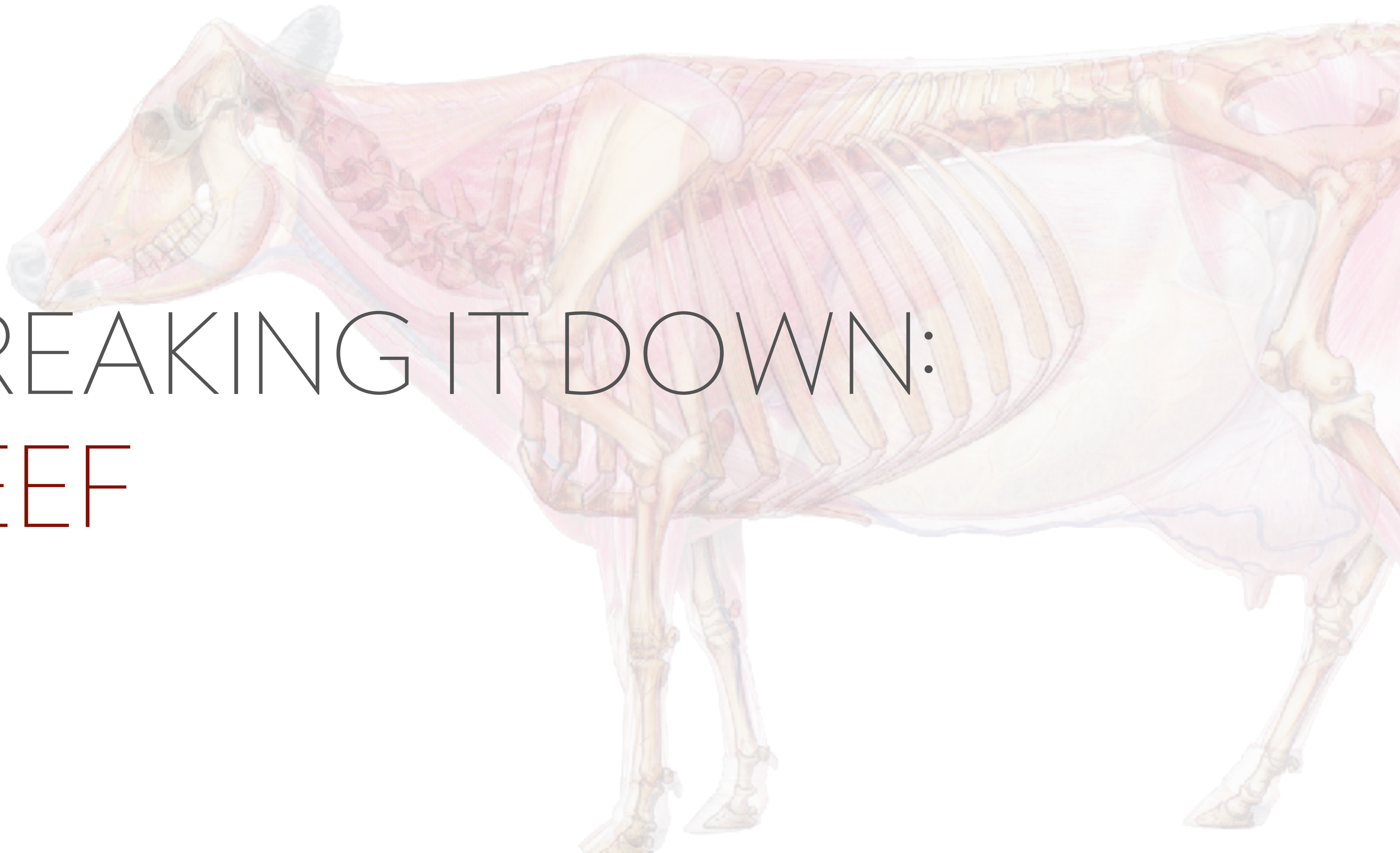


BREAKING IT DOWN:
BEEF

BY ADAM DANFORTH

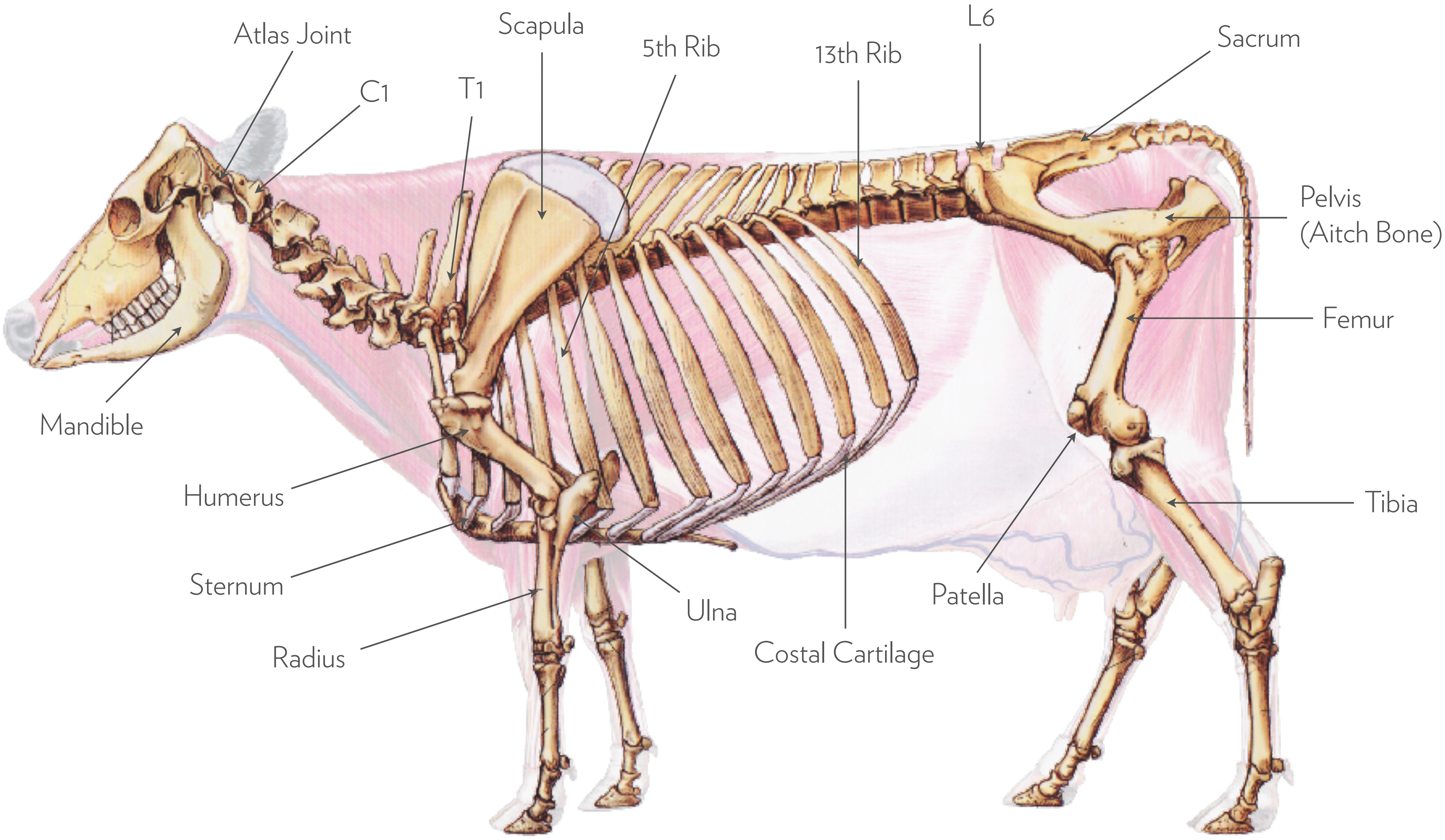
WWW.ADAMDANFORTH.COM

