

Respiratory System

The Lower respiratory system in large animals
is composed of

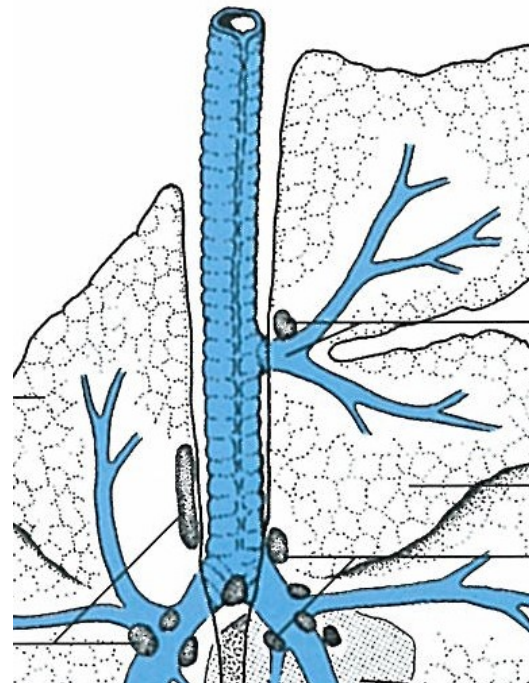
➤ Trachea

➤ Bronchial

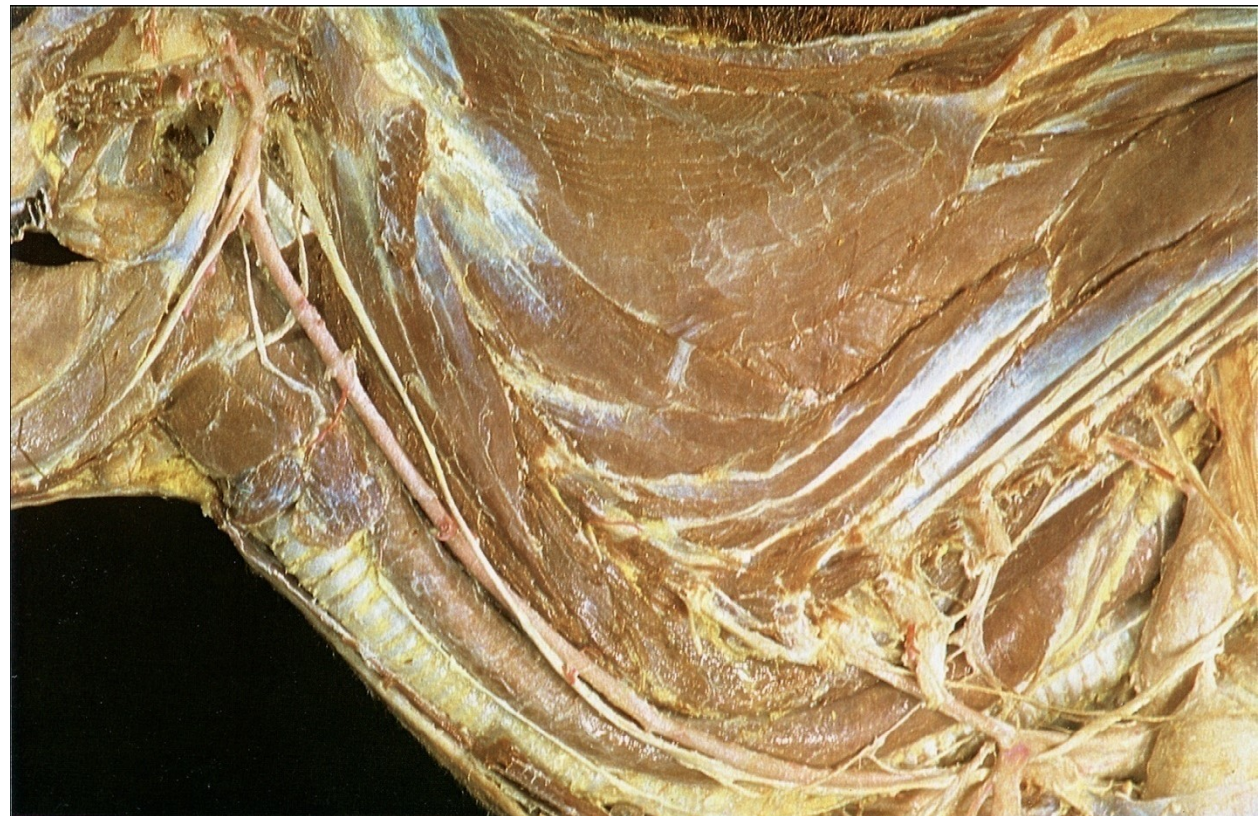
➤ Lungs

Trachea

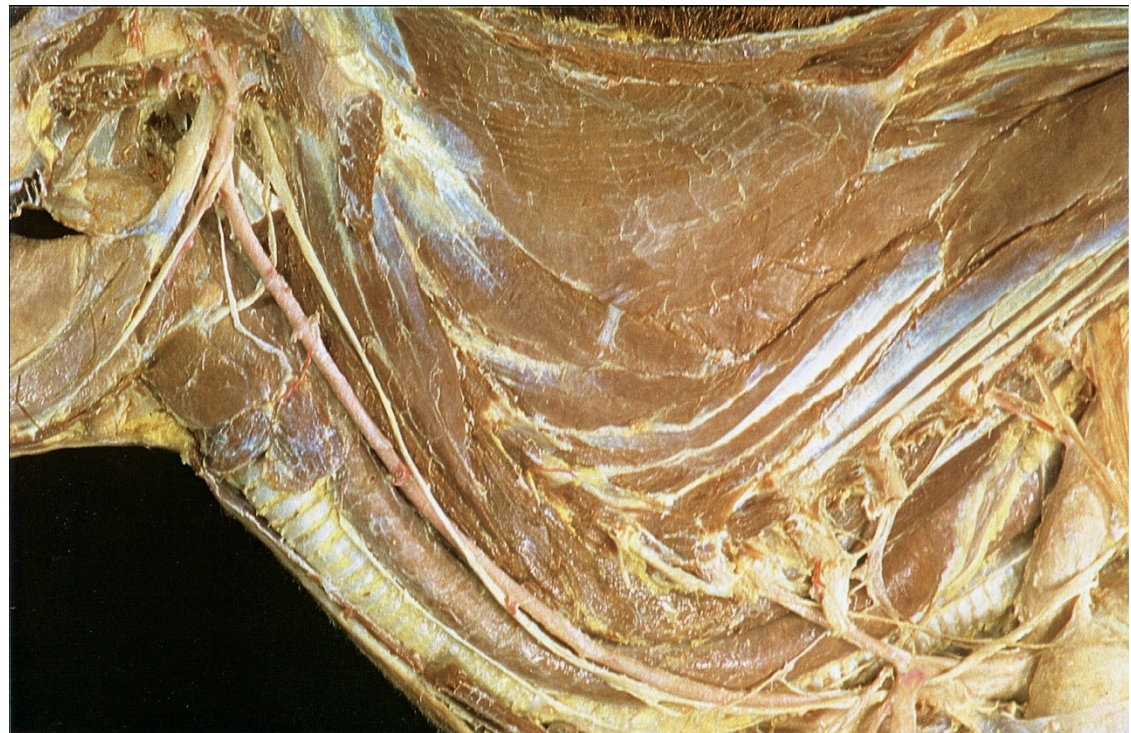
- The trachea is a flexible cartilaginous tube extending from the larynx to the hilus of the lungs where it divides into right and left bronchi
- It is kept permanently open by a series of about 50 'C' shaped cartilaginous rings embedded in its walls
- It occupies a median position except at its termination where it is pushed a little to the right of the median plane by the aortic arch
- Its average length is about 65 cm, the width about 4 cm.



