

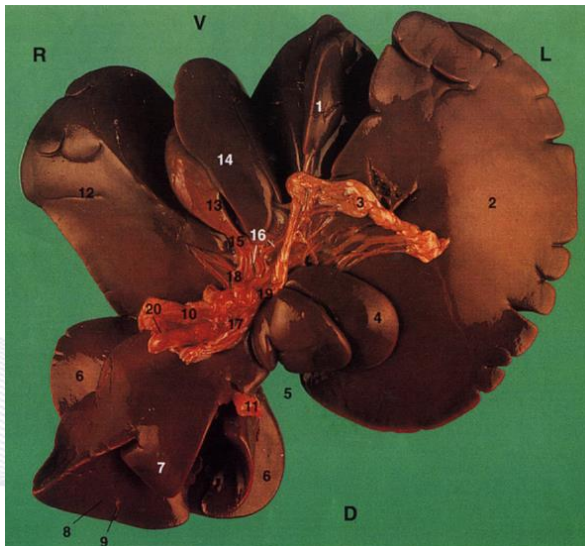
# Veterinary Bioscience: Metabolism

DVM Year 1

VETS30017 / VETS90116



## The gross structure and anatomical relationships of the liver



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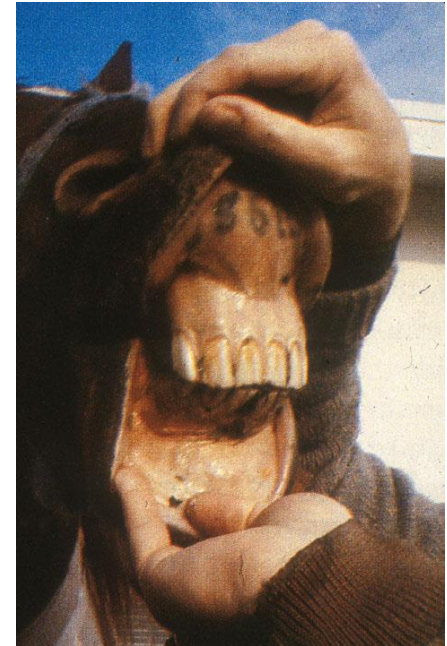
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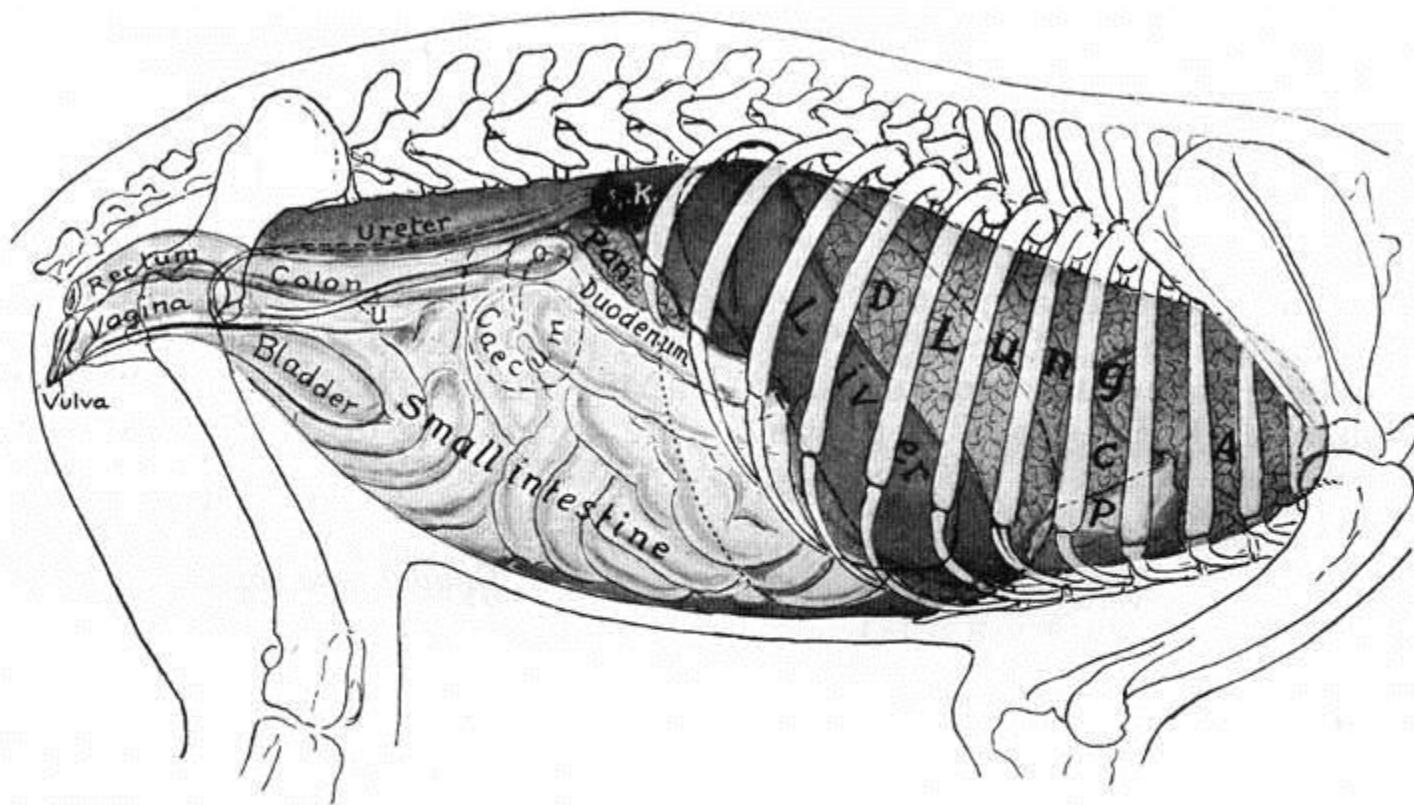
# Clinical case

- 20 year old gelding
- Weight loss
- Jaundice
- Blood enzymes indicate liver damage
- Where do you biopsy the liver in a standing horse?



