

# Veterinærdagene 2024

13.-15. mars, Bergen



Seksjonen er sponset av



Torsdag 14. mars

Program for Smådyr

## The icteric patient – Diagnostic approach

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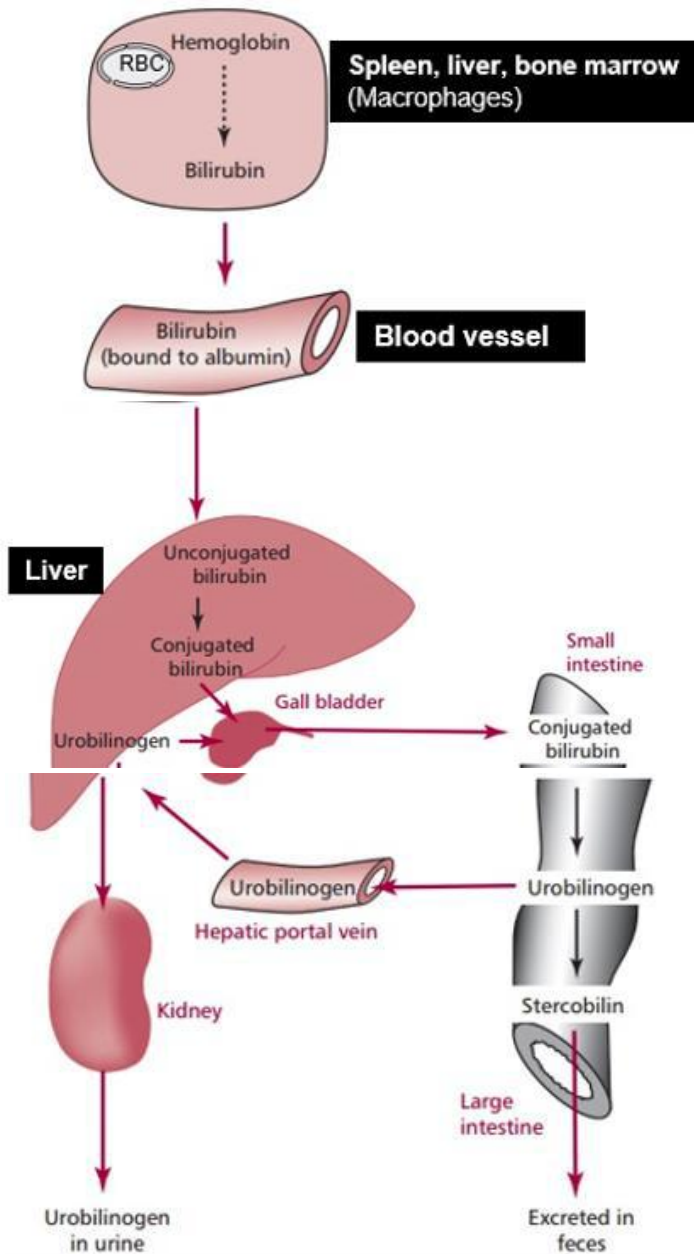
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# ***Lecture***

- **Pathophysiology – (Basic principles)**
- **Diagnostic approach**
- **Summary-Take home points**
- **Clinical cases - Quiz**



When the Rate of TBIL Production **exceeds** Rate of TBIL Elimination by the liver

- >>> Accumulation of TBIL
- >>> Yellowish serum or tissue
- >>> **ICTERUS (Jaundice)**



In clinically healthy animals  
**Serum TBIL** <10  $\mu\text{mol/L}$  (<0.58 mg/dl)