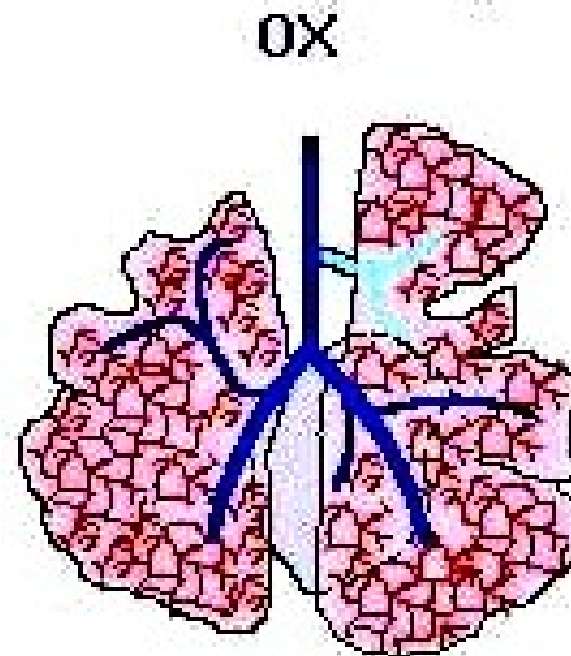
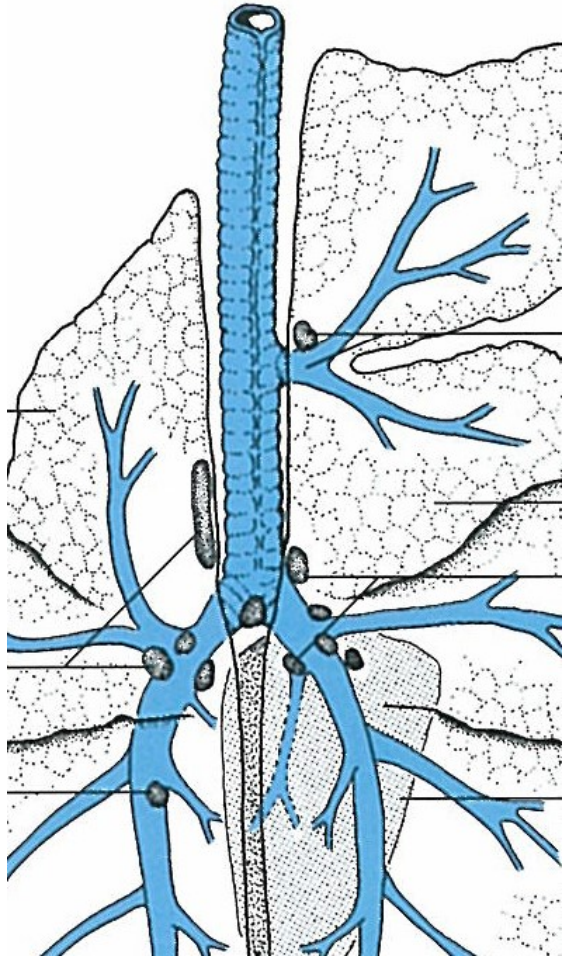
- The trachea has *cervical and thoracic* parts
- The *cervical part* is related *dorsally* to the oesophagus for a short distance and for the rest of its extent to the longus colli muscles.
- *Laterally* it is related to the lateral lobes of the thyroid gland, carotid artery, vagus, sympathetic and recurrent laryngeal nerves, tracheal lymph ducts and cervical lymph glands
- The oesophagus lies on its left.



- The *thoracic part* of the trachea passes backward between the two pleural sacs and divides into two bronchi.
- It is related dorsally to the oesophagus and longus colli muscle.
- Its *left face* is related to the aortic arch, left brachial artery and thoracic duct.
- Its *right face* is crossed by the right vagus.



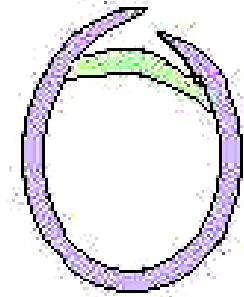
- The trachea in the ox detaches a small apical bronchus to the apical lobe of right lung about the level of the third rib or inter-costal space.



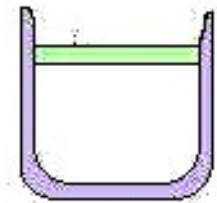
Species Difference

Sheep and Goat

- Average length is about nine or ten inches. In the sheep, the ends of the tracheal cartilages overlap in the cranial third of the trachea and in the caudal third, the left ends of the tracheal cartilages extend further dorsally than the right ends
- The trachea ring of the goat is U shaped on cross section with variable distance between the right and left ends of the cartilages

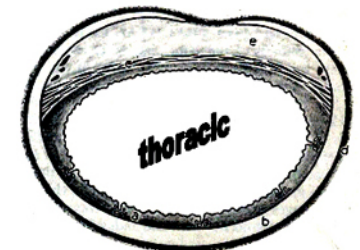
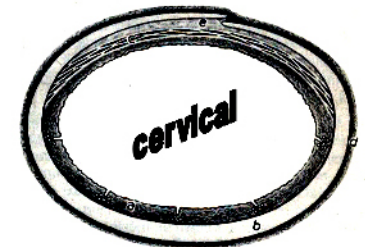


SHEEP



GOAT

Horse



Horse

- Longest; about 75 to 80 cm. The free ends of the rings overlap in the cervical part while they do not meet in the dorsal part
- It does not give any additional bronchus to the right lung and is not adherent to the lungs

Pig

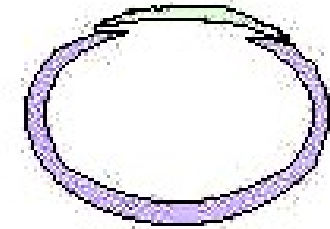
- Consists of 32-35 rings, which overlap dorsally
- Occasionally, adjacent cartilages become partly or completely fused
- A special apical bronchus is detached for the apical lobe of the right lung



PIG

Dog

- It contains about 40 to 45 rings, which are C-shaped, and their ends do not meet dorsally
- Trachealis muscle is attached to the outside of the cartilages



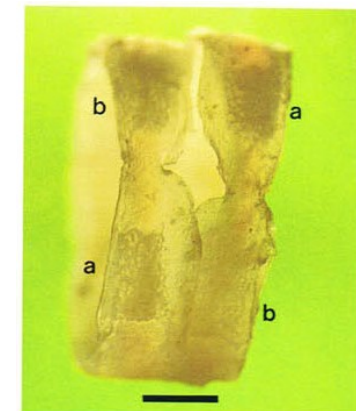
DOG

Rabbit

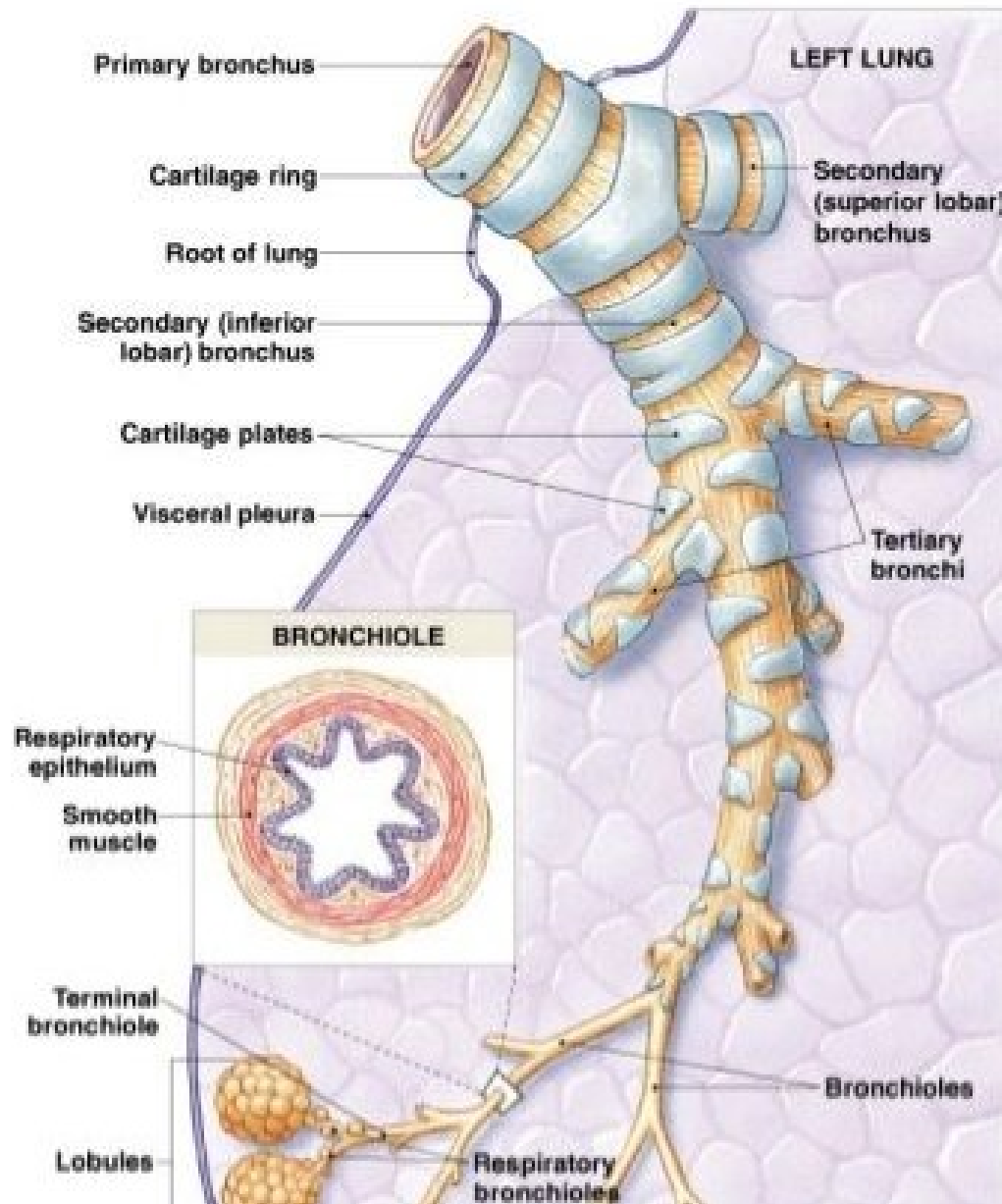
- The trachea is about 6cm long and possesses no apical bronchus

Fowl

- The cartilage rings are complete
- The trachea connects the cranial larynx and syrinx or caudal larynx