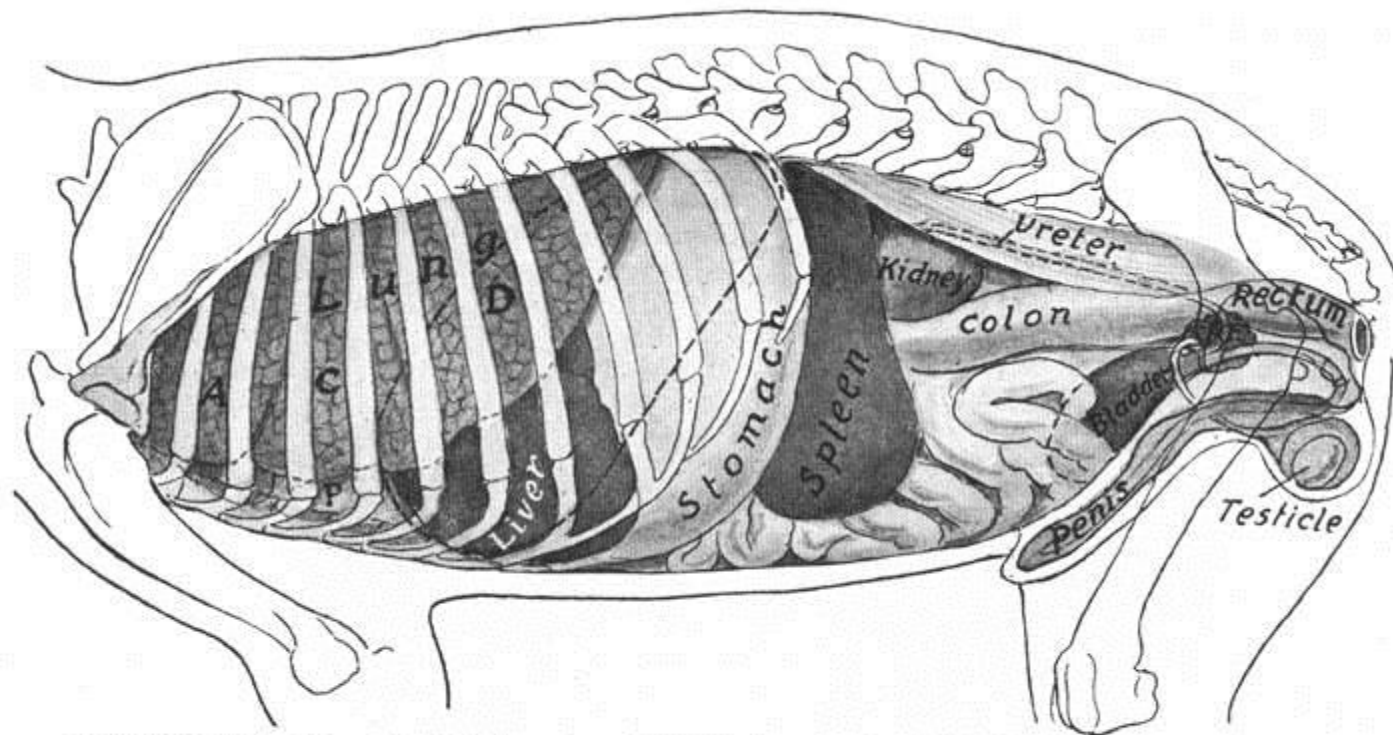
# Liver

- Positioned between:
  - The diaphragm cranially
  - The stomach and intestinal mass caudally
- Bulk lies to the right in all species
- Held in position by
  - Close attachment to the diaphragm
  - Pressure of the viscera



**FIGURE 51-23.** Projection of viscera of dog (female) on body wall; right side.

A, C, D, Apical, middle and diaphragmatic lobes of right lung; K, right kidney; O, ovary; P, pericardium; Pan., right lobe of pancreas; U, horn of uterus. Costal attachment and median line of diaphragm are dotted; also caudal contour of stomach.

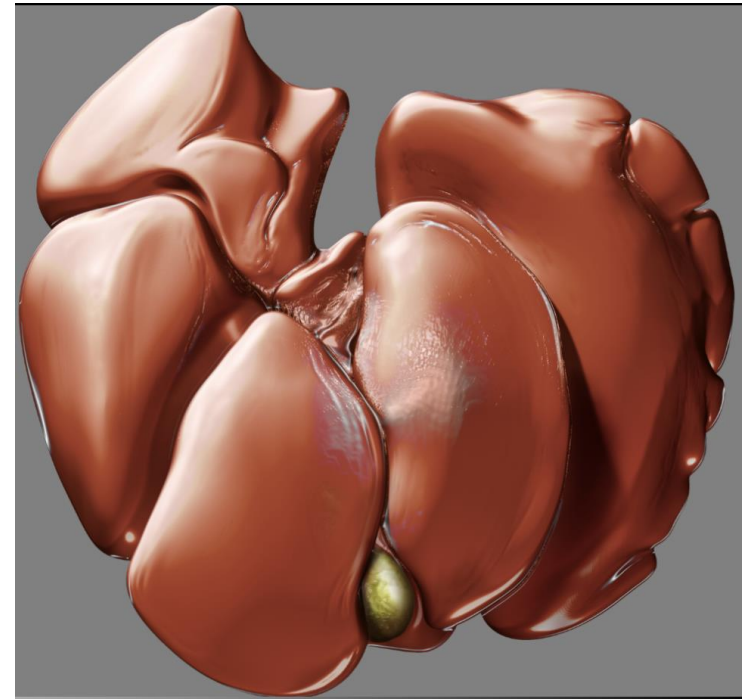


**FIGURE 51-22.** Projection of viscera of dog (male) on body wall; left side.

A, C, D, Apical, middle and diaphragmatic lobes of lung; P, pericardium; Pr, prostate. Costal attachment and median line of diaphragm are dotted.

# External features

- Size and weight varies
  - Carnivores – 3-5% body weight
  - Omnivores – 2-3% body weight
  - Herbivores – 1-1.5% body weight
- Reddish brown in colour but friable
- Highly vascular
- Covered by serosa and tunica fibrosa





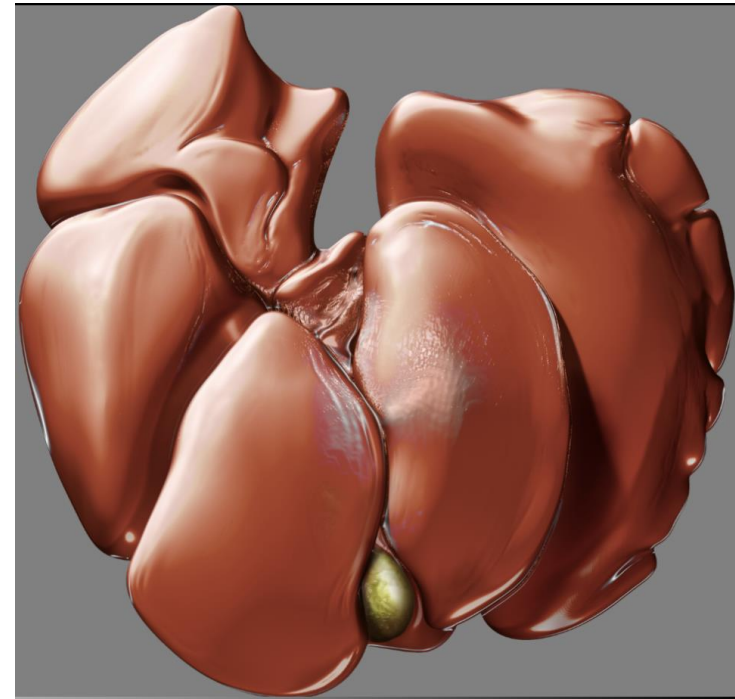
# External features

- Two surfaces
  - Cranial (parietal) or diaphragmatic
    - Convex
    - Faces to the left and right sides and dorsally
  - Caudal or visceral surface
    - Concave
    - Faces mainly caudoventrally and to the left
    - Contains the portal area



# External features

- Two borders
  - Dorsal border
    - Mid line - groove for caudal vena cava
    - To the left of this - notch for the oesophagus
  - Ventral border
    - Sharp edged
    - Notch for the round ligament (ligamentum teres)



# External features - DOG

- Liver is divided into lobes –
  - Left lateral
  - Left medial
  - Quadrate
  - Right medial
  - Right lateral
  - Caudate (caudate and papillary processes)



