THORAX

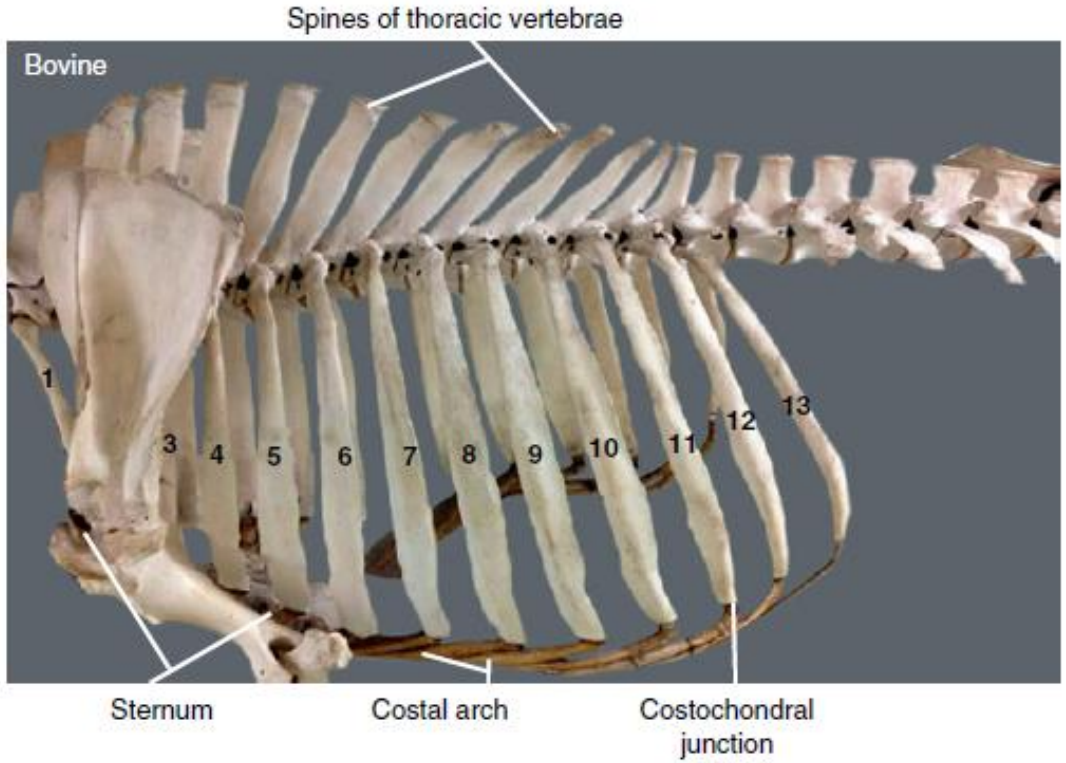
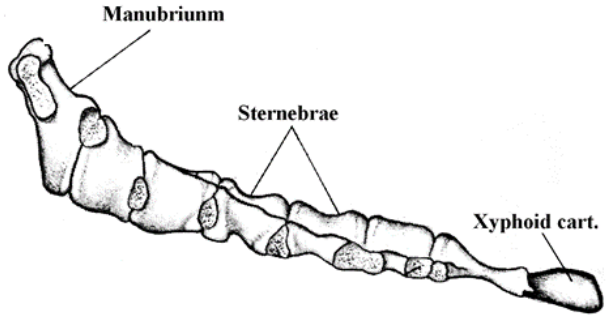


Figure 2.1 Articulated bovine thorax. Rib 2 and part of rib 3 are concealed by the scapula.

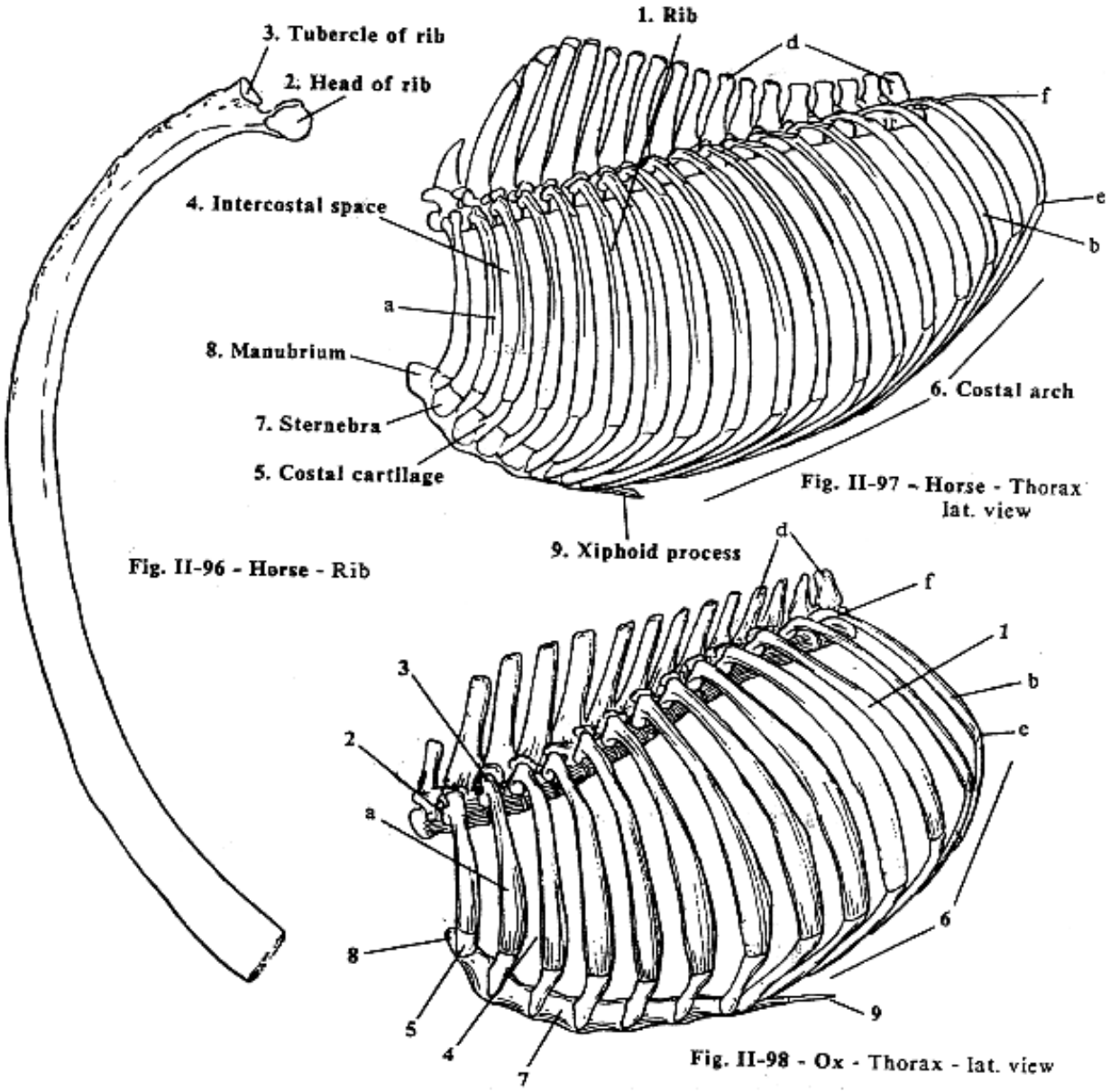


The thorax of ruminants typically includes 13 thoracic vertebrae and 13 pairs of ribs. The floor of the thorax is formed by the sternum. The sternum is composed of seven sternebrae that connect with costal cartilages of 8 out of the 13 ribs.

Note the flat structure of ribs with narrower intercostal T in ruminants when compared with the round ribs of the horse. Rib fractures, although rare, may occur in young calves during difficult calving (dystocia).

The Term “Thoracic Inlet” Means The Entrance To The
Thoracic Cavity. The Boundaries Of The Thoracic Inlet
Include The First Thoracic Vertebra (T1) Dorsally, First
Pair Of Ribs Laterally, And First Sternebra (Manubrium) Ventrally.

Many Structures Pass Into Or Out Of The Thoracic Cavity Through The Thoracic Inlet : Examples Include The Esophagus, Trachea, Common Carotid Arteries, Vagosympathetic Trunks, Longus Coli Muscles, Subclavian Arteries, And External Jugular Veins.



THORACIC MUSCLE

Muscles effective in inhalation

1- External intercostal
2- Levator costarum
3- Rectus thoracis
4- Serratus dorsalis cranialis
5-Diaphragm

……

Muscles effective in exhalation

1.Internal intercostal
2.Serratus dorsalis caudalis
3.Transverse thoracic

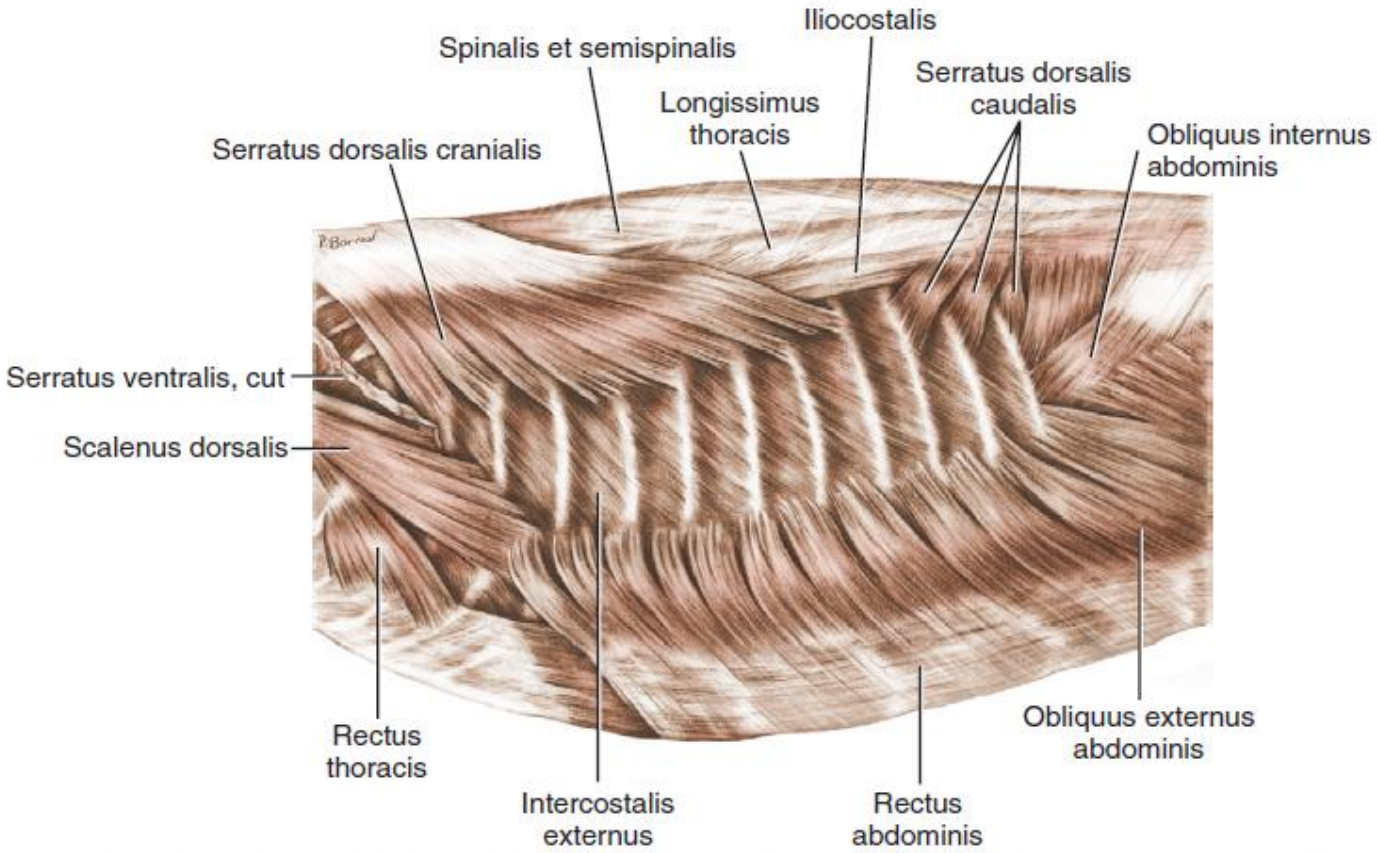
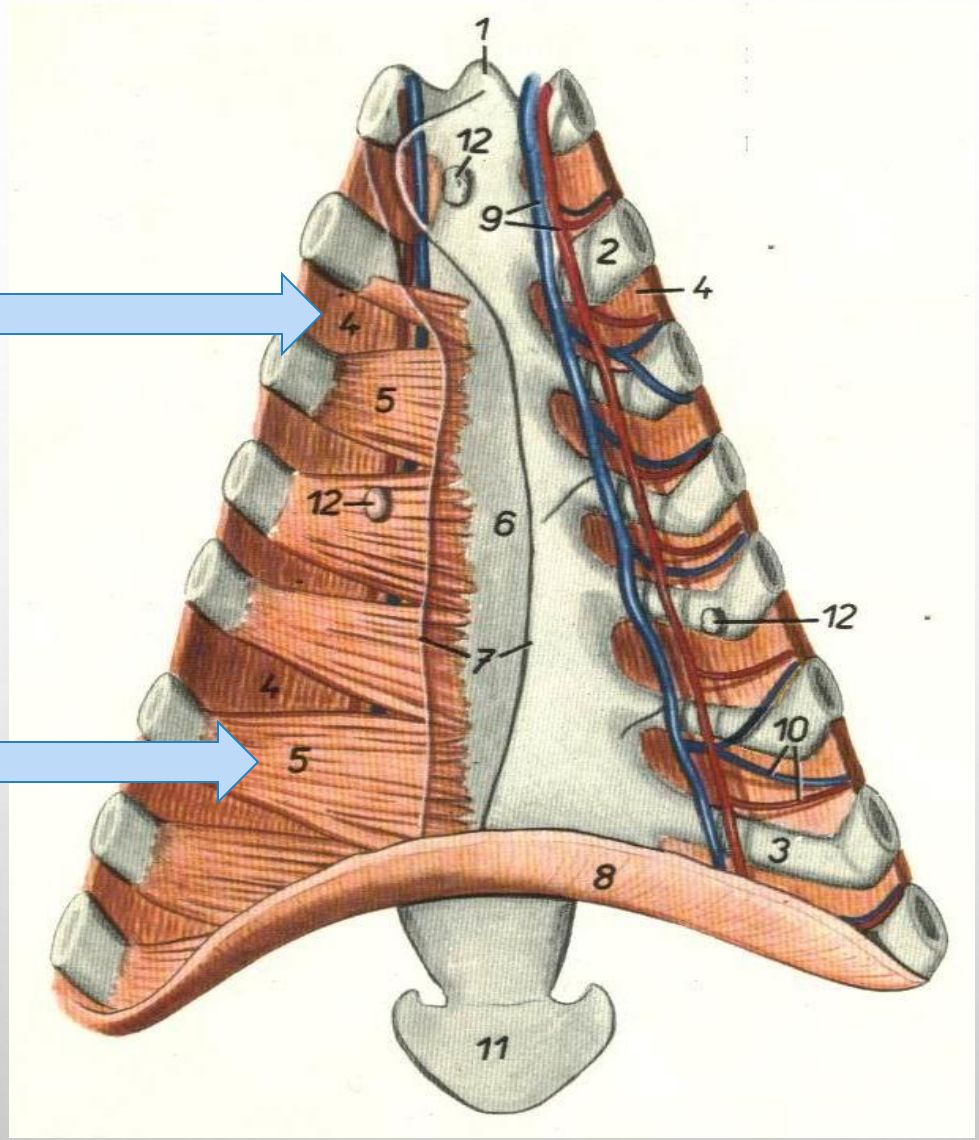
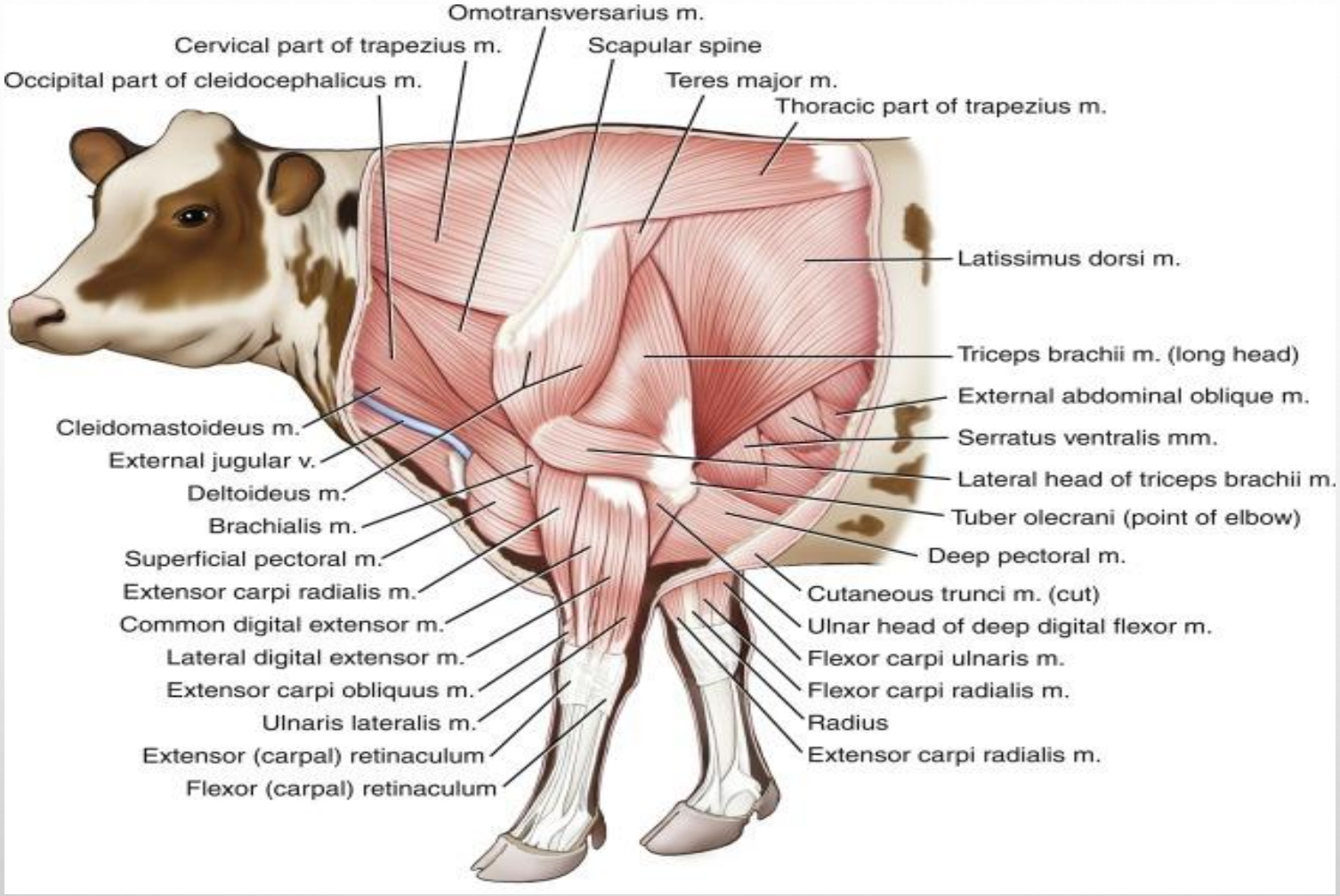