Airways within Lungs



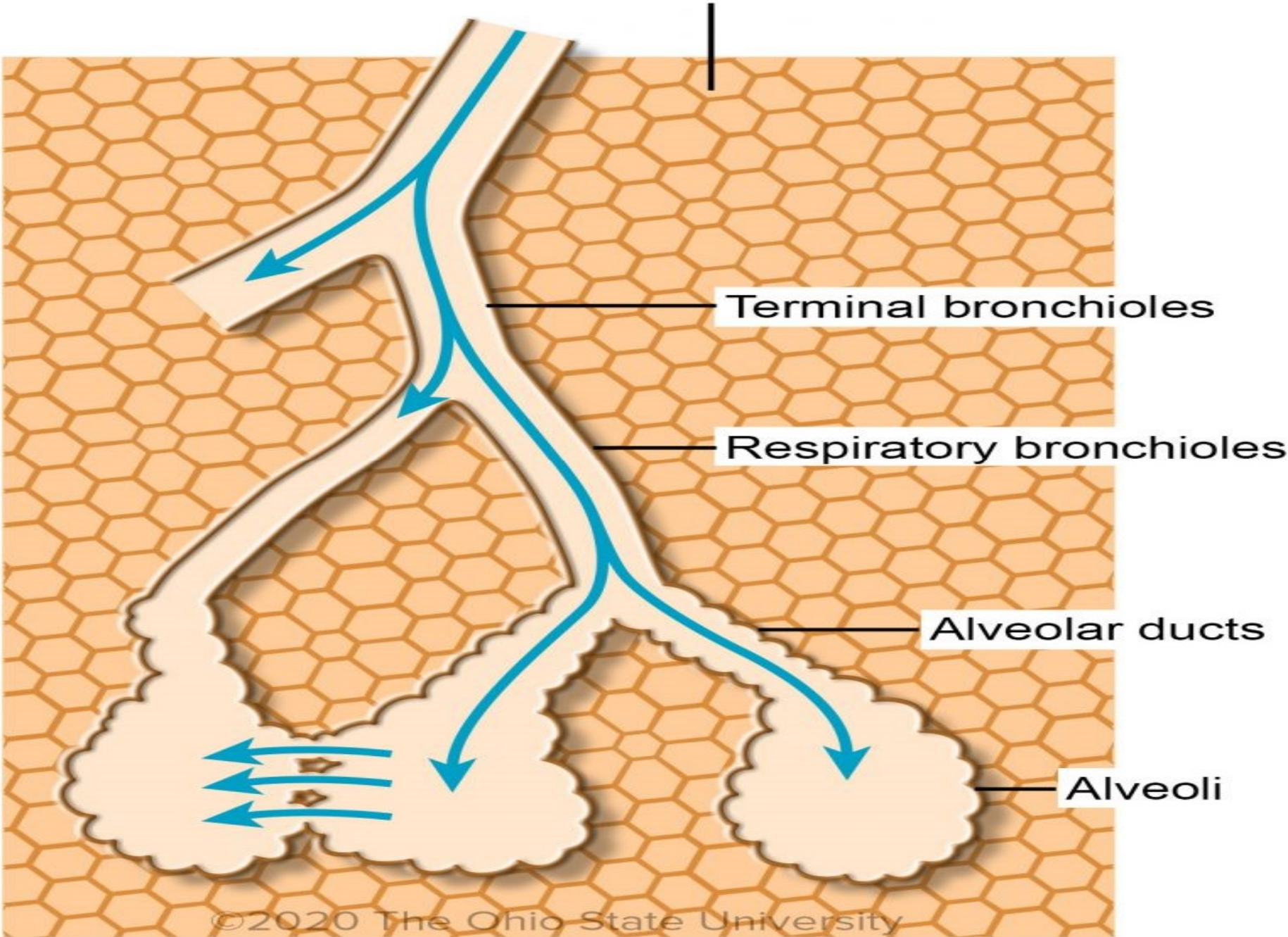
- Each lung has a primary bronchus entering at the **Hilus**.

- Each lobe of a lung has a secondary (a.k.a. lobar) bronchus

- Lobes are functionally divided into bronchopulmonary segments & each segment has a tertiary (segmental) bronchus

- Segments are functionally divided into many lobules & each lobule receives a terminal bronchiole

Cross section of alveolar network



Bronchi

- These are terminal branches of the trachea.
- Two in number i.e. right and left
- The right is shorter than the left. Each passes outwards and backwards and enters the hilus of the corresponding lung and branches like a tree within the lung substance and terminates in air sacs. There is an additional bronchus -the apical bronchus to the apical lobe of the right lung detached about the level of the 3rd rib

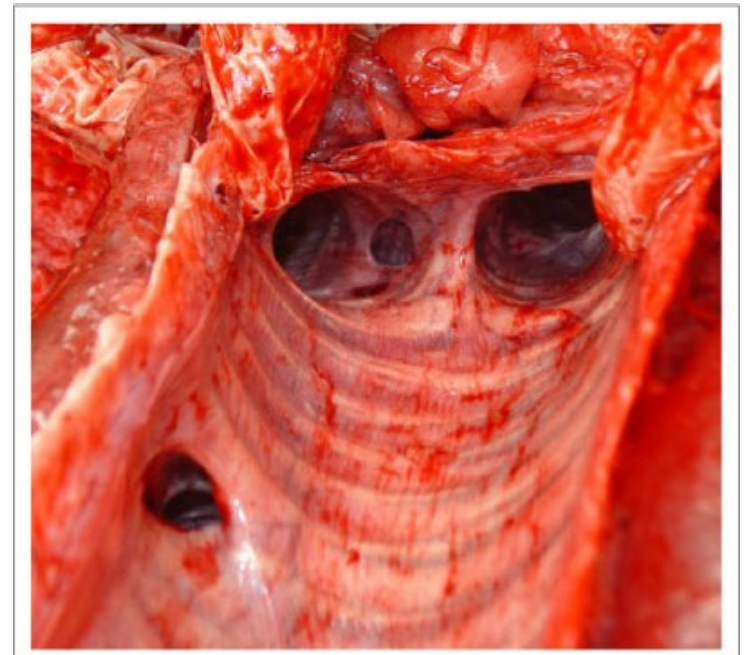
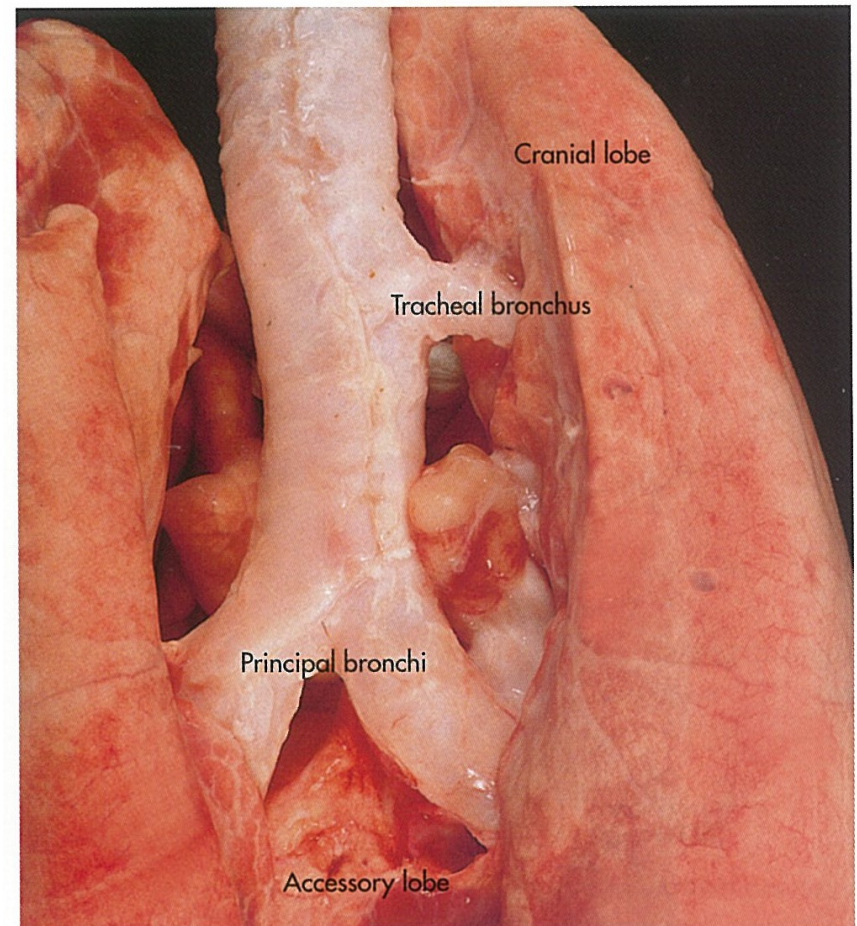


FIGURE 2: Bifurcation of the trachea illustrating the recessed bronchus to the right-cranial-lung lobe.