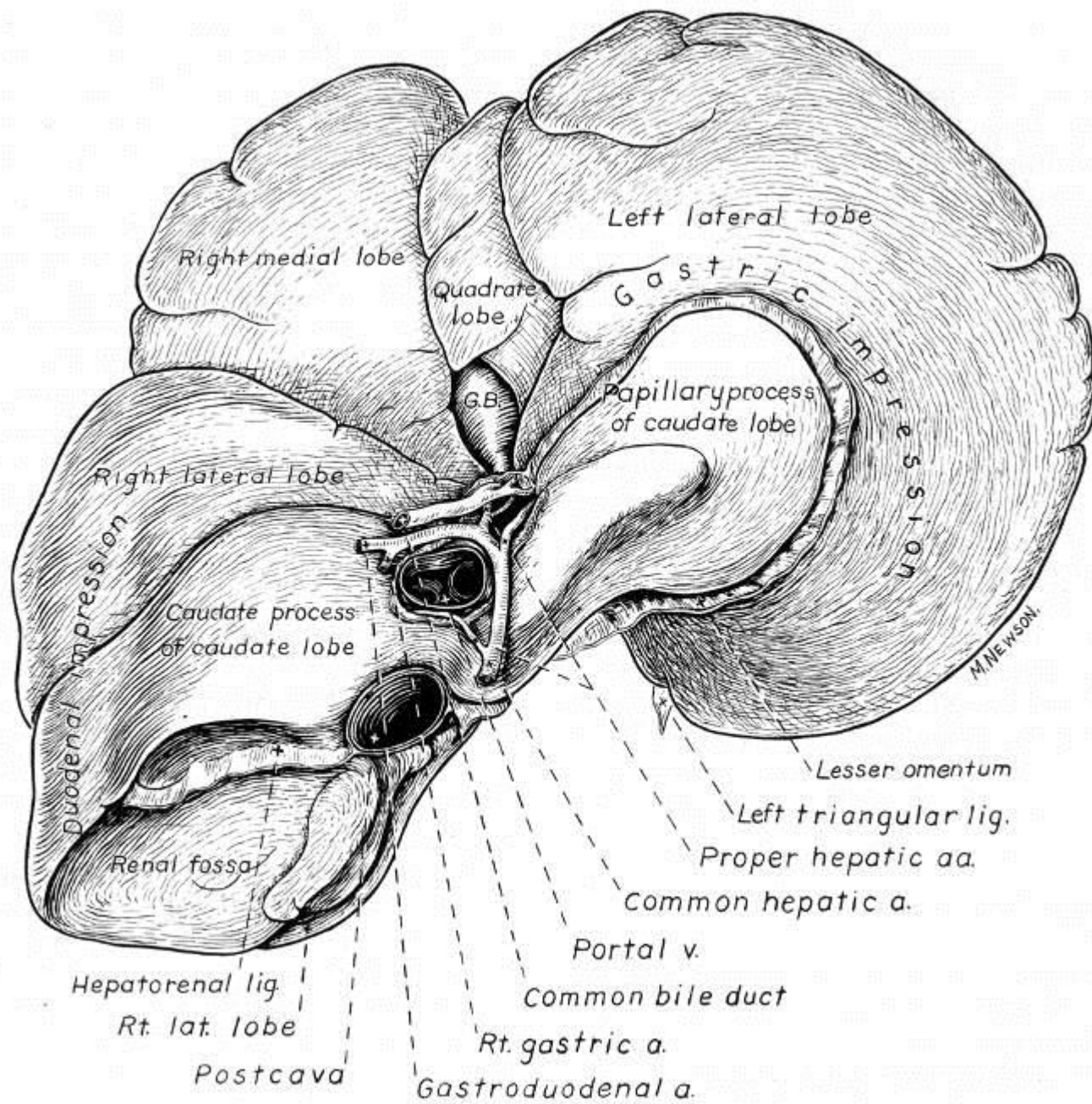


FIG. 13-22. Liver, visceral aspect.

# Ligaments of the liver

- From the cranial surface of the liver to the diaphragm
  - Coronary
  - Falciform
  - Right and left triangular
- Hepatorenal
- Round ligament of liver (ligamentum teres)
- Lesser omentum

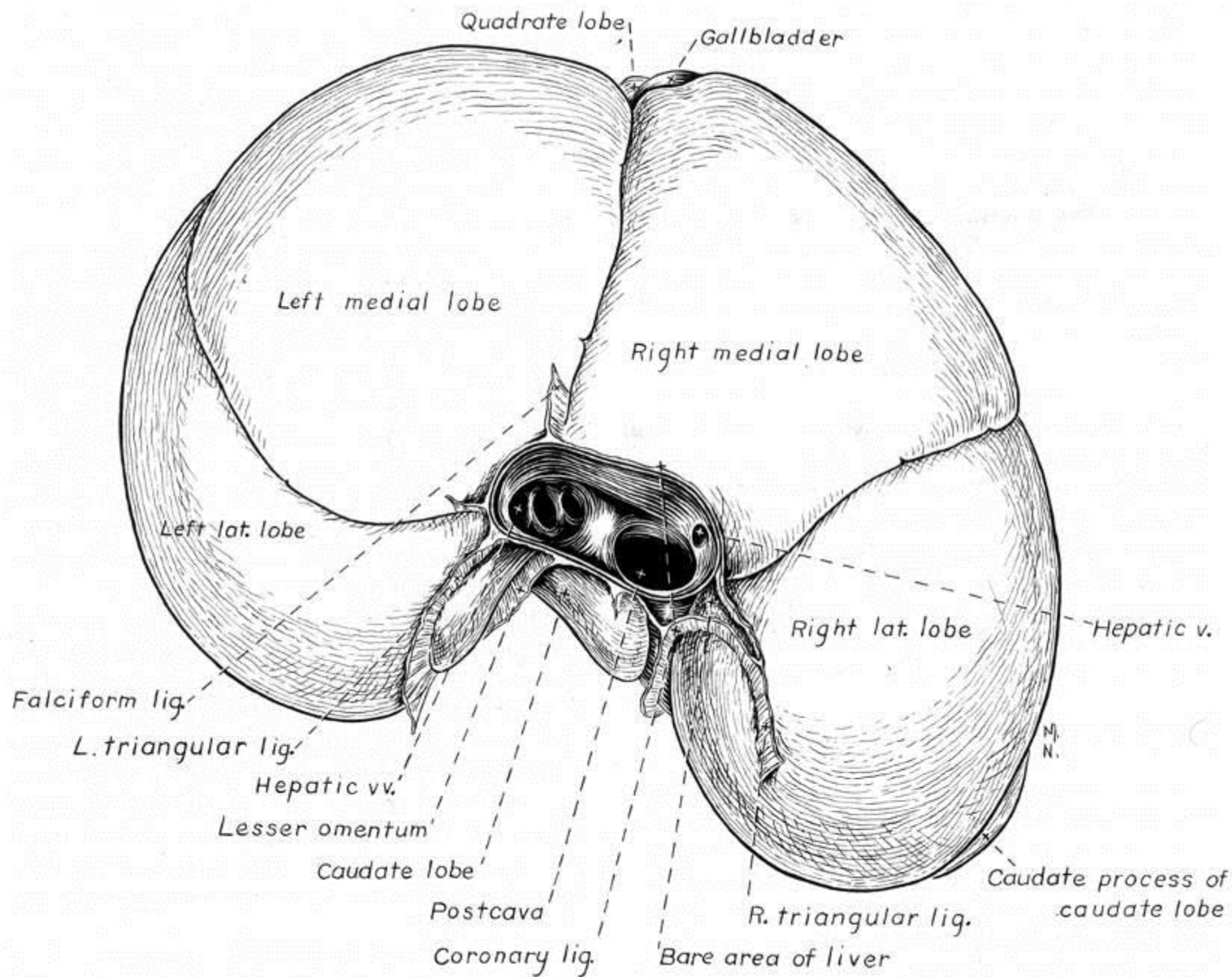


FIG. 13-21. Liver, diaphragmatic aspect.

# Gall Bladder

- Pear shaped
- Partly fused to liver
- Lies between the quadrate and right medial lobes
- Diverticulum of bile duct
- Bile flow - two way in cystic duct
- No gall bladder in the Horse



# Bile Duct System

- Microscopic canaliculi
- Larger ductules – few large hepatic ducts
- Common hepatic duct – leaves portal area
- Cystic duct – side branch
- Bile duct or common bile duct
- Major duodenal papilla

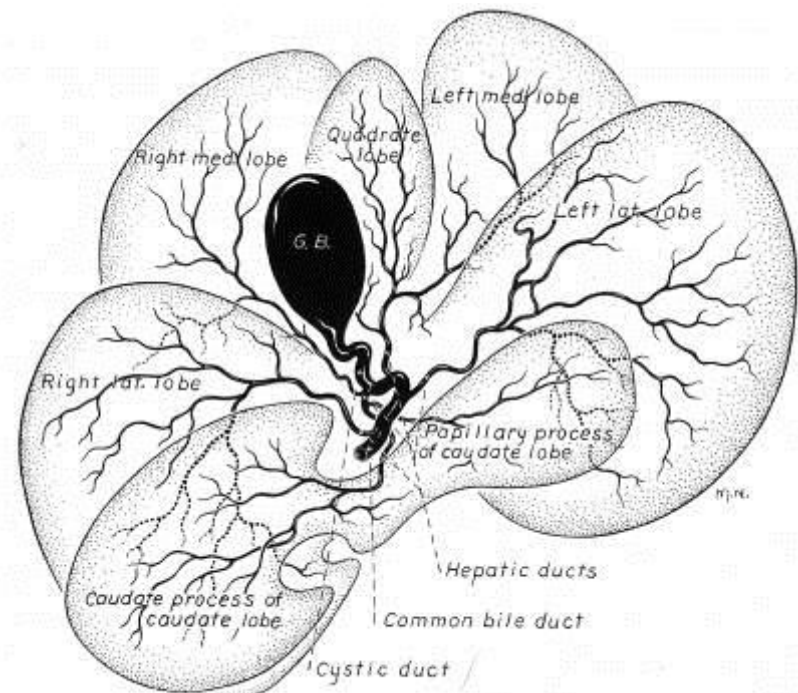


FIG. 13-23. Scheme of the gall bladder and hepatic ducts, visceral aspect.



