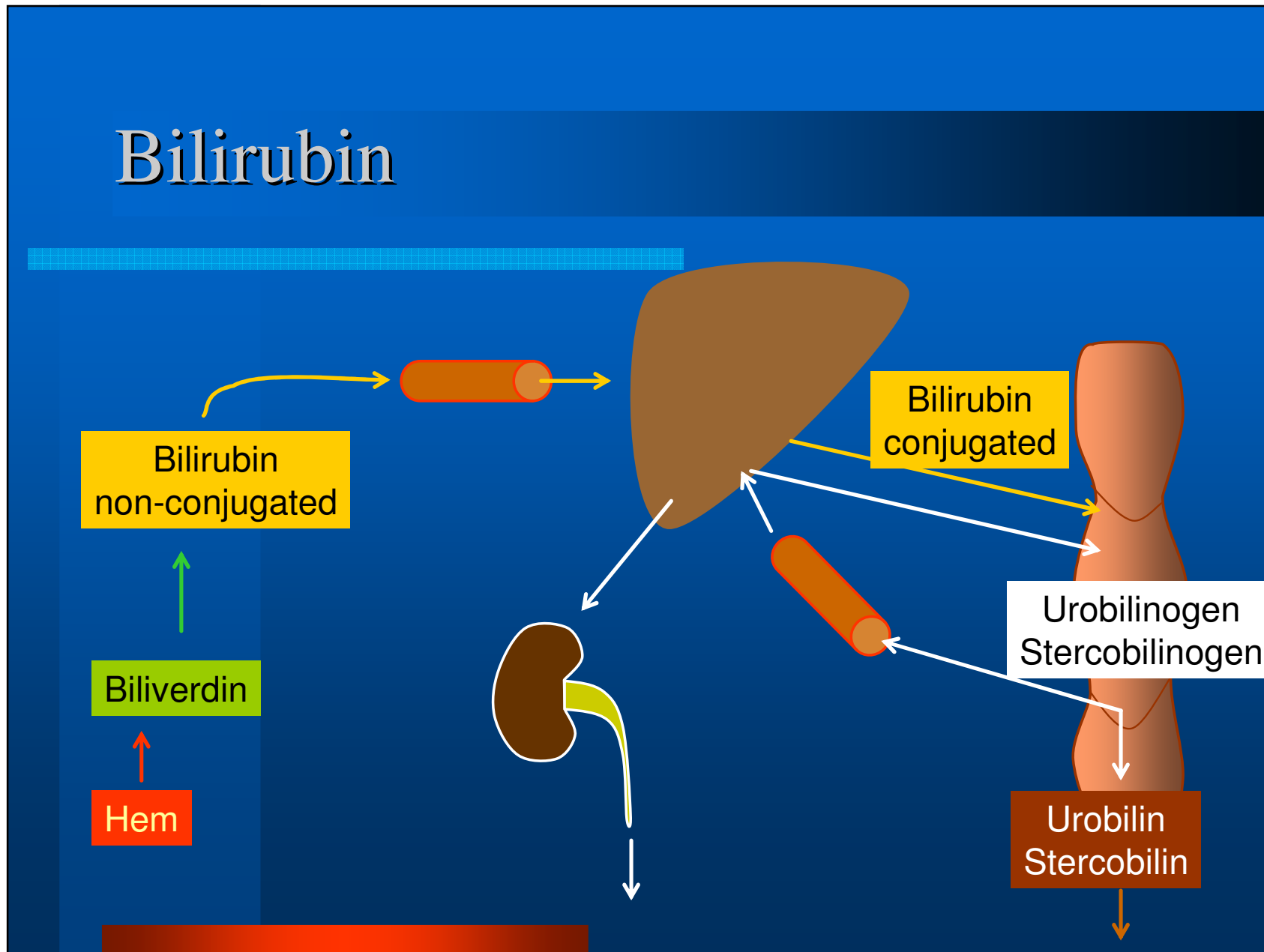


Laboratory examination of liver

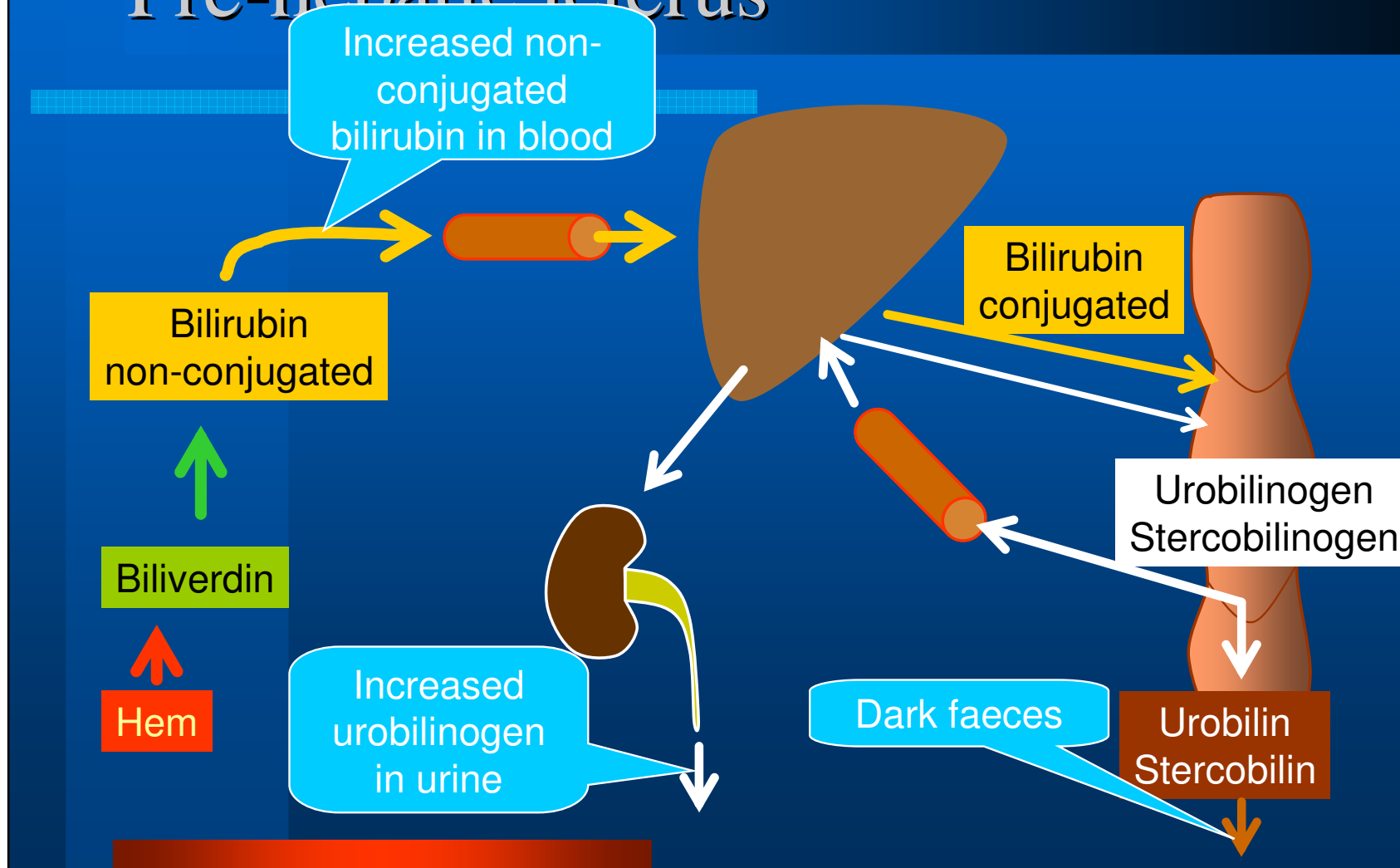
Bilirubin

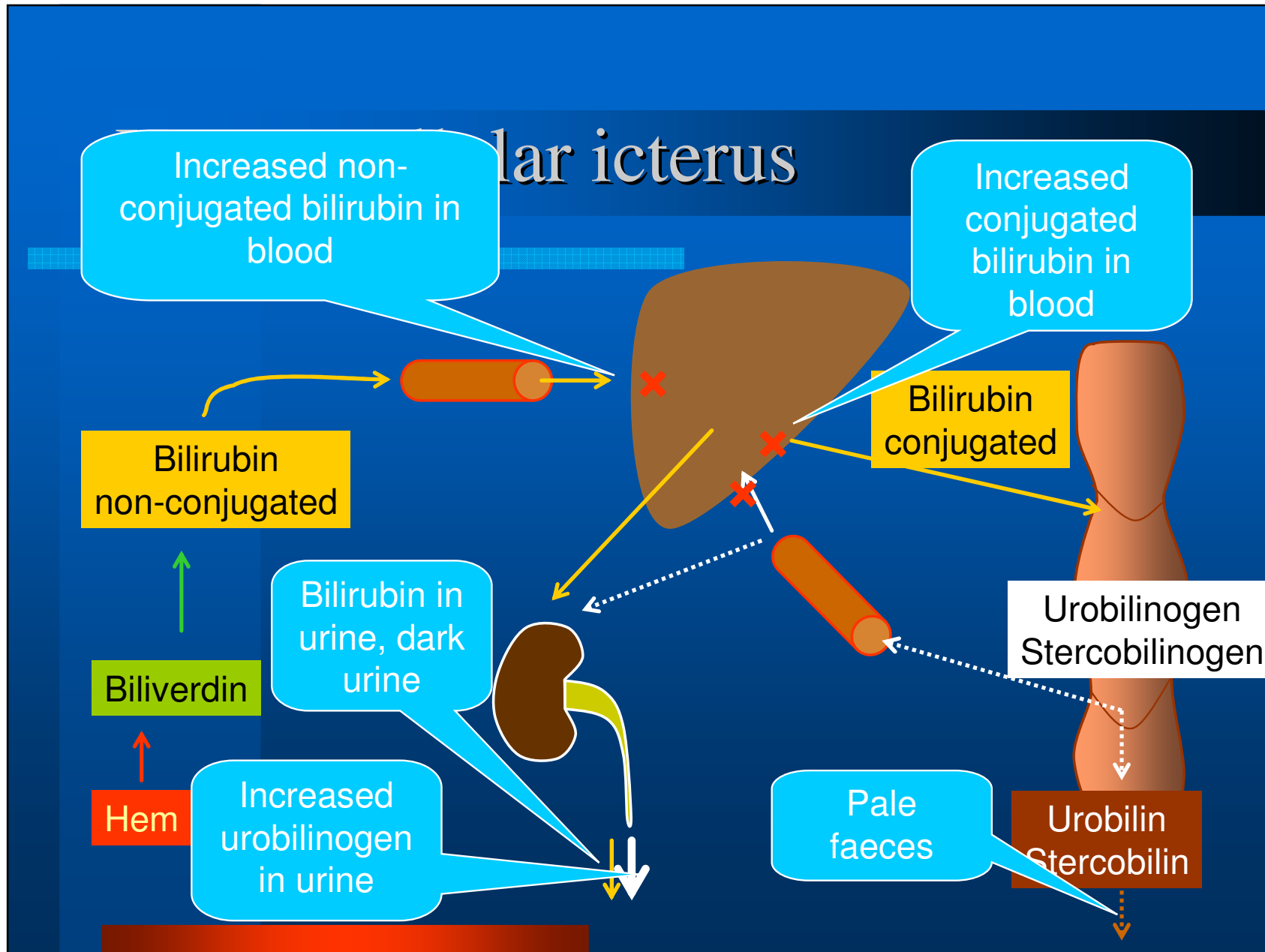


Icterus