- Each bronchus is related above to the branches of the bronchial artery and bronchial lymph glands and below to the divisions of pulmonary artery and vein
- The structure is the same as that of the trachea except that the plates of cartilage replace the cartilaginous rings



Species difference

Sheep and Goat

- It resembles ox

Horse

- There are only two chief bronchi

Pig

- As in ox.
- The apical bronchus to the apical lobe of the right lung detached about the level of the third rib

Dog

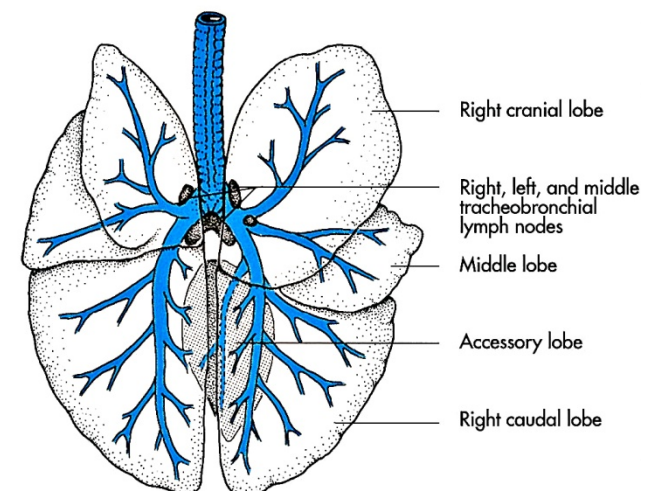
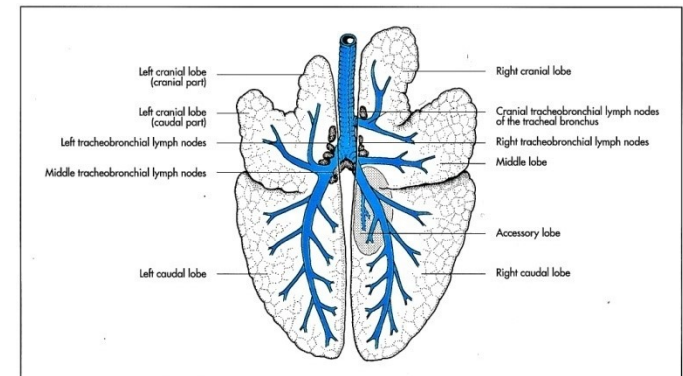
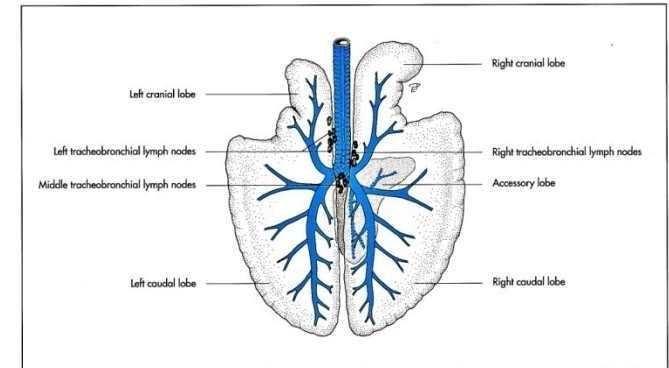
- Each bronchus divides into two branches before it enters the hilus of the lung

Rabbit

- There are two chief bronchi, right and left

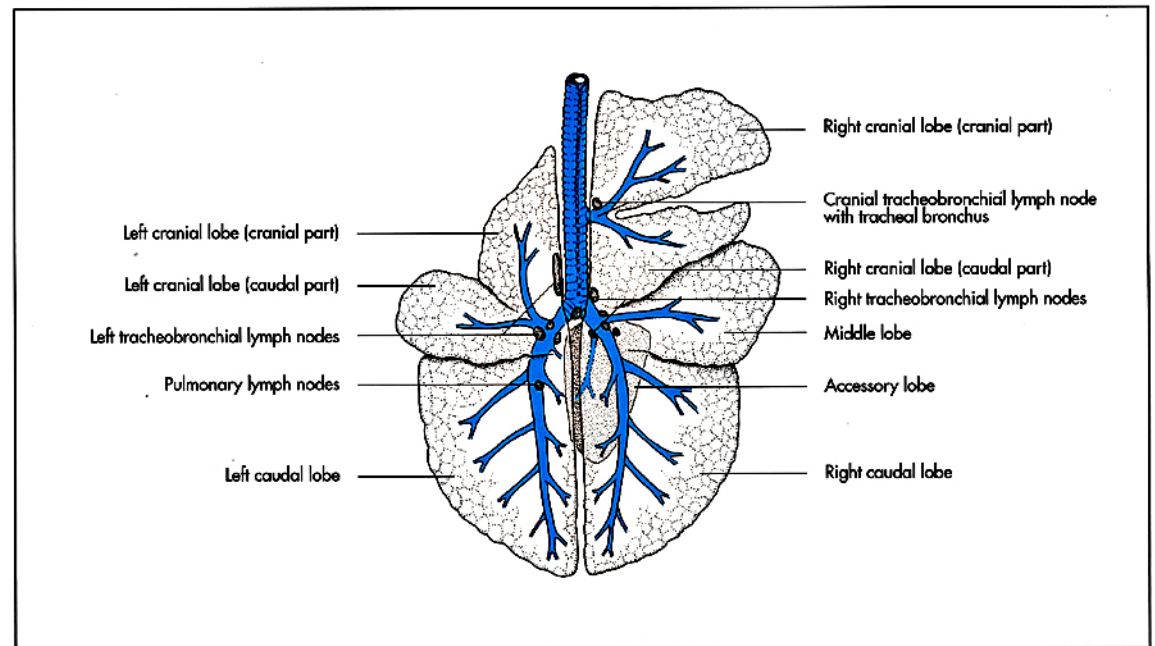
Fowl

- There are two chief bronchi



Lungs of Ox

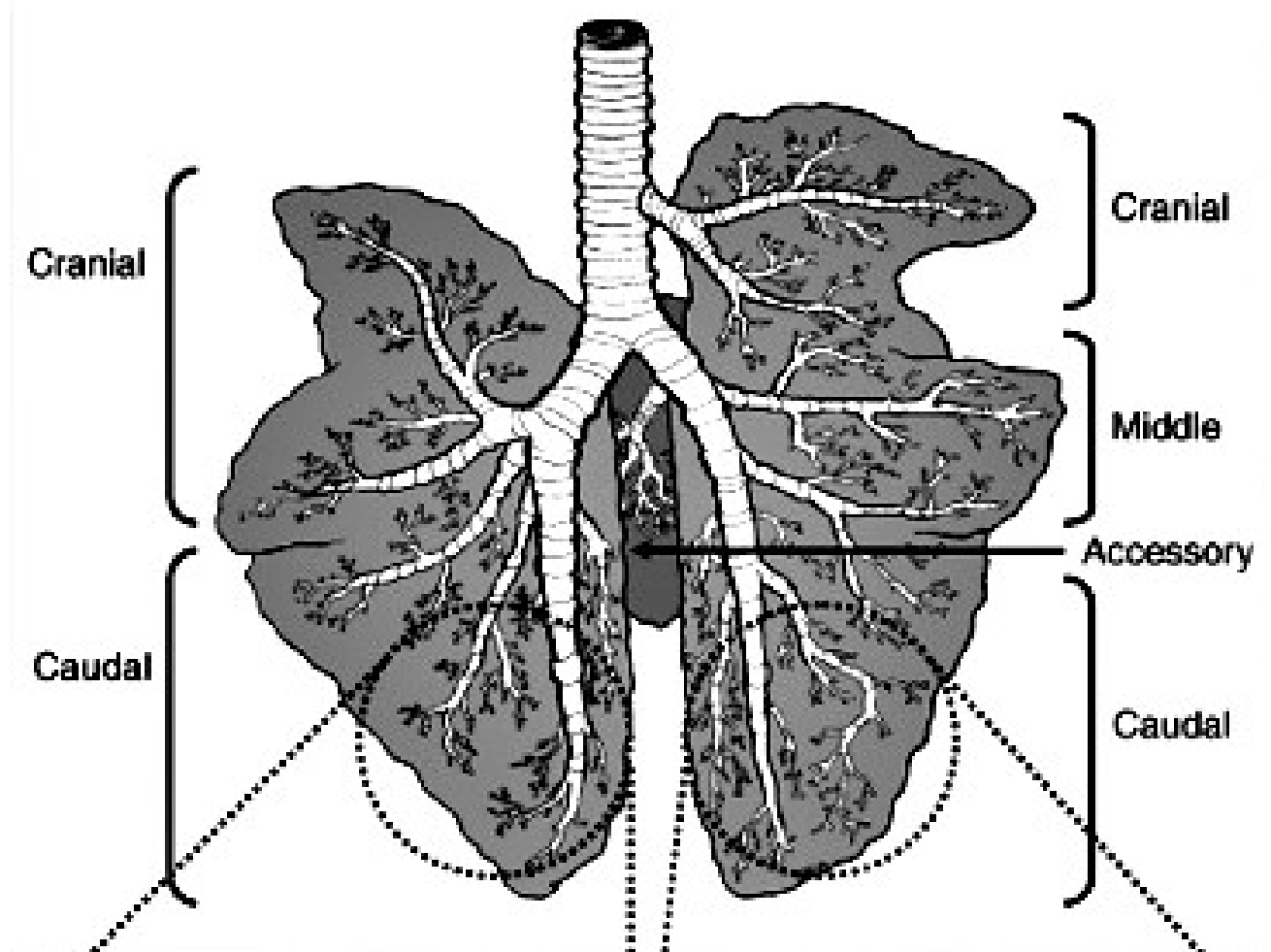
- Essential organs of respiration are right and left and each occupy the greater part of the thoracic cavity
- They are accurately adapted to the walls of the cavity and the other organs contained in it.
- Each lung is soft, spongy and highly elastic
- It crepitates when pressed and floats in water
- The colour varies according to the amount of blood contained in the lung. During life, it is pink in colour
- In dissected bodies, it is light grey in colour and slightly tinged with red. The average weight of lungs is 3.4 kg
- The right lung weighs about half as much as the left one





