

EVALUATION OF LIVER FUNCTION

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HEPATIC SYSTEMS

- *BIOCHEMICAL HEPATOCYtic SYSTEM*
- *HEPATOBIILIARY SYSTEM*
- *RETICULOENDOThELIAL SYSTEM*

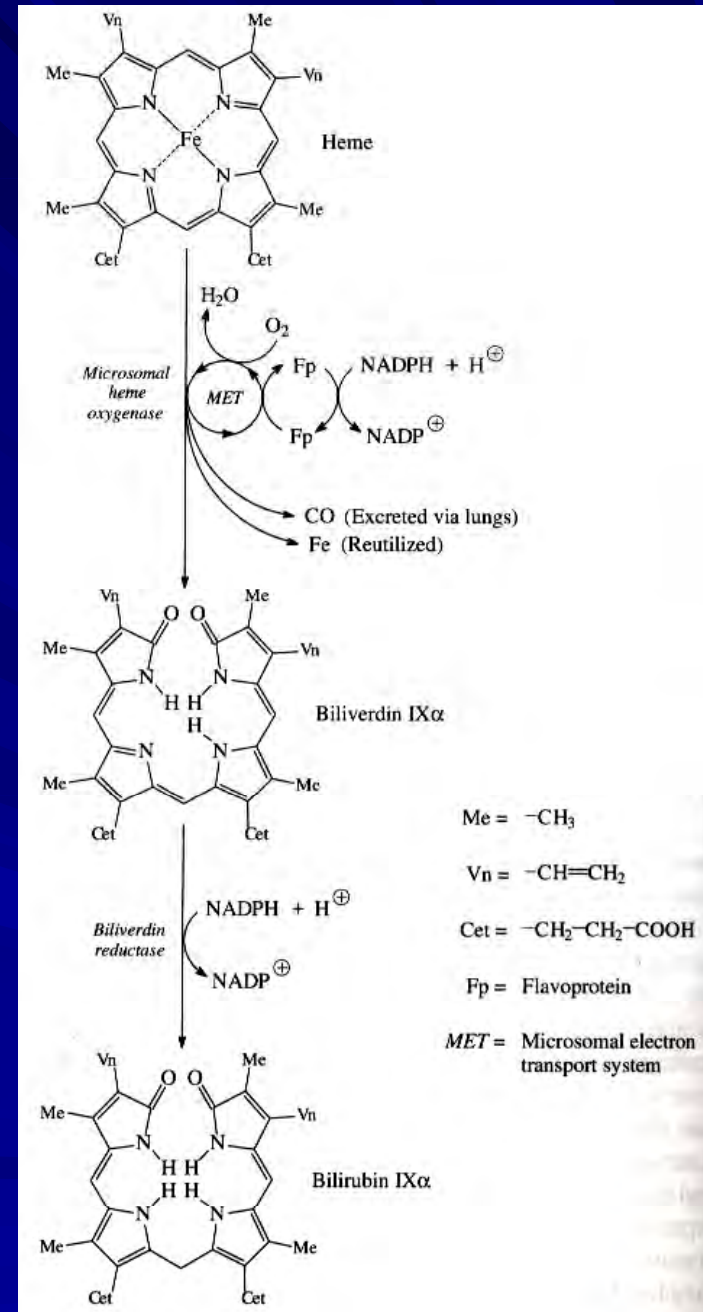