FIGURE 6-33 Superficial muscles of thoracic cage, lateral aspect. (M. serratus ventralis (thoracis) has been removed.)

Internal intercostal

Transverse thoracic





In performing lung auscultation in a live animal, you should place your stethoscope in front of the basal border of the lung and caudal to the caudal border of the triceps brachii muscle.

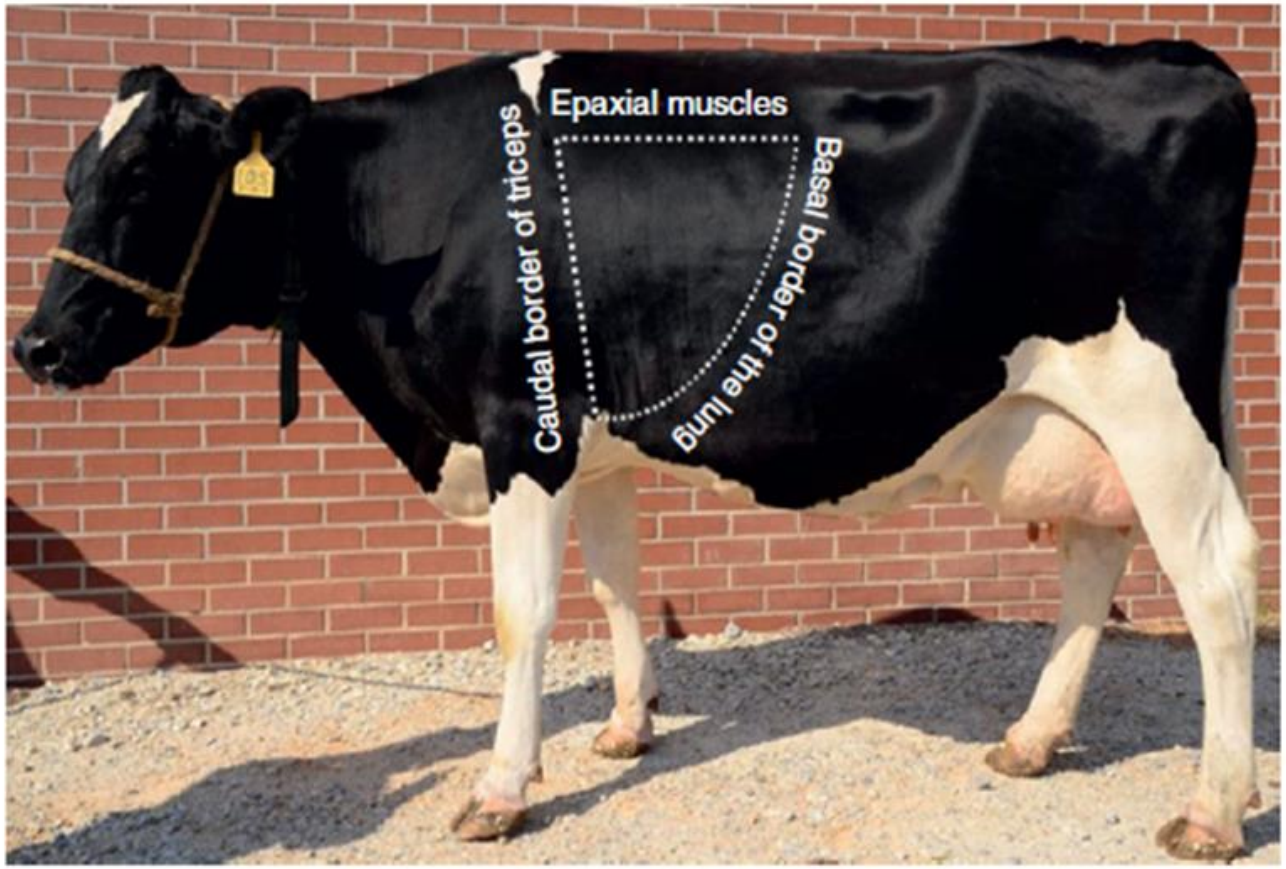


Figure 2.3 Triangular area for lung auscultation on live animal: left lateral view.

Lung auscultation: on a triangular area determined by the following anatomic boundaries:
Cranial: caudal border of the triceps brachii muscle
Dorsal: epaxial muscles
Caudal: the curved line for identification of the basal border of the lungs along the 6-10-11 ribs.

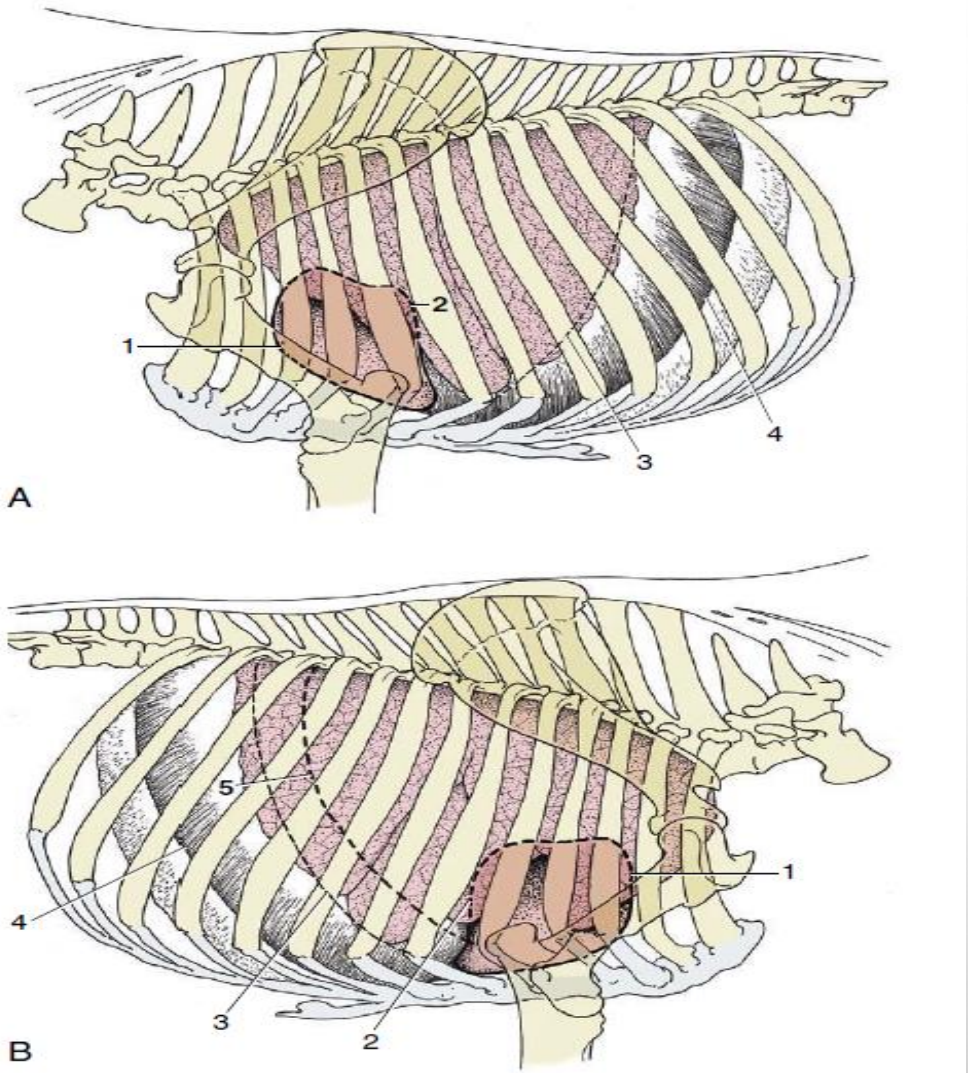
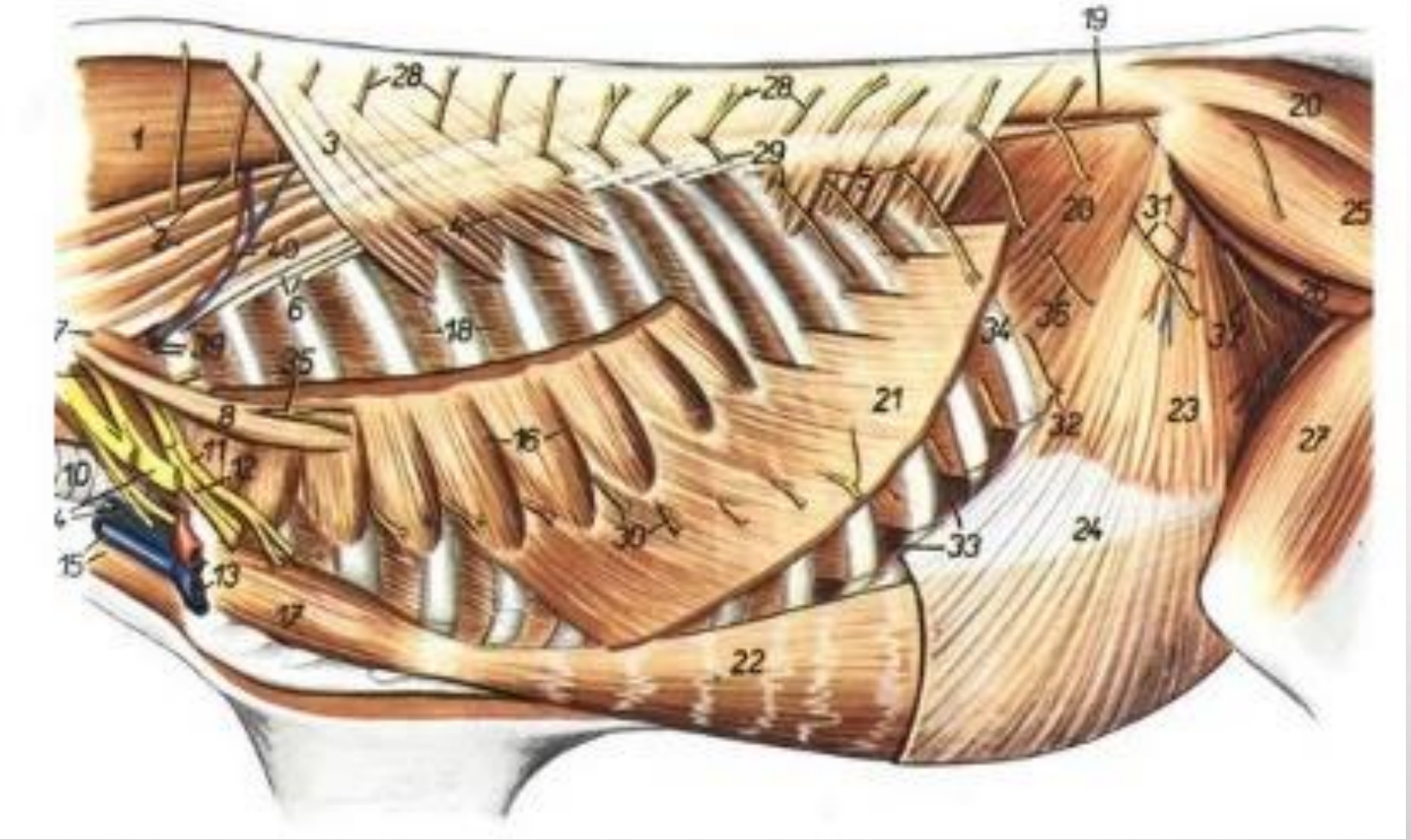
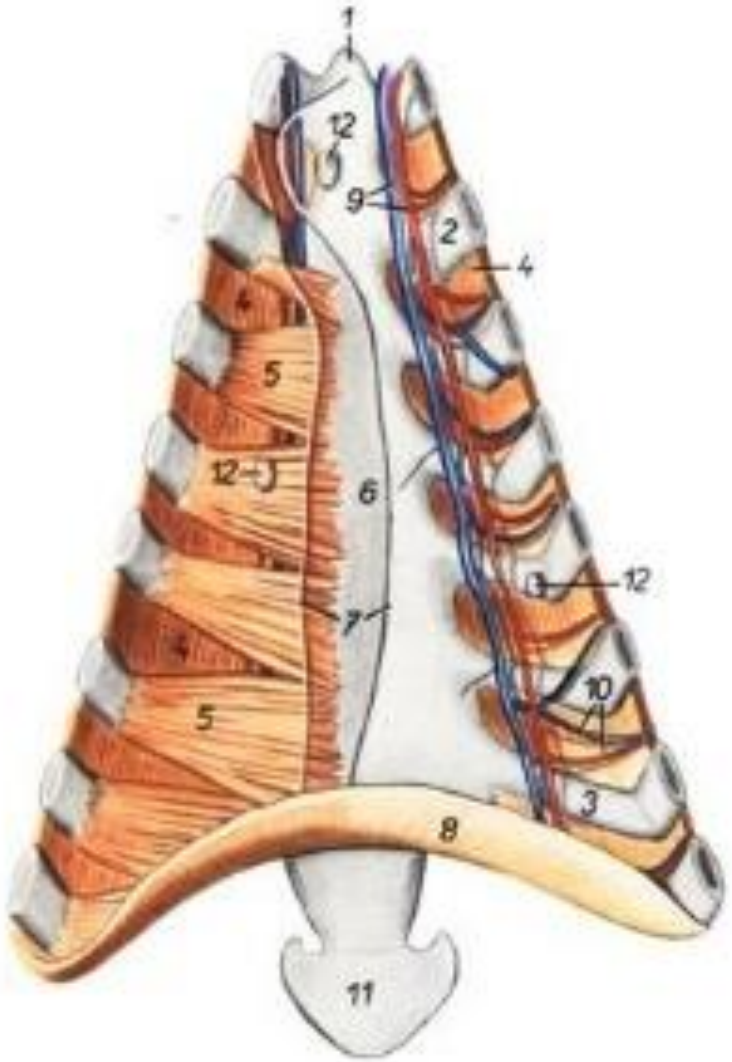


Figure 27–2 Left (A) and right (B) projections of the bovine heart and lungs on the thoracic wall. The basal border of the lung and the line of pleural reflection are also shown. *1,* Cranial extent of heart; *2,* caudal extent of heart; *3,* basal border of lung; *4,* line of pleural reflection; *5,* caudal border of lung percussion area, shown on right side.