Left lung lobes

Right lung lobes



Cranial

Cranial

Middle

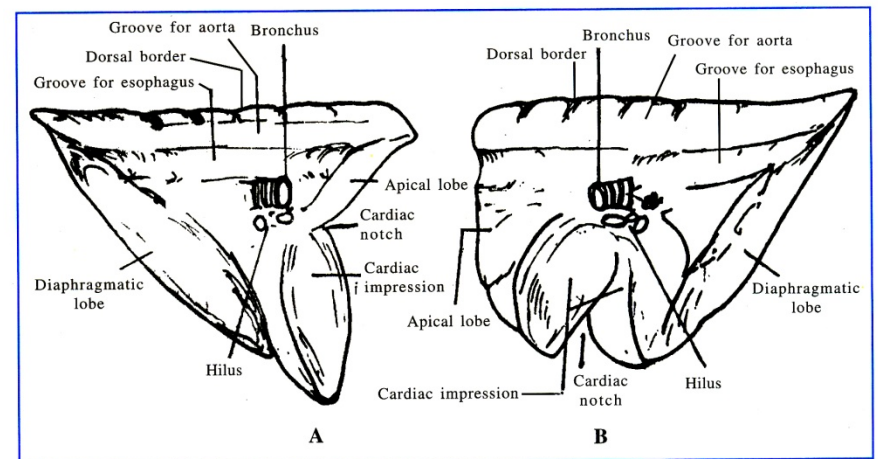
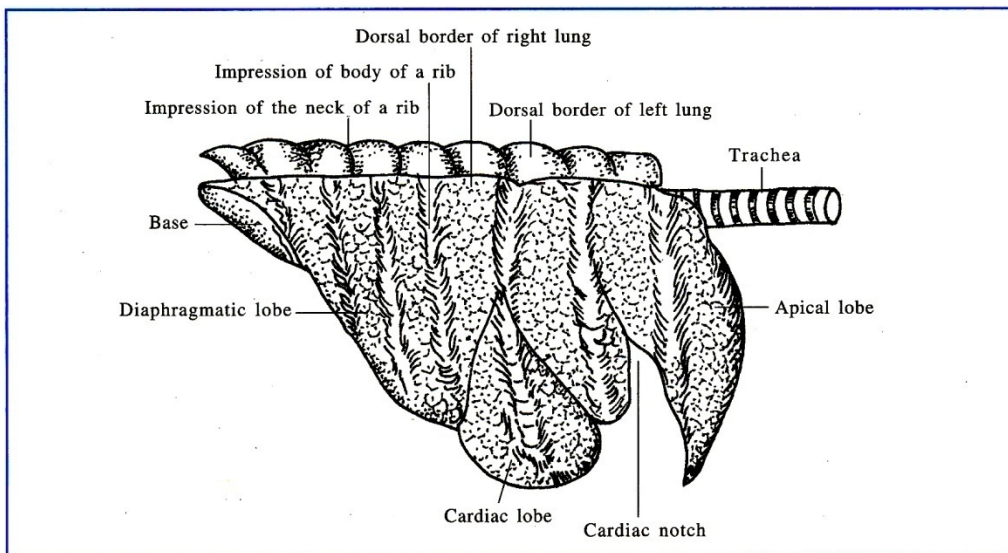
Accessory

