant cuts of beef (Hind Quarter)

Sub-Primal	Retail Meat Sales Cuts	Restaurant Cuts	Alternate Names
Flank	Flank marinating steak	Flank steak	
	Flank steak London broil		
	Lean ground beef		
Short loin	Porterhouse grilling steak	Porterhouse	
	T-bone grilling steak	T-bone	
	Wing grilling steak	Club steak	
	Tenderloin grilling steak	Filet, Fillet mignon, medallion	Tournedo, Chateaubriand, Mignonette
	Striploin grilling steak	New York	Top loin
Sirloin butt	Top sirloin (grilling steak and oven roast)	Sirloin steak	
	Sirloin cap grilling steak		
	Bottom sirloin grilling steak	Tri tip	
	Tenderloin butt grilling steak	Chateaubriand, fillet mignon	
Inside round	Inside round over roast Inside round marinating steak	Top round	Baron, top side
Outside round	Outside round over roast	Bottom round	Gooseneck, silverside, outside flat
	Outside round marinating steak		Rouladen
	Eye of round oven roast		
	Eye of round marinating steak		Swiss steak
	Heel of round (stew or ground)		
Sirloin tip	Sirloin tip over roast		Peeled knuckle
	Sirloin tip marinating steak		Ball tip
			Round tip
			Thick flank
Hind shank	Beef shank (crosscut)	Osso-bucco	
	Stew beef	Shin meat for consommé	
	Lean ground beef		

The Beef Information Centre provides a poster (Figure 19) that outlines the cuts of beef. It can be downloaded from their resource page.

Figure 19. Beef merchandising guide.

The CFIA meat cuts manual is an additional resource that shows each beef cut and location in great detail. It can be accessed on the CFIA website. Table 26 shows the cooking potential for cuts from the different beef primals. Generally, the cuts from the same primal are suited for similar cooking methods. Exceptions have been noted.

Table 27 -Suitable cooking methods for cuts of beef from different primals

Hind Quarter Primal	**Cooking Potential**	**Notes (Exceptions)**
Flank	Moist heat	The flank steak, which can be **marinated** and cooked using dry heat
Long loin	Dry heat	
Hip	Dry heat	The hind shank and heel of round, which have an abundance of collagen, making them ideal for stewing meat
Sirloin tip	Dry heat	
Front Quarter Primal		
Rib	Dry heat	
Square chuck	Moist heat	Aside from one of the top blade muscles, which can have the heavy collagen removed and be portioned into flat iron steaks, which can be prepared using dry heat
Brisket	Moist heat	
Fore shank	Moist heat	

Veal

Muscle or flesh of a veal carcass ranges in colour from pink (or lighter) to red. To be classified as veal by CFIA standards, the dressed carcass must weigh less than 180 kg (396 lb). Veal is most commonly sold in vacuum-packed sub-primals. It is seldom dry aged due to the lack of fat cover on the animal. Figure 20 shows the CFIA veal cuts.

Figure 20. Veal carcass showing primal, sub-primal, and retail cuts.

There are six primal cuts from a side of veal, the leg, flank, loin, breast, shoulder, and front shank. The front, containing the shoulder, breast, and front shank, is separated from the whole loin and flank by cutting between the 6th and 7th ribs. The breast and shank are further separated by a cut that goes from just above the joint of the arm bone perpendicular to the ribs. The shank is then separated by following the natural separation of the arm bone. The leg is separated from the whole loin and flank by a straight cut that passes in front of the pin bone. The flank is then separated from the whole loin by a straight cut approximately parallel to the backbone, passing at a point slightly above the cartilage of the 12th rib.

The primals are further broken down into sub-primals as shown in Figure 21 and Table 28. Note that there are two ways of cutting the leg into sub-primals accepted by CFIA.

Figure 21. Veal primal and sub-primal cuts.