# Icterus

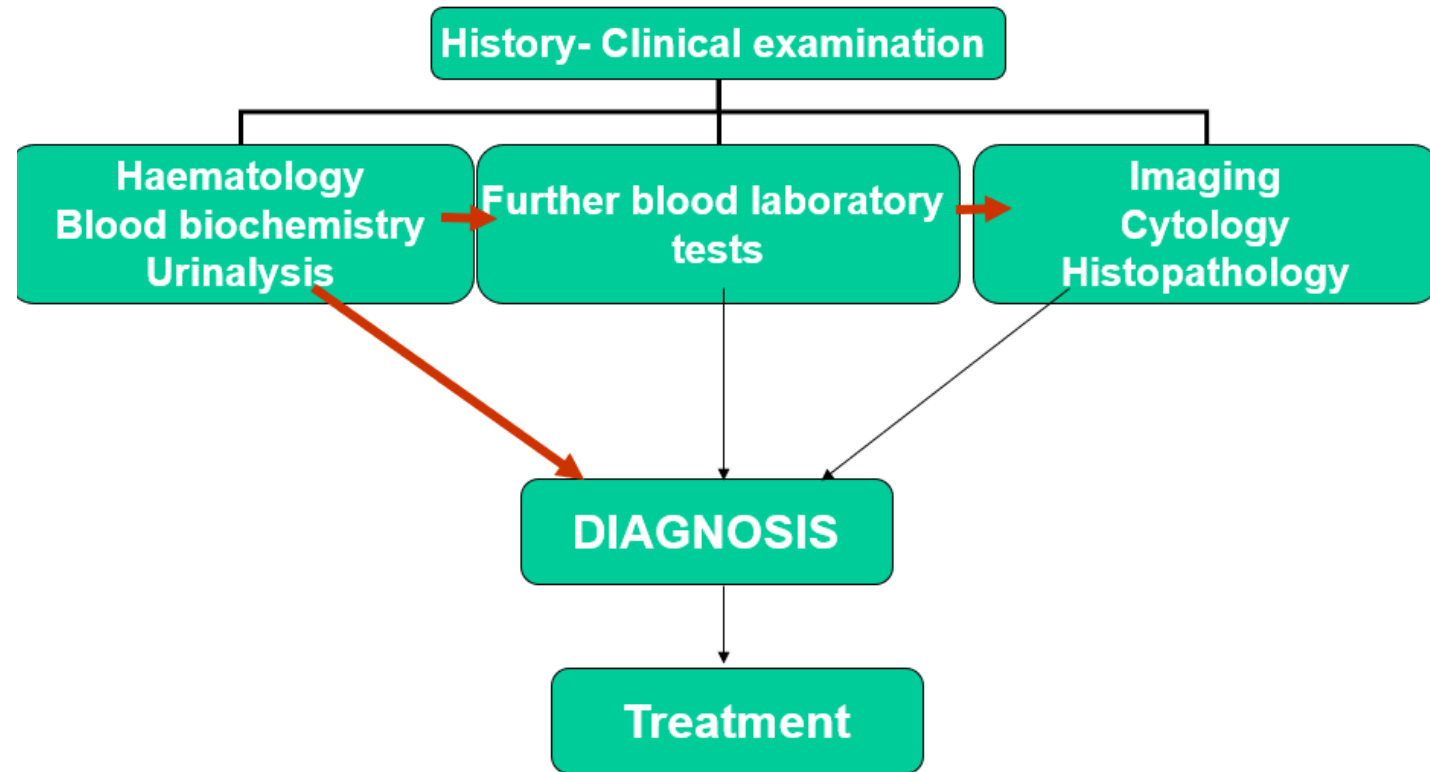
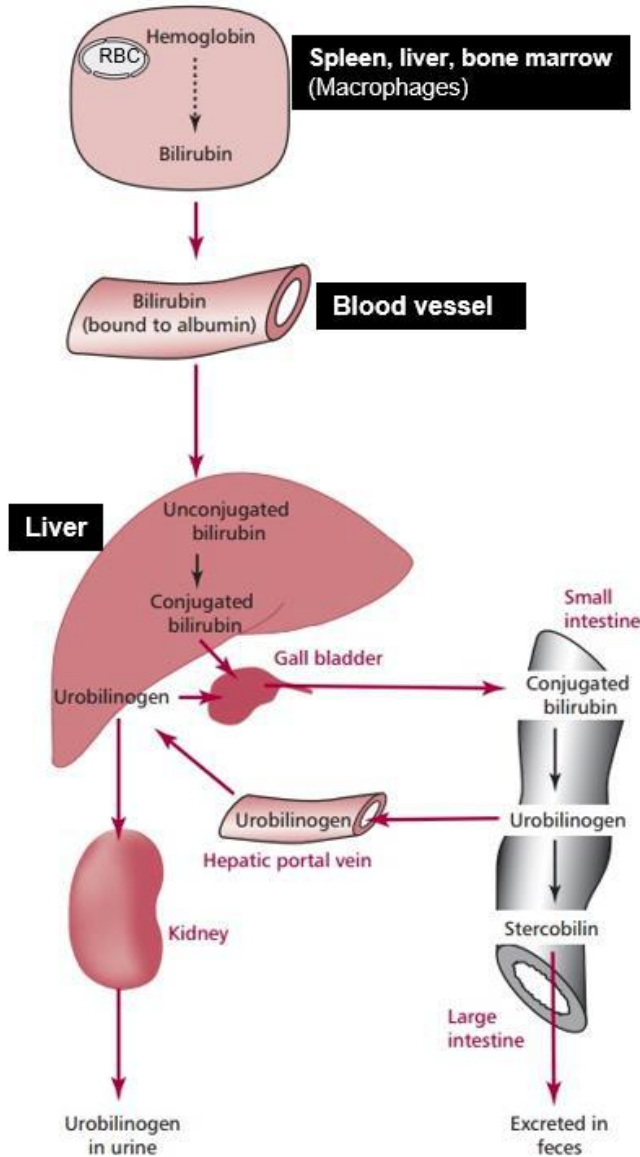
- **Serum** is visibly jaundiced when
  - TBIL  $>20 \mu\text{mol/l}$  ( $>1.17 \text{ mg/dl}$ )