METABOLIC FUNCTION

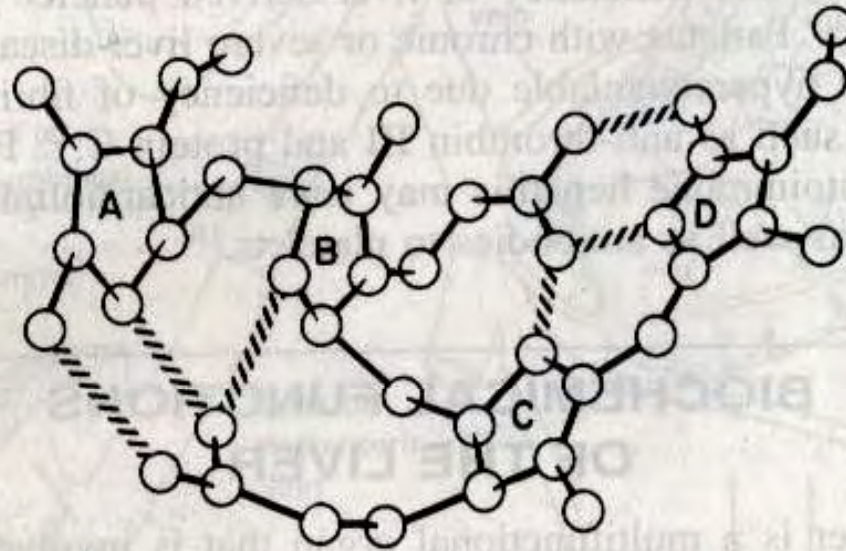
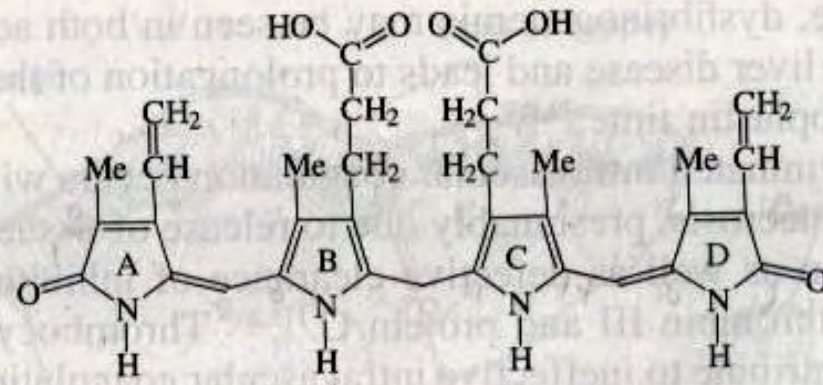
- ***CARBOHYDRATE METABOLISM***
- ***LIPID METABOLISM***
- ***AMONIA METABOLISM***
- ***BILIRUBIN METABOLISM***
- ***XENOBIOTIC METABOLISM***