Table 28- Primal and sub-primal cuts of veal

Primal	Sub-primal
Veal leg	Leg cuts (sub-primal) and Alternative leg cuts (sub-primals)
	Shank (A) and Shank (A)
	Leg, shank portion (B, portion of C) and Heel of round (bottom portion of B), Round (B)
	Leg, butt portion (D, portion of C) and Sirloin Tip (C), Rump (top portion of B), Sirloin (D)
Veal flank	No further breakdown (G)
Veal loin	Loin (E)
	Rib (or rack) (F)
Veal shoulder	Shoulder arm (J)
	Shoulder blade (H)
	Neck (I)
Veal breast	No further breakdown (K)
Veal front shank	No further breakdown (L)

The sub-primals are cut further into retail or restaurant cuts as shown in Table 29.

Table 29- Veal retail and restaurant cuts

Primal	Sub-Primal	Retail Meat Sales Cuts	Restaurant Cuts	Alternate Names
Veal leg	Shank	Veal shank crosscut	Osso-bucco	
	Leg, butt portion	Veal inside round	Cutlets, **scaloppine**	Veal top round
		Veal outside round		Veal bottom round
		Veal leg cutlets (breaded)	Schnitzel	
	Sirloin tip	Veal sirloin tip		Veal knuckle
	Sirloin	Veal top sirloin		Veal hip
Veal flank		Ground, sausage	Ground veal	
Veal loin	Loin	Veal loin roast	Veal strip loin	Saddle
		Veal loin chops	Veal T-bone	
		Veal tenderloin	Veal tenderloin, medallions	
	Rib	Veal rib chops	Veal chop	
		Veal rib roast	Veal rack	Hotel rack
Veal shoulder		Veal shoulder arm	Shoulder roast, chops	Square chuck
		Veal shoulder blade	Cubed veal, ground veal	
Veal breast		Veal breast, rolled, stuffed	Breast of veal, cubed veal, ground veal	Brisket
Veal front shank		Veal shank crosscut	Osso-bucco	

The Veal Farmers of Ontario provide a comprehensive veal cut chart (Figure 22) for download.

Figure 22. Veal merchandising chart. Courtesy Veal Farmers of Ontario

The CFIA meat cuts manual is an additional resource that shows each veal cut and location in great detail. It can be accessed on the CFIA website.

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3.3: Pork

Pork is a very popular and versatile meat. Due to its size, it can be merchandised and delivered as whole, in sides, or broken down into primals (Figure 23). The majority of the pork comes from choice butcher hogs that are about six months old at the age of slaughter. The entire dressed hog carcass weighs about 75 kilograms (165 pounds). Very little of the hog carcass goes to waste. It can be retailed fresh, cured, or **smoked** and can be very profitable if merchandised in a number of ways. Intestines are processed for sausage casings, and fat is harvested to be used in sausage manufacturing as well as **barding** and **larding** of lean meats. Head, feet, and skin are used for their rich amounts of natural gelatin. Occasionally feet and hocks are sold as **sweet pickle**.

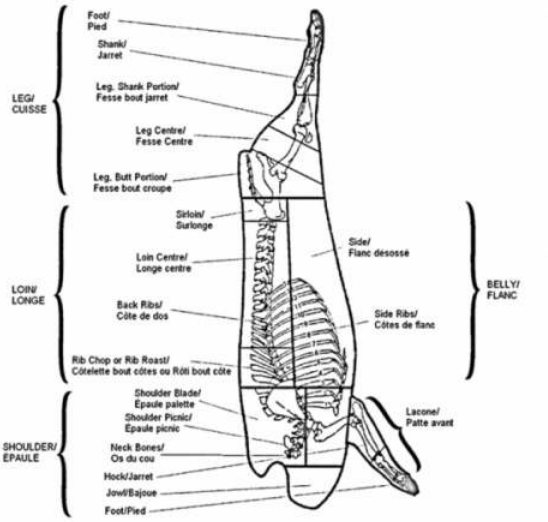

Figure 23. Pork carcass showing primal, sub-primal, and retail cuts.

The side of pork is broken down into sub-primals from the four primals: pork shoulder, pork leg, pork loin, and pork belly as shown in Figure 24 and Table 30.