BEEF

Bos taurus

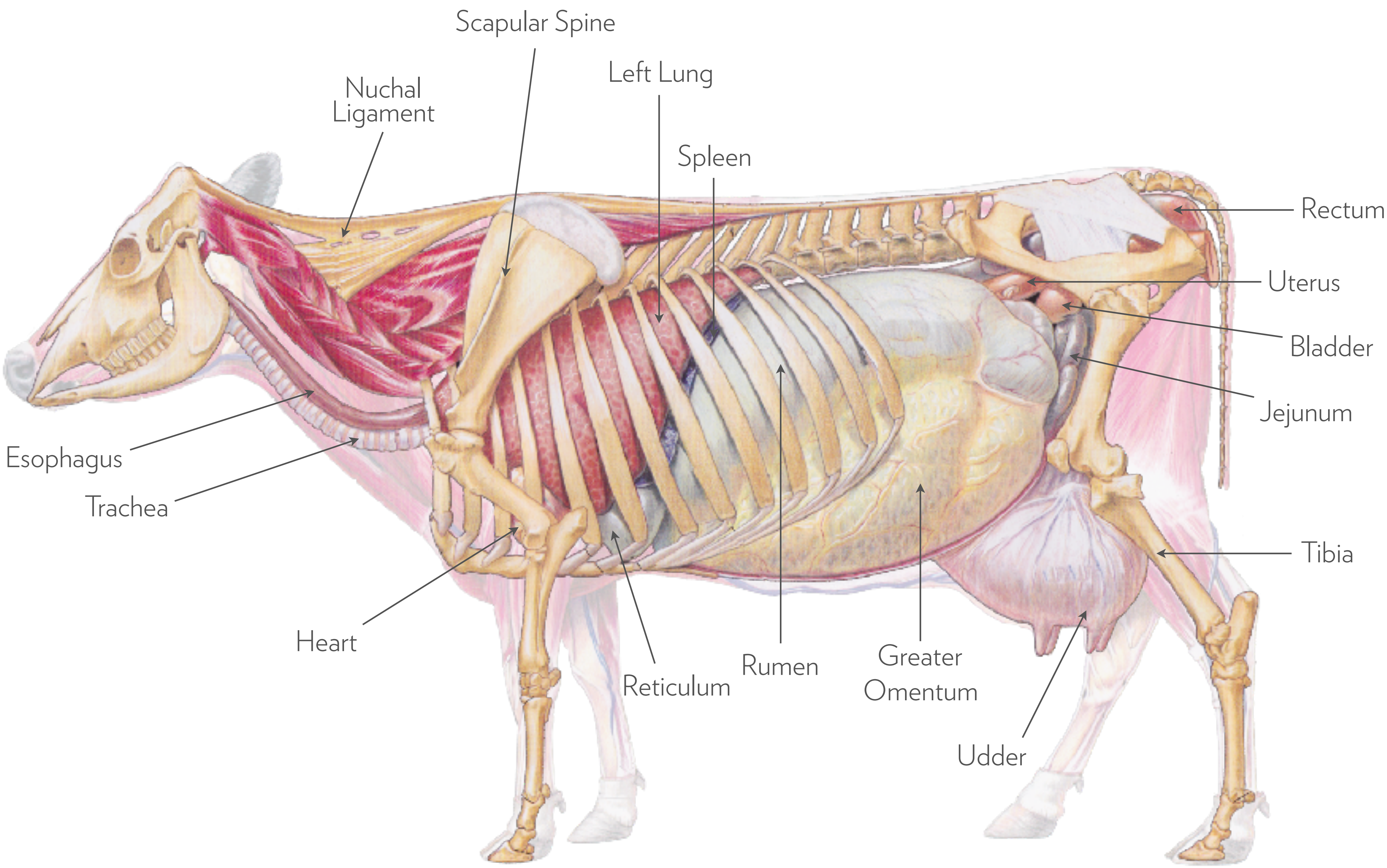
BEEF

The Muscular Structure



BEEF

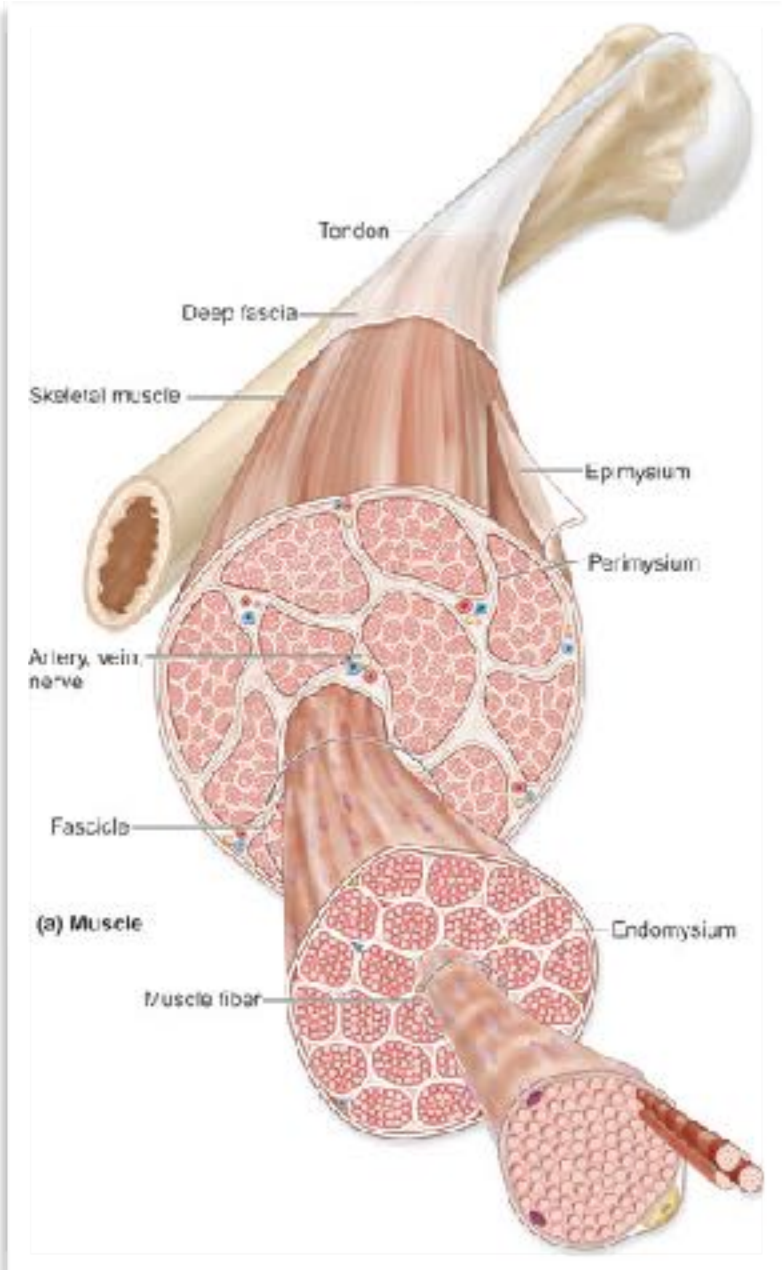
The Skeletal Structure



BEEF

Visceral Basics

Muscle Fibers:
Structural Basics



• The long, slender cells that makeup muscles are called fibers.

