آنزیم شناسی
Transaminases

- GOT or AST
- GPT or ALT
<table>
<thead>
<tr>
<th></th>
<th>AST</th>
<th>ALT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart</td>
<td>7800</td>
<td>450</td>
</tr>
<tr>
<td>Liver</td>
<td>7100</td>
<td>2850</td>
</tr>
<tr>
<td>Sk-muscle</td>
<td>5000</td>
<td>300</td>
</tr>
<tr>
<td>Kidneys</td>
<td>4500</td>
<td>1200</td>
</tr>
<tr>
<td>Pancrease</td>
<td>1400</td>
<td>130</td>
</tr>
<tr>
<td>Spleen</td>
<td>700</td>
<td>80</td>
</tr>
<tr>
<td>Lungs</td>
<td>500</td>
<td>45</td>
</tr>
<tr>
<td>RBC</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>Serum</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
CPK
<table>
<thead>
<tr>
<th></th>
<th>Ck activity</th>
<th>Ck3-MM %</th>
<th>Ck2-MB %</th>
<th>Ck1- BB %</th>
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</thead>
<tbody>
<tr>
<td>SK-muscle</td>
<td>2500</td>
<td>98.9</td>
<td>1.1</td>
<td>0.06</td>
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<tr>
<td>brain</td>
<td>555</td>
<td>0</td>
<td>2.7</td>
<td>97.3</td>
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<tr>
<td>heart</td>
<td>473</td>
<td>78.7</td>
<td>20</td>
<td>1.3</td>
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<tr>
<td>liver</td>
<td>~ 1</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>
Aldolase

- ALD A : FDP
- ALD B : F1P
- ALD C : ?
- Disease of Skeletal muscle 10-50 times
- Duchenne disease
- Myasthenia gravis & MS
- In MI 5-8 times
- Pattern parallel AST
- Injection of cortisone & ACTH 10-18 times
• Hydroxy butyrate dehydrogenase (HBDH)
• HBDH assay = LD1 assay
ALP

- Isoenzyme: liver, bone, intestinal, placental, renal
**Gamma-glutamyl transferase (GGT)**

- GGT present in all cells except muscle
- Small in cytosol & large fraction in cell membrane
- GGT elevated in all liver disease
- GGT more sensitive than ALP, GOT, GPT in obstructive jaundice
- Normal: skeletal disease, children older than 1 y, pregnancy
## Comparison of GGT, ALP & NTP

<table>
<thead>
<tr>
<th>Condition</th>
<th>ALP</th>
<th>NTP</th>
<th>GGT</th>
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</thead>
<tbody>
<tr>
<td>Biliary tract disease</td>
<td>4.0</td>
<td>6.2</td>
<td>11.9</td>
</tr>
<tr>
<td>Acute &amp; chronic hepatitis</td>
<td>1.5</td>
<td>1.1</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Amylase

• Amylase hydrolased α-1,4 linkage

• Types of amylase:
  – Beta: plant & bacterial. Terminal reducing, splits a maltose at a time
  – Alpha: animal & human. Random hydrolased α-1,4 linkage
Human amylase

- MW = 55000 – 60000
- Electrophoresis: β & γ globulins
Types of human amylase

• P – type & S – Type (ptyalin)

• Macroamylase: usually S-type with IgA, IgG or other normal proteins
Causes of hyperamylasemia

- Pancreatic disease (P)
- Renal insufficiently (mixed)
- Mumps (s)
- Diabetic ketoacidosis (M)
- Acute alcoholism (M)
- Medicinal opiates (p)
- Heroin lung (s)
Lipase

- Glycoprotein
- MW = 54000
- Concentration lipase in pancreas ~ 20000 serum
- alpha position carbons
- Lipase activated by NaCl
Cholinesterase

• Choline esterase I = true cholinesterase
  – RBC, lung, spleen, nerve endings, gray matter of the brain

• Choline esterase II = pseudochoilihinesterase
  – Serum, Liver, pancreas, heart, white matter of the brain
Cholinesterase

• Liver function
• Insecticide poisoning
• Normal range
  – 4000-12000 U/L
  – Level at birth = ¼ adults
  – In 2 month = adults
Cholinesterase

• 30-50% decrease
  – Acute & chronic hepatitis

• 50-70% decrease
  – Advanced cirrhosis & carcinoma

• Decrease slightly in pregnancy
Acid phosphatase

• Prostatic isoenzyme