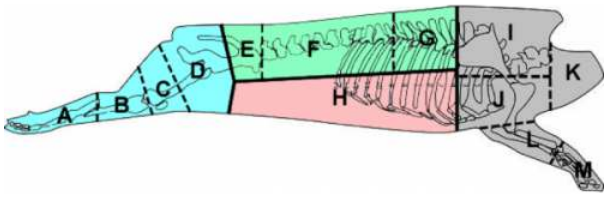

Figure 24. Pork primal and sub-primal cuts.

Table 30 -Pork primals and sub-primals

Primal	Sub-Primal
Pork leg	Pork leg butt portion (D)
	Pork leg shank portion (C)
	Pork hock (B)
	Pork foot (A)
Pork loin	Pork loin rib end (G)
	Pork loin centre (F)
	Pork sirloin (E)
Pork belly	No further breakdown (H)
Pork shoulder	Pork shoulder blade (I)
	Pork shoulder picnic (J)
	Pork jowl (K)
	Pork foot (M)
	Pork hock (L)

Pork Leg

The pork leg is a very lean portion of the hog. It can be separated into three muscle groups: the inside, outside, and tip. It also contains a hock and a foot. The leg is tender and mostly free from connective tissue, making it ideal for dry heat cookery. Fresh roasts and steaks are processed from the leg as well as **cutlets.** Most commonly, the pork leg is cured and smoked to produce ham. It can also be dry cured and aged to produce prosciutto. Retail and smoked cuts from the leg are shown in Table 31.

Table 31 Pork Leg retail and smoked cuts

Primal	Retail Meat Sales Cuts	Retail Cured and smoked Cuts	Alternate Names
Pork Leg	Pork leg inside roast	Pork leg ham whole (b)(bl)	Fresh ham
	Pork leg outside roast	Pork leg ham piece boneless	
	Pork leg tip roast		
	Pork leg steak (b)(bl)	Pork leg ham steak (b)(bl)	
	Pork leg cutlet		Schnitzel
	Pork leg shank portion	Pork leg ham (shank portion)	
	Pork leg centre portion		
	Pork leg butt portion		
	Pork hock	Pork leg ham (butt portion)	Shank
	Pork foot	Pork hock (smoked)	Trotter

Pork Loin

The pork loin is commonly split into three sections: the rib, sirloin, and loin centre. Alternatively, the pork loin can be split at the end of the tenderloin, labelling the two halves as pork loin rib half and pork loin sirloin half. The pork loin is most often

merchandised fresh for **chops** and roasts. The loin in the most tender primal of the hog and is ideal for dry heat cookery. It can be cured and smoked to make favourites such as back bacon. Retail and smoked cuts from the loin are shown in Table 32.

Table 32 Pork Loin retail and smoked cuts. Note: (b) denotes bone-in cut; (bl) denotes boneless cut

Primal	Retail Meat Sales Cuts	Retail Cured and smoked Cuts	Alternate names
Pork loin	Pork loin centre chops (b)(bl)	Pork loin centre chop (smoked)	Kassler loin
	Pork loin centre roast (b)(bl)	Pork loin centre back bacon (smoked)	Canadian bacon
	Pork back ribs		
	Pork sirloin chop (b)(bl)	Pork sirloin chop smoked	Baby back ribs
	Pork sirloin roast (b)(bl)		
	Pork rib chop (b)(bl)	Pork rib chop smoked	
	Pork loin rib country-style chop		

Pork Shoulder

The pork shoulder is very popular for use in sausage making due to the higher fat content. The sub-primals pork shoulder blade and pork shoulder picnic are derived from the shoulder along with a pork hock and a pork foot. It can be merchandised as fresh roasts and steaks, cured and smoked products, and for deli meats such as capicollo. Retail and smoked cuts from the shoulder are shown in Table 33.