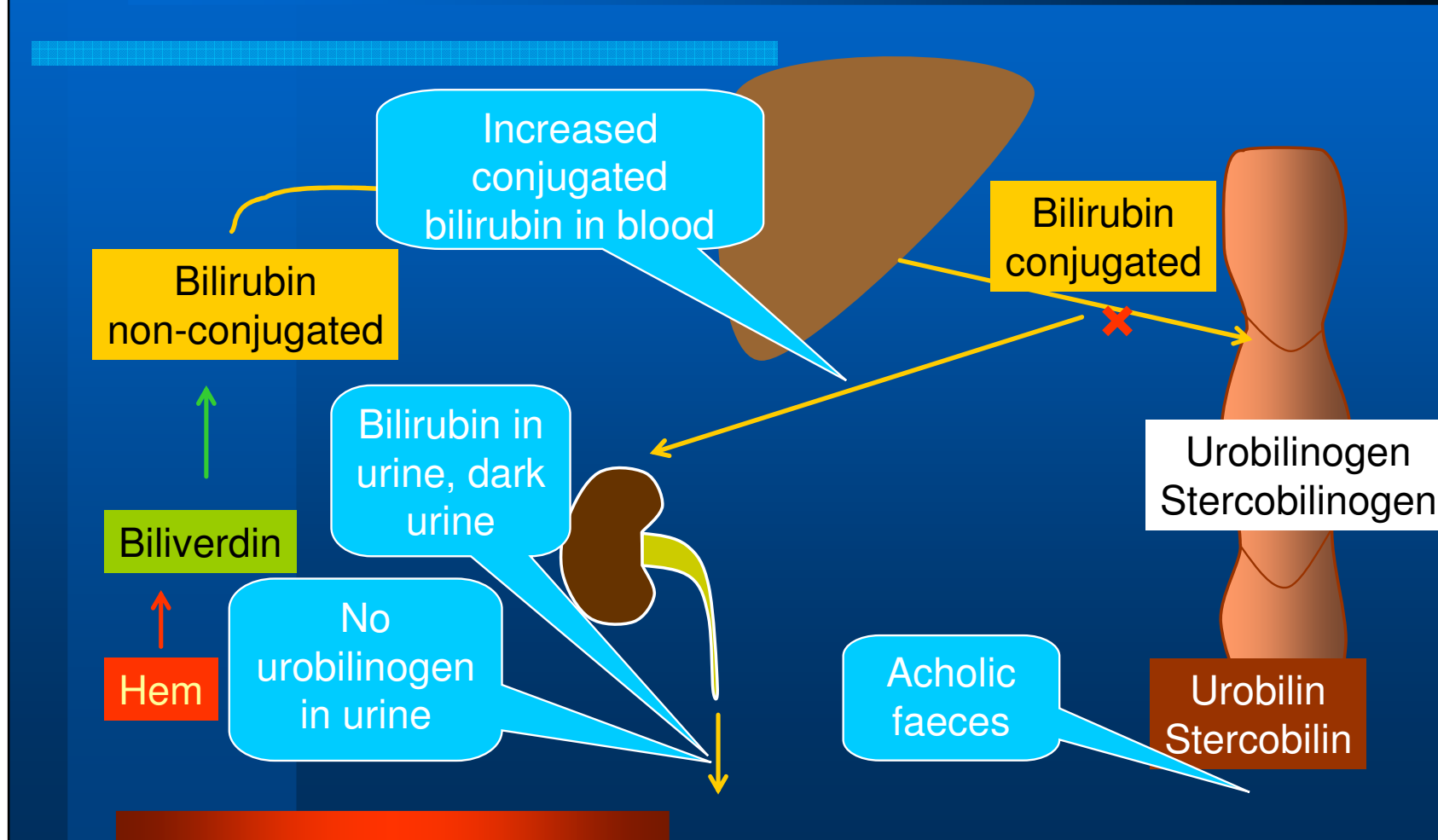
- **Pre-hepatic**
 - Hemolysis
- **Hepatocellular**
 - Liver damage
- **Post-hepatic**
 - Obstruction of biliary tract

Pre-hepatic icterus











Post-hepatic icterus



Icterus

	Non conj. S-Bi	Conj. S-Bi	U-Bi	U-UBG	Urine	Faeces
Pre-hepatic	↑↑	●	●	↑		
Hepatocellular	↑↑	↑↑	↑↑	↑		
Post-hepatic	(↑)	↑↑	↑↑	-		

Blood markers of liver damage

- **Bilirubin (conj., non-conj.)**
- **Transaminases**
 - Alanine aminotransferase (ALT)
 - Aspartate aminotransferase (AST)
- **Obstructive enzymes**
 - Alkaline phosphatase (ALP)
 - γ -glutamyl transferase (GGT)