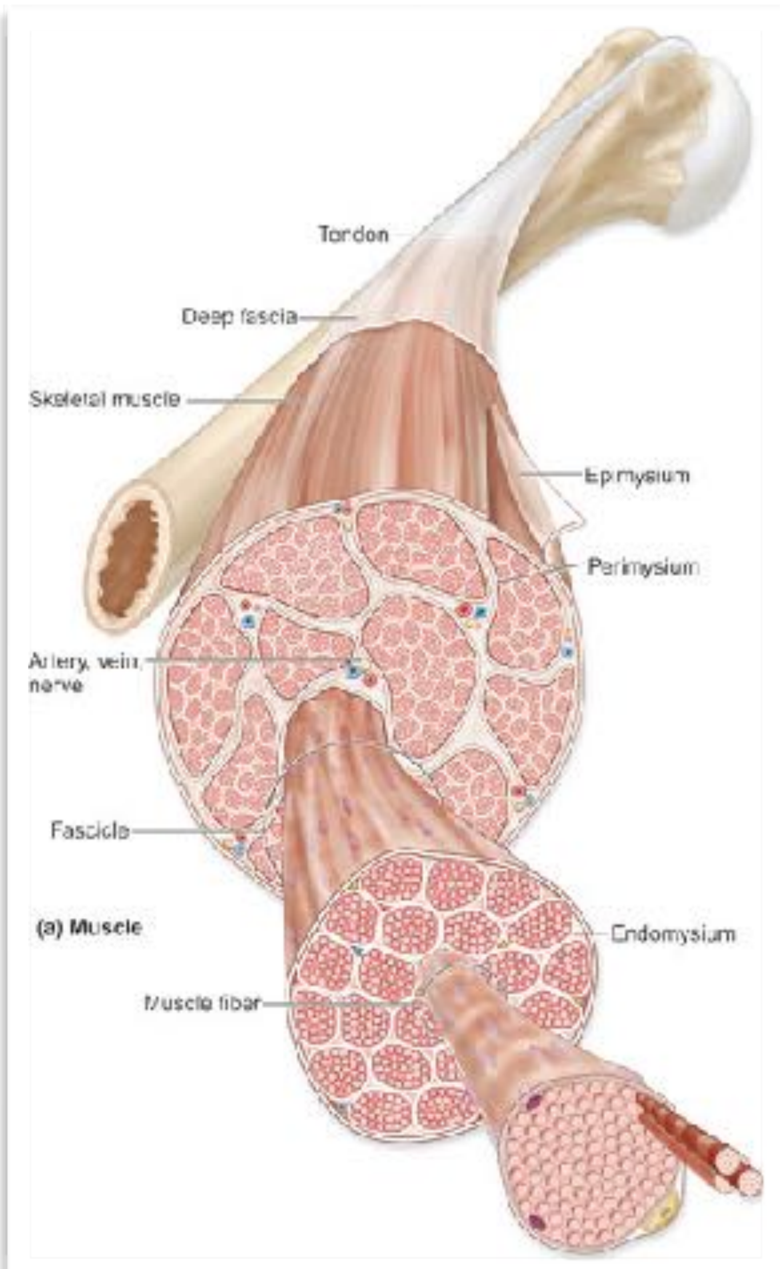
• Fibers are organized into bundles that are, in turn, grouped together by connective tissue. Fascicles are the smallest fiber bundle that we can see with the naked eye.

•Muscular endurance (not strength) is created by oxygen, fat, and connective tissue. The more a muscle needs to work, the more oxygen it needs to run, the more fat it needs as fuel, and the more connective tissue it needs as structural support.

• Therefore, the less a muscle works, the more tender and lean it is (tenderloin); the more a muscle works, the more tough and fatty it is (shoulders).

• The stronger a muscle needs to be, the thicker the fibers and the bigger the muscle. The strongest muscles, and thickest fibers, are those requiring short, sudden bursts of energy (fight or flight responses). The fatter (stronger) the fiber, the harder it is to cut or chew through, making it less tender.

Muscle Fibers:
Structural Basics



• Muscles fibers are easier to separate than to sever. Hence, we perceive meat to be more tender when we can separate the fibers more easily.