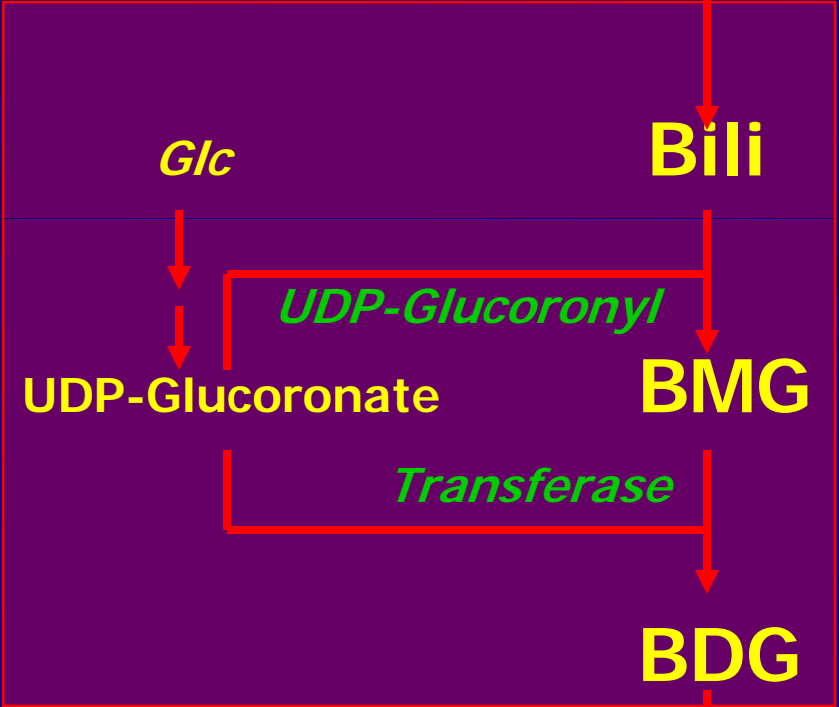
HEME CATABOLISM

■ HEME OXYGENASE

■ BILIVERDIN REDUCTASE



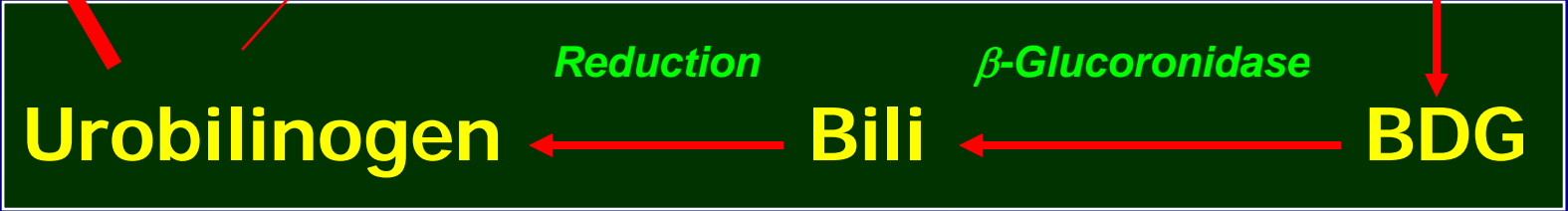




STOOL

Urobilinogen

Urine



HYPERBILIRUBINEMIA

ICTERUS, JAUNDICE

- ***DIRECT, CONJUGATED***
- ***INDIRECT, UNCONJUGATED***
- ***MIX***

INDIRECT (UNCONJUGATED) HYPERBILIRUBINEMIA

- NEONATAL PHYSIOLOGIC JAUNDICE
- RBC ABNORMALITIES
- CRIGLER – NAJJAR TYPE I SYNDROME
UDP-Glucoronyl Transferase
- CRIGLER – NAJJAR TYPE II SYNDROME
- GILBERT DISEASE

DIRECT (CONJUGATED) HYPERBILIRUBINEMIA

- ***CHOLSTASIS***
- ***DUBIN – JHONSON SYNDROME***
- ***ROTOR SYNDROME***

HEPATIC JAUNDICE

May Be:

- ***DIRECT***
- ***INDIRECT***
- ***MIXED***

SYNTHETIC FUNCTION

- *ALBUMIN*
- *ALPHA-1 ANTITRYPSIN*
- *CERULOPLASMIN*
- *CLOTTING FACTORS*

TESTS OF LIVER INJURY

- *LIVER FUNCTION TESTS*
- *AUTOIMMUNE MARKERS*
- *MARKERS OF VIRUS INFECTION*
- *TUMOR MARKERS*

PLASMA ENZYME LEVELS

- Enzymes Primarily Reflecting **Hepatocellular Injury**
- *Aspartate Aminotransferase (AST, GOT)*
- *Alanine Aminotransferase (ALT, GPT)*
- *Lactate Dehydrogenase (LD)*

- Enzymes Primarily Reflecting **Canalicular Injury**
- *Alkaline Phosphatase (ALP)*
- *Gamma-Glutamyl Transferase (GGT)*
- *5'-Nucleotidase (5'-NP)*
- *Lucine Aminopeptidase (LAP)*

Factors Affecting Enzyme Activities In Plasma

- Cellular and Subcellular Localization
- Rate of Enzyme Production
- Enzyme Gradient
- Plasmal Half-Life
- Assay Condition

ALANINE AMINOTRANSFERASE (ALT)

- Primarily Found in Liver, But Significant amounts Are Also Present in Kidney
- Hepatocyte : Plasma Ratio Is 3000 : 1
- Plasma Half-Life Is 47
- Decrease Synthesis with Pyridoxal deficiency and Fibrosis
- Is More Specific For detecting Liver Disease In Nonalcoholic, asymptomatic patients

ASPARTATE AMINOTRANSFERASE (AST)