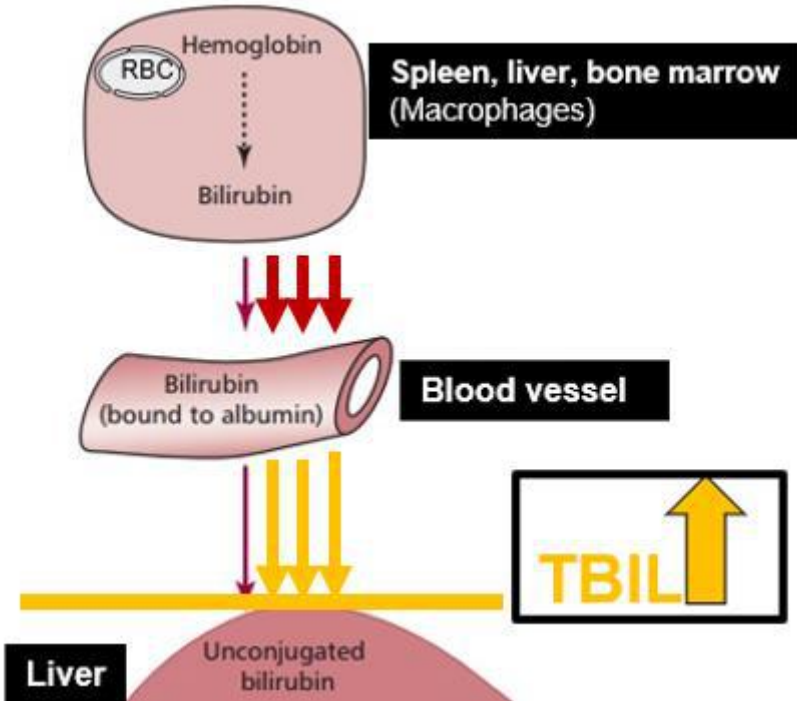
- **Mucus membranes** visibly jaundiced
  - serum TBIL  $>30 \mu\text{mol/l}$  ( $>1.75 \text{ mg/dl}$ )



# Icteric patients require extra diagnostic effort, owner compliance, expense



# Pre-hepatic icterus>>> Haematology is the first step

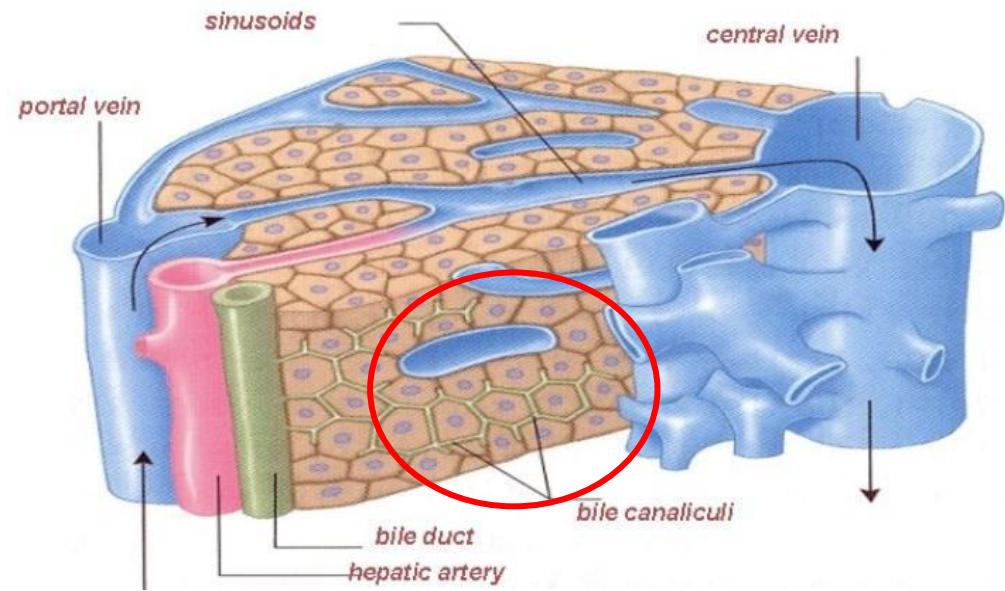
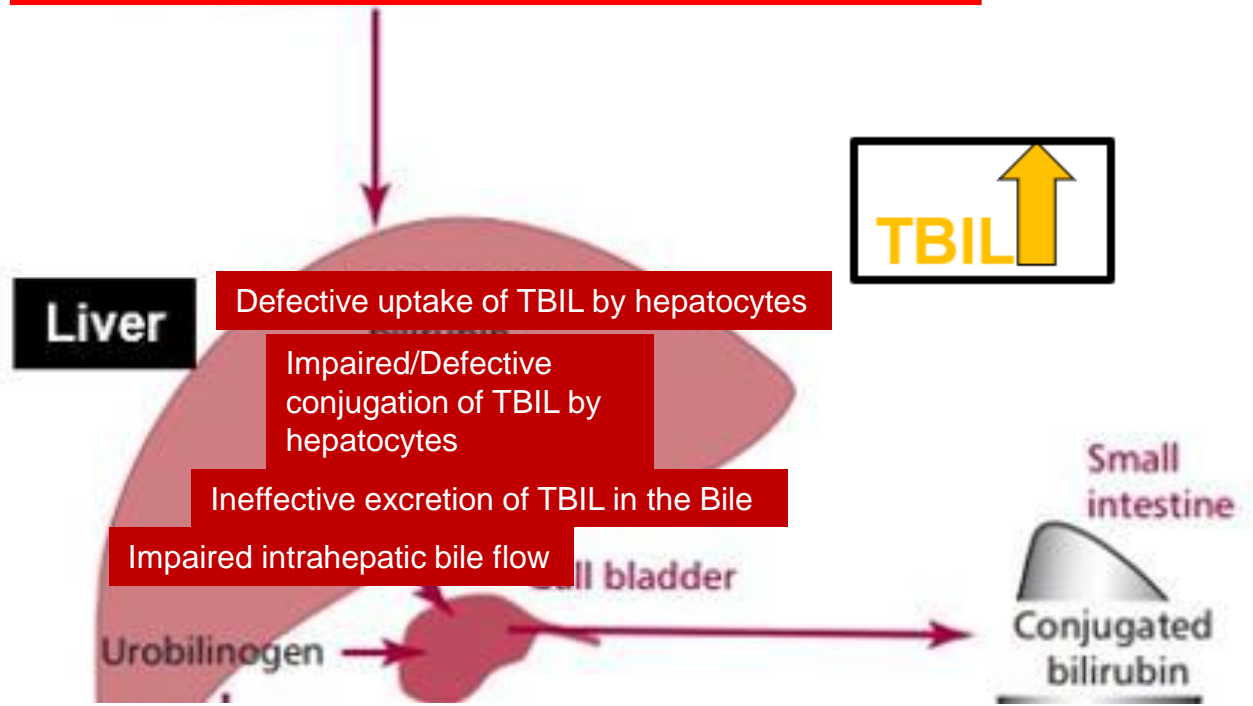
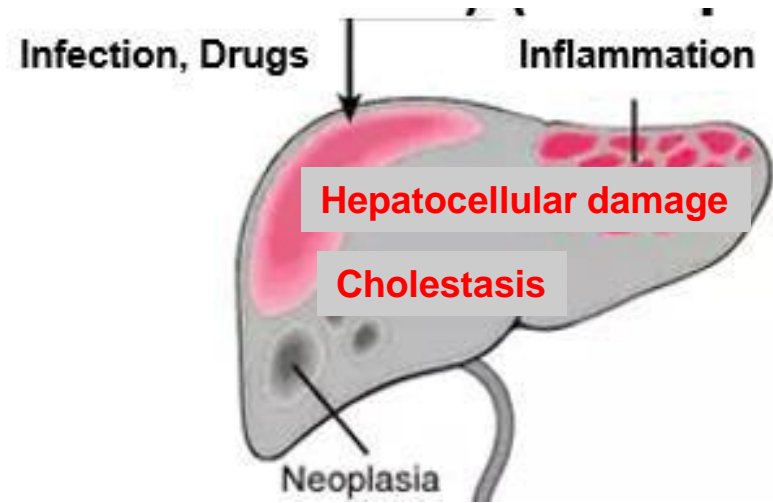