# Blood supply to the liver

- Hepatic artery – branch of celiac – most of the  $O_2$
- Portal vein – 70-80% of total blood supply
- All blood is collected by a single set of veins -
  - Central veins of lobules
  - Progressively larger hepatic veins
  - Drain to caudal vena cava

## Nerve supply:

- Sympathetic
- Parasympathetic

# Formation of the Liver in the embryo

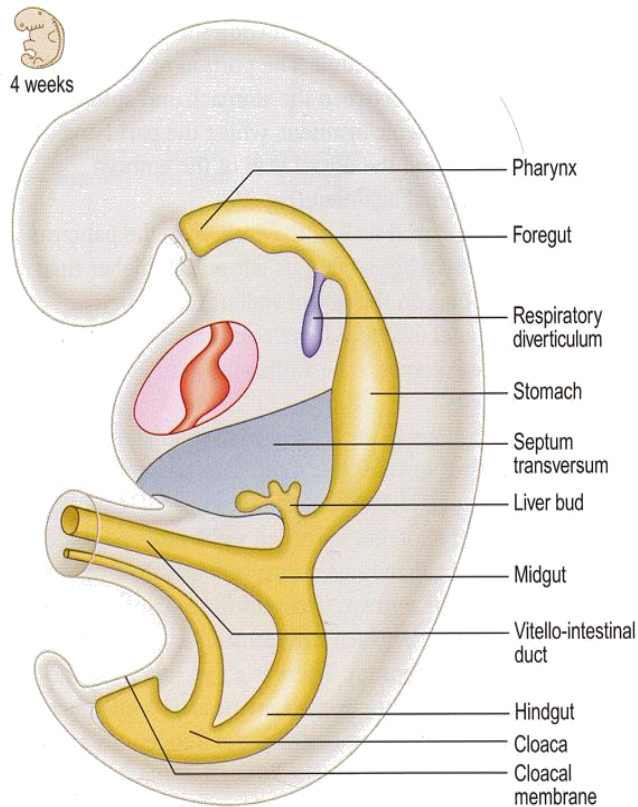
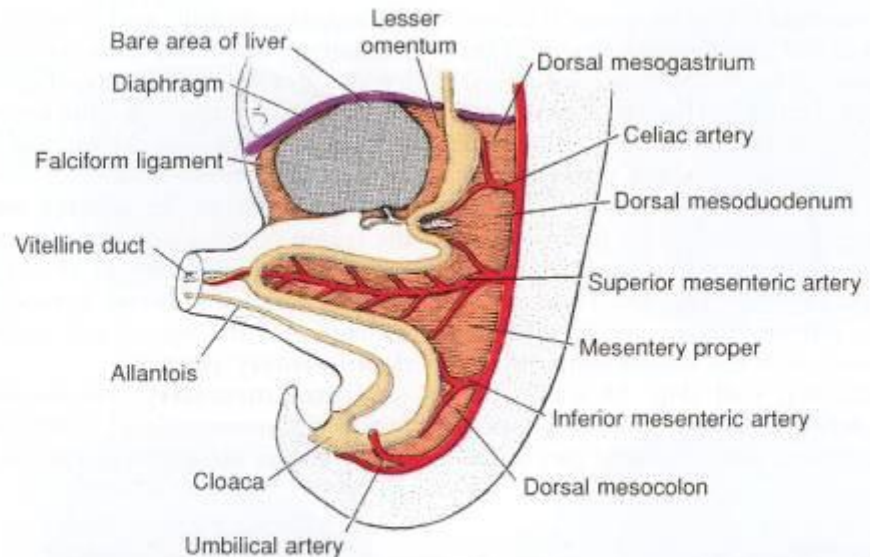


Fig. 7.1 The gut tube in a 4-week embryo.

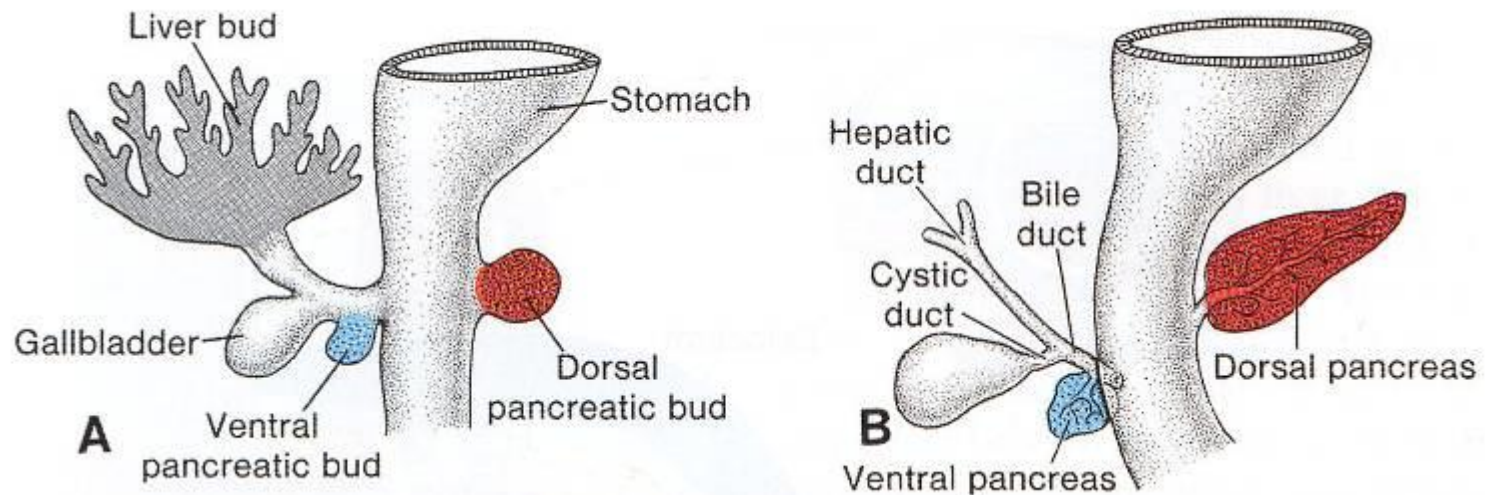
- Diverticulum from ventral surface of fore-gut at junction of Stomach/duodenum
- Initially grows into the mesoderm of the septum transversum



**Figure 14.4** Primitive dorsal and ventral mesenteries. The liver is connected to the ventral abdominal wall and to the stomach by the falciform ligament and lesser omentum, respectively. The superior mesenteric artery runs through the mesentery proper and continues toward the yolk sac as the vitelline artery.