- Distributed In ALL Body Tissues

- Has Two Isozymes

CYTOPLASMIC

Hepatocyte : Plasma Ratio Is 7000 : 1

Plasma Half-Life Is 17 h

MITOCHONDRIAL

Plasma Half-Life Is 87 h

Release By Severe Hepatocellular Damage

- Is Used For Monitoring Therapy With Potentially Hepatotoxic Drugs

HEPATOCELLULAR INJURY

- In **Acute Hepatocellular Injury** Such as hepatitis Initially *AST Increases More Than ALT*
After 24-48 h, ALT Increases More Than AST
ALT/AST > 1.0 in Viral & Toxic Hepatitis
- In **Acute Alcoholic Hepatitis**
AST Increases More Than ALT, Because of Severe Damage & Pyridoxal deficiency
- In **Chronic Hepatocyte Injury** such As Cirrhosis
ALT Is Elevated More Than AST
But As Fibrosiss Progresses, ALT Activity Declines
So by The Time, AST Is Often More than ALT
- Mild & Prolonged Elevated ALT Suggest **Viral Hepatitis C**

ALKALINE PHOSPHATASE (ALP)

- ALP Is Found on Canalicular Surface and Is Therefore a Marker of Biliary Dysfunction

- Serum ALP Has Two Forms

 - Mainly in Unbound Form*

 - To a Lesser Extent, Complexed with Lipoproteins
or Rarely Immunoglobulins*

- In Cholestasis, a High-molecular-weight ALP Appears in Serum

- Normal Serum ALP, Rejects Cholestasis

Gamma-Glutamyl Transferase (GGT)

- **Like ALP, Is Found on Canalicular Surface and Is Therefore a Marker of Biliary Dysfunction**
- **Also Is Found in Microsomes, Which Is Induced by Ethanol, Phenobarbital, Phenytoein**
- **So It Is a Marker of Alcoholism**

Acute Injuries and / or Necrotic Lesions

- AST → *Increased*
- ALT → *Increased*
- LD → *Increased*
- ALP → *Increased*
- Bilirubin → *Increased*
- Total Protein → *Normal*
- Albumin → *Normal*
- Ammonia → *Normal*

Hepatic Cirrhosis

- AST → *Normal*
- ALT → *Normal*
- LD → *Normal*
- ALP → *Normal to Slightly Increased*
- Bilirubin → *Increased*
- Total Protein → *Decreased*
- Albumin → *Decreased*
- Ammonia → *Increased*

Acute Fulminant Hepatic Failure

- AST → *Highly Increased*
- ALT → *Increased*
- LD → *Increased*
- ALP → *Increased*
- Bilirubin → *Increased*
- Total Protein → *Decreased*
- Albumin → *Decreased*
- Ammonia → *Increased*

Acute Biliary Obstruction

- AST → *Normal*
- ALT → *Normal*
- LD → *Normal*
- ALP → *Increased*
- Bilirubin → *Increased*
- Total Protein → *Normal*
- Albumin → *Normal*
- Ammonia → *Normal*

Passive Congestion

- AST → *Slightly Increased*
- ALT → *Slightly Increased*
- LD → *Slightly Increased*
- ALP → *Normal to Slightly Increased*
- Bilirubin → *Normal to Slightly Increased*
- Total Protein → *Normal*
- Albumin → *Normal*
- Ammonia → *Normal*

Space-Occupying Lesion

- AST → *Normal to Increased*
- ALT → *Normal to Increased*
- LD → *Increased*
- ALP → *Increased*
- Bilirubin → *Normal to Increased*
- Total Protein → *Normal*
- Albumin → *Normal*
- Ammonia → *Normal*

AUTOIMMUNE MARKERS

- **Primary Biliary Cirrhosis (PBC)**
Antimitochondrial Antibody (AMA)
- **Primary Sclerosing Cholangitis (PSC)**
Perinuclear Antineutrophil Cytoplasmic Antibodies (p-ANCA)
Antinuclear Antibodies (ANAs)
Anti-smooth muscle Antibodies (ASAMs)
- **Autoimmune Hepatitis**
Anti-smooth muscle Antibodies (ASAMs)
Antinuclear Antibodies (ANAs)
Antibodies to Liver-Kidney Microsomal Antigens (Anti-LKM)

TUMOR MARKERS FOR *HEPATOCELLULAR CARCINOMA (HCC)*

- **Alpha-Fetoprotein (AFP)**
Increased in >90% Patients
It Is Not Specific
- **Ferritin**

MARKERS OF HEPATITIS VIRUS INFECTION

- HBsAg
- HBsAb
- HBcAb
- HBeAg
- HBeAb
- HCV
- HAV