- If **anaemic\***, very likely due to Haemolytic anaemia when
  - PCV<25% in dogs, PCV<20% in cats
  - If Mild anaemia >> less clear cut
    - Can be associated with hepatic or post-hepatic icterus
      - Due to inflammation/chronic dz, non-regenerative
    - Clinical decision
  - **Biochemistry & Urinalysis** should be performed
    - Commonly increased ALT (hepatocellular damage due to hypoxia)
    - Haemoglobinuria (not uncommon in severe intravascular haemolysis)
- If patient is **not** anaemic >>> icterus is **not** pre-hepatic



# Hepatic icterus

# >>> serum Biochemistry



Alanine aminotransferase (ALT)

Aspartate aminotransferase (AST)



Hepatocellular damage

Inside the hepatocyte

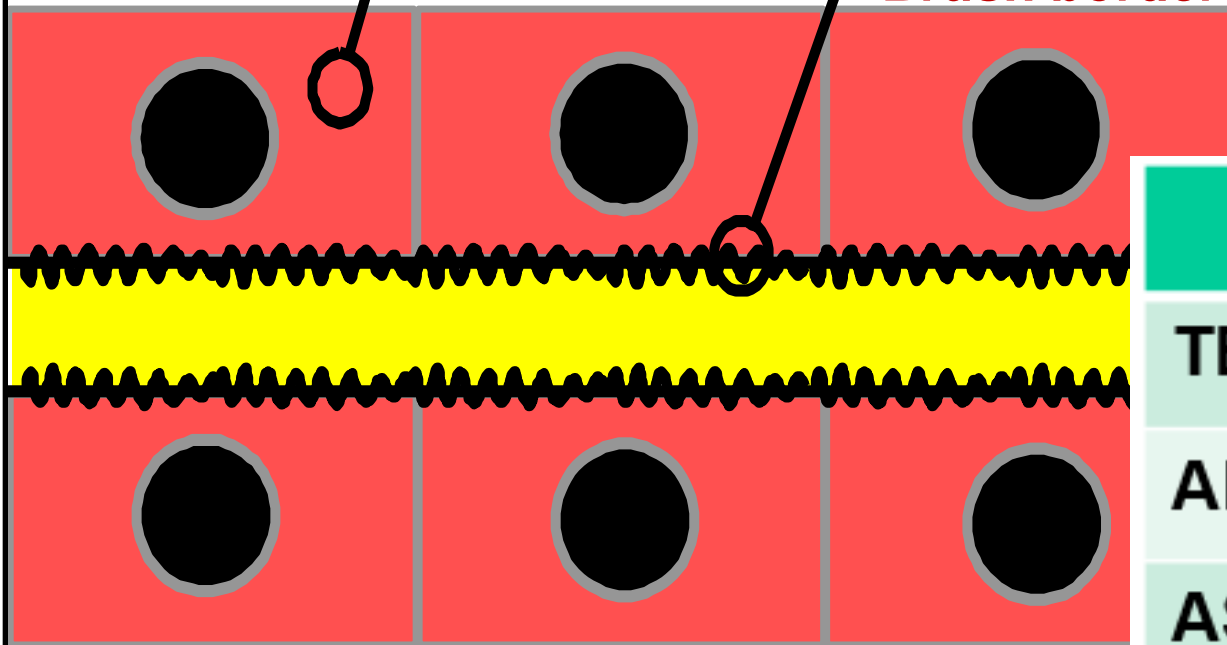
Cholestasis



Alkaline phosphatase (AP)