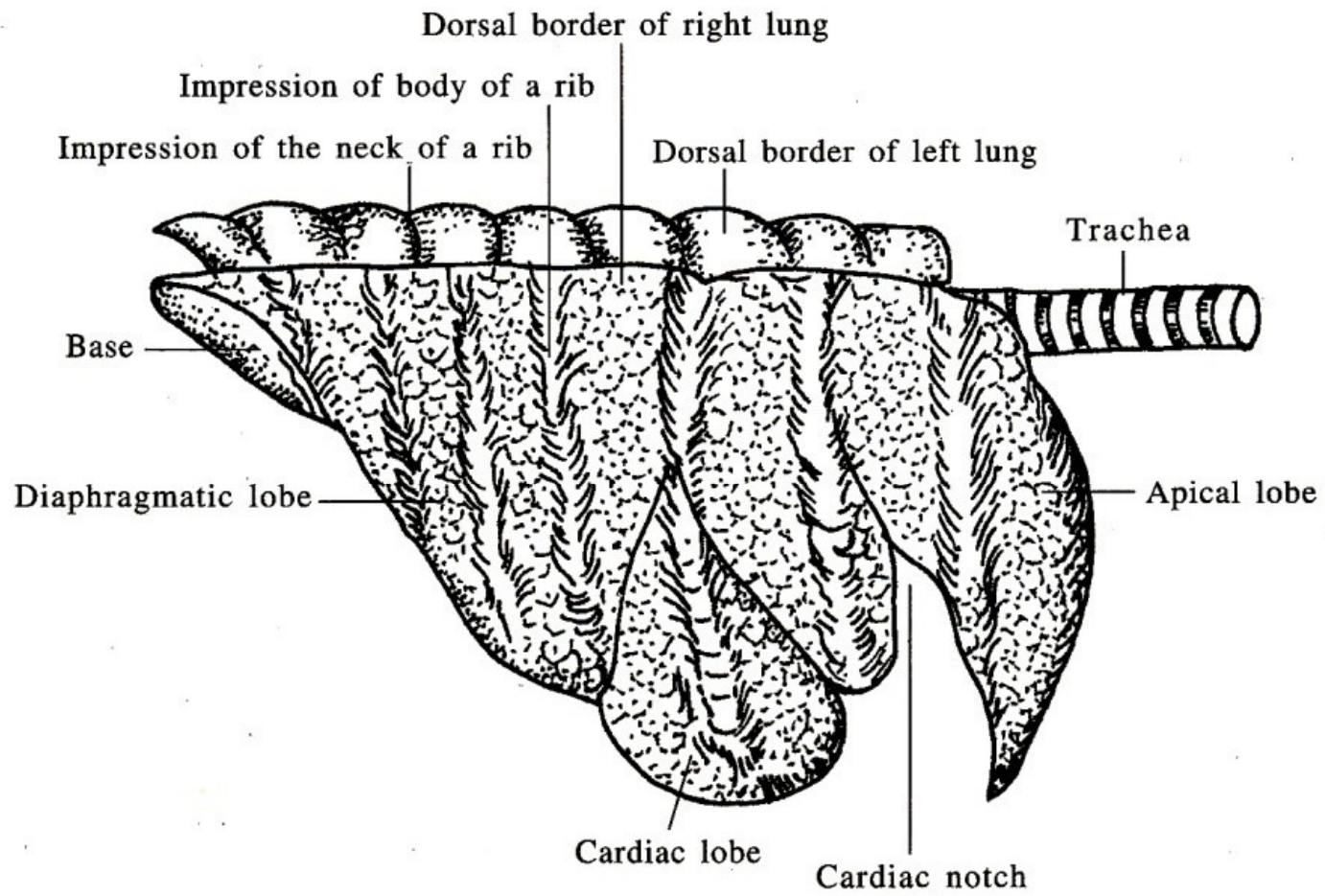
Caudal

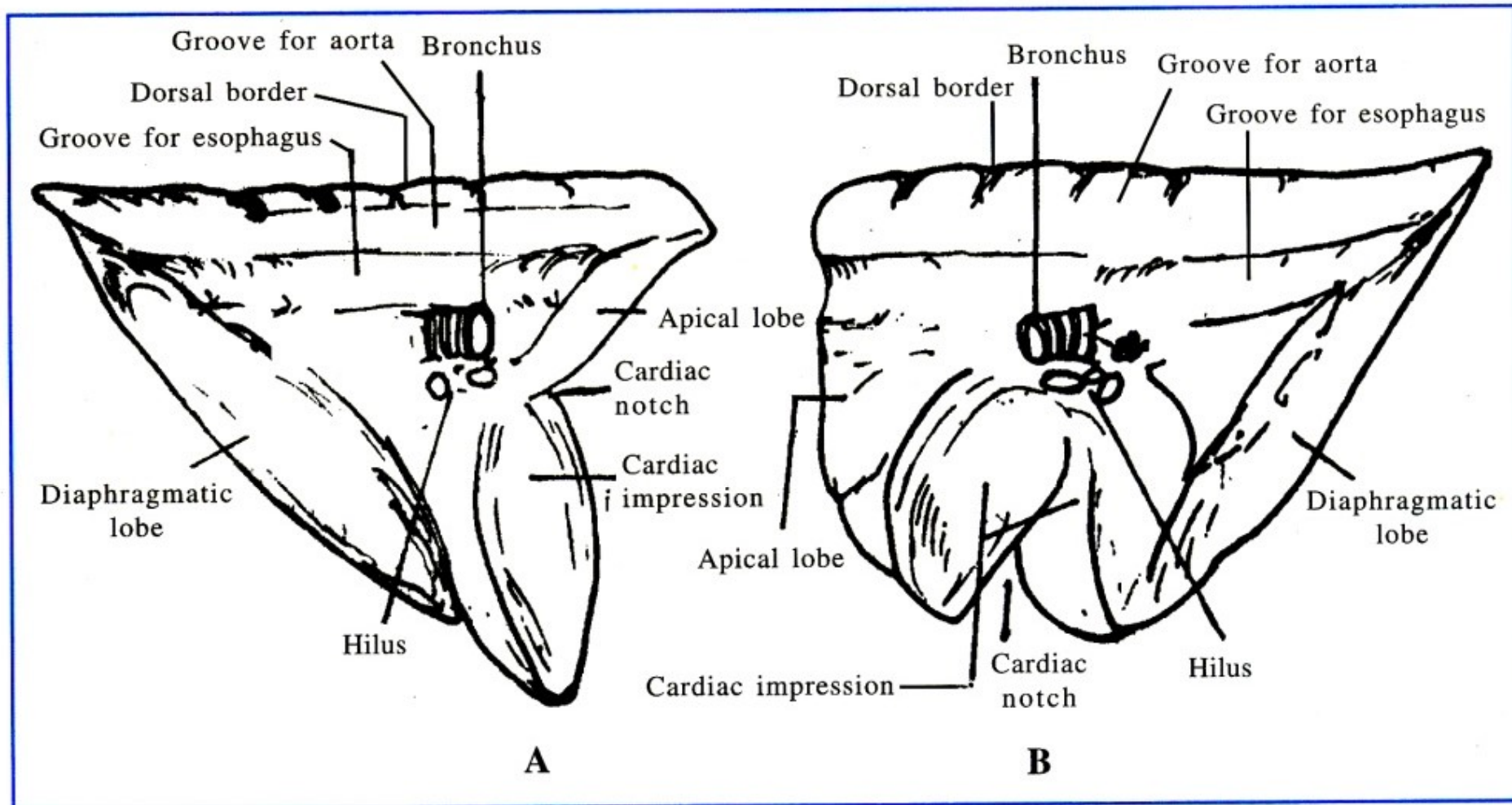
Caudal

- The fetal lung presents the following characters,
 - It is much smaller
 - It is firmer and does not crepitate
 - It is pale grey in colour
 - It sinks in water

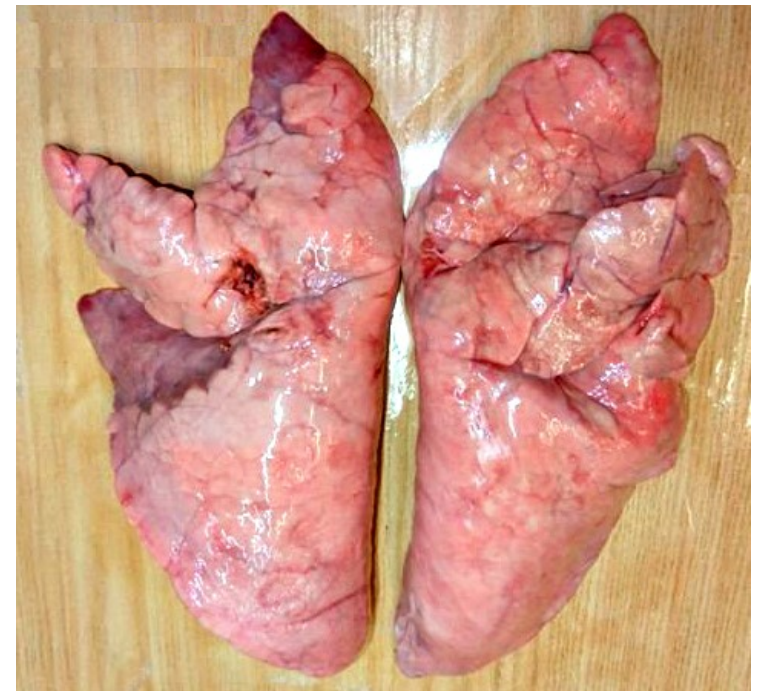
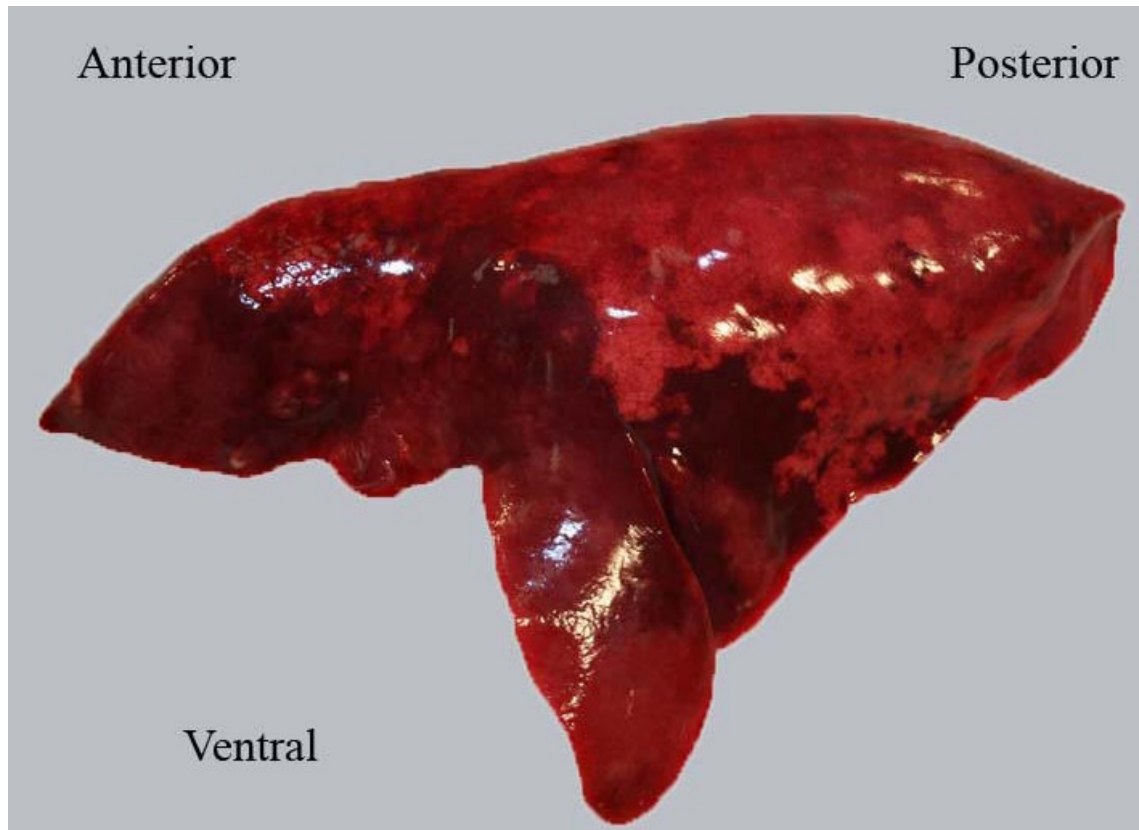
- The **right lung** is larger than the left.
- Each lung presents for description two surfaces, two borders, a base and an apex.
- The **costal surface** is convex and lies against the lateral wall of the thorax, it presents impressions of the ribs
- The **mediastinal surface** is less extensive and molded on the mediastinum and its contents
- It presents a little in front of its middle, an irregular depression -the **hilus** of the lung where the structures, which compose the root of lung, enter or leave the organ







- In front of the root, each lung presents a large cavity adapted to the heart -the **cardiac impression**.
- Behind the hilus and slightly above it are two grooves -a dorsal one for the **aorta** and a ventral for the **oesophagus**.
- The dorsal border is long, thick and rounded.
- The ventral border is thin and presents two deep fissures, which divide the lungs into a variable number of lobes



Left lung

- It presents a large quadrilateral **cardiac notch** extending from the ventral end of the third intercostal space to the fourth intercostal space and here the pericardium and heart are in contact with the chest wall. Behind this notch there is a fissure
- The fissure and notch divide the left lung into three lobes
 - the one in front of the cardiac notch is the apical lobe,
 - behind it is the cardiac lobe
 - behind the fissure is the diaphragmatic lobe.



Thoracic viscera in situ, in left lateral view. The ribs have been removed close to their costochondral junctions except for three important 'marker' ribs (1, 3 and 6) and those parts that do not enclose the left pleural cavity.



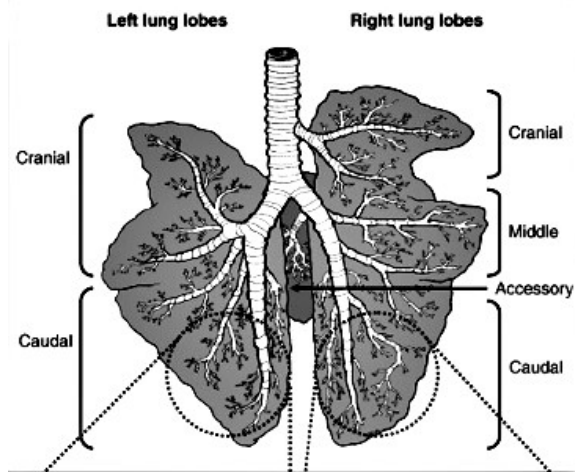
The left lung; lobation, lobulation and topography. Removal of ribs 1, 3 and 6 shows the lung and the cranial mediastinum more clearly.