Surgical incision into the thorax through the intercostal muscles should be made midway through the intercostal space between the ribs. This is necessary to avoid damaging the intercostal Vessels and nerves running at the caudal border of each rib.



Bovine. View of floor of thorax.

Figure 16

1. *manubrium sterni* — manubrium of sternum
2. *costa II* — second rib
3. *cartilago costalis VII* — seventh costal cartilage
4. *mm. intercostales externi* — external intercostal muscles
5. *m. transversus thoracis* — transverse thoracic muscle
6. *corpus sterni* — body of sternum
7. *laminae pleurae mediastinalis* — insertion of pleural mediastinum
8. *diaphragma* — diaphragm
9. *a. et v. thoracica interna* — internal thoracic artery and vein
10. *rami intercostales ventrales* — ventral intercostal branches
11. *cartilago xiphoidea* — xiphoid cartilage
12. *lnn. sternales* — sternal lymph nodes

Diaphragm

Thoracentesis: This can be done for both diagnostic and therapeutic purposes. A procedure for the removal of excess inflammatory fluid from the chest. Cannulation can generally be performed at the lower seventh intercostal space (7 ICS).

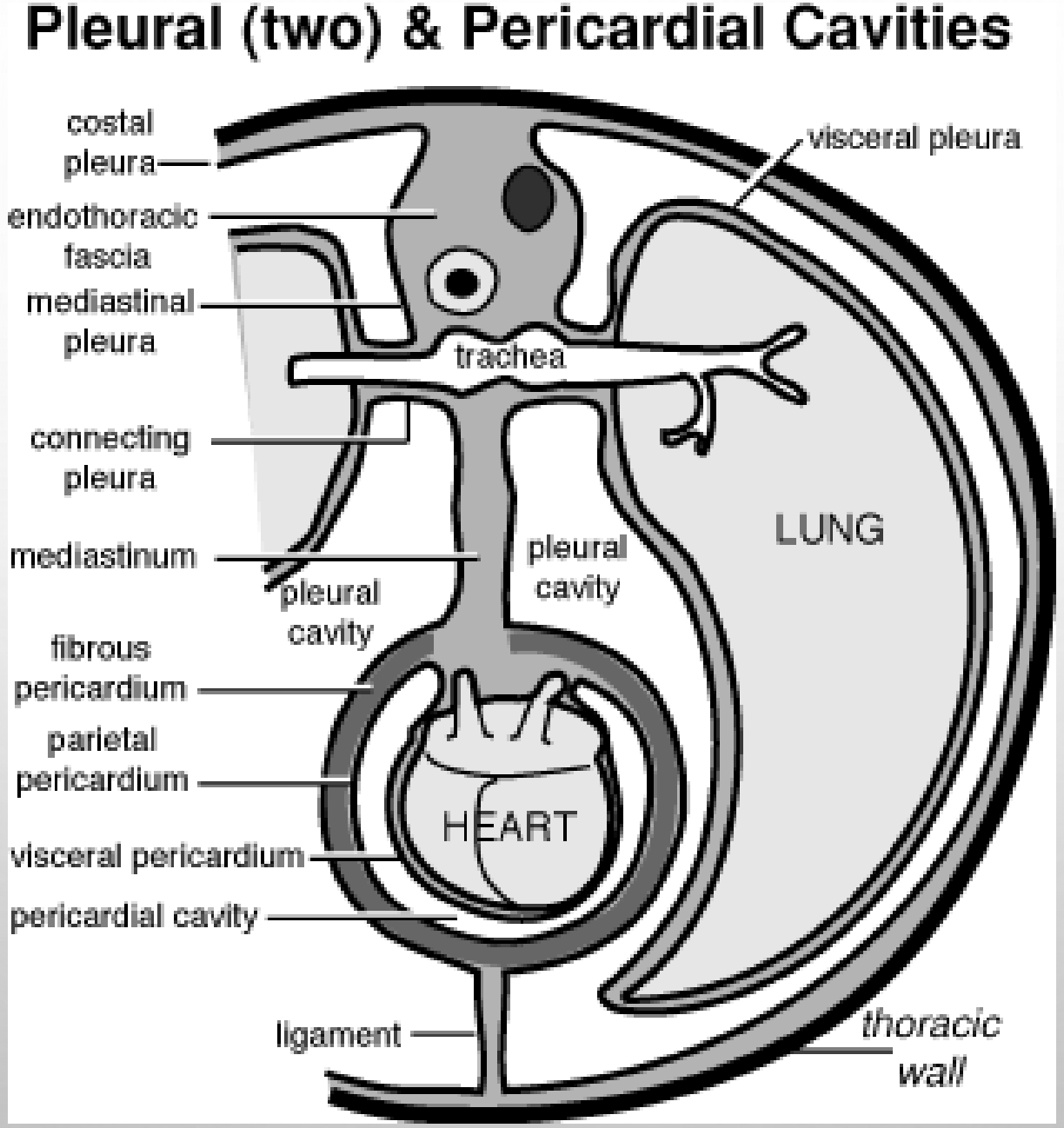
Pericardiocentesis

The pericardial sac normally contains a small amount of pericardial fluid. Fluid accumulation within the pericardial cavity can lead to muffling of the heart sounds or splashing heart sounds (also referred to as “washing machine” sounds). In cattle, the 2 most common clinical entities involving the pericardium and pericardial cavity are traumatic reticulopericarditis and idiopathic hemorrhagic pericarditis

FIGURE 18.1-4 Pericardiocentesis performed with a spinal needle in a cow. The needle is inserted under ultrasonographic guidance at the level of the 5th intercostal space on the left side, just caudal to the point of the elbow.

FIGURE 18.1-5 Inserting a large-bore thoracic drain into the pericardium of a cow to drain the pericardial effusion. The drain is inserted at the level of the 5th intercostal space on the left side, just caudal to the point of the elbow.

Mediastinum



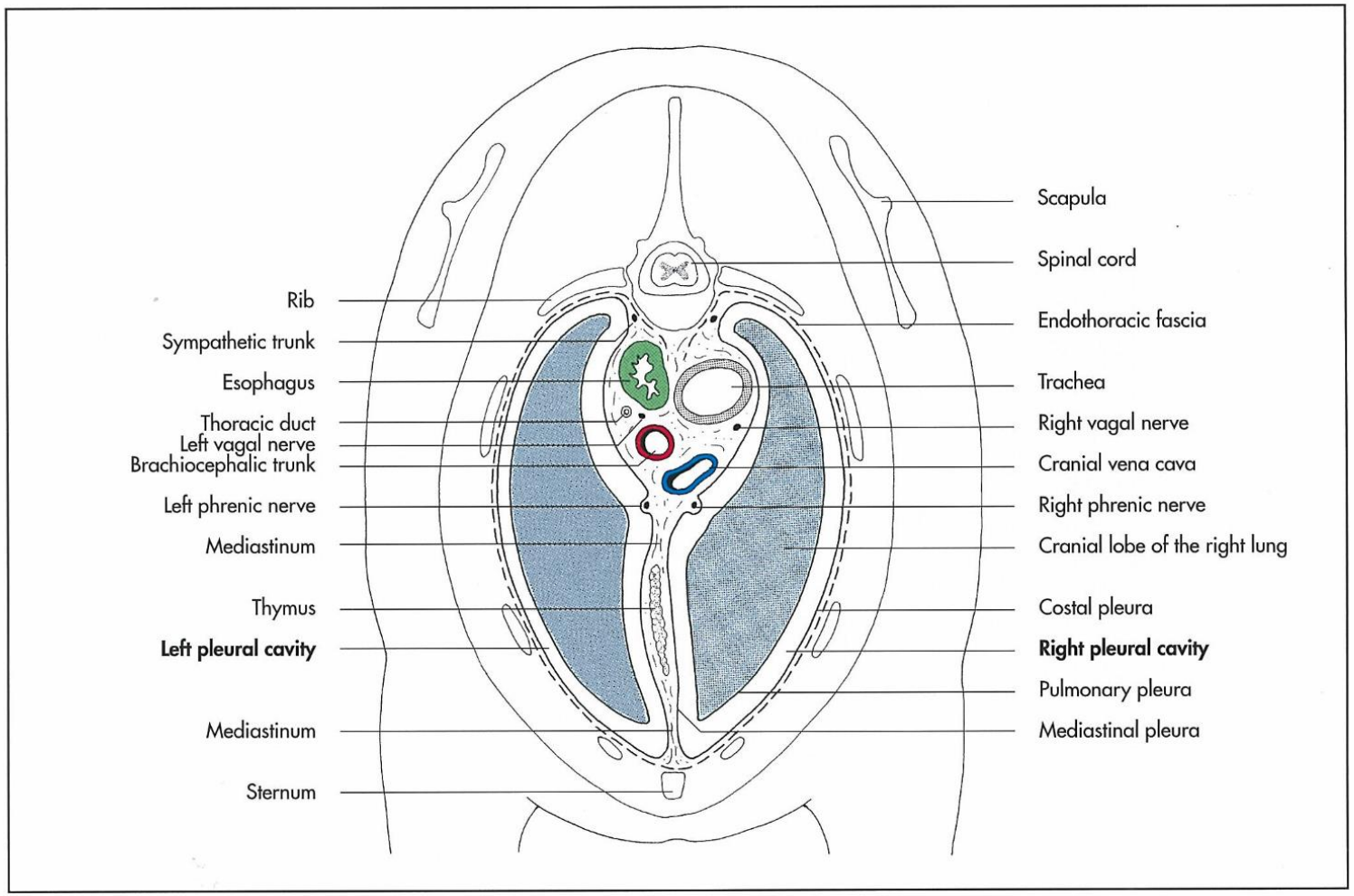


Fig. 6-5. Transverse section of the canine thorax at the level of the cranial mediastinum, caudal aspect, serosal clefts enlarged, schematic.

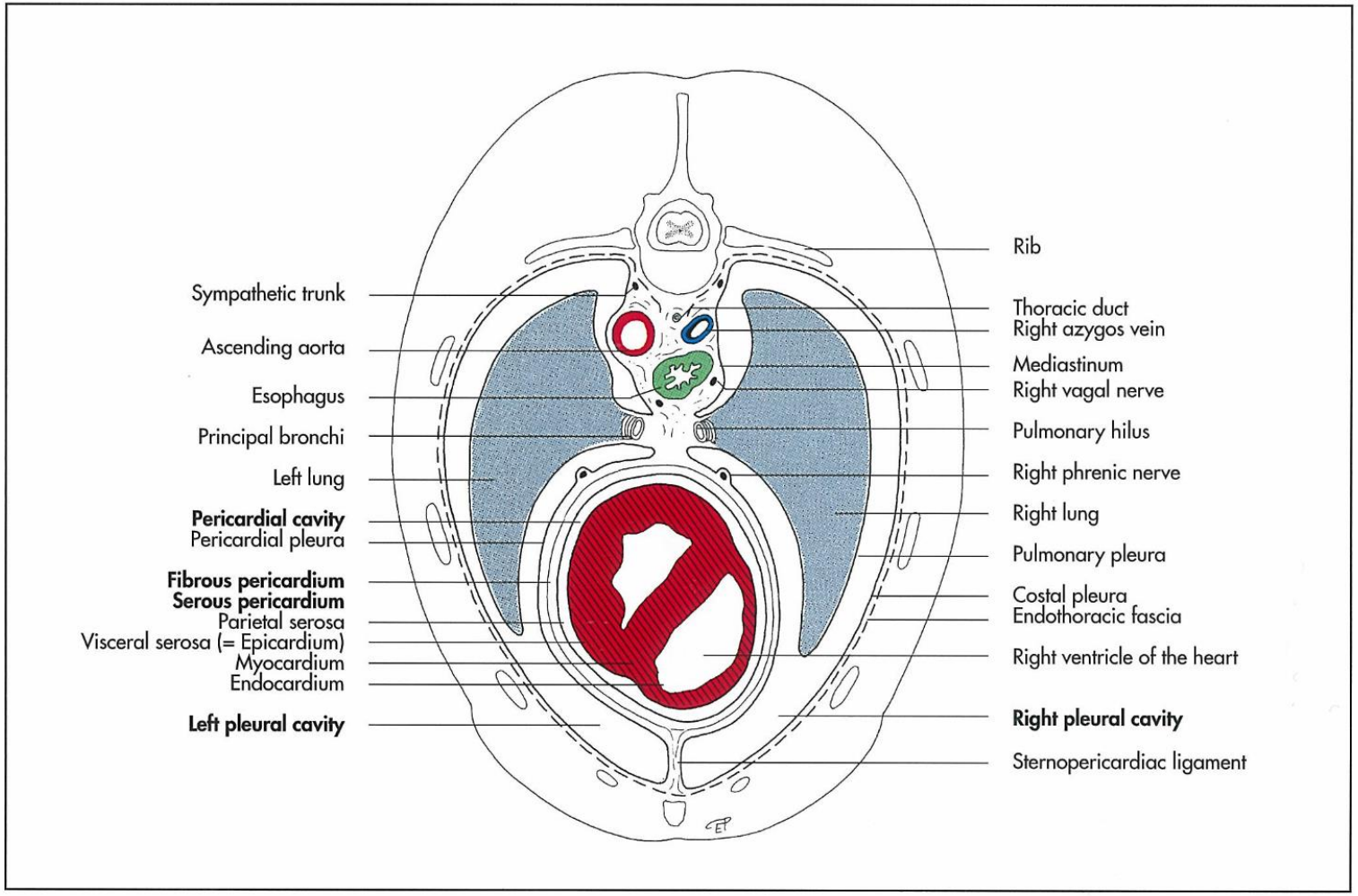


Fig. 6-6. Transverse section of the canine thorax at the level of the medial mediastinum, caudal aspect, serosal clefts enlarged, schematic.