Gamma glutamyl transferase (GGT)

Brush border-Biliary endothelium

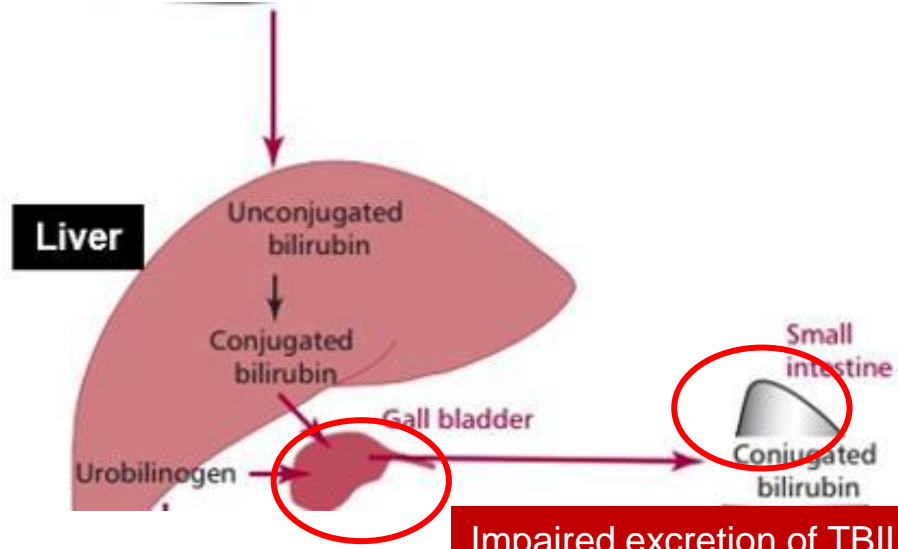
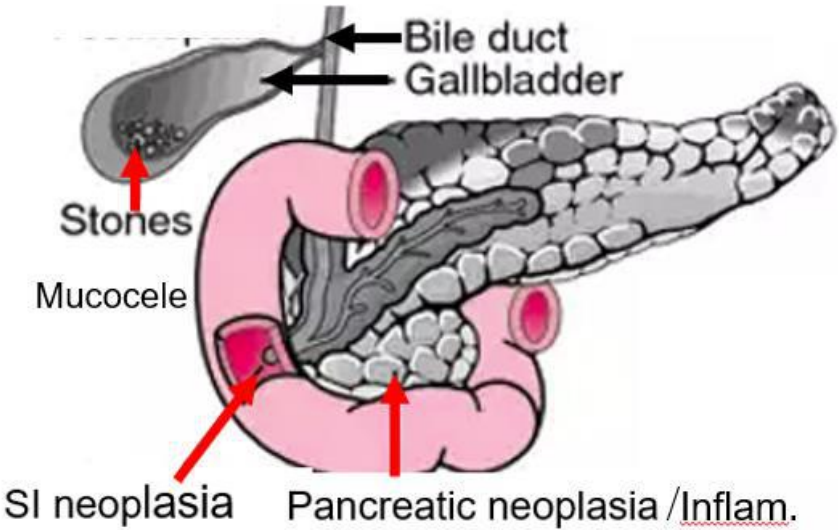


	HEPATIC
TBIL	↑↑
ALT	↑↑↑
AST	↑
ALP	N or ↑
GGT	N or ↑



# Post-Hepatic icterus

# >>> serum Biochemistry



Impaired excretion of TBIL due to Bile flow mechanical obstruction (extrahepatic cholestasis) (BIL in the bile spills in blood)