# Formation of the Liver in the embryo

- Hepatocytes and bile duct system are endoderm derived

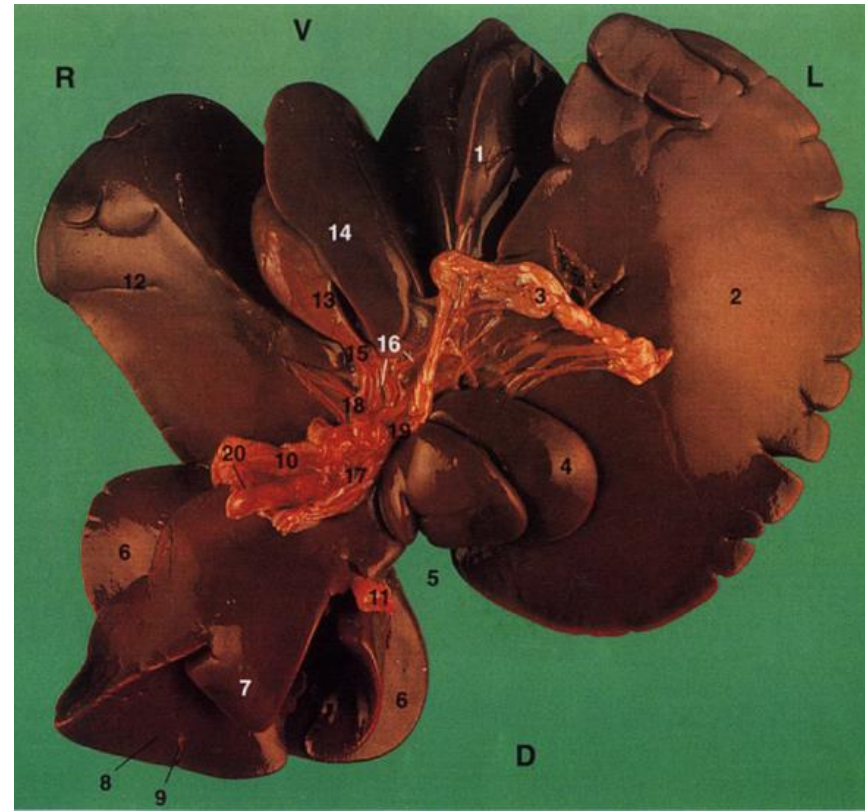
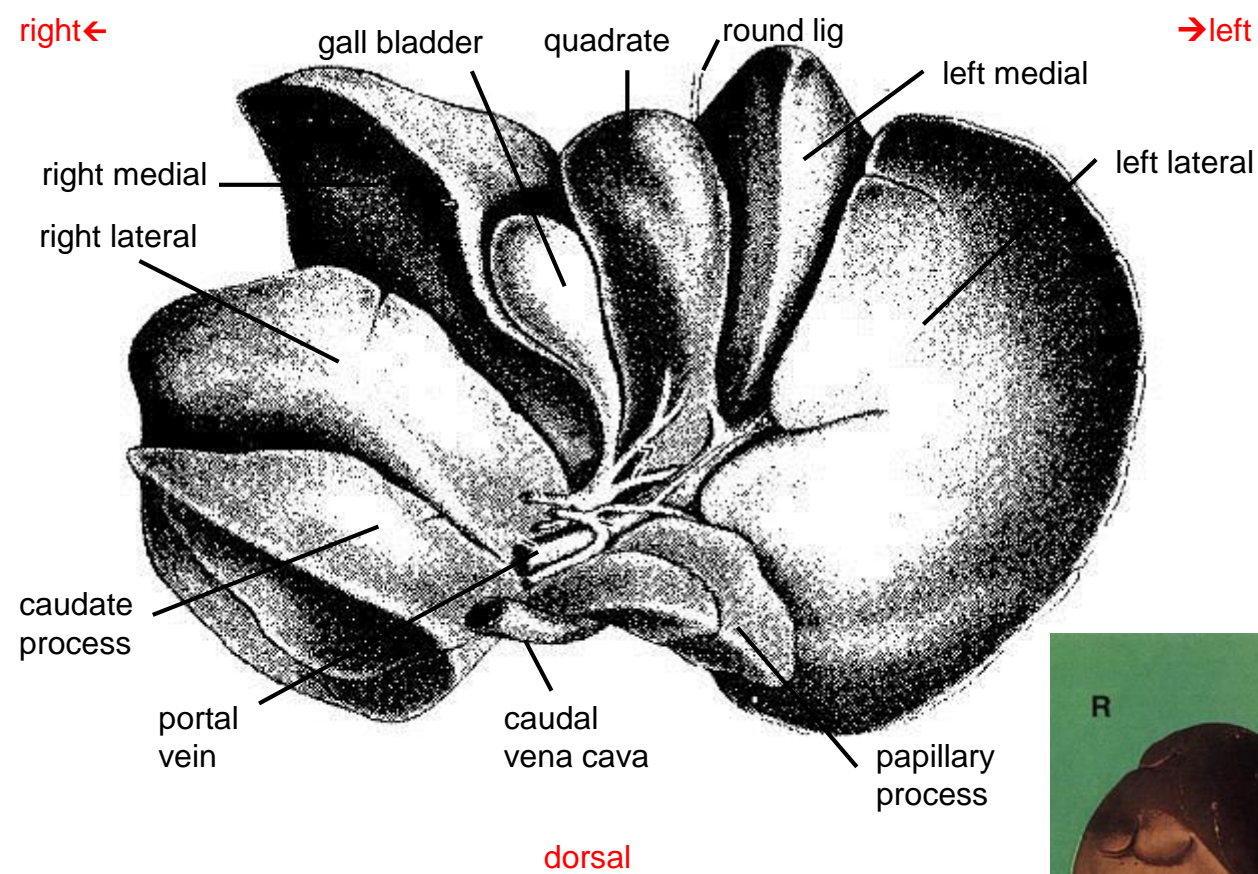


# Comparative aspects - Dog

- Liver
  - Relatively large
  - Almost entirely within costal area
  - R:L proportion ~ 3:2
  - Deeply divided into 5/6 lobes



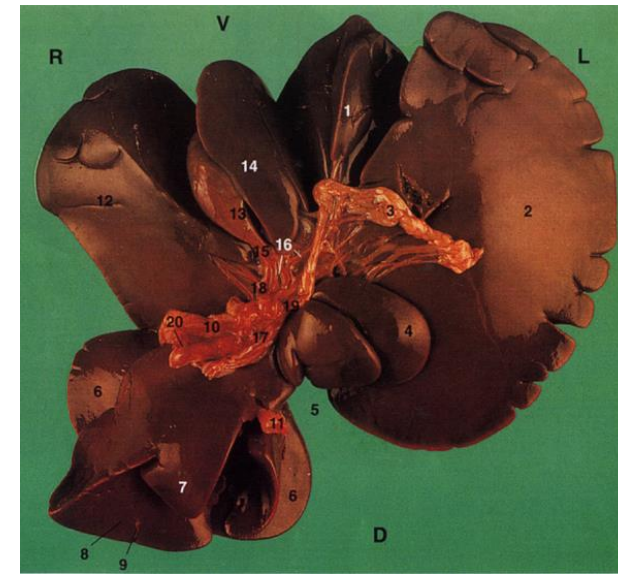




Dog - liver

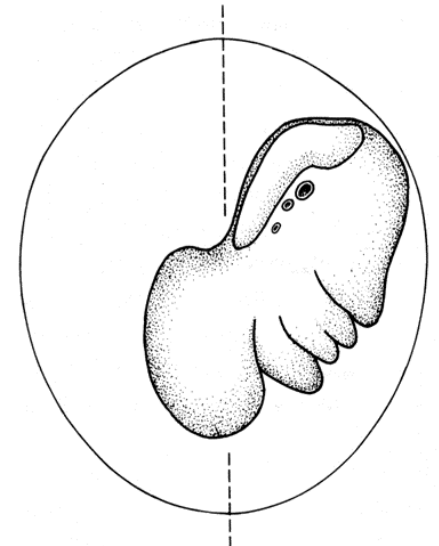
# Comparative aspects - Dog

- Gall bladder
  - Sunk deep between quadrate/R. medial lobes
  - To R of median plane
  - Appears at visceral surface
  - Common bile duct opens -
    - On major duodenal papilla 5-8cm distal to pylorus
    - In conjunction with the pancreatic duct



# Comparative aspects - Horse

- Liver
  - Smaller proportion
  - Long axis is oblique
  - 2/3 lies to right of median plane
  - Dorsal border -  
left part does not extend  
as far dorsally as the right