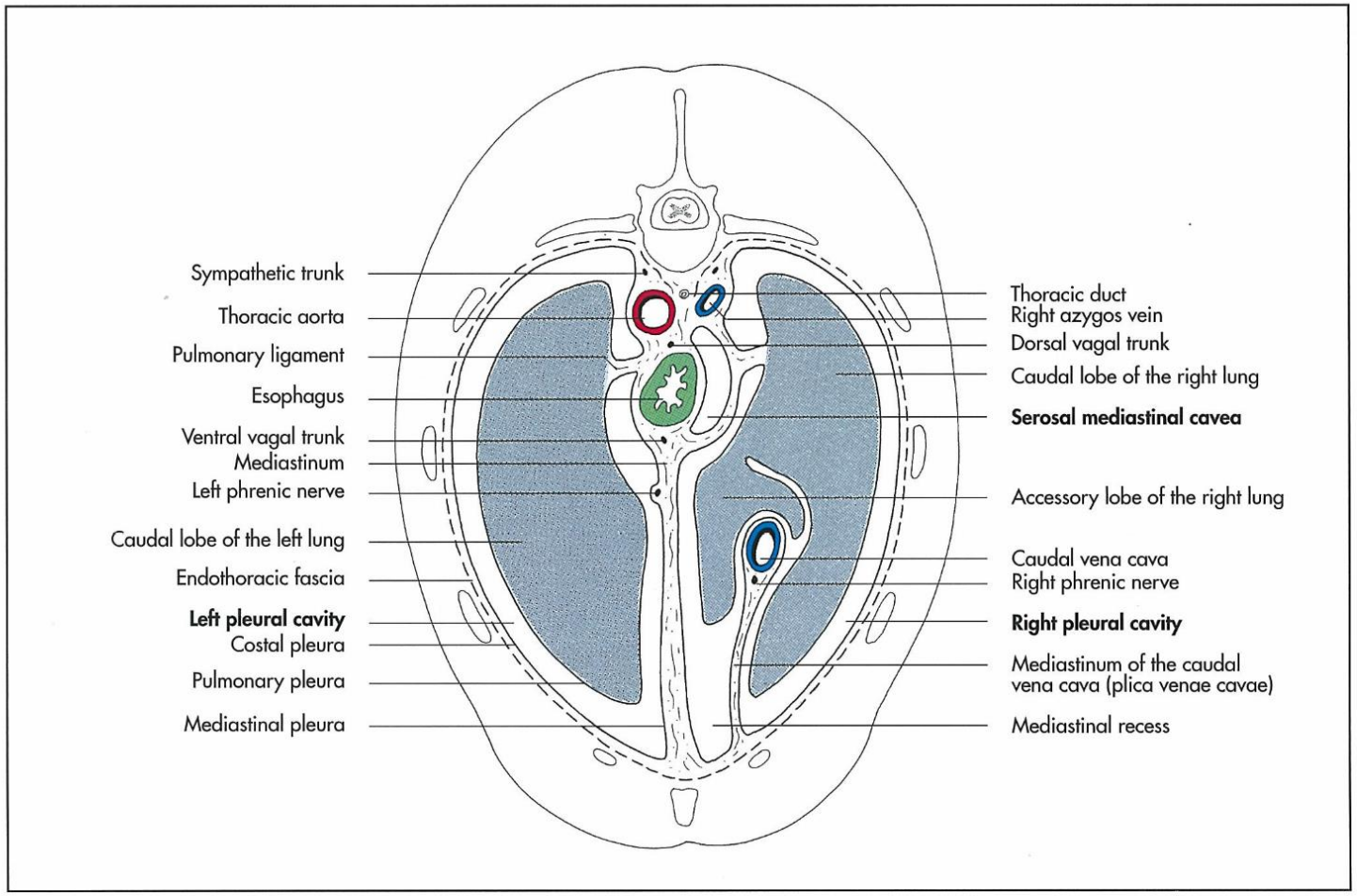
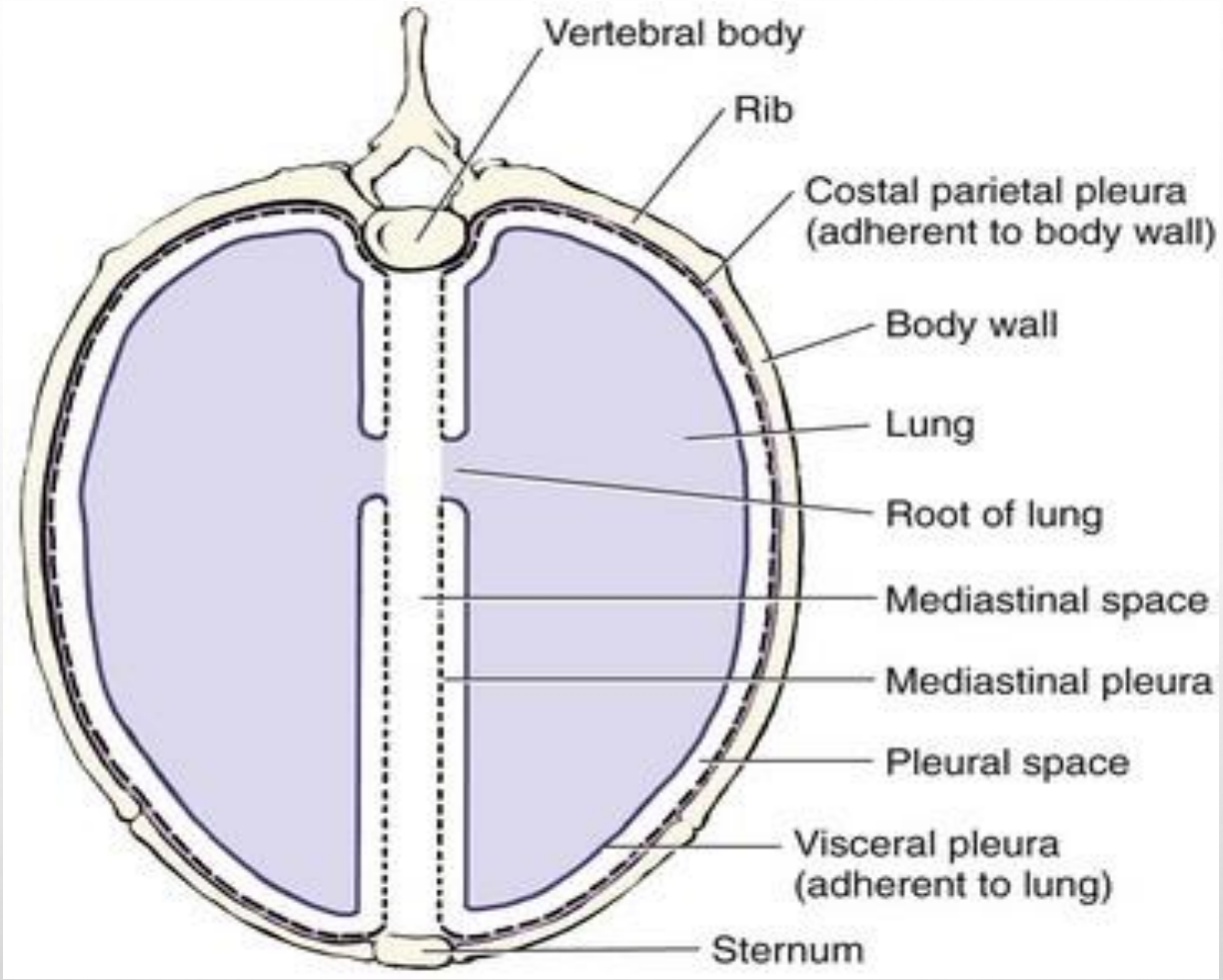


Fig. 6-8. Transverse section of the canine thorax at the level of the caudal mediastinum, caudal aspect, serosal clefts enlarged, schematic.



In ruminants, the mediastinum is relatively thick compared with the relatively thin and perforated caudal mediastinum in horses. This suggests that cattle can sustain a unilateral infection without affecting the other side of the pleural cavity or unilateral pneumothorax.

LUNGS

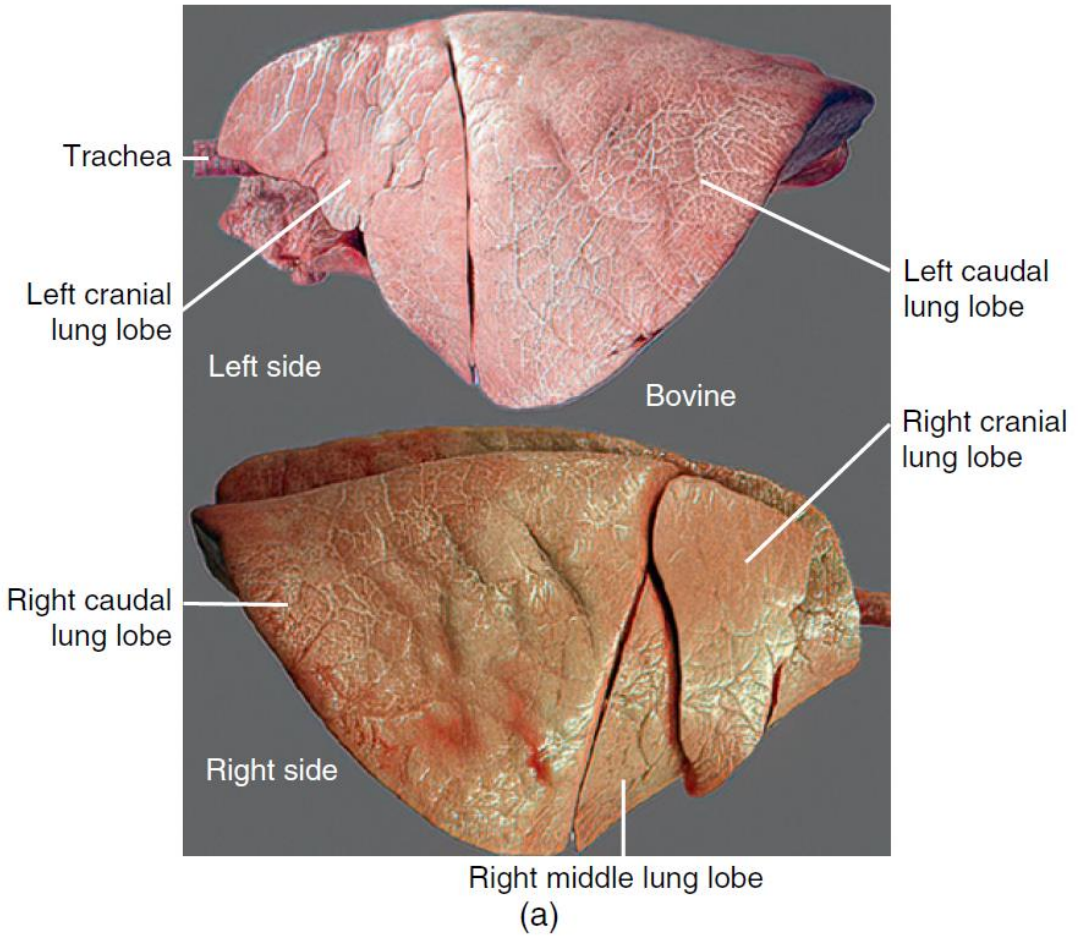
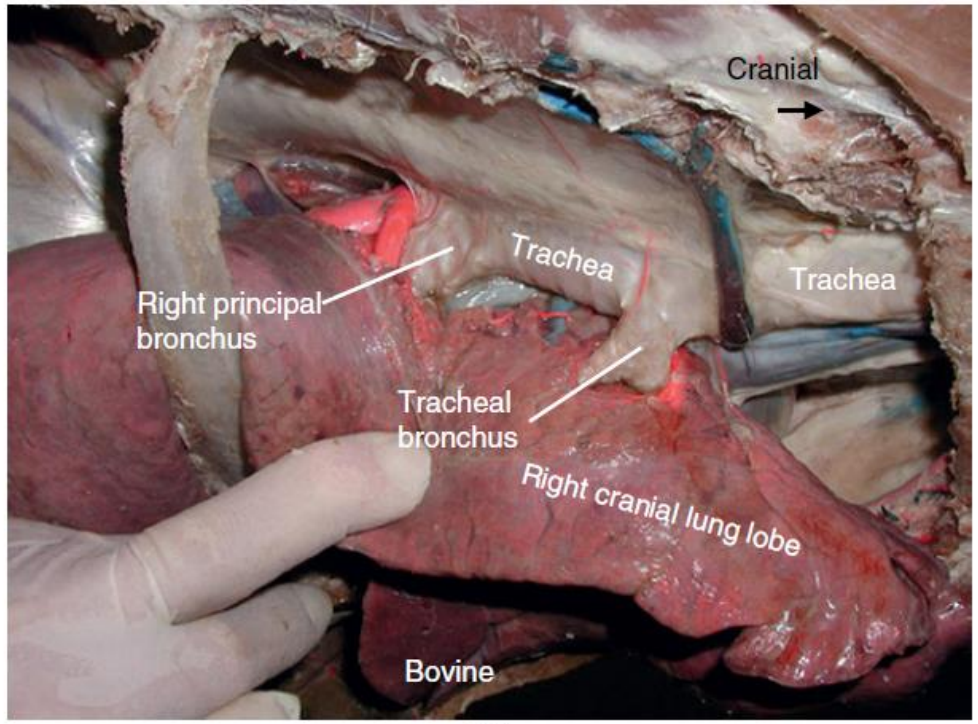
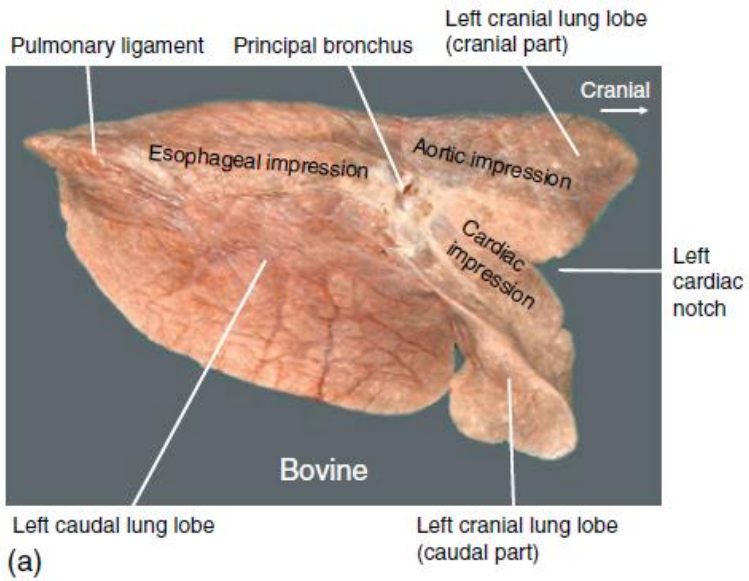


Figure 2.9 (a) Inflated fresh left and right views of bovine lungs; (b) inflated fresh bovine lungs (dorsal and ventral views. 1) right cranial lung lobe, 2) right middle lung lobe.); (c) reflection of the right bovine lung to expose the bronchi on the right side: note the bifurcation of the tracheal bronchus into the cranial and caudal parts of the right lung cranial lobe; (d) medial surfaces of the left (a) and right (b) bovine lungs; (e) dorsal view of lamb lungs. Source: Minnesota Veterinary Anatomy, University of Minnesota.

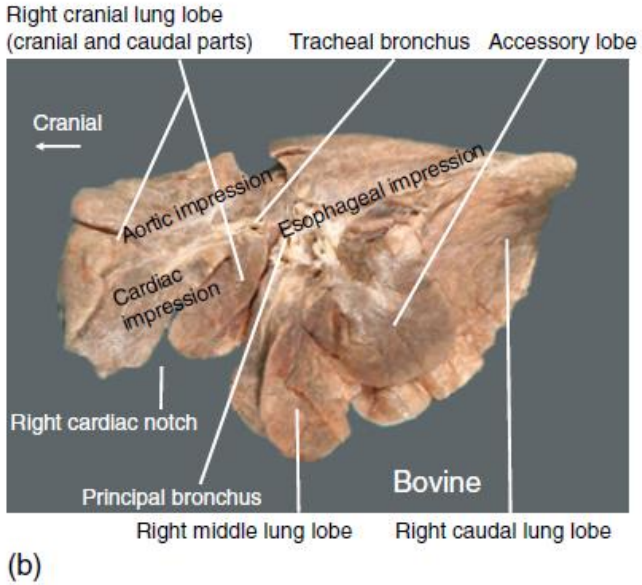
The lungs of cattle have higher connective tissue contents than those of horses. This renders cattle have a higher respiratory rate (RR) and lower functional residual capacity compared with horses (RR averages 30 breaths/minute in cattle compared with an average of 12 breaths/minute in horses). The smaller chest of cattle (13 ribs) compared with the larger chest of horses (18 ribs) is thought to contribute to the differences in breathing pattern between the two species.