Right lung

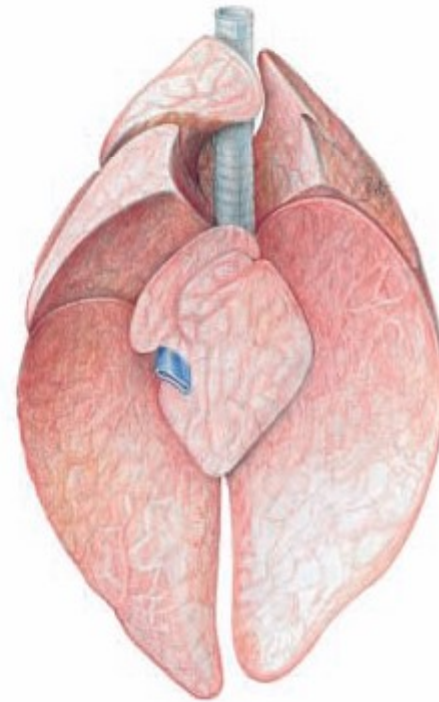
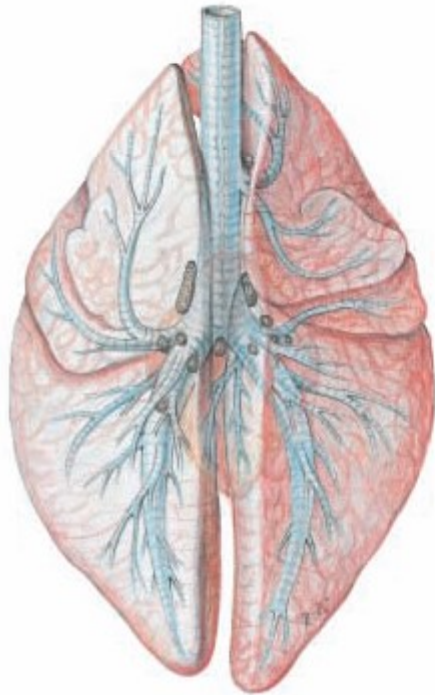
- It has two fissures on the ventral border dividing it into
 - Apical lobe
 - Cardiac lobe
 - Diaphragmatic lobe
- The apical lobe is divided into two parts by a deep fissure



- The apical lobe of the right lung is much larger than that of the left lung and occupies the space in front of the pericardium, pushing the mediastinum against the left wall
- The apical lobe of the right lung receives a special bronchus from the trachea opposite the third rib or space and is adherent to the trachea from here backward
- The mediastinal face presents a small mediastinal or intermediate lobe.



- The base of the lung is oval in outline; its surface (diaphragmatic surface) is deeply concave, in adaptation to the thoracic surface of the diaphragm
- The apex of the lung is prismatic, narrow and flattened transversely. It curves downward, and is related deeply to the cranial mediastinum.

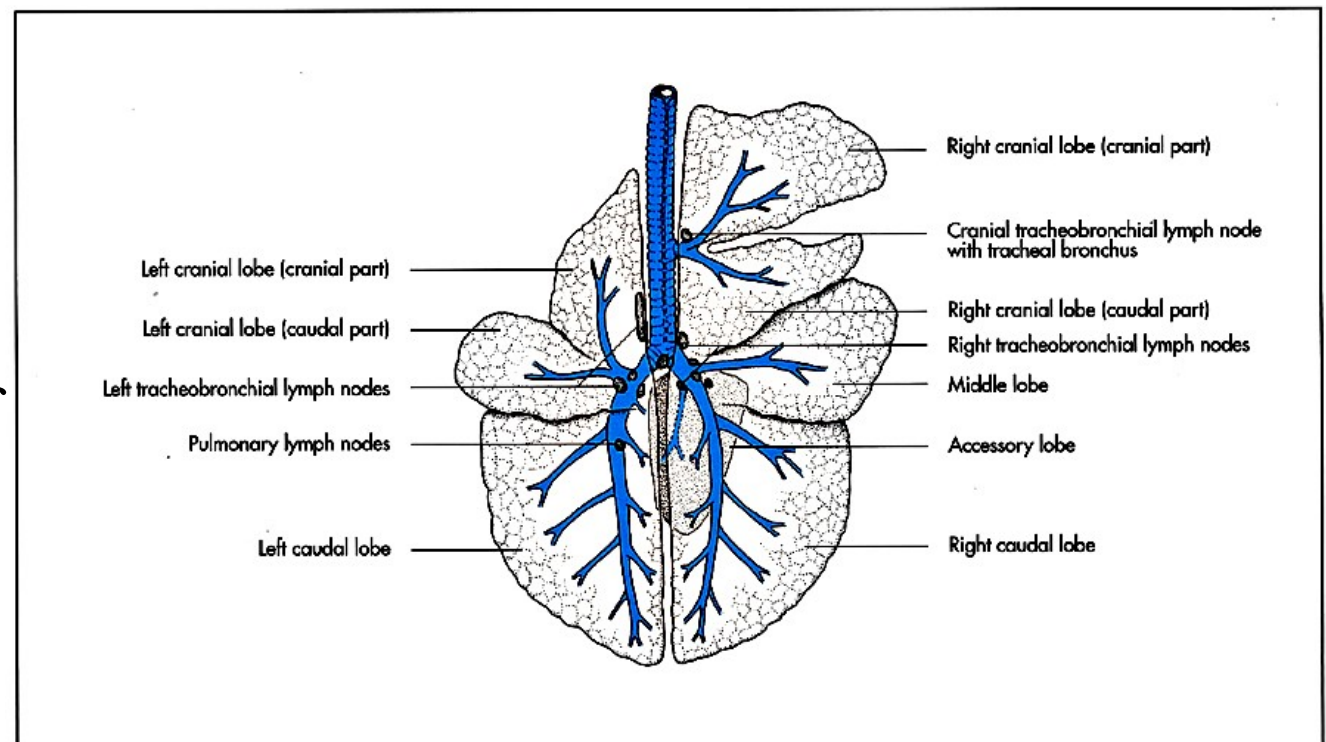


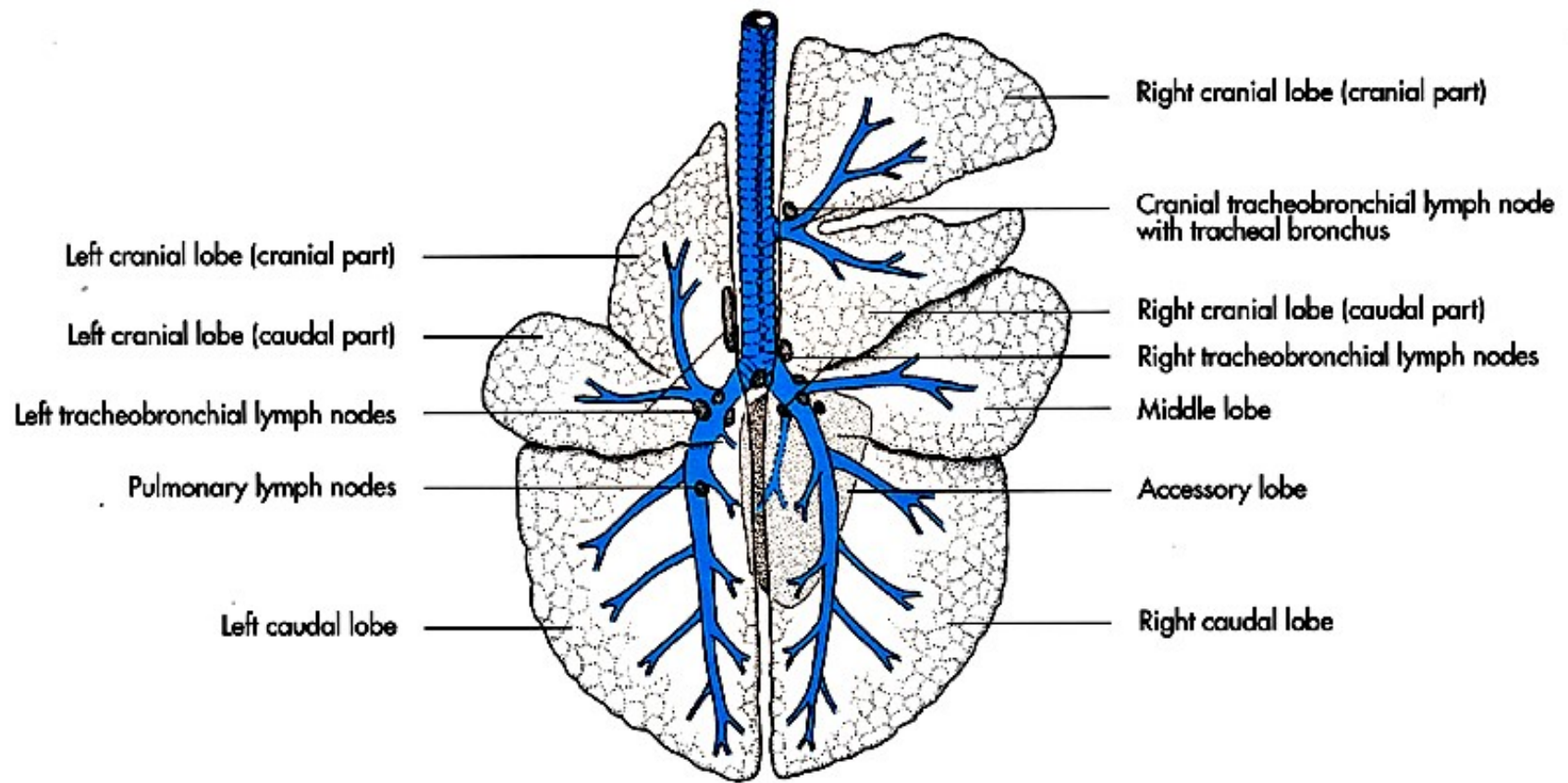
- The root of the lung is composed of the structures, which enter or leave the lung at the hilus on the mediastinal surface. These are
 - The bronchus
 - The pulmonary artery
 - The pulmonary veins
 - The bronchial artery
 - The pulmonary nerves and
 - The pulmonary lymph vessels