Table 33- Pork shoulder retail and smoked cuts. Note: (b) denotes bone-in cut; (bl) denotes boneless cut

Sub-primal	Retail Meat Sales Cuts	Retail Cured and Smoked Cuts	Alternate Names
Pork shoulder blade	Pork shoulder blade Steaks (b)(bl)		
	Pork shoulder blade roast (b)(bl)	Pork cottage roll (smoked)	Pork butt Boston butt
Pork shoulder picnic	Pork shoulder picnic blade portion	Pork shoulder picnic (smoked)	The blade and picnic together are sometimes referred to as the Montreal shoulder
	Pork shoulder picnic shank portion		
	Pork riblets		
Pork jowl		Pork jowl (smoked)	Jowl bacon
Pork foot		Pickled pigs' feet	
Pork hock		Smoked hocks	

Pork Belly

The pork belly contains the most amount of fat on the hog. It contains the pork side ribs and pork breastbone. When the side ribs are removed, the retail name for the belly is side pork. This is the section cured and smoked to make pork side bacon. The side pork can also be rolled and processed to make pancetta. Retail and smoked cuts from the belly are shown in Table 34.

Table 34 Pork belly retail and smoked cuts.

Primal	Retail Meat Sales Cuts	Retail Cured and Smoked Cuts	Alternate names
Pork belly	Side pork fresh	Pork side bacon	Pork belly
	Pork side ribs		Spareribs
	Pork side ribs center cut		St. Louis ribs

Figure 25 shows the different pork cuts. For a complete Canadian pork cuts chart, visit Manitoba Pork.

Figure 25 Pork cut chart.

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3.4: Lamb

Lamb refers to young male and female sheep. They are slaughtered at approximately six months of age. The lamb carcass dressed weight is usually between 25 and 27 kg (50 and 60 lb). Because it is young, lamb is very tender, promoting dry heat cooking for most of the animal. Due to the high price per pound and small carcass size, lamb is most often marketed with the bone in. Sheep over the age of 12 months is referred to as mutton. Mutton has a much stronger flavour and is less tender than lamb.

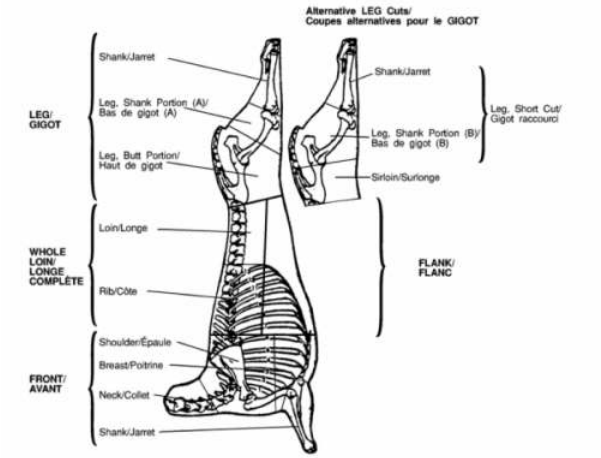

Figure 26 Lamb carcass.

The lamb carcass (Figure 26) is broken into four primals: front, leg, loin, and flank. The lamb front is then broken into four sub-primals: the lab shoulder, neck, fore shank, and breast. The lamb leg can be left whole or split into leg shank and butt portion. The loin consists of two parts: the rib and loin. Locations of primal and cub-primal cuts of lamb are shown in Figure 27 and Table 35.

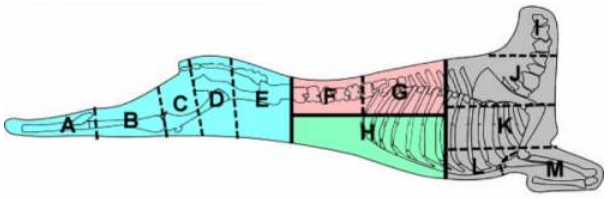

Figure 27. Lamb primal and sub-primal cuts.

Table 35 – Primal and sub-primal cuts of lamb.

Primal	Sub-primals
Leg	Shank (A),Leg, shank portion (B), Leg, butt portion (C and D), Sirloin (E)
Loin	Rib (rack) (G), Loin (F)
Flank	No further breakdown (H)
Front	Shoulder (J), Breast (L), Neck (I), Shank (M)

The primals and sub-primals are further broken down into retail and restaurant cuts as shown in Table 36.

Table 36: Retail and restaurant cuts of lamb.