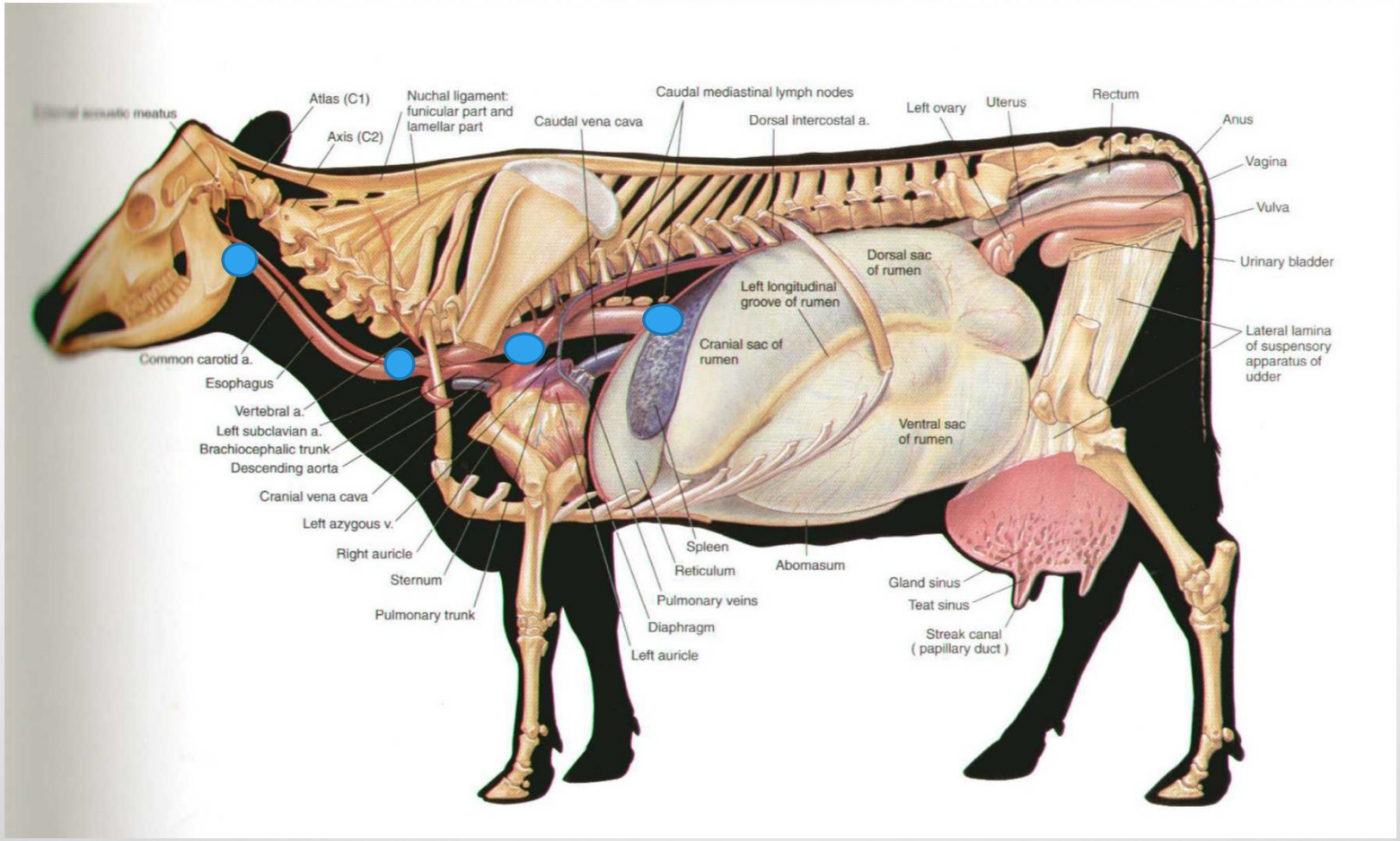
(c)



(a)



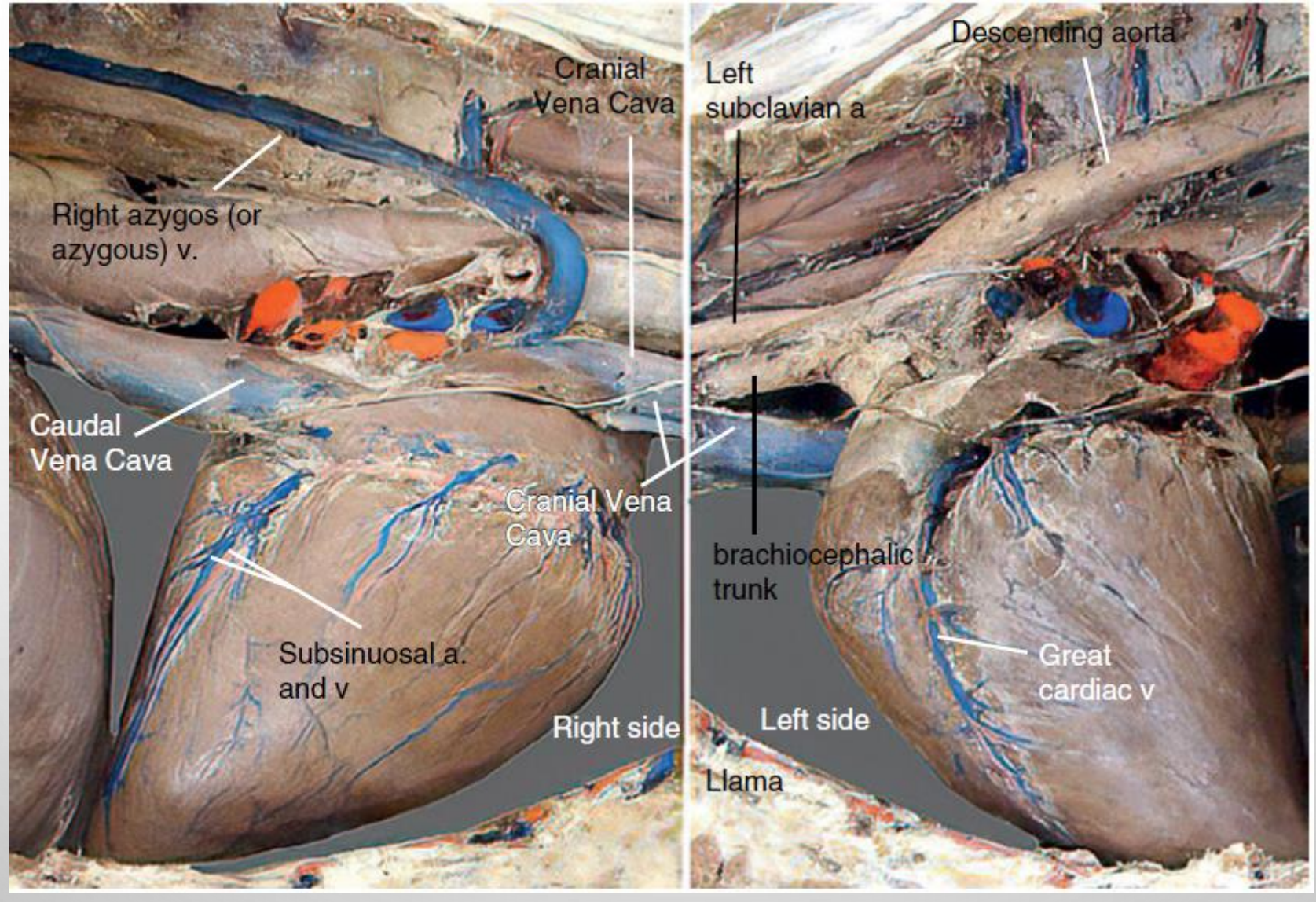
(b)



Esophageal choke: there are four common sites for foreign bodies or food boluses to lodge in the esophagus. These include:

- **Over the larynx (at the beginning of the esophagus)**
- **At the thoracic inlet (due to the sharp angulation of the esophagus and the crowded thoracic inlet)**
- **Over the base of the heart**
- **In an area just cranial to or at the esophageal hiatus**

Esophageal choke



THE WORD "AZYGOS" MEANS "UNPAIRED." THE RIGHT AZYGOS VEIN IS PRESENT IN RUMINANTS, CAMELIDS, HORSES, DOGS, AND CATS. IT DRAINS VENOUS BLOOD FROM THE THORACIC WALL (INTERCOSTAL VEINS) AND EMPTIES INTO THE CRANIAL VENA CAVA. IT MAY NOT BE PRESENT IN THE LAST FEW INTERCOSTAL SPACES. THE LEFT AZYGOS VEIN IS PRESENT IN RUMINANTS AND SWINE BUT IS ABSENT IN CAMELIDS, CARNIVORES AND EQUINE. IN RUMINANTS, THE LEFT AZYGOS VEIN DRAINS INTO THE CORONARY SINUS OF THE RIGHT ATRIUM.

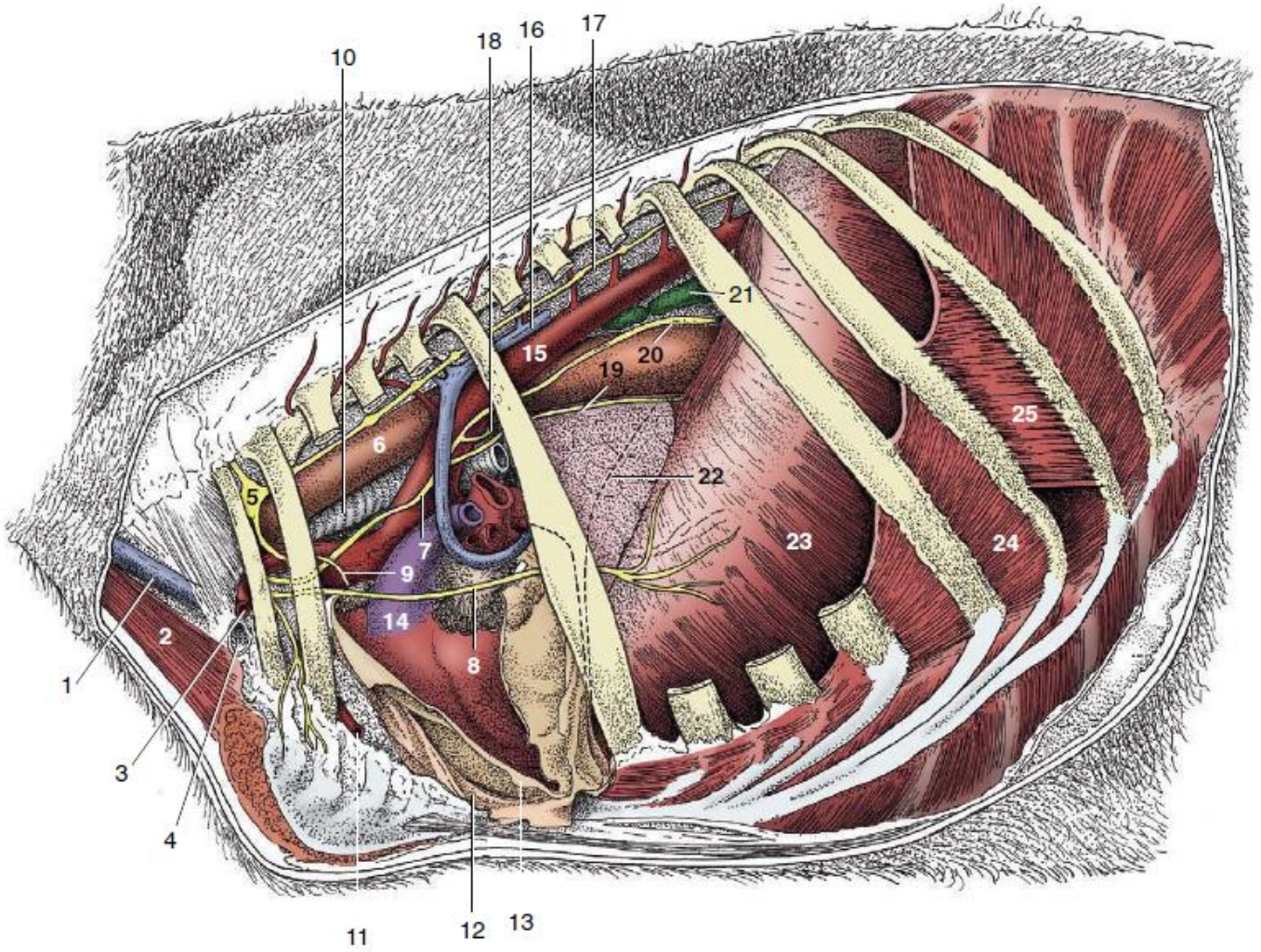


Figure 27–3 Left lateral view of the bovine thoracic cavity. The left lung and part of the mediastinal pleura have been removed. *1,* External jugular vein; *2,* sternocephalicus; *3,* axillary artery; *4,* axillary vein; *5,* cervicothoracic ganglion; *6,* esophagus; *7,* vagus; *8,* phrenic nerve; *9,* one of the cardiac nerves; *10,* trachea; *11,* internal thoracic artery; *12,* mediastinal pleura; *13,* pericardium, reflected; *14,* pulmonary trunk; *15,* aorta; *16,* left azygous vein; *17,* sympathetic chain; *18,* recurrent laryngeal nerve; *19,* ventral vagal trunk; *20,* dorsal vagal trunk; *21,* caudal mediastinal lymph nodes; *22,* cranial extent of diaphragm; *23,* diaphragm; *24,* internal intercostal muscle; *25,* external intercostal muscle.