Bronchi

- Each bronchus enters the hilus of the lung
- The left bronchus first gives off a branch, which supplies both the apical and cardiac lobes and is then continued as the stem bronchus to the diaphragmatic lobe
- The right bronchus gives off a branch, which supplies the cardiac lobe and is continued as the stem bronchus to the diaphragmatic lobe

- The apical bronchus from the trachea supplies the apical lobe. The lobulation of lung is very evident on account of abundant interlobular tissue





Sheep and Goat

- It resembles those of ox
- Lobulation is much less distinct than in the ox

Horse

- The lungs of the horse are not divided by deep fissures, as in case of most mammals
- The left lung consists of a chief part -the body and an apex. In addition to these, the right lung has an **intermediate lobe**
- The lobulation of the lung is not very evident on account of the small amount of interlobular tissue
- The cardiac notch is larger in the right lung than the left
- **Behind the root of the lung, the two lungs are adherent to each other on the triangular area. Behind the area of adhesion the mediastinal pleura forms a fold called the *pulmonary ligament (ligament of lung)***

Pig

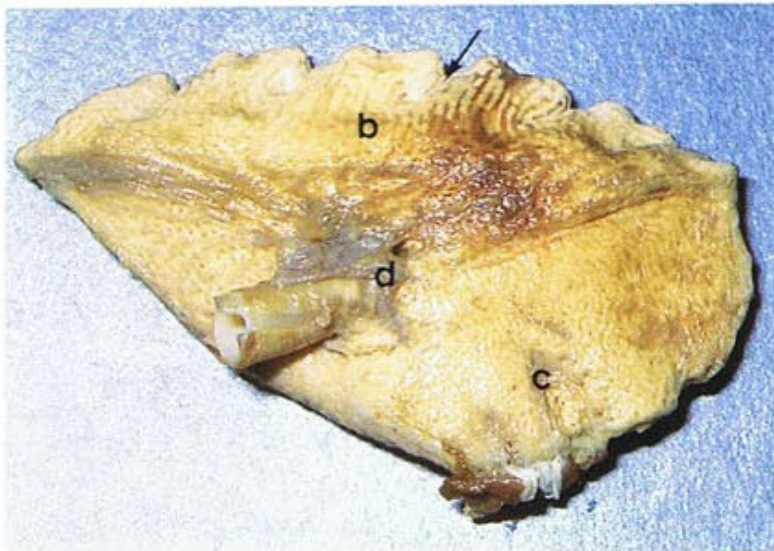
- The right lung has four lobes- apical, cardiac, diaphragmatic and intermediate
- In some cases, apical lobe is divided into two parts. Sometimes it is fused with cardiac lobe
- Lobulation is distinct
- The apical bronchus is present for the right apical lobe at the level of 3rd rib

Dog

- The costal surface of lungs is convex
- Lobulation is not distinct
- Interlobular fissures are deep and extend to the root
- The right lung has four lobes and left has three
- The cardiac notch is larger on the right side than on the left

Fowl

- They are small and occupy the dorsal part of the thorax. They are intimately adherent to the ribs and the costal impressions are deeper
- The stem bronchus enters the ventral surface of the lung about its middle. It continues backwards through the lungs and opens into the abdominal air sacs
- Within the lungs, the stem bronchus gives off secondary bronchi, which enter the cervical, clavicular and thoracic air sacs
- Numerous tertiary bronchi radiate towards the periphery



Air sacs

- These are thin walled sacs lined with mucous membrane. They all form a means of communication between a bronchus and the interior of some of the pneumatic bones.
- There are 9 sacs,

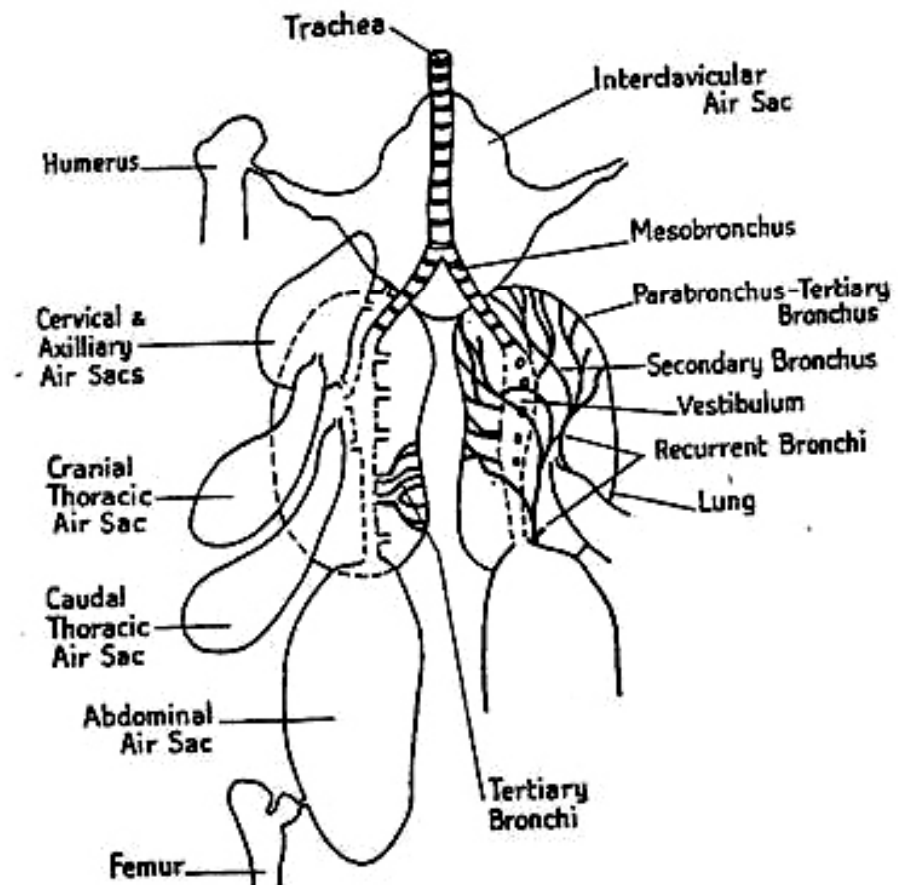
cervical

clavicular

cranial thoracic

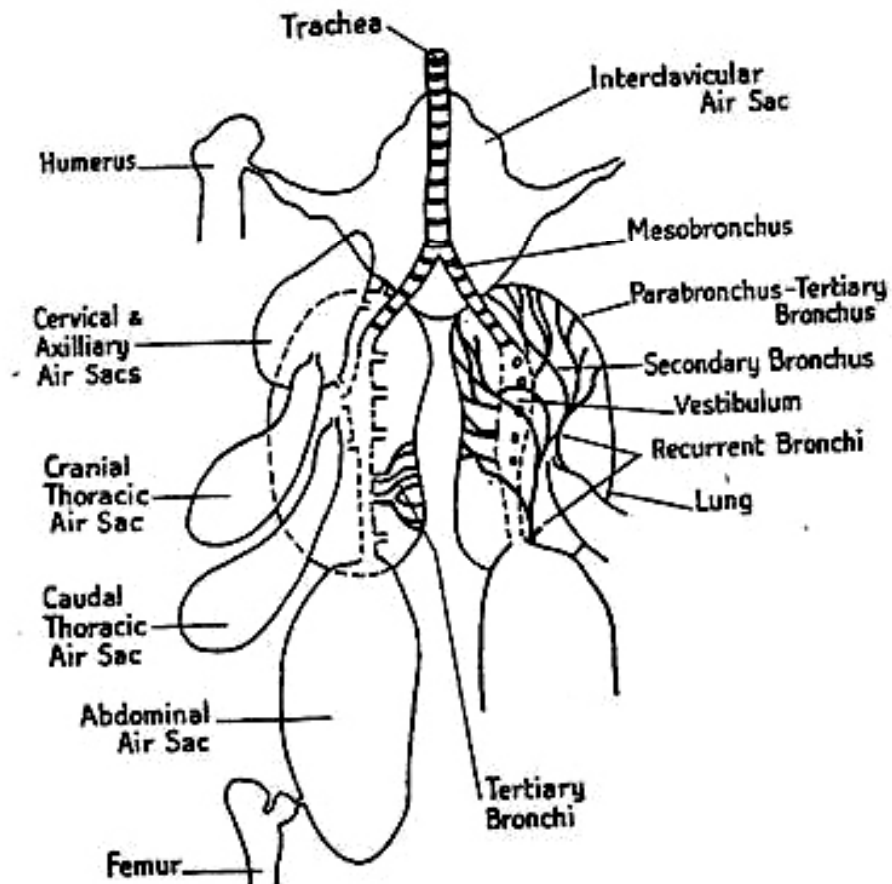
caudal thoracic

abdominal



- All are paired except the
- clavicular, which is single

- The thoracic air sac does not communicate with pneumatic bones
- All the air sacs together contribute to the reduction of the specific gravity of the avian body
- It is playing vital role in the regulation of the body temperature
- It also helps in even distribution of the body weight during the flight and in voice production



THANKS
THANKS