	POST-HEPATIC
TBIL	↑↑
ALT	N or ↑
AST	N
ALP	↑↑↑
GGT	↑↑↑



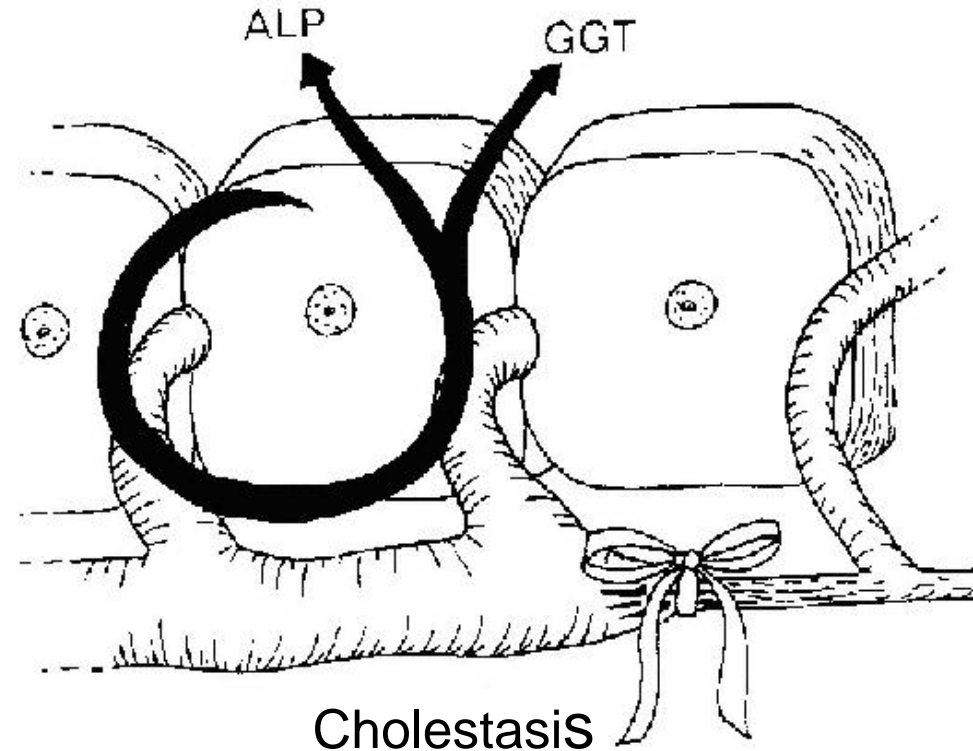
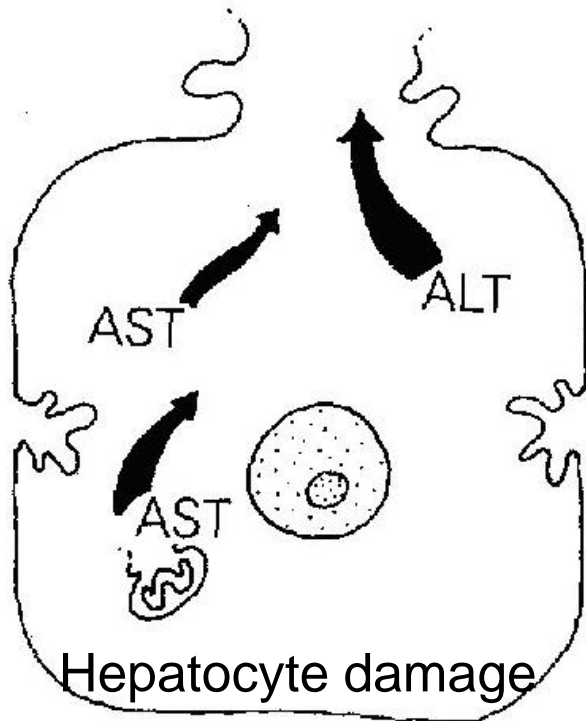
# ***Is the icterus hepatic or post-hepatic?***

- Liver disease (**hepatic**) most common cause of icterus
  - Approx. 85% of dogs and cats
- Extrahepatic bile duct obstruction (**post-hepatic**)
  - Approx. 15% of cases
- **Hepatic vs Post-hepatic : BIOCHEMISTRY & IMAGING**
- **Biochemistry**
  - Characterise the increase of the liver enzymes
- **Abdominal ultrasonography (& CT in some cases)**
  - Liver, pancreas, gall bladder, intestines, effusion

# Characterisation of increased liver enzymes can help

	HEPATIC	POST-HEPATIC
TBIL	↑↑	↑↑
ALT	↑↑↑	N or ↑
AST	↑	N
ALP	N or ↑	↑↑↑
GGT	N or ↑	↑↑↑

**Hepatic:** ALT proportionally higher than ALP/GGT  
**Post-hepatic:** ALP/GGT proportionally higher than ALT



# What about the liver enzymes in the icteric cat?

Half lives ALT (4 hrs vs 60 hrs) & ALP (6 hrs vs 70 hrs) **much shorter** than dog >> **so even mild increases are significant**