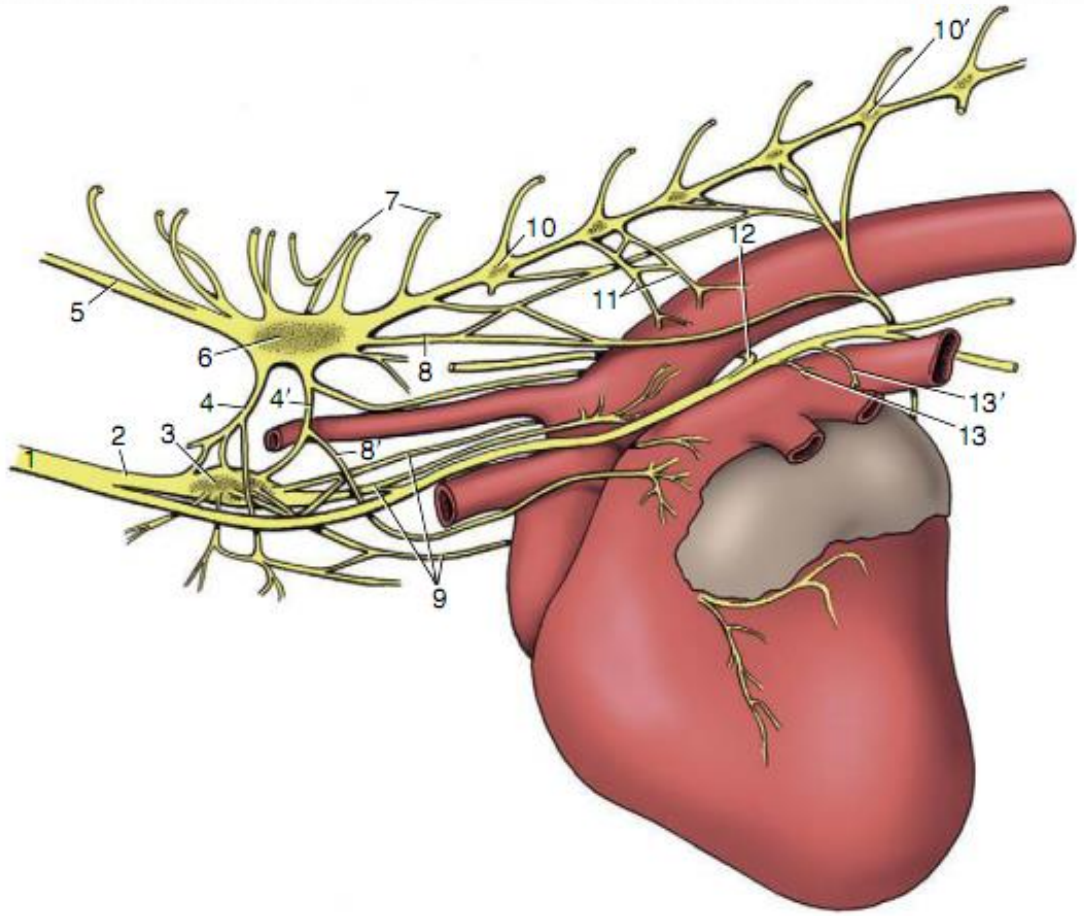
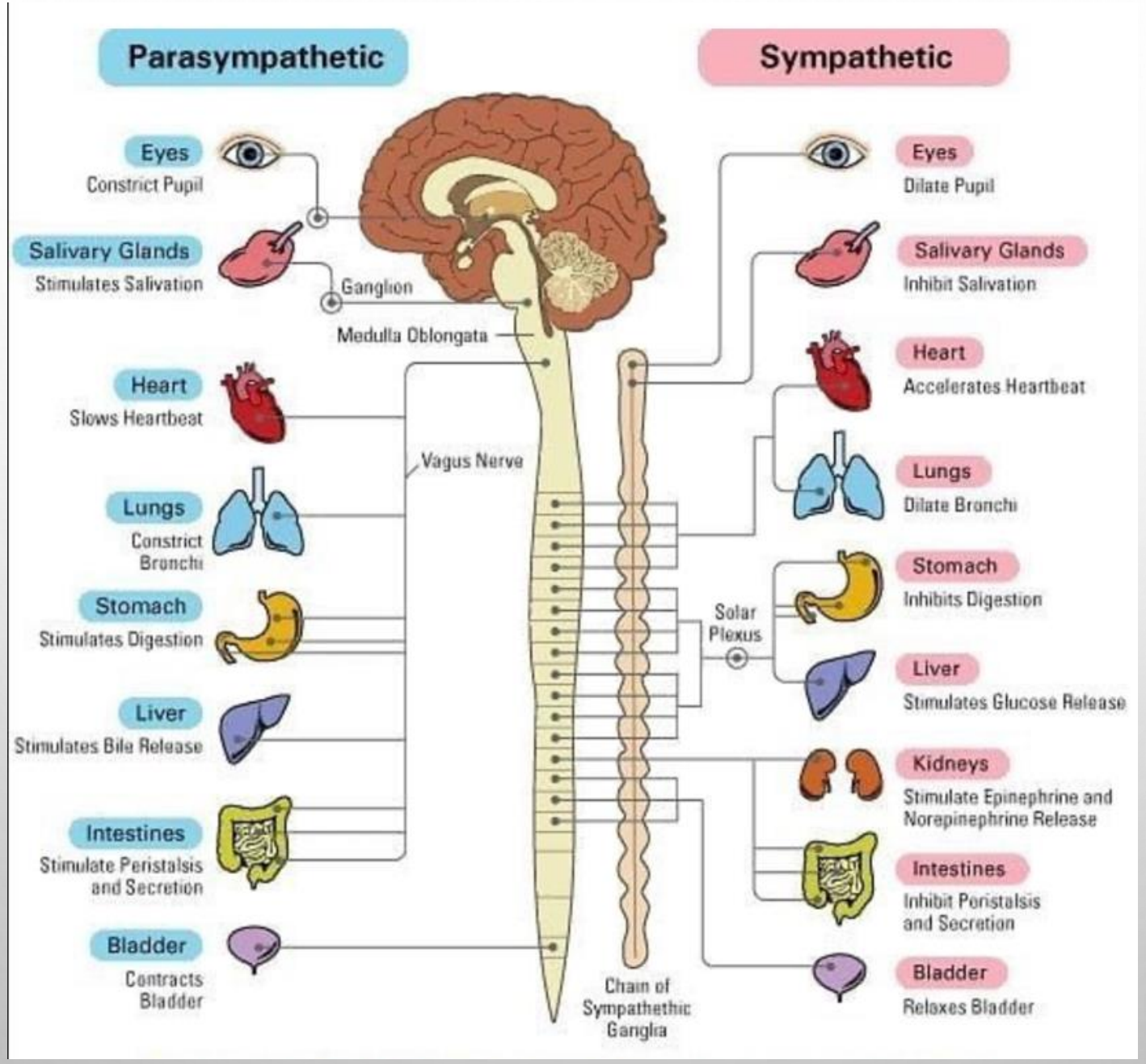


Figure 7–22 Cardiac nerves and related ganglia of the dog; left lateral view. *1,* Vagosympathetic trunk; *2,* sympathetic trunk; *3,* middle cervical ganglion; *4, 4′*, cranial and caudal limbs of ansa subclavia; *5,* vertebral node; *6,* cervicothoracic ganglion; *7,* communicating branches; *8, 8′*, caudodorsal and caudoventral cervicothoracic cardiac nodes; *9,* vertebral cardiac nodes; *10, 10′*, third and seventh thoracic ganglia; *11,* thoracic cardiac nodes; *12,* left recurrent laryngeal node; *13, 13′*, cranial and caudal vagal cardiac nodes.


Parasympathetic
Sympathetic
Eyes
Constrict Pupil
Salivary Glands
Stimulates Salivation
Ganglion
Medulla Oblongata
Heart
Slows Heartbeat
Vagus Nerve
Lungs
Constrict Bronchi
Stomach
Stimulates Digestion
Liver
Stimulates Bile Release
Intestines
Stimulate Peristalsis and Secretion
Bladder
Contracts Bladder
Chain of Sympathethic Ganglia
Solar Plexus
Eyes
Dilate Pupil
Salivary Glands
Inhibit Salivation
Heart
Accelerates Heartbeat
Lungs
Dilate Bronchi
Stomach
Inhibits Digestion
Liver
Stimulates Glucose Release
Kidneys
Stimulate Epinephrine and Norepinephrine Release
Intestines
Inhibit Peristalsis and Secretion
Bladder
Relaxes Bladder

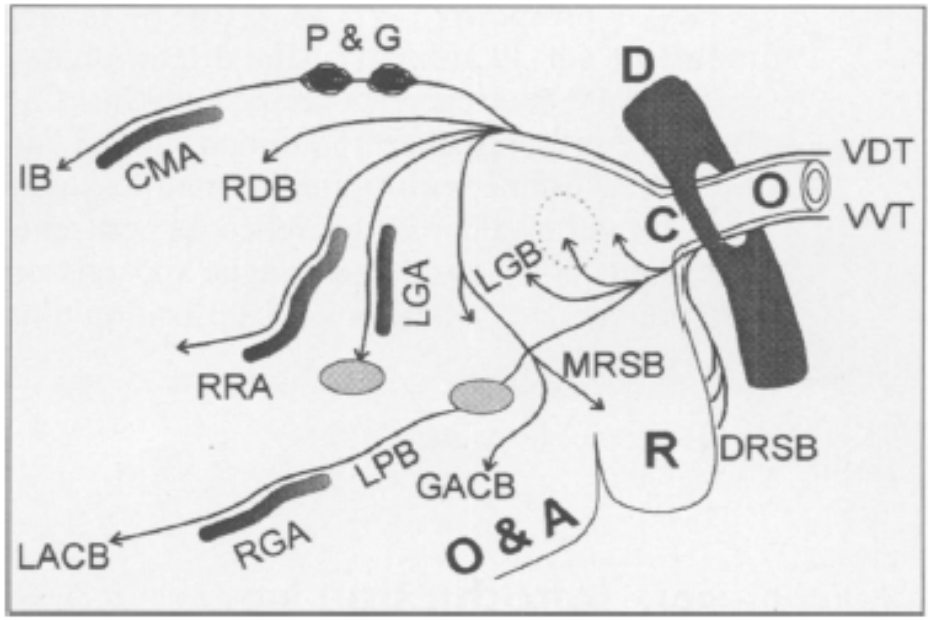


Figure 2. Abomasal innervation and localization of vagus nerve lesions observed at necropsy in cases presenting clinical signs compatible with vagal indigestion following surgical correction of abomasal dilation or volvulus. C — cardia; D — diaphragm; O & A — omasum and abomasum; R — reticulum; E — esophagus; CMA: cranial mesenteric artery; DRSB: diaphragmatic reticular surface branches; GACB — great abomasal curvature branch; IB — intestinal branch; LACB — lesser abomasal curvature branch; LGA — left gastric artery; LGB — liver and gallbladder branches; MRSB — medial reticular surface branch; LPB — long pyloric branch; RDB — ruminal dorsal branch; P & G — celiac and cranial mesenteric plexus & ganglia; RGA — right gastric artery; RRA — right ruminal artery; VDT — vagal dorsal trunk; VVT — vagal ventral trunk. ⬭ : localization of the nerve lesions (adapted from Habel (18) and Barone (19)).

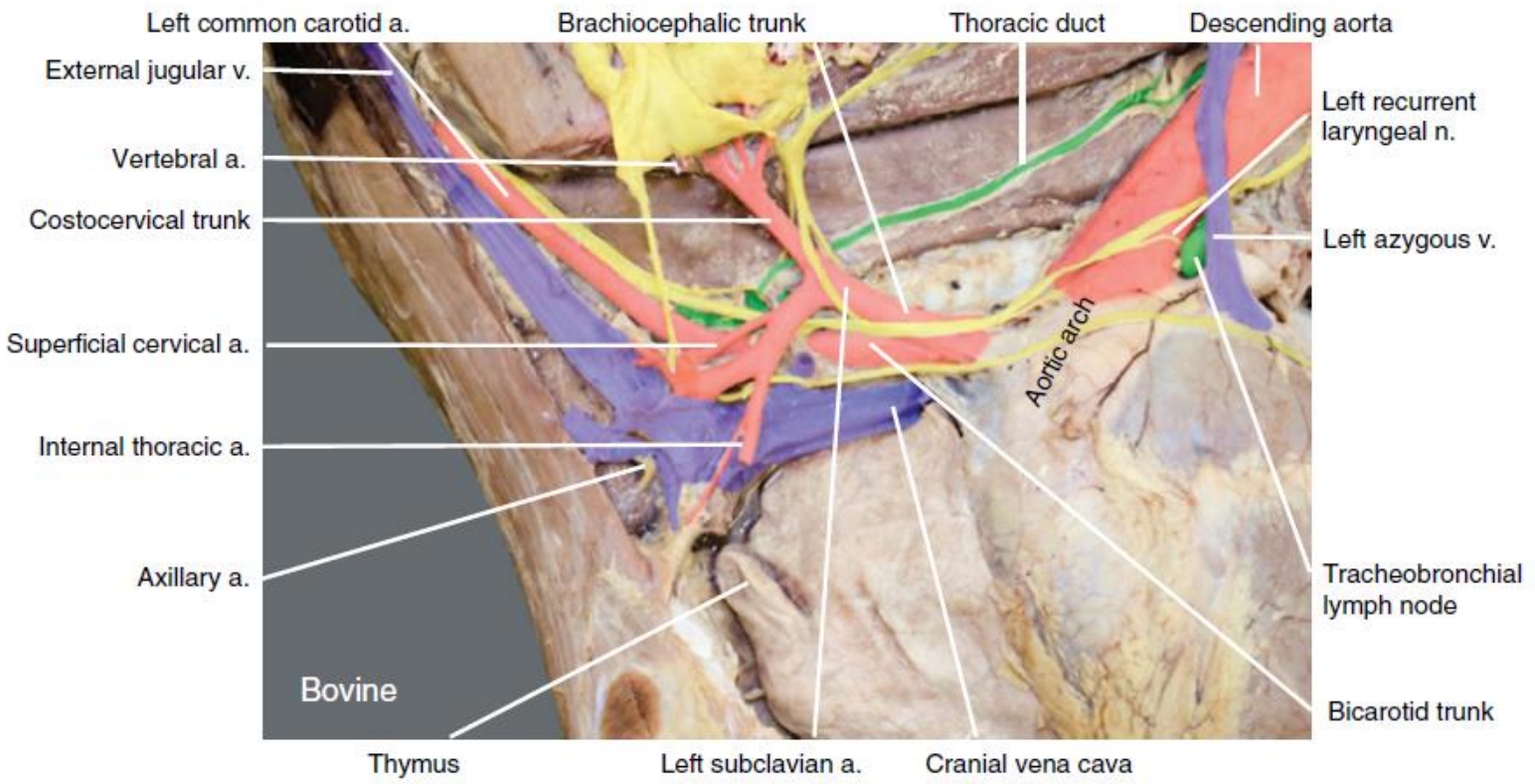


Figure 2.11 Bovine left thorax (cranial part). Figure shows vessels and nerves cranial to the heart. Nerves are labeled in Figure 2.12.

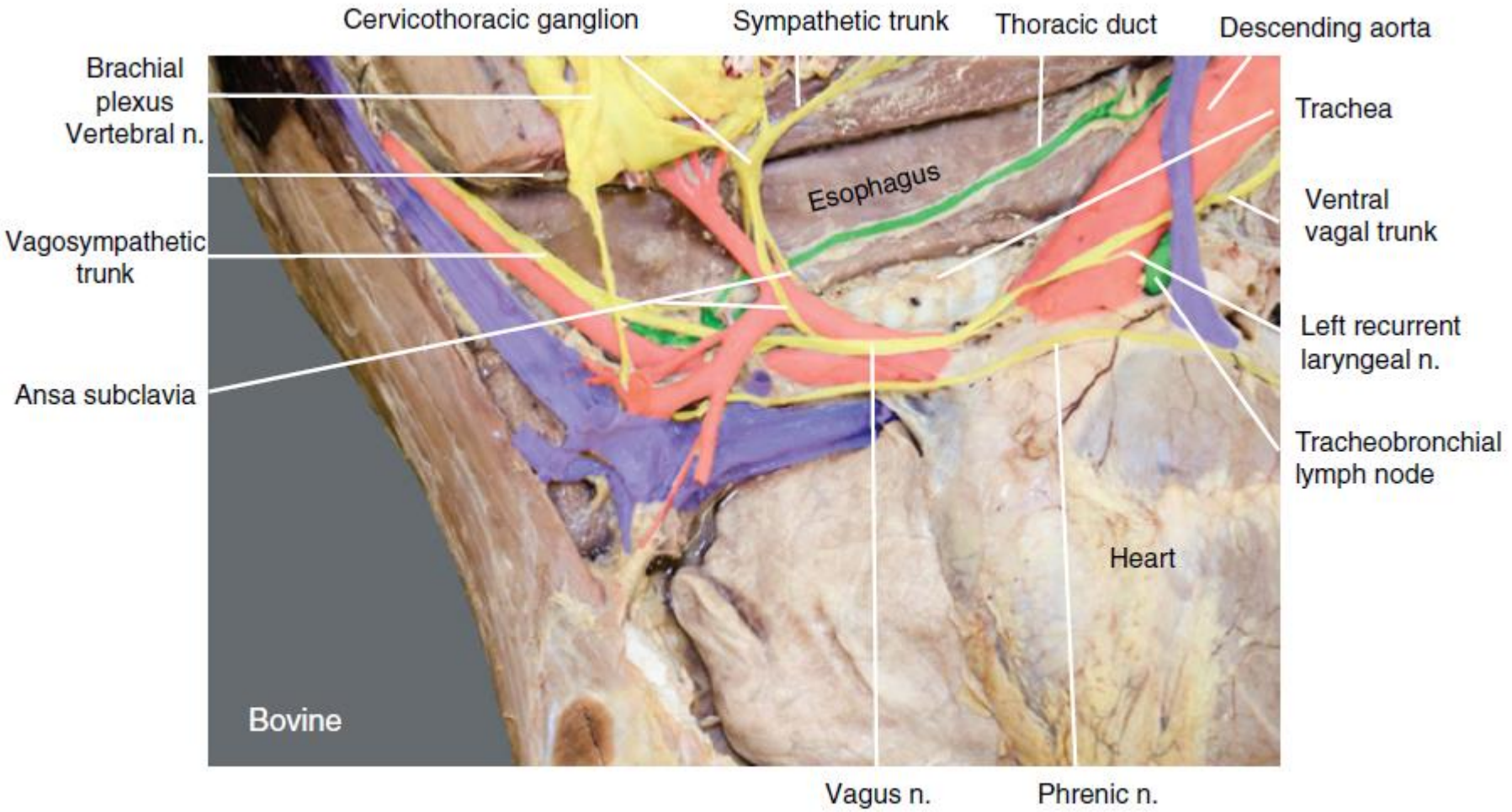


Figure 2.12 Bovine left thorax (cranial part). Figure shows major nerves cranial to the heart.