Primal	Retail Meat Sales Cuts	Restaurant Cuts	Alternate Names
Lamb leg	Lamb leg shank portion	Leg of lamb	
	Lamb leg butt portion		
	Lamb leg sirloin chops	Lamb sirloin (boneless)	
	Lamb shank		
Lamb loin	Lamb loin chops	Lamb T-bone	
	Lamb rib chops	Lamb chops	Lamb popsicles
	Lamb rack	Rack of lamb	Both lamb racks can be used to produce a crown roast
Lamb flank	Lamb flank rolled (boneless)		
Lamb shoulder	Lamb shoulder arm chops		
	Lamb shoulder blade chops		
	Lamb neck chops		
	Lamb shoulder roast	Lamb shoulder	Oyster shoulder
	Lamb shank		

Figure 28 displays retail lamb cuts. To download this poster:

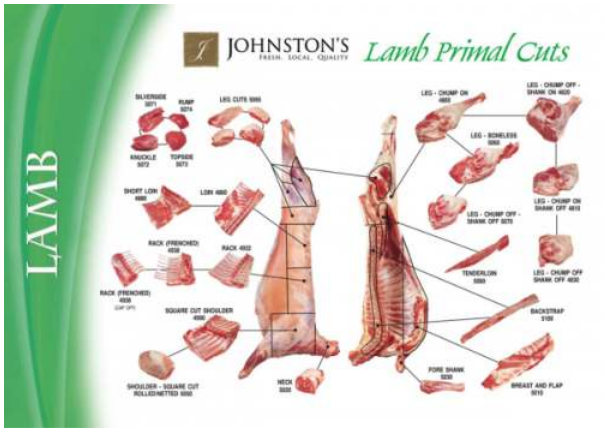

Figure 28 Lamb cuts.

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3.5: Offal (Variety Meats)

Offal, also referred to as **variety meats**, is the name for internal organs and entrails of a butchered animal. The word does not refer to a particular list of edible organs, which varies by culture and region, but includes most internal organs excluding muscle and bone. Some cultures shy away from offal as food, while others use it as everyday food or in delicacies.

Some offal dishes are considered gourmet food in international cuisine. This includes foie gras, pâté, and sweetbreads. Other offal dishes remain part of traditional regional cuisine and may be consumed especially in connection with holidays such as the Scottish tradition of eating haggis on Robbie Burns Day. Intestines are traditionally used as casings for sausages.

Depending on the context, offal may also refer to those parts of an animal carcass discarded after butchering or skinning. Offal not used directly for human or animal food is often processed in a rendering plant, producing material that is used for fertilizer or fuel or, in some cases, it may be added to commercially produced pet food. Table 37 lists the most common types of offal from the various species.

Table 37 Common types of offal

Species	Common Offal	Uses/Notes
Beef	Heart	Beef offal is more commonly retailed
	Liver	
	Kidney	
	Tongue	
	Tripe	
	Oxtail	The only external offal meat
Veal	Heart	
	Liver	Veal offal is more commonly served in restaurants than other types.
	Kidney	
	Tongue	
	Brains	
	Sweetbreads	Thymus gland
Pork	Liver	Pork offal is stronger in flavour; the liver is most commonly used in pâté.
	Heart	
	Kidney	
	Intestines	Used for sausage casings
	Skin	Used to make cracklings or chicharron
	Blood	Used for blood sausage and black pudding
Lamb	Liver	Lamb offal is milder in flavour
	Heart	
	Kidney	
	Tongue	
	Intestines	Used for sausage casings
Chicken	Heart, Liver, Gizzard	These three are often referred to as **giblets** as a whole.
Duck/Goose	Liver	fatty livers.

- **Liver:** Liver is very fine textured and is almost devoid of the characteristic fibre bundles found in red meat (liver has no grain). Consequently, it is very tender and can be sliced in any direction needed to attain the best yield. It can be prepared using dry heat. It has a very distinct flavour and is relatively inexpensive.
- **Kidney**: Kidneys are either smooth, bean-shaped (in lamb and pork) or irregularly shaped with reddish-brown lobes and deep clefts (beef). Beef kidneys are very tough and require intense moist heat cookery.
- **Heart**: Heart is retailed whole, halved, or cut into slices depending on species and size. The inside of the heart contains string-like sinew, which should be removed if the heart is being stuffed and cooked. Dry heat is suitable for cooking heart. It is commonly stuffed and roasted whole or slices are seasoned and pan-fried.