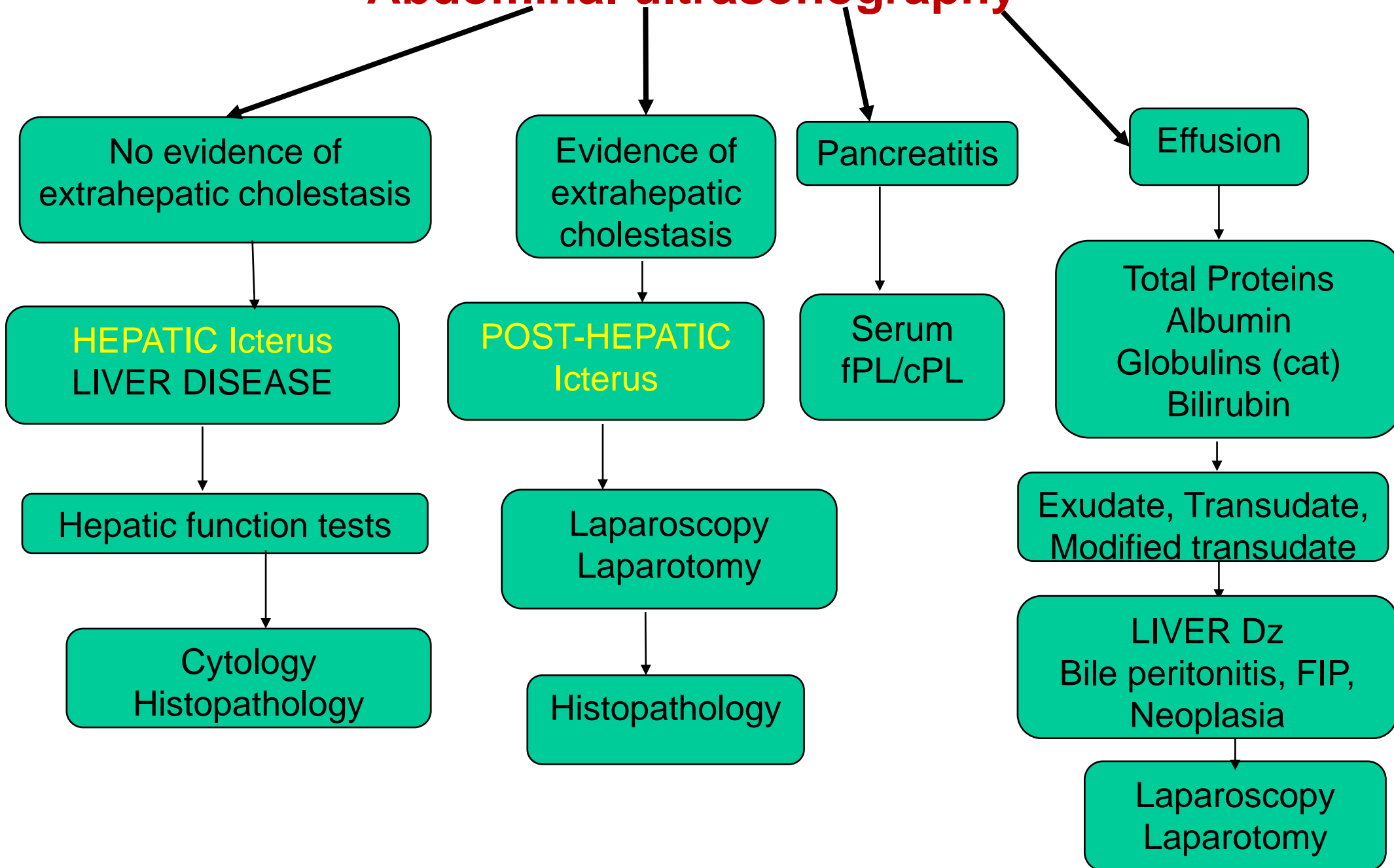
Remember that hyperthyroidism can increase ALT  $\pm$  ALP **but not** TBIL

Increased ALT **without** other liver enzyme increases probably reactive to a disease outside the liver (secondary hepatopathy)

Glucocorticoids **do not increase** ALP in cats (only in dogs)



# Abdominal ultrasonography



No evidence of  
extrahepatic cholestasis

**HEPATIC Icterus**  
LIVER DISEASE

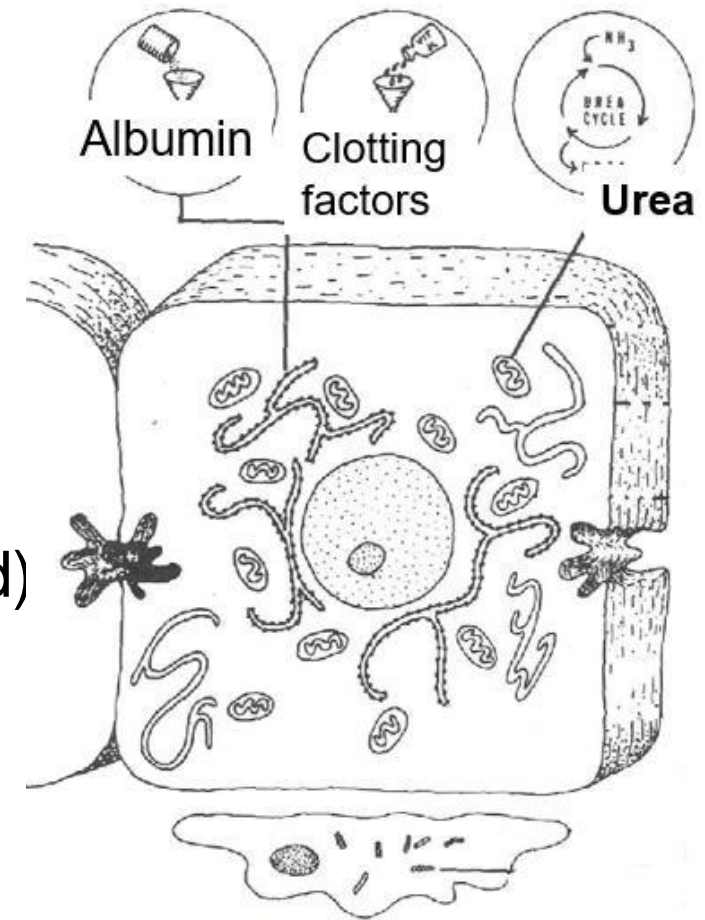
Hepatic function tests

Cytology  
Histopathology

**Severe LIVER DISEASE**

Albumin/Urea ↓

Clotting times ↑ (prolonged)



## MEASUREMENT OF SERUM BILE ACIDS

Assess the ability of the liver/hepatocytes  
to retrieve bile acids from the enterohepatic circulation