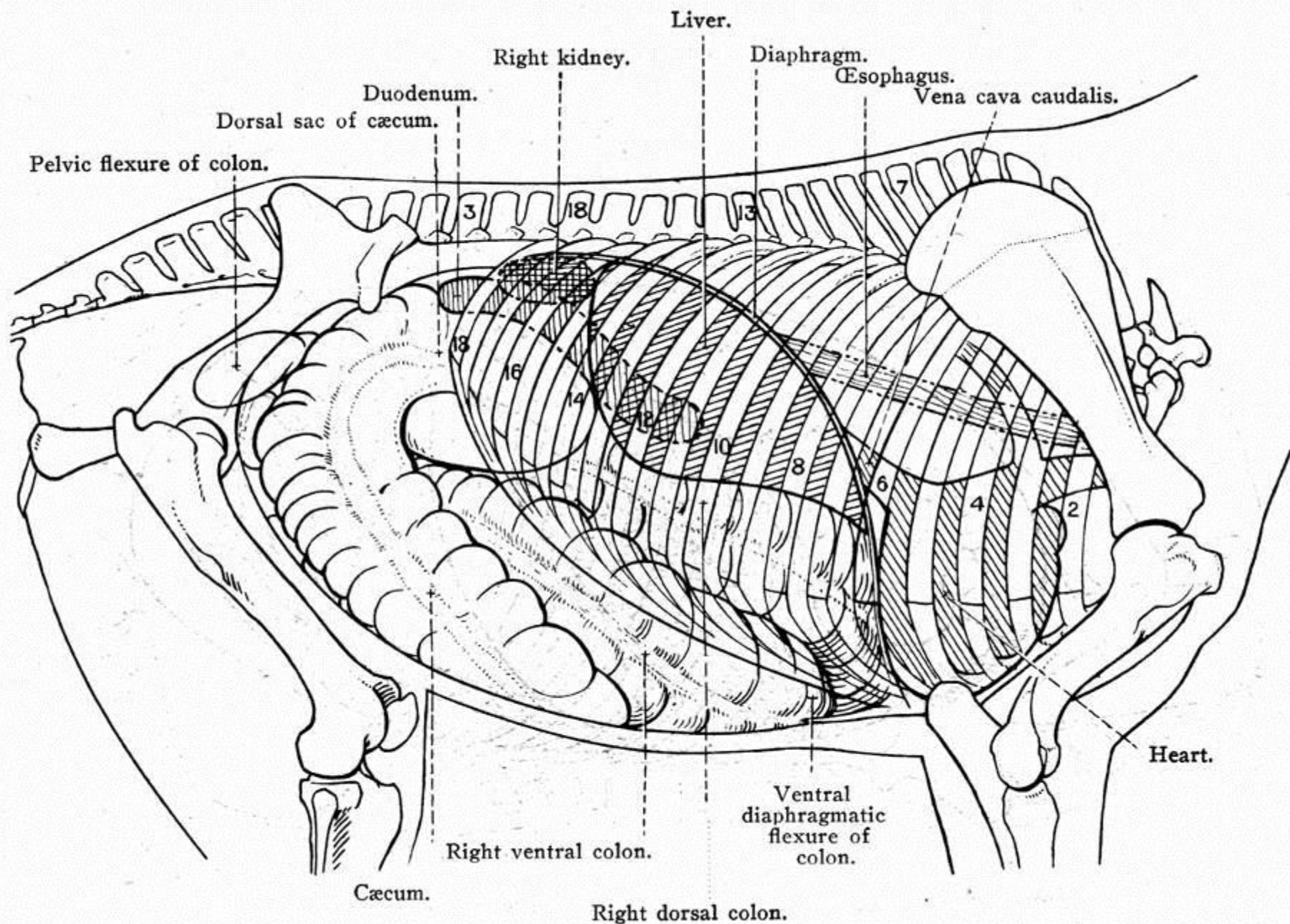
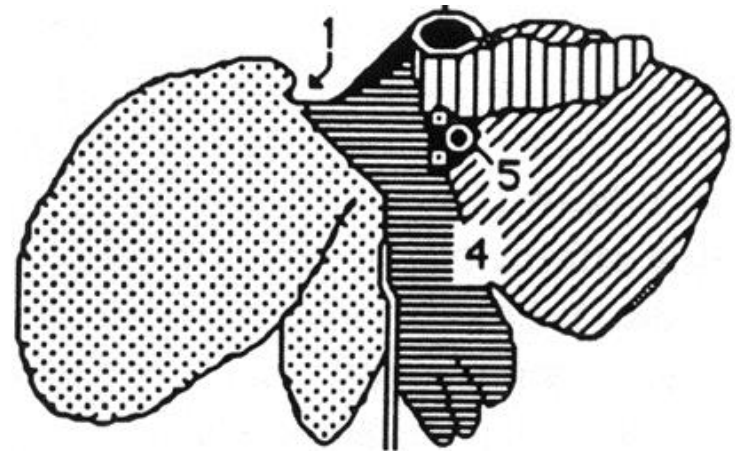


FIG. 40.—Diagram illustrating the topography of the thoracic and abdominal viscera as seen from the right.

# Comparative aspects - Horse

- Liver - lobes

- Left
- Quadrate
- Right
- Caudate



- Hepatorenal ligament - attaches liver to base of caecum as well as right kidney

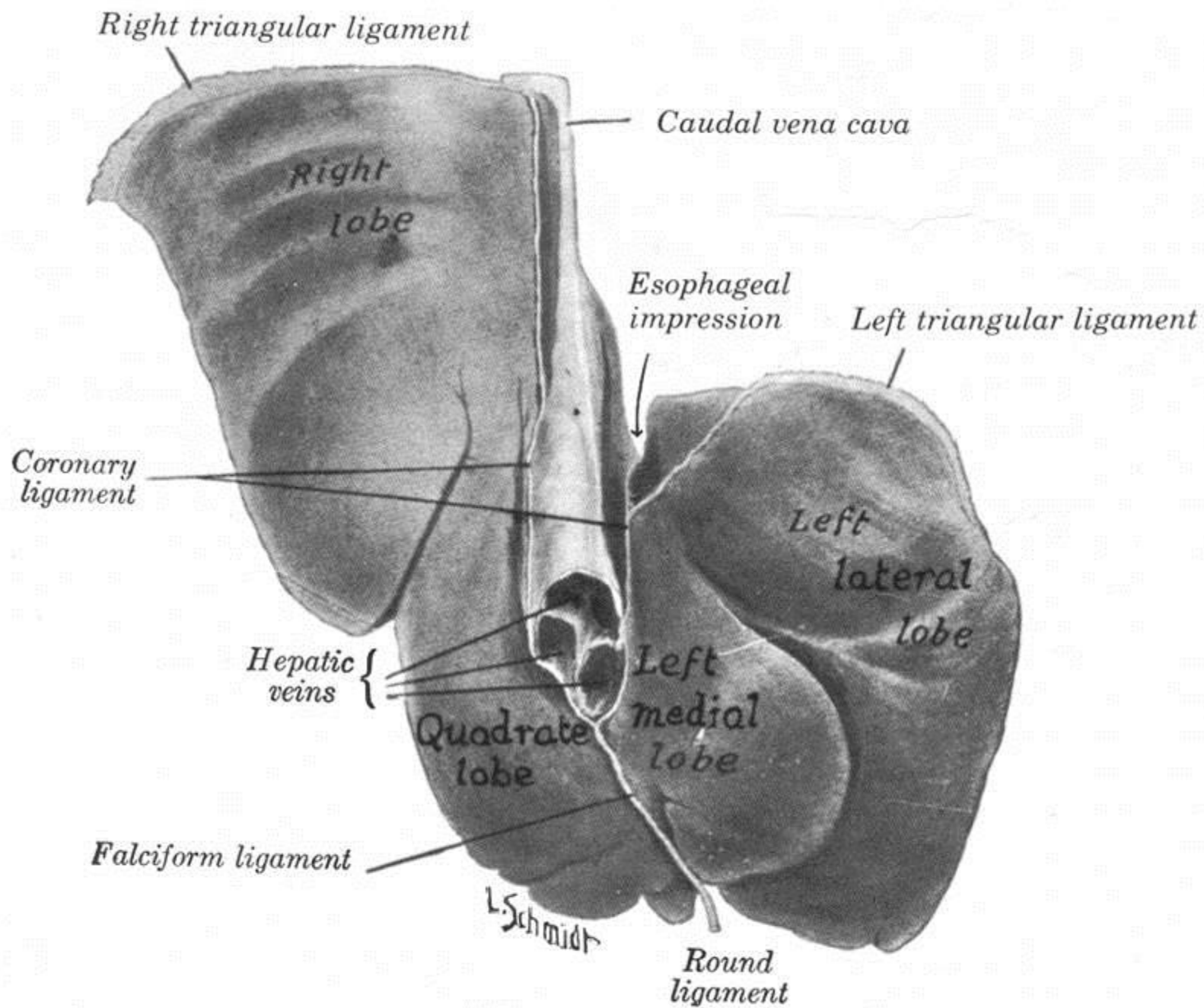
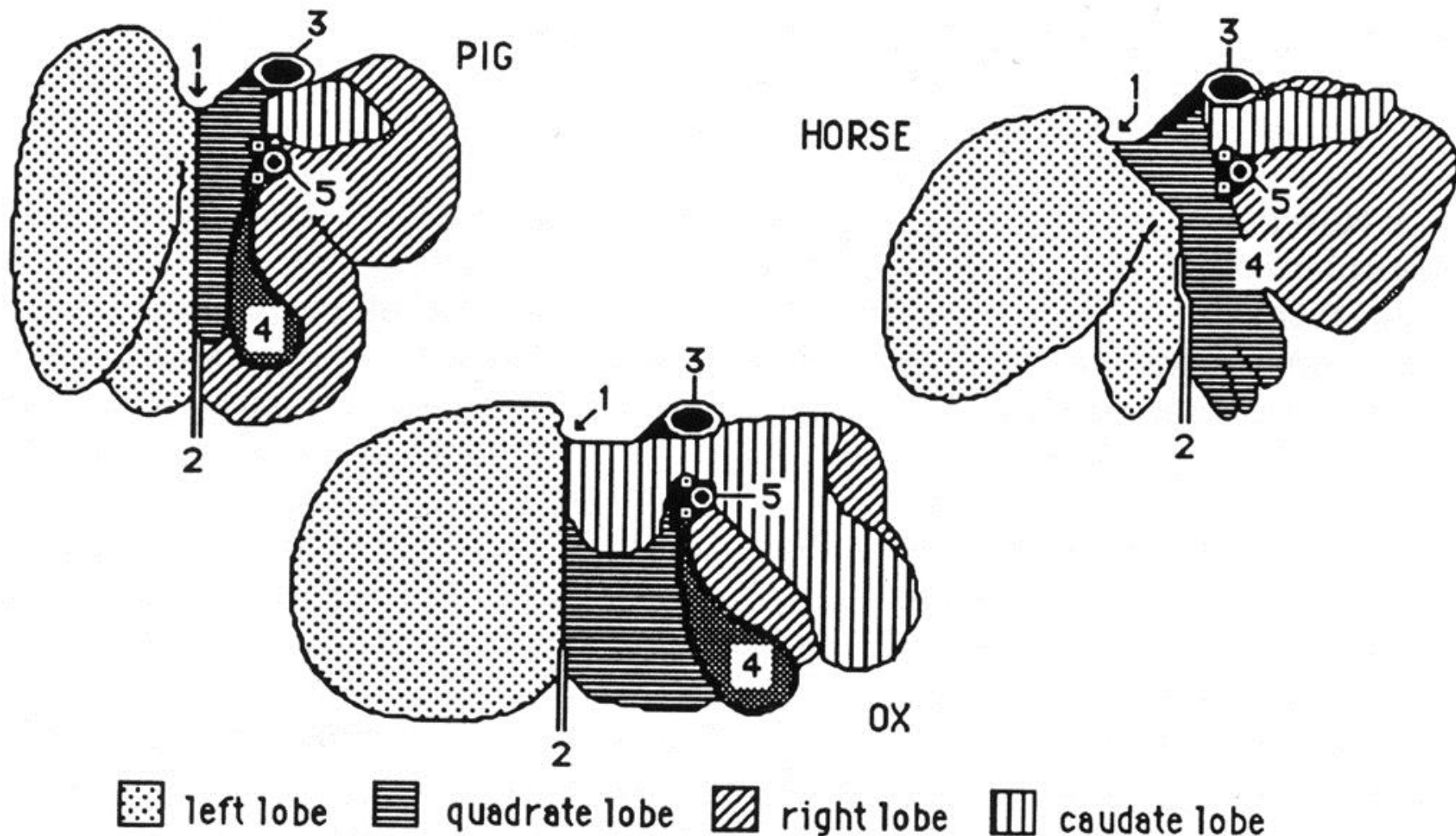