• Cutting across the grain of a muscle makes shorter fibers that are grouped together. This allows our teeth to separate the bundles rather than sever them, giving the impression of greater tenderness.

• Muscle fibers tighten as they cook, expelling their interior moisture and causing them to dry up. (Think, wringing out a towel.)

• As moisture is lost and evaporates, density of fibers increases: the more you cook it, the drier and tougher it will get.

• As fibers cook, heat breaks down the interior proteins into new flavor compounds.

• The older the animal, the more proteins (flavor potential) are contained within the muscle fibers. The more proteins in the fibers, the thicker (tougher) the fibers.

Collagen:
Structure and Succulence

• Collagen is the main structural protein found in connective tissue throughout the body. This includes tendons, ligaments, silverskin, and all fascia.

• Collagen, and the cross-liking between fibers, is the main factor in muscle tenderness. As an animal ages, more cross-links develop, making meat from older animals less tender.

• The more a muscle needs to work, the more connective tissue will be present, as the structural support of these tissues helps provides the necessary endurance.

• Structural muscles have the highest concentration of connection tissue. The closer to the ground (shanks, lower leg, etc) the more connective tissue is needed; the closer to a bone, the more connective tissue the muscle needs.

• During cooking (temperatures over 122° F) collagen reacts with water (called hydrolysis) and begins to break down into gelatin, the sticky, unctuous substance that adds body and some of the mouthfeel we associate with delicious food.

• Meats with high concentrations of collagen benefit most from cooking in moist environments where the additional moisture aids in the hydrolysis of collagen into gelatin.

• Unlike muscle fibers, which get drier as they cook, collagen softens and the resulting gelatin adds succulence to otherwise dry cuts.

Muscle Pigmentation:
Myoglobin States

Deoxygenated

Oxygenated

Oxidized

- Myoglobin, a protein, is responsible for muscle color, similar to how hemoglobin is responsible for blood color.

- Myoglobin carries oxygen from the bloodstream into muscles where oxygen is then supplied to fibers.

- Muscles that need more oxygen (for endurance) are darker and redder in color due to higher concentrations of myoglobin.

- Therefore, white, or lighter, meat operates with little to no oxygen, while darker meats require more oxygen to function.

- The darker the meat, the more endurance it needs; the more endurance it needs, the more connective tissue it will have, making it less tender.

- The darker the meat, the more connective tissue and fat will be present, making it more flavorful after proper cooking.

Muscle Pigmentation:
Myoglobin States: Deoxygenated

Deoxygenated

- This first state occurs when myoglobin is not holding on to any oxygen. After an animal is dead there is no more circulation of oxygen-rich blood and no need for muscle fibers to operate: no more oxygen for the myoglobin to carry around.

- Hence, the default state of myoglobin in meat is the deoxygenated state, the result of the myoglobin's last delivery of oxygen to an eager muscle fiber.

- Meat in this first state is purplish-red. This may sound familiar to anyone who has sliced open a raw steak or separated a bunch of ground lamb to find the interior tinged with a purple hue; red meat cuts that have been vacuum sealed also tend show deoxygenated coloration.

- What you see is myoglobin without access to oxygen — that is, until you give it access to the air around it.

Muscle Pigmentation:
Myoglobin States: Oxygenated

Oxygenated

• The second state of myoglobin occurs when it picks up some oxygen.

• When myoglobin is oxygenated it is called *oxymyoglobin*, which is bright red.

• Oxygenation can happen from anywhere oxygen resides: living muscles gather oxygen from the bloodstream; meat picks up oxygen during exposure to air.

• Myoglobin binds with oxygen whenever it has the opportunity, so when you cut open that raw steak, break apart a pile of ground lamb, or open a vacuum sealed packaged of red meat, the hue shifts from purplish-red to cherry red, a process known as “blooming.”

Muscle Pigmentation: Myoglobin States: Oxidized

Oxidized

• Myoglobin may like to carry around oxygen, but it is not all that great at holding on to it.

• The bond between myoglobin and oxygen is highly unstable and susceptible to being broken through exposure to things like bacteria, enzymes, light, or even more oxygen.

• When oxygen breaks away, it often steals an electron, leaving myoglobin in an oxidized state called *metmyoglobin*.

• Metmyoglobin is brownish-red and responsible for the unattractive hue of meat left in compromising conditions for too long — on the counter, in the fridge, under heat lamps — but it does not always indicate spoilage or rancidity.