ALT & AST

- ALT: in cytoplasm
- AST: cytoplasm, mitochondria

- AST > ALT ... necrosis of hepatocytes

ALT & AST

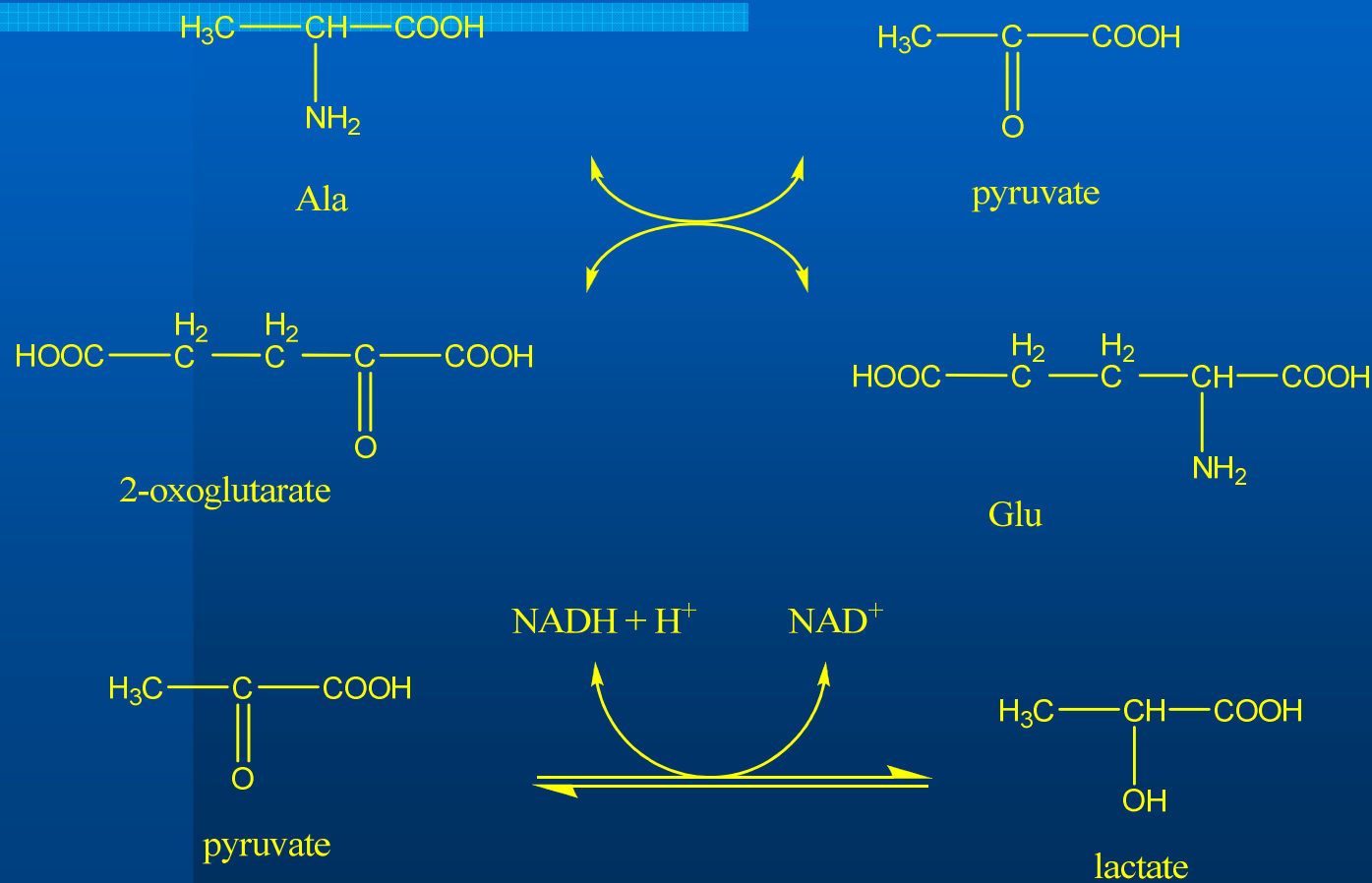
- **Also in other organs**

- **AST: heart!**
- **Muscle**
- **Lungs**
- **Kidney**
- **...**

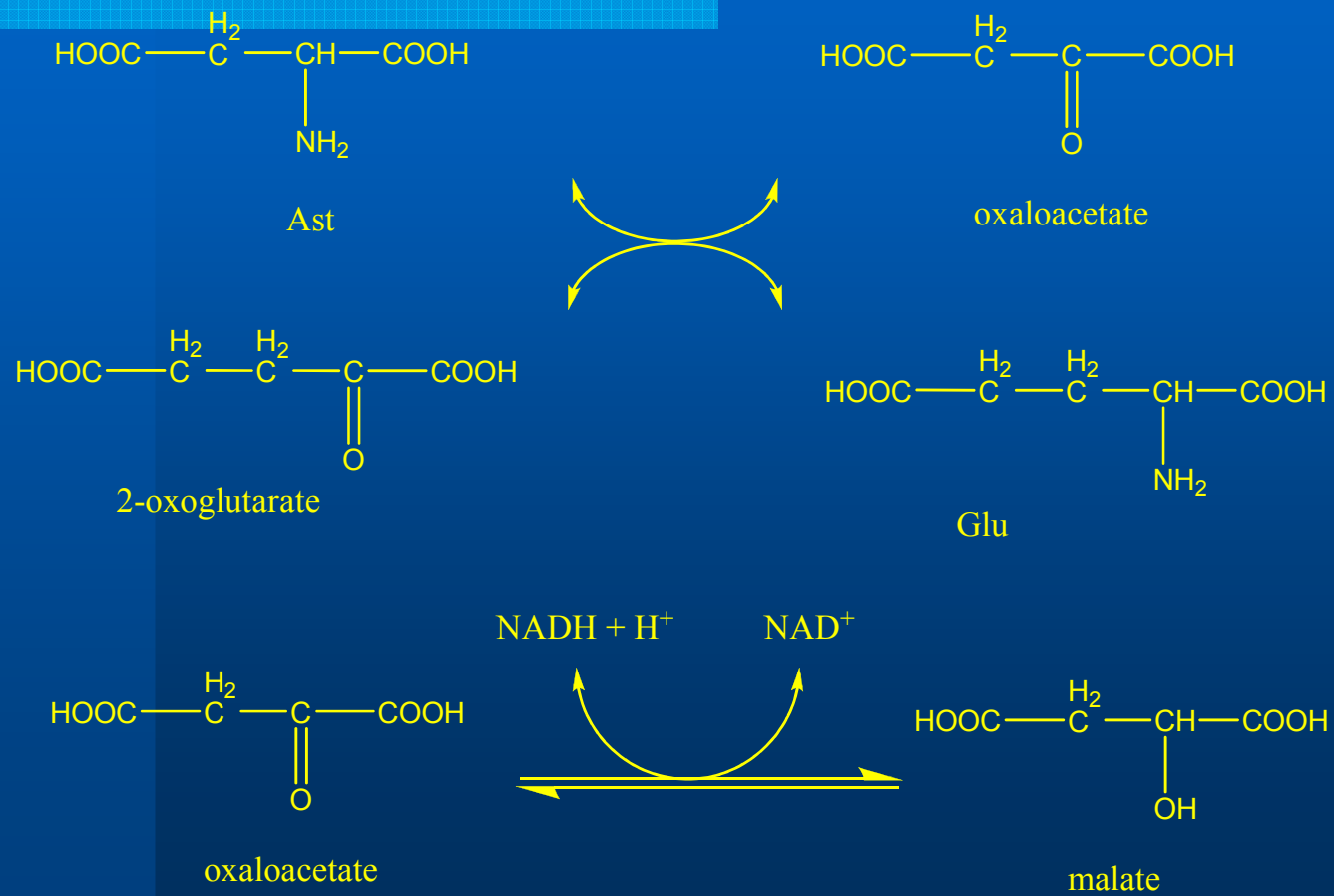
Estimation of ALT and AST

- **Indirect Warburg optical test**
- **ALT: coupled with lactate dehydrogenase**
- **AST: coupled with malate dehydrogenase**

Estimation of ALT



Estimation of AST



Alkaline phosphatase (ALP)

- **Biliary obstruction**
- **Other isoforms**
 - Bones
 - Placenta
 - Intestine
- **Increased also in some tumors**

γ -glutamyl transferase (GGT)

- **Biliary obstruction**
- **Toxic injury**
 - Alcohol
 - Cytostatics, antimicrobial drugs etc.

General signs of liver damage

- **Jaundice**
- **Disorders of blood coagulation**
 - Excessive bleeding
 - Thrombotic disorders
- **Hypoproteinemia**
 - Swellings
 - Ascites

Examination of liver function

- „Liver tests“
 - Bilirubins, ALT, AST, ALP, GGT
- **Urine – bilirubin, urobilinogen**
- **Coagulation parameters**
- **Blood proteins**

Choline esterase (ChS)

- **Degrades esters of choline**
- **Hepatocytes → blood**

- **↓ ChS = ↓ proteosynthesis**
 - **hepatopathy**
 - **starvation, malnutrition**
 - ... (intoxication with organophosphates...)