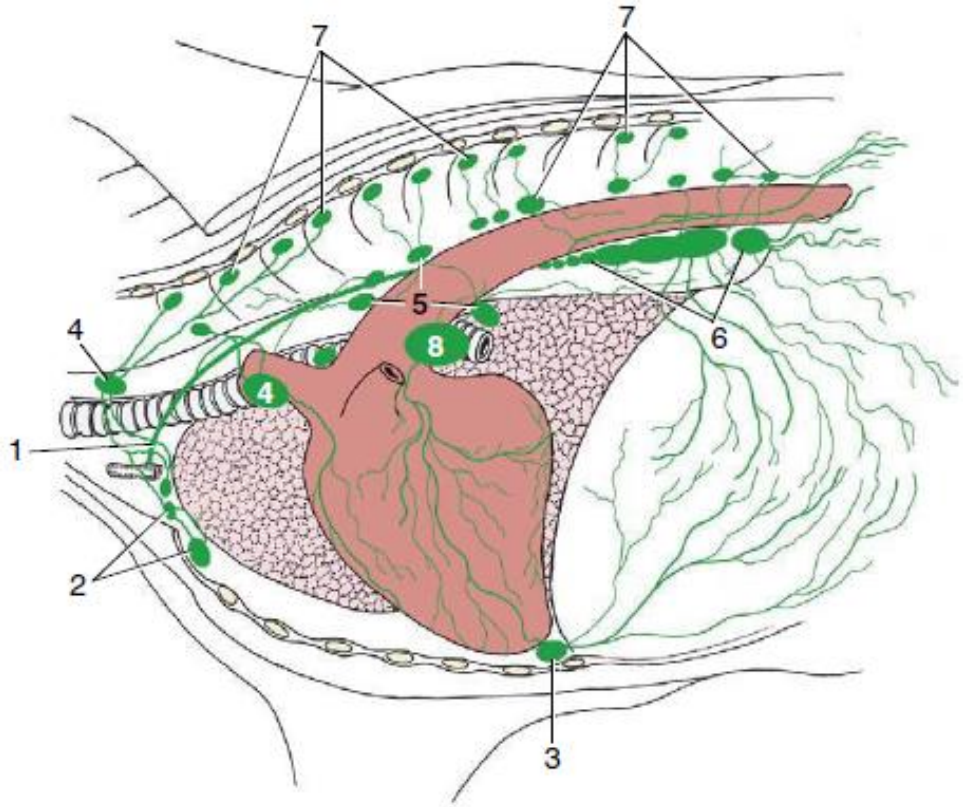
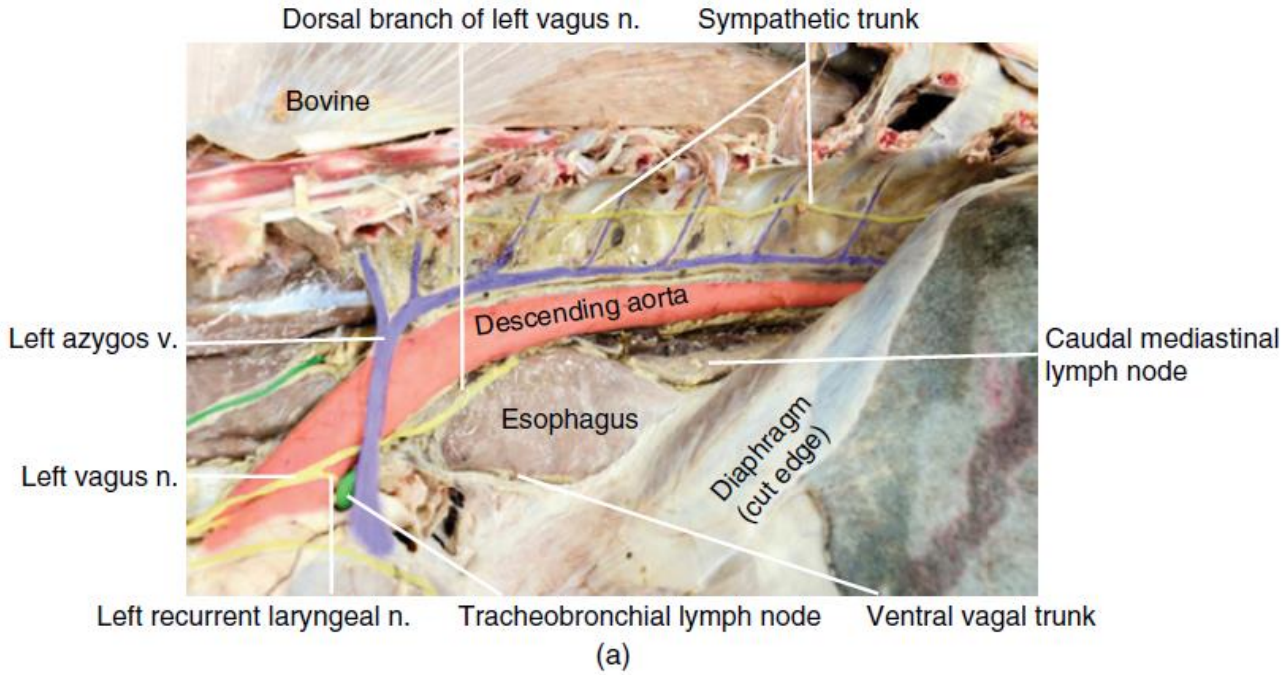
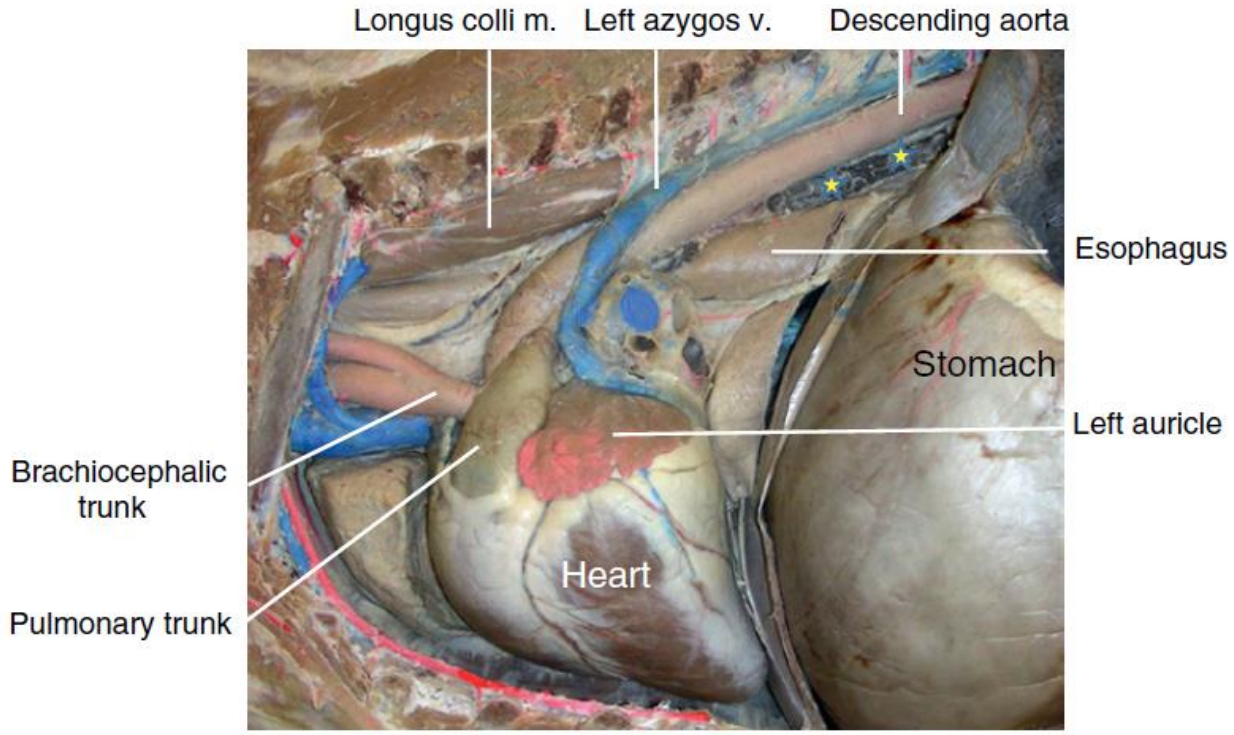
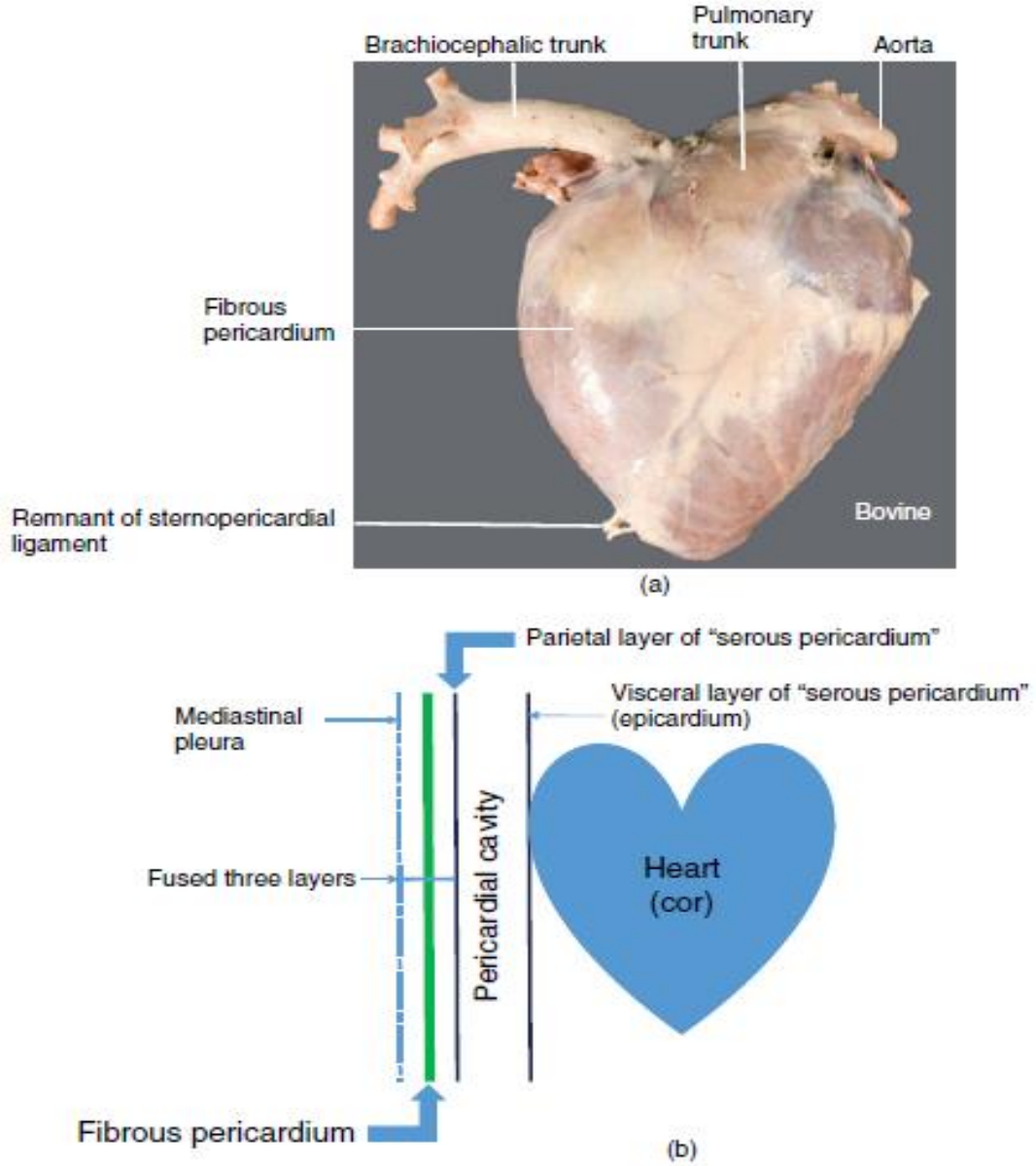


Figure 27–8 Lymph drainage of the bovine thoracic wall and mediastinum. *1,* Thoracic duct; *2,* cranial sternal lymph nodes; *3,* caudal sternal lymph node; *4,* cranial mediastinal lymph nodes; *5,* middle mediastinal lymph nodes; *6,* caudal mediastinal lymph nodes; *7,* intercostal and thoracic aortic lymph nodes; *8,* tracheobronchial node.

Excessive enlargement of the caudal mediastinal lymph node may put pressure on the esophagus and the dorsal vagal trunk in the caudal mediastinum. This could lead to difficulty in the process of swallowing, digestion, and gas eructation. A condition called vagal indigestion results from irritation of the vagal nerve and results in the disruption of normal rumen motility, rumen tympany , and abdominal distention.







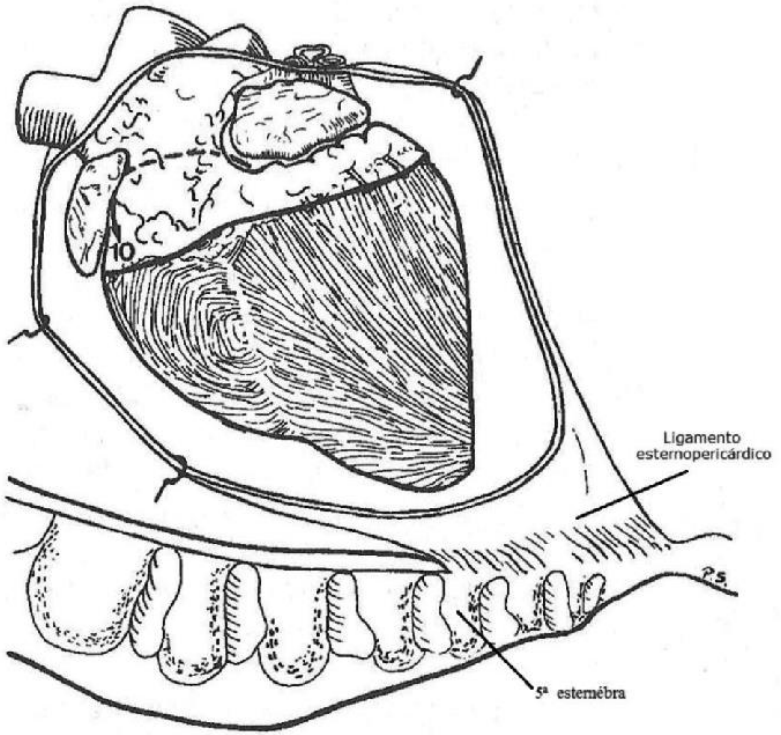


Figure 2.14 (a) Isolated bovine heart (auricular surface). Figure shows fibrous pericardium covering the auricular (left) surface of the heart; (b) schematic illustration of the layers of the pericardium. Understand that the layers of the pericardium form a sac around the heart. The fibrous pericardium extends ventrally from the apex of the heart to form the **sternopericardial ligament** that anchors the heart to the sternum (not illustrated). The outer three layers (with the fibrous pericardium being the thickest) are fused and are inseparable. The pericardial cavity is a very small capillary space filled with a small amount of serous fluid. The visceral layer of the serous pericardium (or the epicardium) adheres closely to the wall of the heart.