FIGURE 18-52. Liver of young horse, hardened *in situ*; parietal surface.

# Comparative aspects - horse

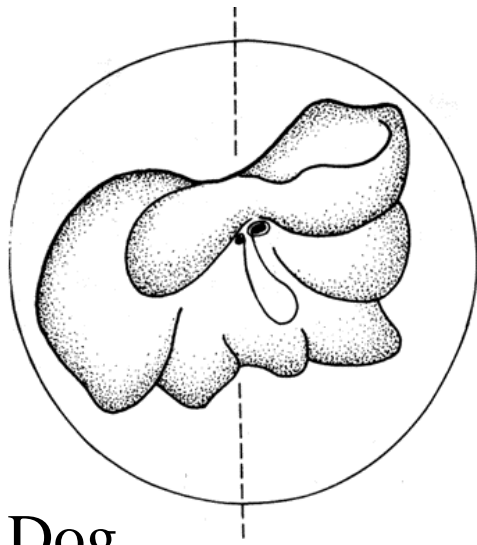
- Bile Duct System
  - NO GALL BLADDER
  - Bile duct opens
    - 13-15 cm distal to the pylorus
    - On the major duodenal papilla
      - Hepatopancreatic ampulla
    - In conjunction with the pancreatic duct



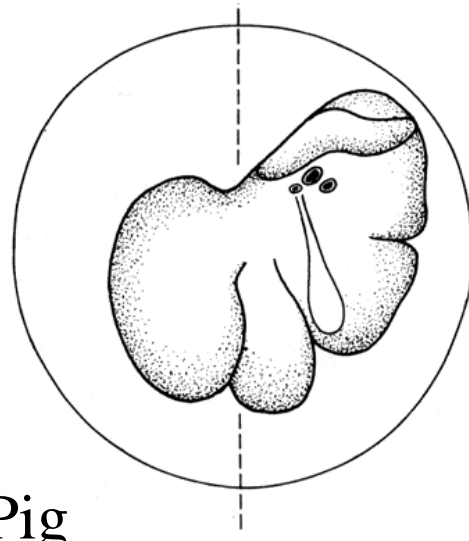
**FIGURE 4-5. Livers of pig, horse, and ox, visceral surfaces.**