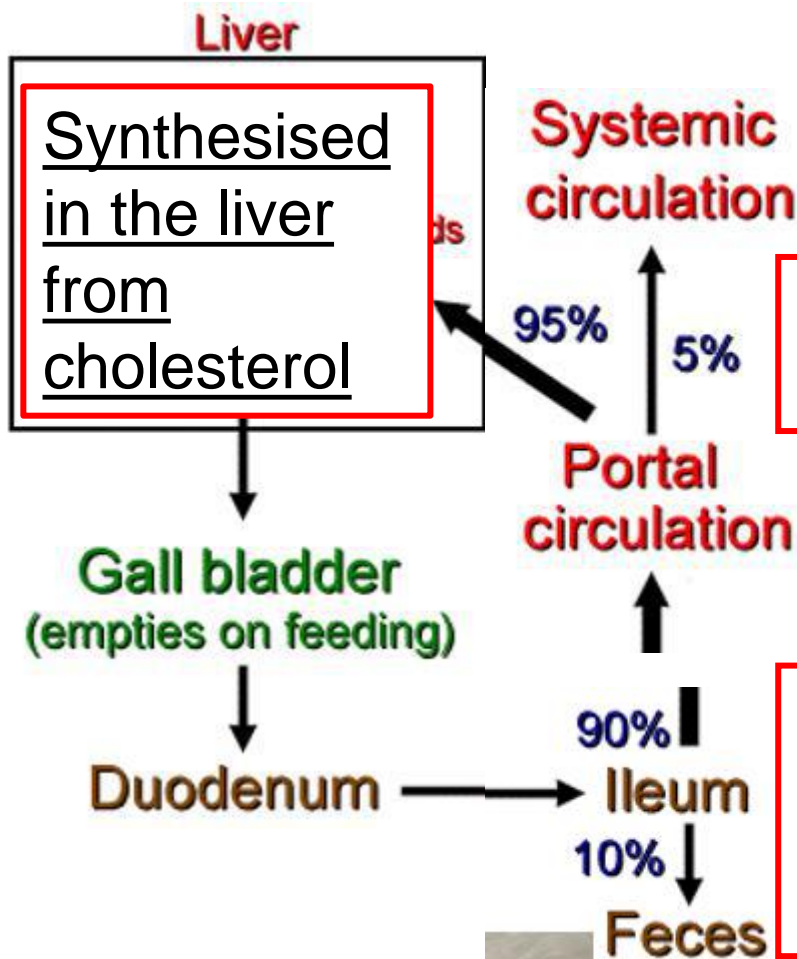
**The most sensitive hepatic function test**



# Bile acids

Assess the ability of the liver/hepatocytes to retrieve bile acids from the enterohepatic circulation

**The most sensitive hepatic function test**



Enterohepatic circulation/recycling  
Re-excreted by Liver

Reabsorbed in Ileum (90%)

In the large intestine:

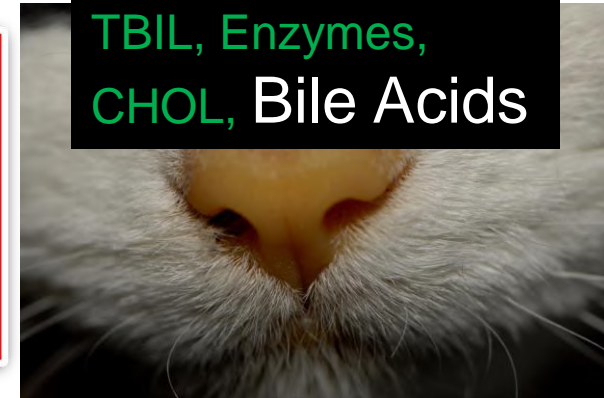
Deconjugated by bacteria to free acids (10%). Lost in the faeces

Bile contains  
TBIL, Enzymes,  
CHOL, Bile Acids

**DO NOT MEASURE BILE ACIDS**

**WHEN THE PATIENT IS CLINICALLY ICTERIC**

**Bile acids will be increased due to cholestasis,  
not necessarily due to Hepatic dysfunction**





# Causes of hepatic icterus

## • DOG

- Cholangiohepatitis
  - e.g. infectious
- Chronic active hepatic dz
- Diffuse neoplasia
- Cirrhosis
- Toxins/Medications
  - Anti-epileptic drugs
  - Anthelmintics
  - Anaesthetics
  - Paracetamol
- Breed related hepatic disease

## • CAT

- Cholangiohepatitis
- Hepatic lipidosis
- Diffuse neoplasia
- FIP
- Toxins/Medications
  - Paracetamol

## Causes of post-hepatic icterus

- Pancreatitis (especially in the cat)
- Pancreatic neoplasia (head of pancreas)
- Fibrosing duodenitis
- Bile duct trauma/neoplasia/stricture
- Gall bladder mucocele
- Cholelithiasis

## ***Take home points***

- **Marked anaemia and icterus >> Haemolytic anaemia.**
- **Hepatic dz is a more common cause of icterus than post-hepatic dz.**
- **Magnitude of liver enzyme increases can indicate whether hepatic (ALT>> ALP/GGT) or post-hepatic (ALP/GGT >>ALT) icterus is present.**
- **In cats, mild increases in liver enzymes are clinically significant.**
- **Increased serum CHOL & TRIGS and evidence of cholestasis (increased ALP/GGT/TBIL) can indicate pancreatitis.**
- **Hyper-/Hypo-thyroidism do not cause icterus (increased TBIL).**
- **Do not measure Bile Acids when the patient is clinically icteric (hepatic or post-hepatic icterus) if you wish to assess hepatic function.**
- **Abdominal ultrasonography **is essential** in the diagnostic investigation of an icteric patient.**