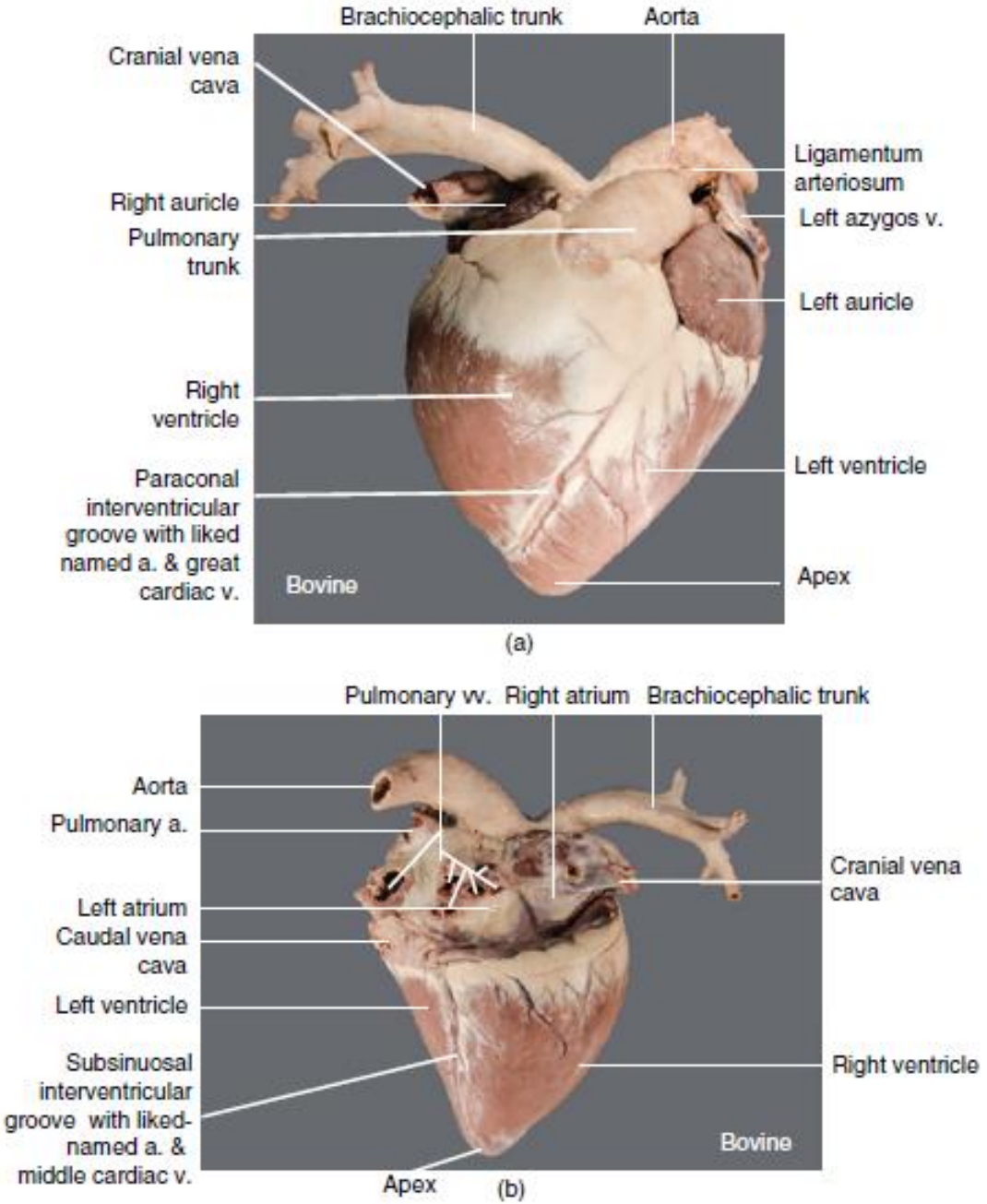


Figure 2.15 Bovine heart. External features of the heart on (a) auricular (left) surface; (b) atrial (right) surface.

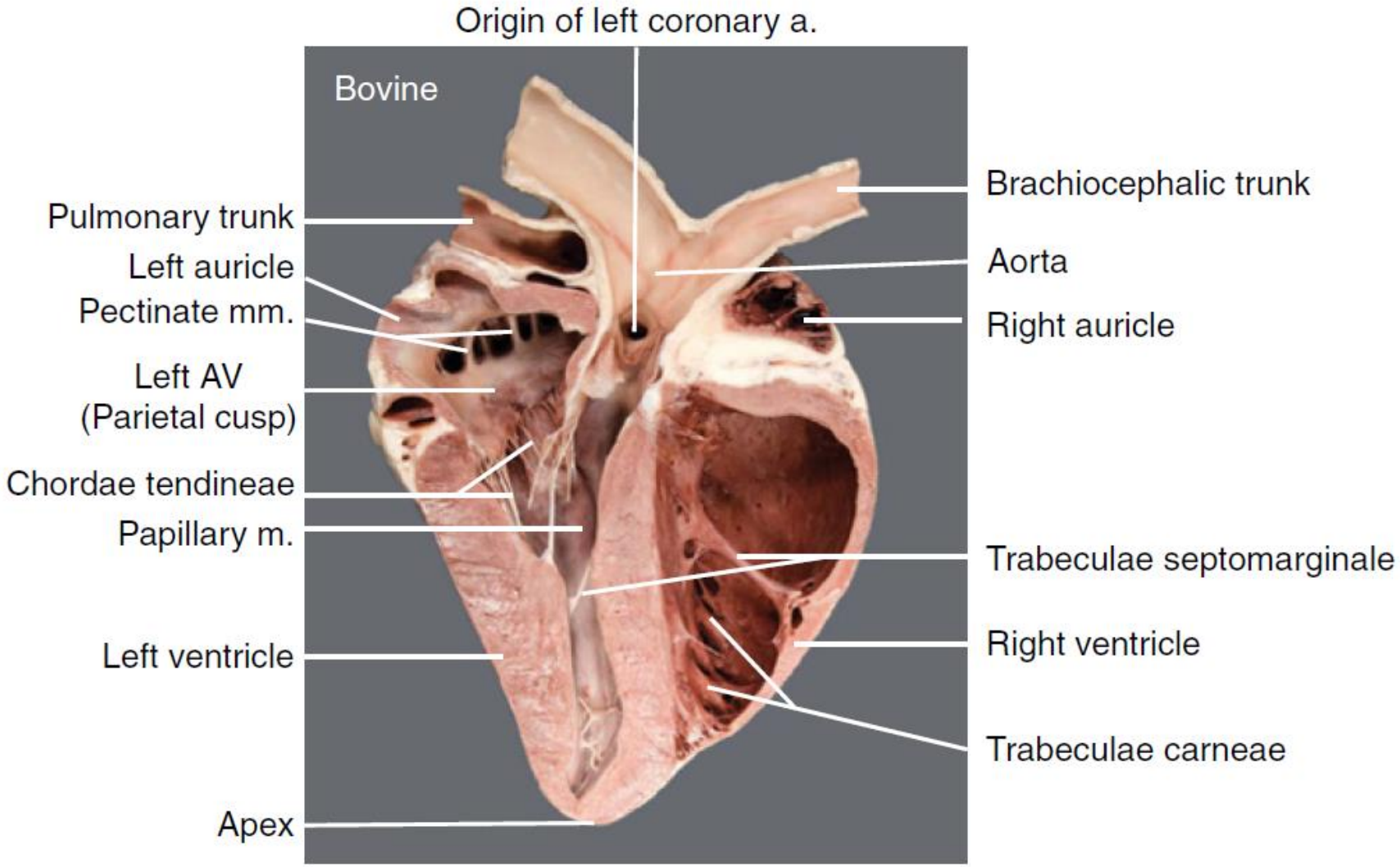


Figure 2.17 Bovine heart: sagittal section. Note the difference in wall thickness of the right (thin) and left (thick) ventricles. The term "trabeculae septomarginale" is plural for trabecula septomarginalis.

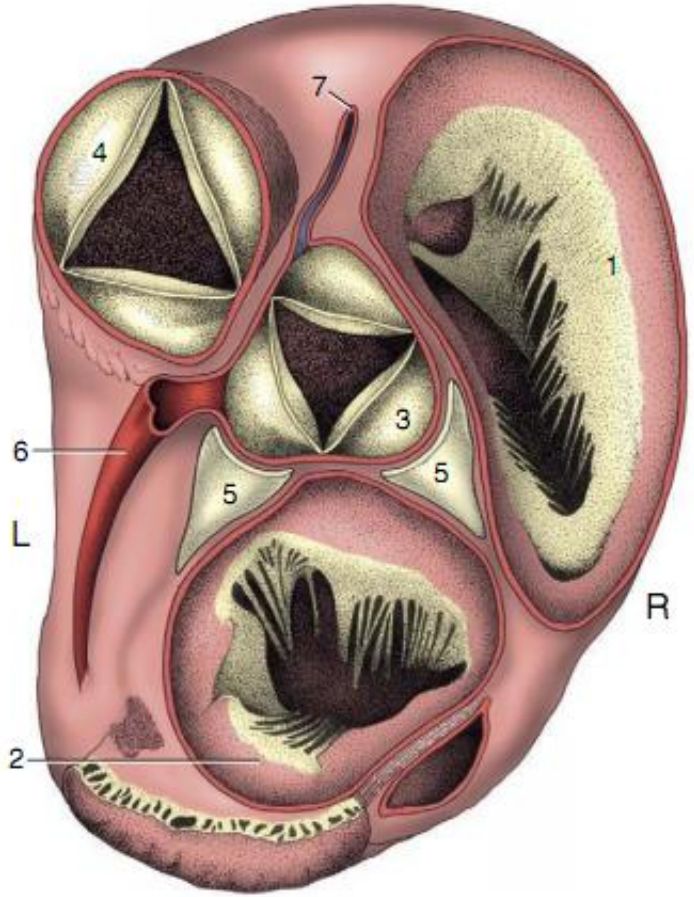
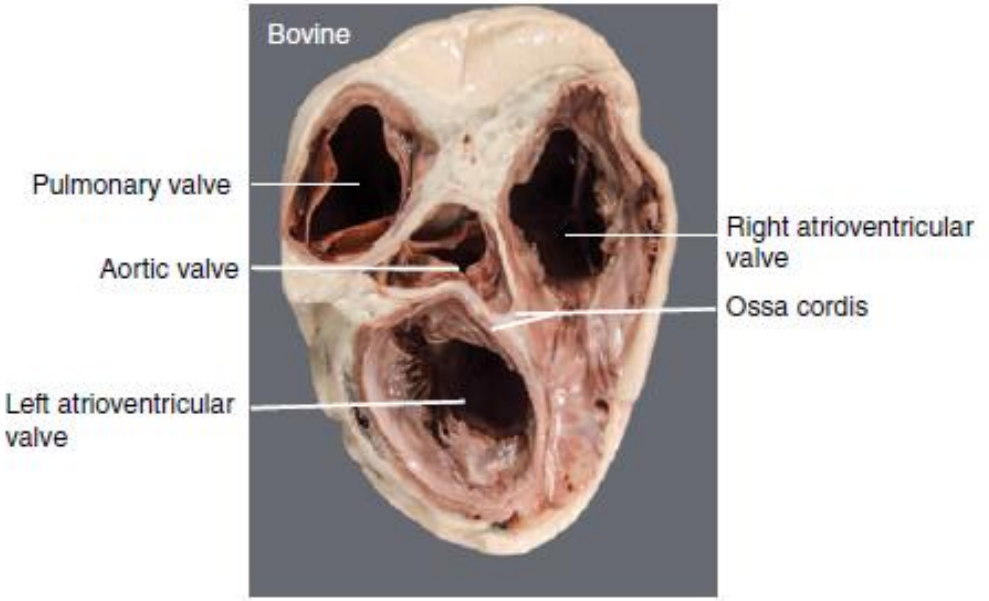
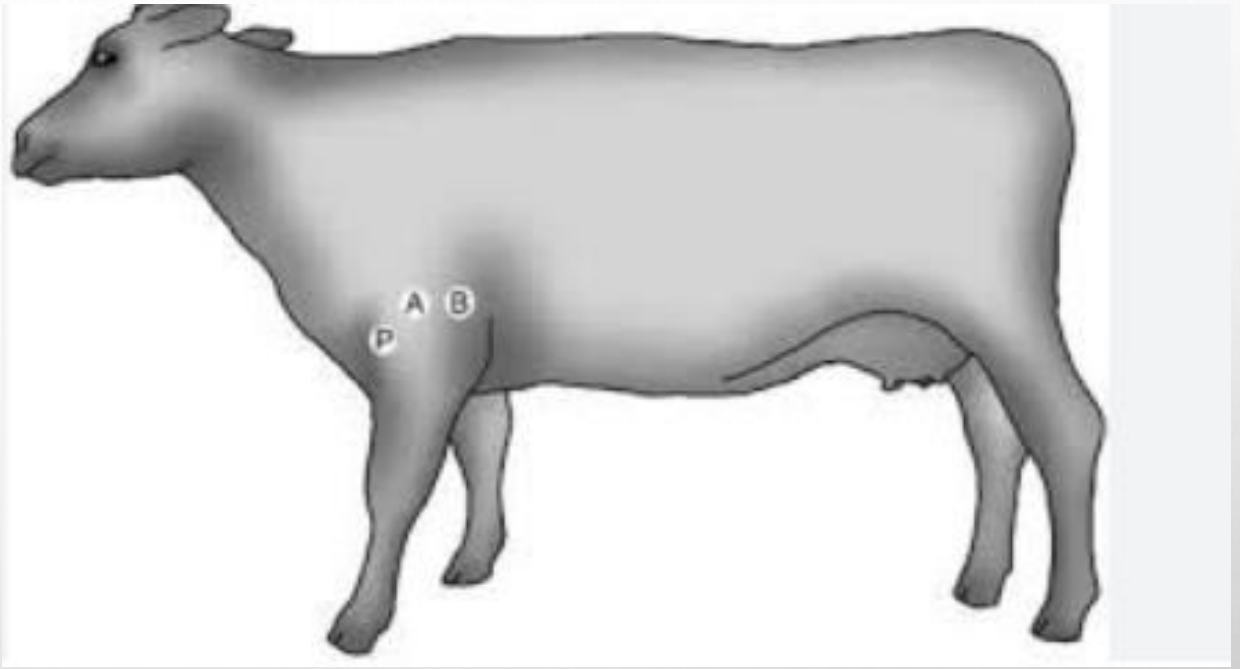


Figure 7–13 Dorsal view of the base of the bovine heart after removal of the atria. The ossa cordis on both sides of the aortic valve have been exposed. *1,* Right atrioventricular valve; *2,* left atrioventricular valve; *3,* aortic valve; *4,* pulmonary valve; *5,* ossa cordis; *6,* left coronary artery; *7,* right coronary artery.



Three valves (**pulmonary, aortic,** and **mitral**) are auscultated on the left side, and one valve, the right atrioventricular valve (**R-AV**),is heard on the right side. The location of the heart sounds on the left side of the thorax can be defined by the acronym PAM 345 low-high-low (**345-LHL**).



On the left chest, identify the following:
1) The pulmonary (**P**) valve may be best heard when the stethoscope is placed over the third intercostal space low at the costochondral junction (CCJ). (**3L**)
2) The aortic (**A**) valve may be best heard at the fourth intercostal space high just ventral to the shoulder joint. (**4H**)
3) The mitral (**M**) valve may be best heard at the fifth intercostal space low at the CCJ. (**5L)**
4) The **RAV** may be best heard on the right side at the third or fourth intercostal space (ICS) at the CCJ (**R-AV 3–4th ICS, low**). **(3–4 L)**