1. Esophageal notch
2. Round ligament of liver
3. Caudal vena cava

4. Gallbladder, or point where gallbladder would have been in horse
5. Hepatic porta

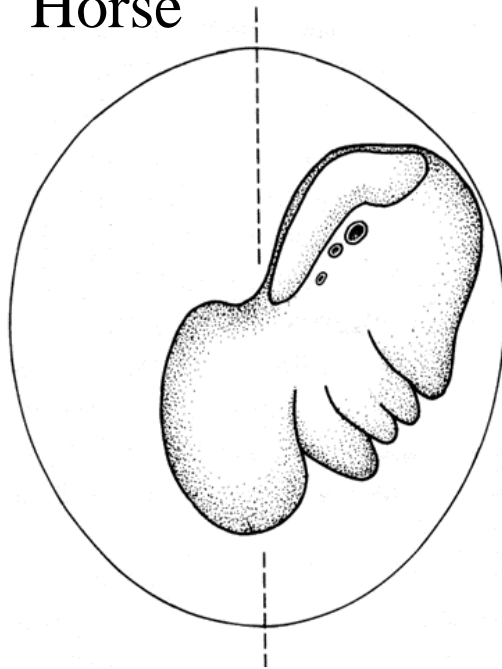


Dog

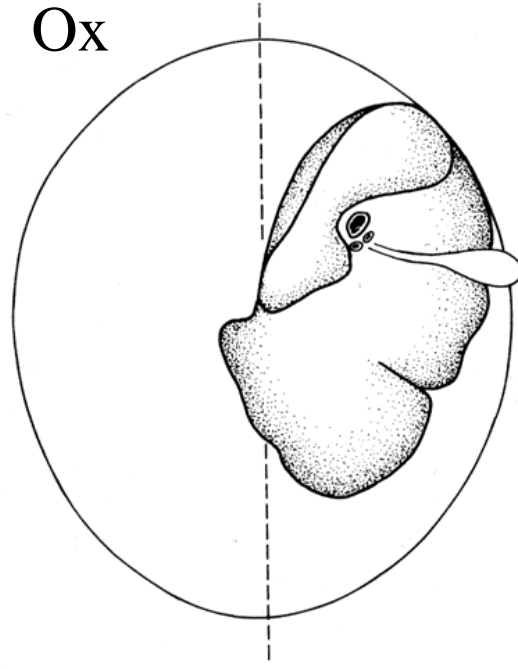


Pig

Horse



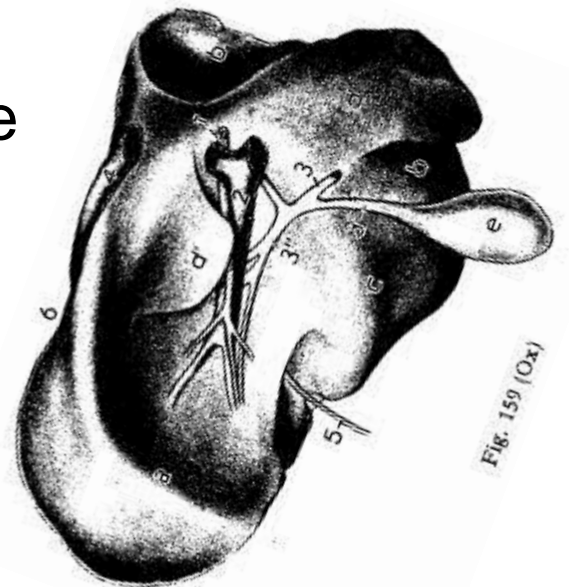
Ox



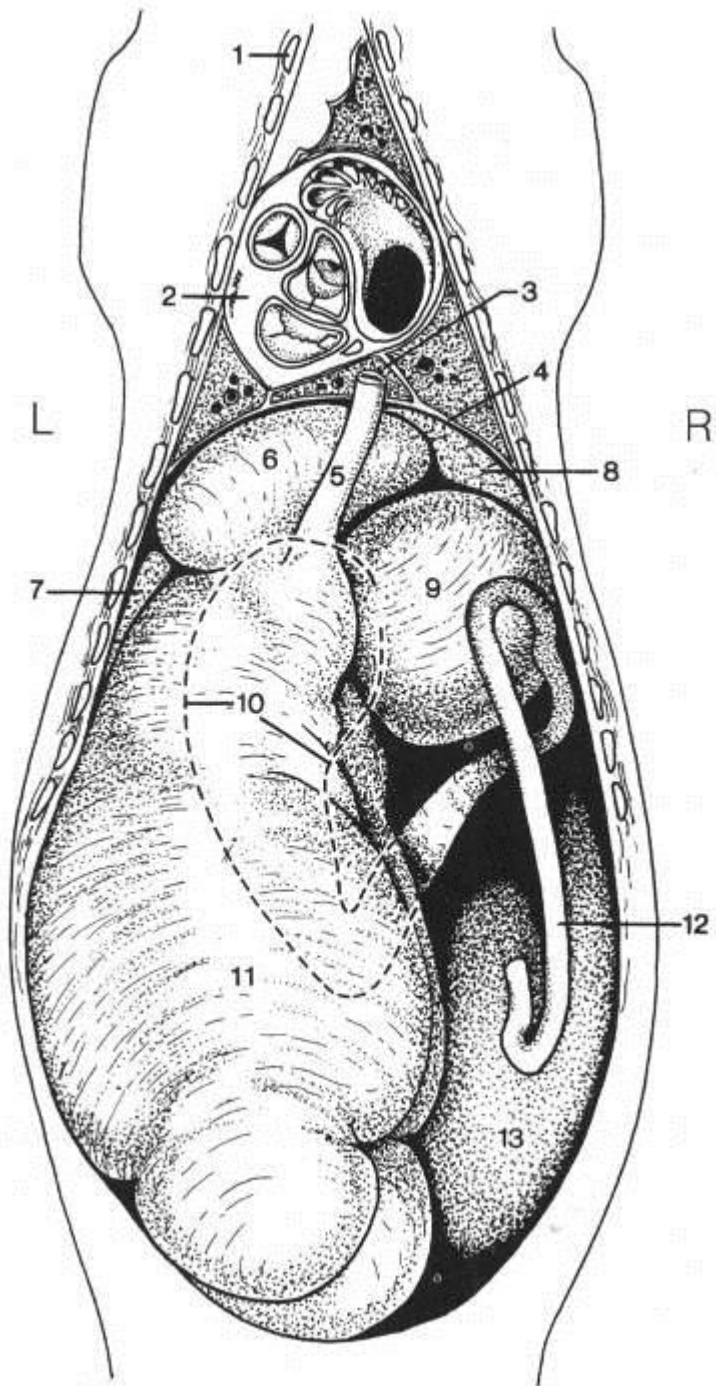


# Comparative aspects - cow

- Liver
  - Contact with right abdominal wall 7<sup>th</sup> – last rib
  - Largely covered by lung
  - May be palpated in cranial R. paralumbar fossa
  - Lies almost entirely to R. of midline
    - Rotated 90° in embryo
      - Right lobe - dorsal
      - Left lobe - ventral







# Comparative aspects

## - Cow

- Gall bladder
  - Piriform shape
  - Projects beyond lateral margin of the right lobe
- Bile Duct opens -
  - In 2<sup>nd</sup> bend of the sigmoid flexure
  - About 60cm from the pylorus
  - Alone on the major duodenal papilla



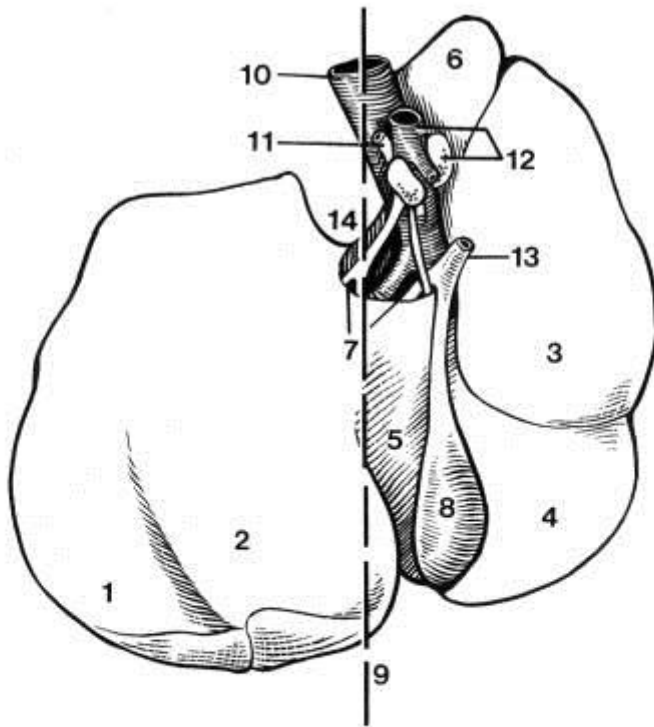
# Comparative aspects - Pig

- Liver
  - Resembles dog in position and lobation
  - Has 4 major lobes + short quadrate + caudate
    - No papillary process
  - High content of interlobular c.t. - speckled appearance to liver surface ('Morocco leather')
- Bile Duct opens
  - Alone 2.5-5cm from the pylorus





# Pig



**Figure 36-8.** Visceral surface of the liver.

1, Left lateral lobe; 2, left medial lobe; 3, right lateral lobe; 4, right medial lobe; 5, quadrato lobe; 6, caudate process; 7, porta; 8, gallbladder; 9, approximate position of median plane; 10, caudal vena cava; 11, hepatic artery; 12, portal vein and hepatic lymph nodes; 13, bile duct; 14, esophageal notch.



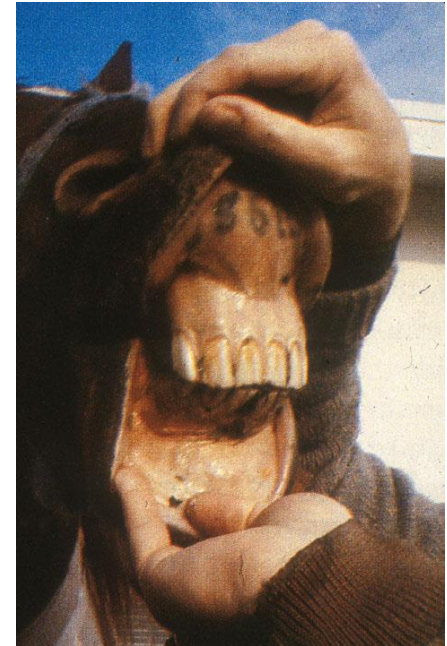
# Comparative aspects - Avian

- Liver
  - Dark brown in adult
  - Lobes of liver embrace caudal portion of heart
- Bile ducts
  - Two bile ducts - one from each lobe
  - Enter distal end of duodenum
  - Close to pancreatic ducts



# Clinical case

- 20 year old gelding
- Weight loss
- Jaundice
- Blood enzymes indicate liver damage
- Where do you biopsy the liver in a standing horse?



# Site for liver biopsy





# Site for liver biopsy



# Site for liver biopsy