Live Weights vs. Final Yields

Live Weight
- *How much the animal weighed when it was alive*

Carcass Weight
- *The **Live Weight** minus the blood, hide, and guts*

Cutting Yield
- *The **Carcass Weight** minus the bones (for boneless cuts) and trimmings*

Dressing Percentage (DP)
Carcass Weight (**50 lb.**) / *Live Weight* (**100 lb.**) = **50%**

Cutting Yield (CY)
Pounds of Meat (**35 lb.**) / *Carcass Weight* (**50 lb.**) = **70%**

Final Yield
Pounds of Meat (**35 lb.**) / *Live Weight* (**100 lb.**) = **35% !!!**

General Processing Percentages			
Species	Dressing Percentage	Example Live Weight	Final Yield
Beef	*62%*	*1000 lb.*	**434 lb.**
Pork	*74%*	*200 lb.*	**104 lb.**
Lamb	*50%*	*100 lb.*	**35 lb.**
Goat	*48%*	*80 lb.*	**27 lb.**
Chicken	*70%*	*6 lb.*	**2.5 lb.**
Turkey	*77%*	*20 lb.*	**9 lb.**

Live Weights vs. Final Yields

Factors effecting dressing percentage (DP) are:

- Gut fill: *the more full the gut, the lower the DP*
- Muscling: *the more muscle, the higher the DP*
- Fatness: *the more fat, the higher the DP*
- Mud: *the more mud, the lower the DP*
- Wool: *the more wool, the lower the DP*

Factors effecting cutting yield (CY) are:

- Fatness: *the leaner the animal, the higher the edible meat yield (CY)*
- Muscling: *heavy muscling equals more meat (CY)*
- Bone-in vs. Boneless: *keeping the bones in the cuts will dramatically increase the CY and the final weight of the products (though not change the amount of edible meat)*
- Trimming: *the closer you trim, the less yield; leaving more surface fat will increase the CY (though not edible meat)*
- Ground Leanness: *the leaner the ground products, the lower the CY*

Live Weights vs. Final Yields

LAMB EXAMPLES:

The equation for determining the final yield is:

(Dressing Percentage x Cutting Yield) x Live Weight = Final Yield

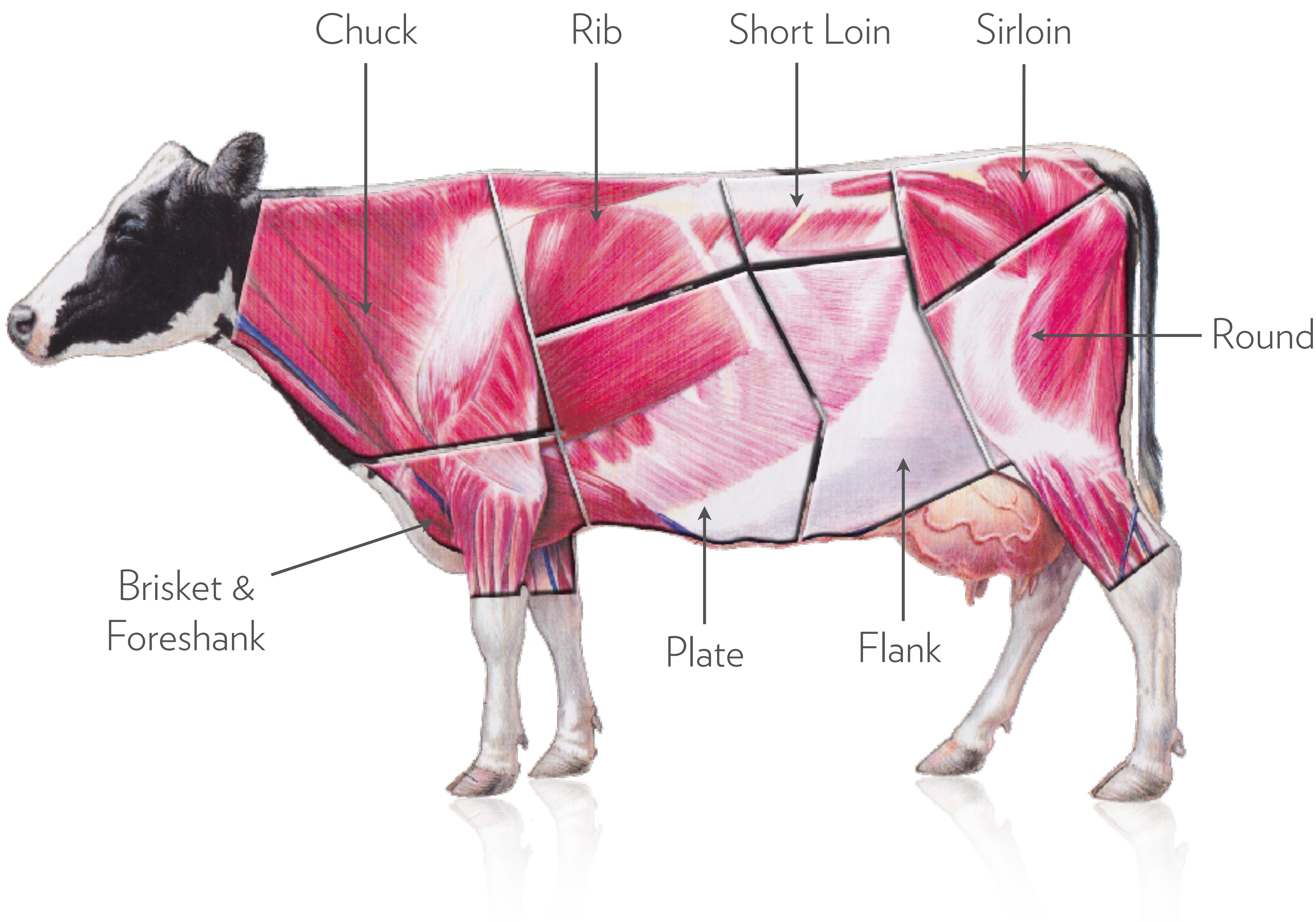
Average market lamb, shorn, weighed full, 120 lb., bone-in chops and roasts, closely trimmed, regular ground lamb:
(.51 X .75) X 120 = 38% X 120 = 46 lb. of meat