- **Tongue**: The surface of the tongue is very coarse and requires a long period of slow cooking to be able to remove it (six to eight hours of simmering). Once skinned, the tongue can be sliced and is quite tender. There is a very large amount of gelatin in the meat which provides a rich flavour. It is often pickled or corned before cooking.
- **Tripe:** Tripe is processed from the muscular inner lining of the stomach. It can be smooth or honey-combed depending on which chamber of the animal's stomach it is harvested from. It is commonly sold fresh or pickled. Washed tripe, also known as dressed tripe, is boiled and bleached, giving it the white colour more commonly seen for sale. Tripe requires moist heat cookery to break down its rubber-like texture. It is most commonly used in soups and stews.
- **Sweetbreads**: Sweetbreads are the thymus glands of calves and mature beef. They are pinkish-white in colour. Veal or calf sweetbreads are considered a great delicacy. They are largest in size when the calf is five to six weeks old and decrease in size as the animal ages. Sweetbreads should be thoroughly soaked in cold water, then blanched so that the membrane can be removed. They then can be braised, or cooled then sliced and breaded for pan frying.
- **Brain**: Brains are a small volume seller. They perish very quickly so are generally frozen at the plant as soon as they are harvested from the animal. They are mild in flavour and have a delicate texture. Calves brains are most commonly used. They can be prepared much the same as sweetbreads. Brain is extremely high in cholesterol.
- **Oxtail**: Oxtail is classified as offal even though it is not an internal organ. Oxtail is mainly used for making soup to extract its rich flavours. It is more bone than meat, but the meat from the oxtail, once properly braised, is very rich in flavour.
- **Cheeks and head**: These are not technically offal, but increasingly popular are beef and veal cheeks, while pork heads are used to make headcheese, a type of sausage consisting of the meat from the head set in a gelatin base made from the cooking liquid.
- **Caul fat:** Fine membrane of fat which covers the stomach of hogs, Caul fat is used for barding (wrapping or covering) lean cuts of meat, ground fillings and sausage meat.

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3.6: Game Cutting

The term *game* refers to meat and poultry that are generally found in the wild. It has always filled an important role on the plates of hunters, but it is becoming more popular in the food service industry, especially the loin and leg portions. Any game meat offered for sale must be inspected, just as domesticated meats are. Wild game that can be hunted legally cannot be sold.

Game meats processed for consumers are farm raised, much the same as domestic animals:

- Deer, often referred to as venison, is the most common game meat. It is processed at less than two years of age, ensuring a mild flavour and tender meat. It is often processed very similar to lamb, as it is a smaller game animal.
- Other large game, such as buffalo (or bison), elk, moose, and caribou, are processed much the same way as beef.
- **Boar**, or wild pig, is processed the same way as traditional pork. It can be more difficult to cook as it is leaner and less tender than traditional pork. The loin should be prepared using dry heat, but the rest of the animal is best prepared using moist heat.

Game meats are lower in internal fat content, so cooking them requires care. During processing, the majority of the external fat cover is removed from game meats. The strong flavour often associated with game meats is predominantly found in the fat.

The bone structure for game meats is identical to that of domestic animals. Most other cuts are generally processed into ground meats for burger patties and sausage.

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3.7: Poultry Cuts

Poultry refers to the edible flesh, with adhering bones, of any bird that is commonly used as food. Types of poultry include chickens, ducks, geese, turkey, quail, pheasant. All poultry is processed in a similar manner. It is either cooked whole or segmented in a number of ways depending on how it is to be used.

All segments of small, young poultry can be prepared using dry heat cooking methods. Older birds, once they stop laying eggs, are butchered and marketed as stewing hens or boiling fowl. These birds need moist heat preparation and are ideal for pot pies, stews, and soups. All poultry should be fully cooked to at least 74°C (165°F) to eliminate the presence of salmonella.