Carbohydrate deficient transferrin (CDT)

- **Transferrin**
 - glycoprotein
 - 4 to 6 residues of sialic acid
- **Alcohol abuse:**
increased proportion of less glycosylated transferrin = CDT (> 6 %)

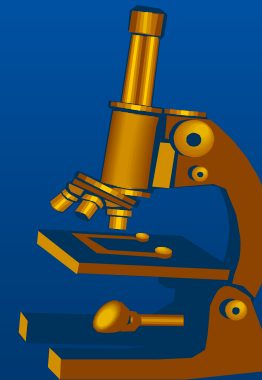
Casuistry 1

Bi tot.	55.4	Total protein	68
Bi conj.	19.1	Albumine	21
ALT	2.19		
AST	1.68		
GGT	29.59		
ALP	1.19		



Casuistry 2

Bi tot.	28.3	Hb	57
Bi conj.	1.7		
ALT	0.13		
AST	0.41		
GGT	0.39		
ALP	1.18		



Casuistry 3

Bi tot.	79.6	U-Bi	pos.
Bi conj.	66.2	U-Ubg	neg.
ALT	2.13		
AST	1.76		
GGT	24.6		
ALP	18.4		



Casuistry 4

Bi tot.	36.8
Bi conj.	2.8
ALT	0.76
AST	0.54
GGT	3.12
ALP	1.16



Examination of pancreas

Biochemical examination of pancreas

- **Lysis of pancreatic cells**
(α -amylase, lipase)
- **Endocrine function**
- **Exocrine function**

α -amylase (AMS)

- **Pancreas**
 - P-isoenzyme
- **Salivary gland**
 - S-isoenzyme
- **Both isoenzymes can be distinguished by immunochemical techniques**

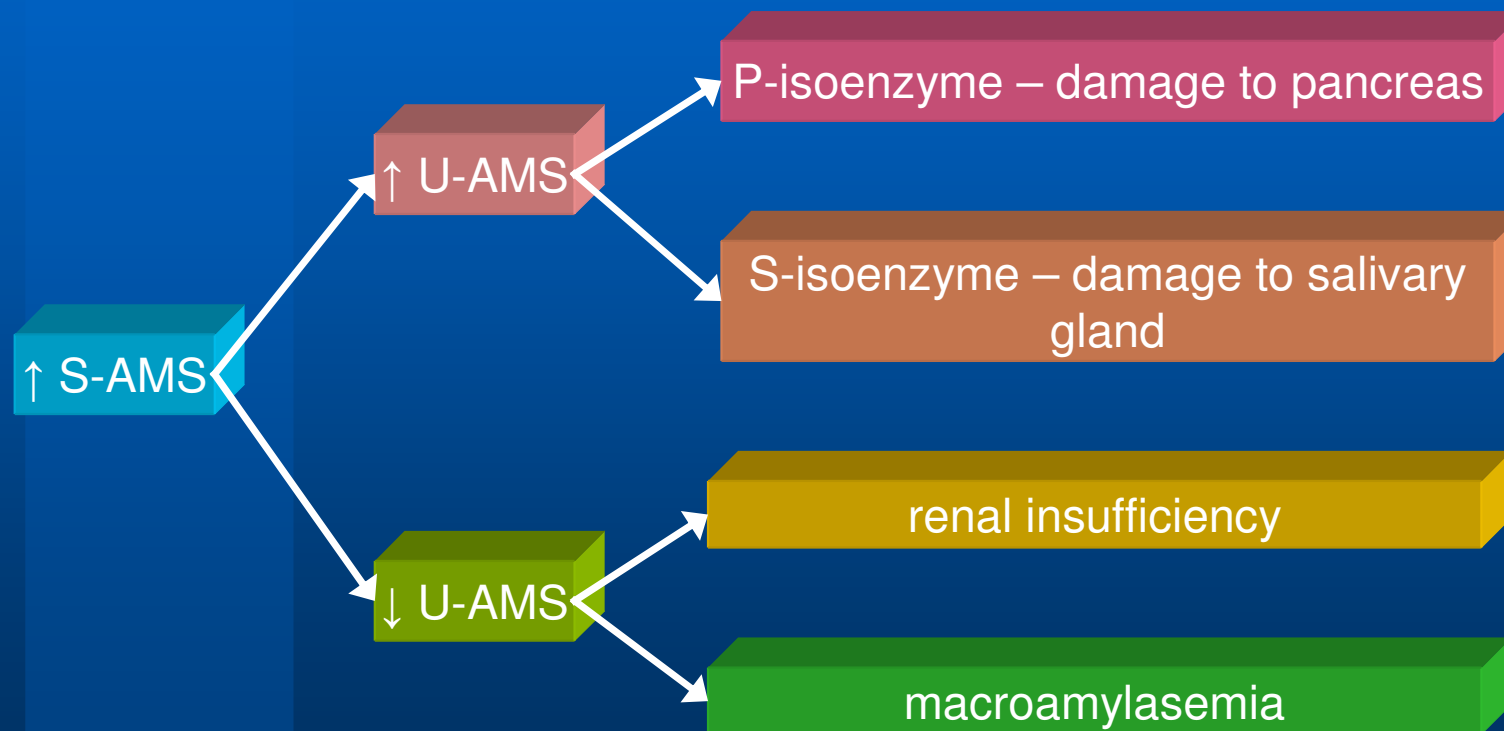
α -amylase (AMS)