Average market lamb, shorn, weighed empty, 120 lb., bone-in chops and roasts, closely trimmed, regular ground lamb:
(.54 X .75) X 120 = 41% X 120 = 49 lb. of meat

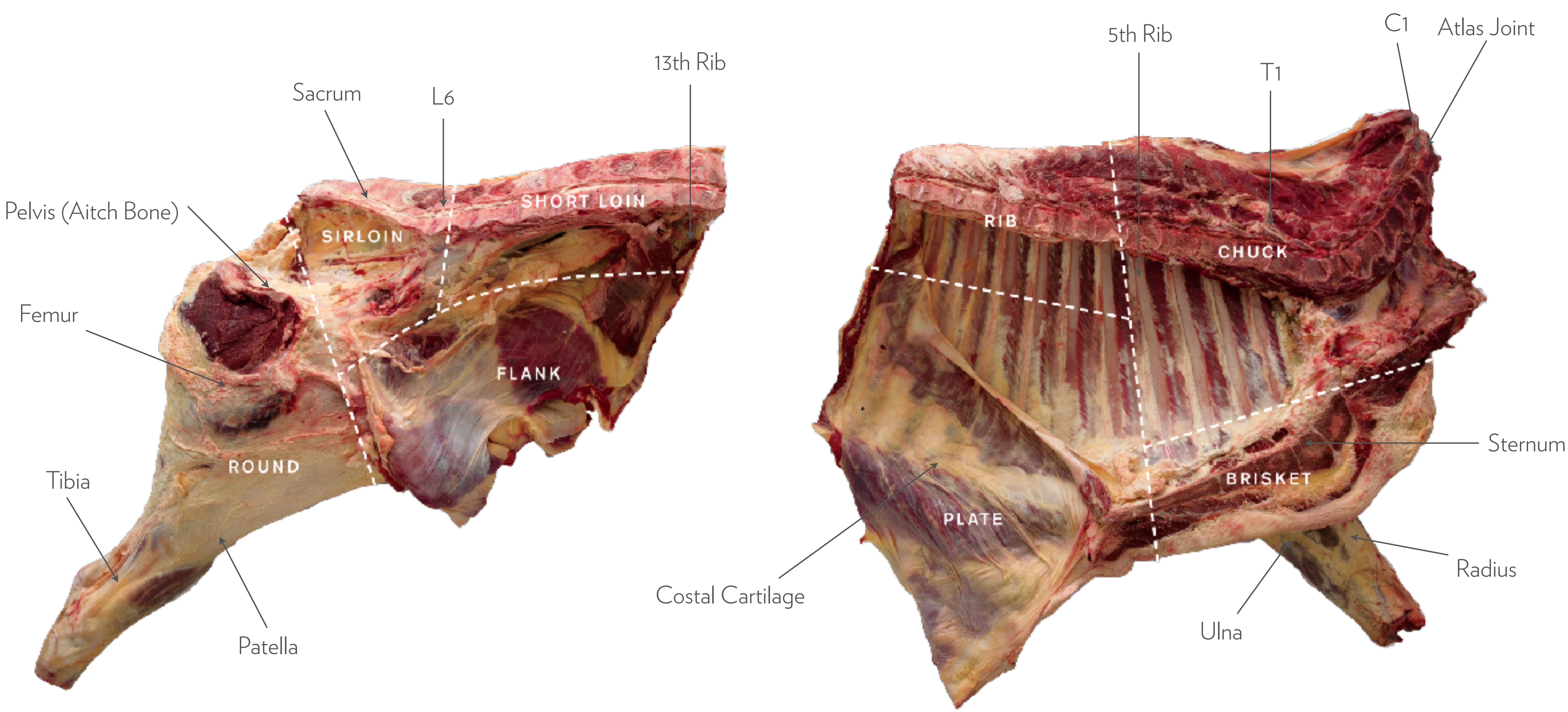
Average market lamb, shorn, weighed full, 120 lb., some bone-in and some boneless chops and roasts, closely trimmed, regular ground lamb:
(.51 X .68) X 120 = 35% X 120 = 42 lb. of meat