A bird can be split in half lengthwise through the backbones and keel bone, or it can be split into a front quarter and a hind quarter. The front quarter of the bird contains the breast and wing meats, while the hindquarter contains the legs. It is common to further break the poultry into segments.

For maximum yield and precise processing, poultry can be segmented by cutting through the soft natural joints of the bird. The term *8-cut chicken* is used to describe a chicken segmented into two drumsticks, two thighs, and both breasts split in half across the rib bone (one half may contain the wing). This procedure is always done with the bone in. These segments can be processed further to boneless skinless cuts if desired. Figure 29 shows a fully segmented frying chicken, and Table 37 lists the common chicken cuts.

Figure 29. Segmented frying chicken.

Table 37- Common chicken cuts

Cut	Retail Cuts	Restaurant Cuts
Chicken breast	Chicken breastbone in	Suprême (chicken breast with wing drumette attached)
Chicken breast boneless/skinless		
Chicken breast fillets (or tenders)		
Chicken leg	Chicken leg (back attached)	Chicken Ballotine (boneless leg)
Chicken drumstick		
Chicken thigh (bone in)		
Chicken thigh (boneless skinless)		
Chicken wing	Chicken wing (whole)	Chicken wings split, tips removed
Chicken winglette (or wingette)		
Chicken wing drumette		
Chicken wing tip		
Backs and Necks	Chicken backs and necks	Chicken ribs, backs and necks are used for stock

White Meat Cuts

White or light meat comes from the breast and wings. The breast and wings are generally separated, but a chicken breast with the drumette portion of the wing still attached is called a **suprême.** Wings can be broken down into three parts: wing tip, winglette, and wing drumette (Figure 30).

Figure 30. Segmented chicken wing.

The breast can also be broken down further and the tenderloins (**fillets**) removed. The portion without the tenderloin can be split and pounded into a thin cutlet known as a **paillard**. Figure 31 shows the chicken breast whole and with the fillets removed from the bottom portion.

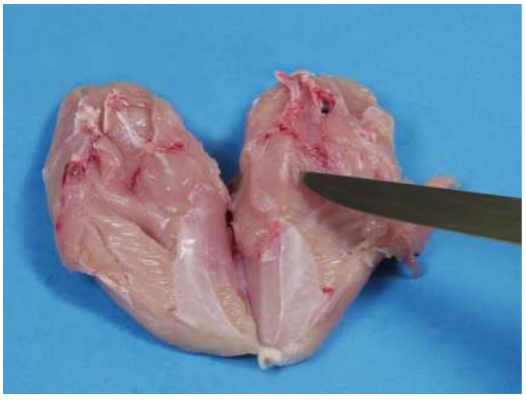

Figure 31a. Chicken breast whole

Figure 31b. Boneless skinless chicken breast with fillets removed.

Dark Meat Cuts

The dark meat of poultry comes from the legs, which can be broken down into two parts: the thigh and the drumstick. In restaurants, you may occasionally find a boneless leg that has been stuffed, which is called a **ballotine**.

Chicken legs are split at the knee joint to separate the thigh from the drumstick. Drumsticks are usually cooked bone in, while thighs can be deboned and skinned to use in a variety of dishes, including slicing or dicing for stir-frys and similar dishes.

Figure 32 shows a whole chicken leg broken down into a drumstick and boneless thigh.

Figure 32a. A whole chicken leg

Figure 32b. A drumstick

Figure 32c. Chicken thigh with skin and bone

Figure 32d. skinless, boneless chicken thigh

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3.8: Summary

Meat and poultry continue to be a large portion of the Canadian diet. Although the composition of meat and poultry doesn't change, the cutting and terminology for both food service and retail continues to evolve. Input from different ethnic groups and cuisines, consumer preferences, heath concerns, and ingredient costs all will have impacts on how we prepare meat and poultry, and also how we cut and process it.

If you are referencing recipes and cookbooks from other parts of the globe, you may come across terminology or cuts of meat that are not mentioned here, but with a bit of research you should be able to put them into context and find a Canadian equivalent.

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3.9: Activities

Activities

- Break down primal cuts of beef, pork, lamb, and veal into sub-primals and secondary cuts
- Break down whole poultry into secondary cuts

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