- **Small protein (MW = 50 000)**
- **Elevation**
 - damage to **producing glands**
 - impaired elimination by **kidneys**

α -amylase (AMS)

- **in serum (S-AMS)**
 - short half-life (6 – 12 h)
 - returns to normal in 3 days
- **in urine**
 - later
 - higher activity
- **in ascitic fluid**

α -amylase (AMS)



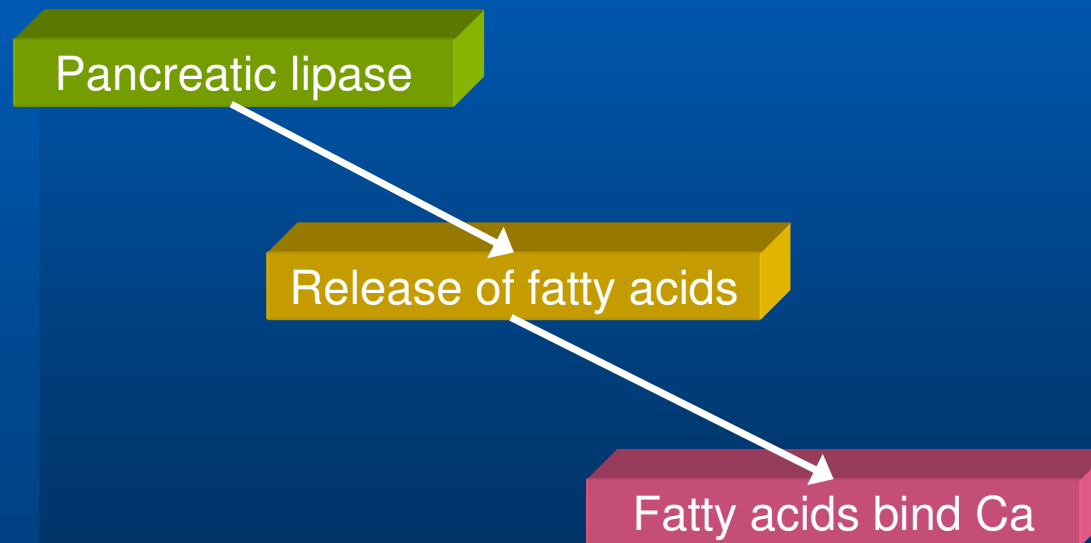
Racek J. et al.: Klinická biochemie. 2nd Ed., Galén, Praha 2006

Pancreatic lipase

- **Specific for pancreas**
- **More sensitive than AMS**

Other markers of acute pancreatitis

- ↓ S-Ca



Examination of exocrine pancreatic function

- Duodenal juice after stimulation with secretin & cholecystokinin
 - volume, pH, HCO_3^- , amylase, lipase, trypsin
- Chymotrypsin and elastase in faeces
- Breath tests with ^{13}C -triglycerides