Lean, heavily muscled market lamb, shorn, weighed empty, 120 lb., bone-in chops and roasts, closely trimmed, regular ground lamb:
(.57 X .78) X 120 = 44% X 120 = 53 lb. of meat

Fat, light muscled market lamb, long fleece, weighed full, 120 lb., bone-in chops and roasts, closely trimmed, regular ground lamb:
(.48 X .65) X 120 = 31% X 120 = 37 lb. of meat

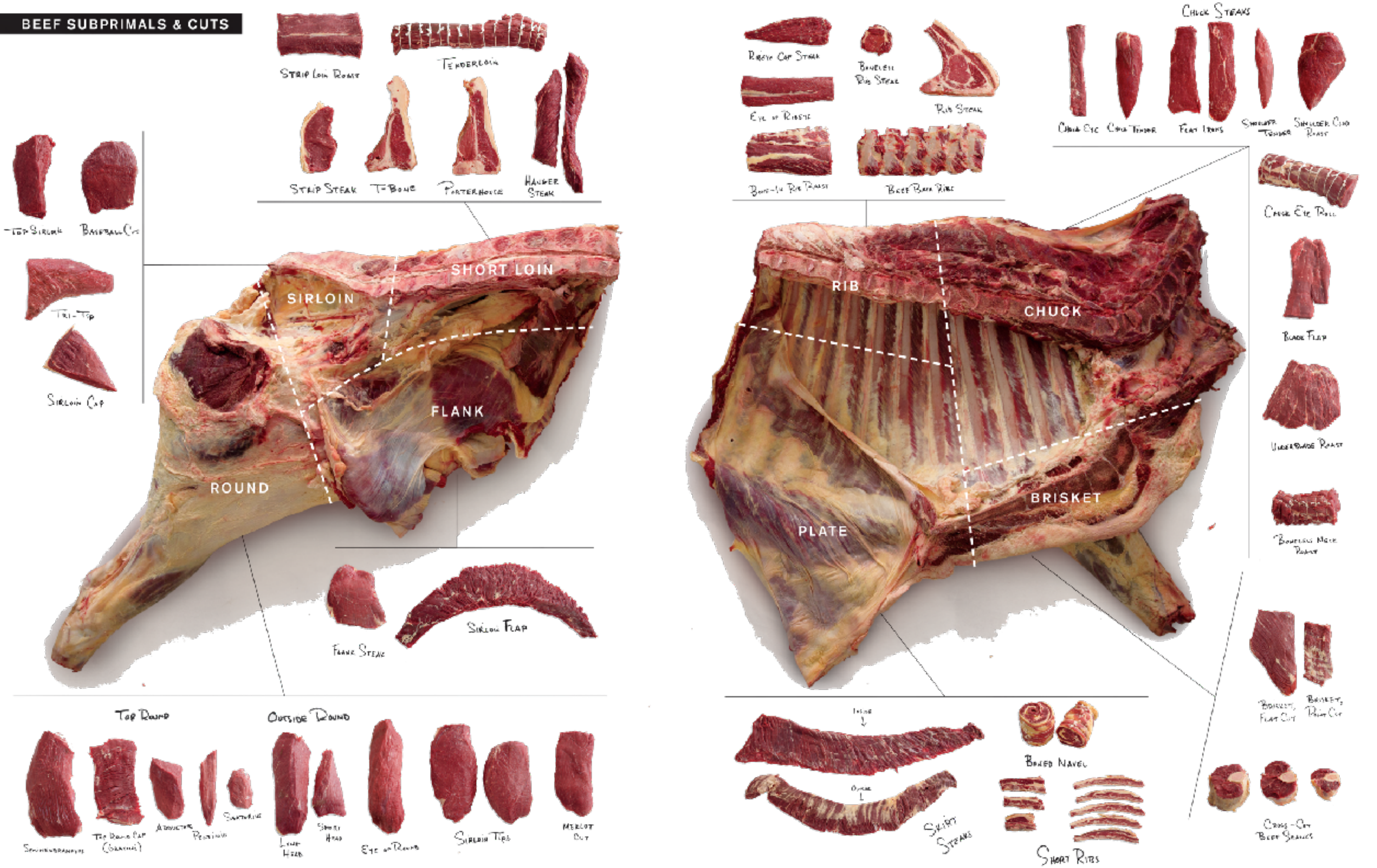


Beef Primals



Pelvis (Aitch Bone)
Sacrum
L6
13th Rib
SIRLOIN
SHORT LOIN
Femur
FLANK
Tibia
ROUND
Patella
5th Rib
T1
C1
Atlas Joint
RIB
CHUCK
Sternum
BRISKET
PLATE
Costal Cartilage
Radius
Ulna

BEEF SUBPRIMALS & CUTS



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