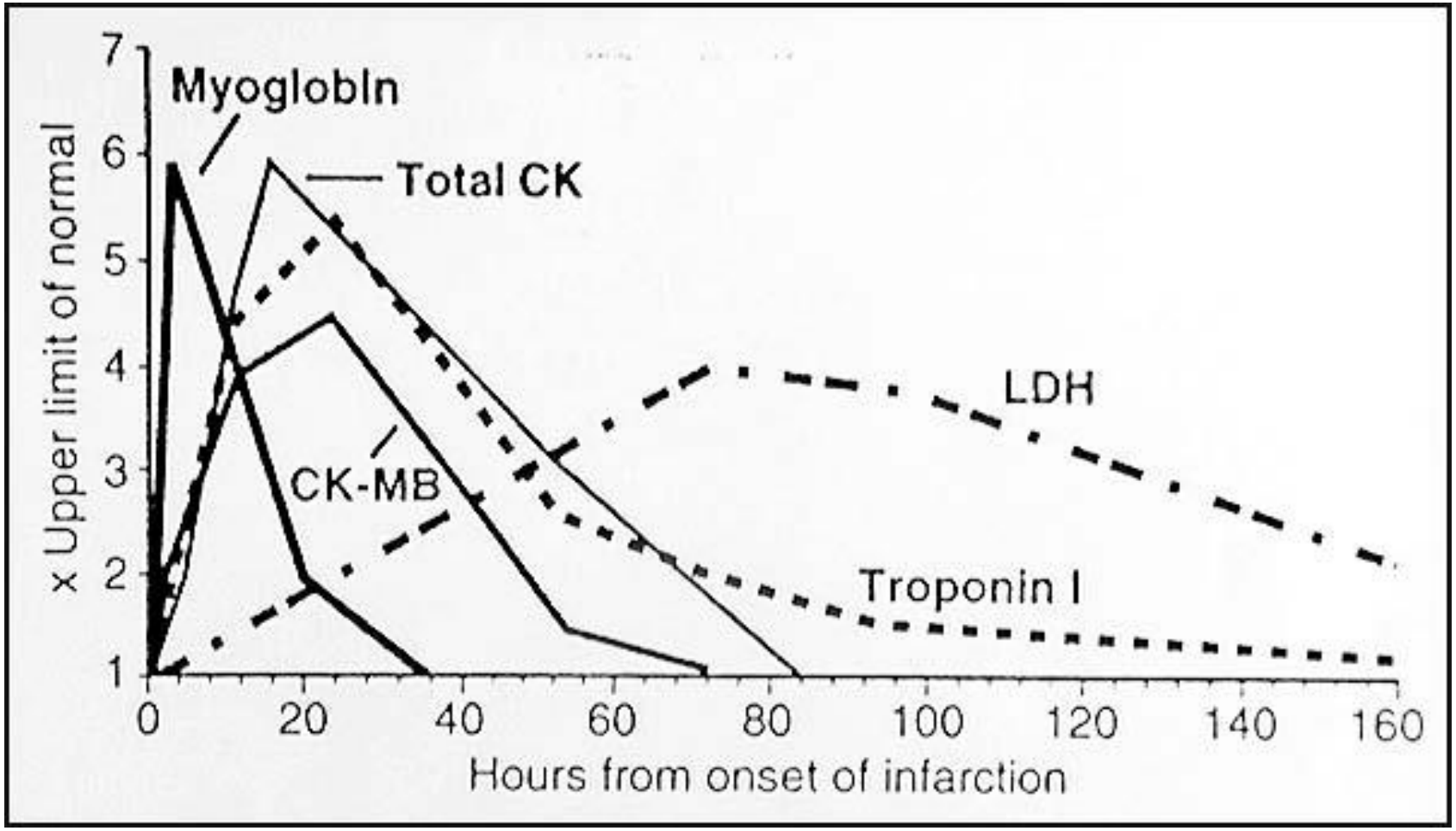
Enzymes in Medical Diagnosis

Diagnostic Enzymes & Liver Disease

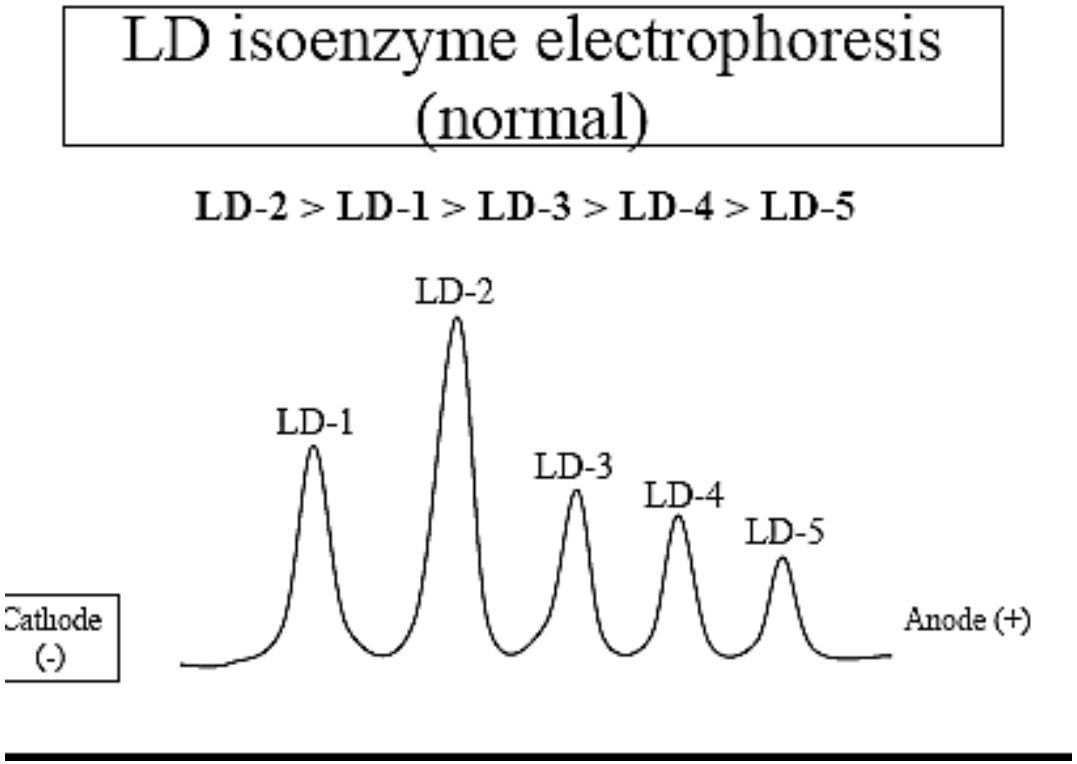
- Concept
- Examples: ALT, AST, LDH, CK (CPK)
- Liver disease: ALT & AST
  - ALT is the most specific
  - Ratio can also be diagnostic (ALT/AST)
  - In liver disease or damage (not of viral origin):
    - ratio is less than 1
  - With viral hepatitis:
    - ratio will be greater than 1

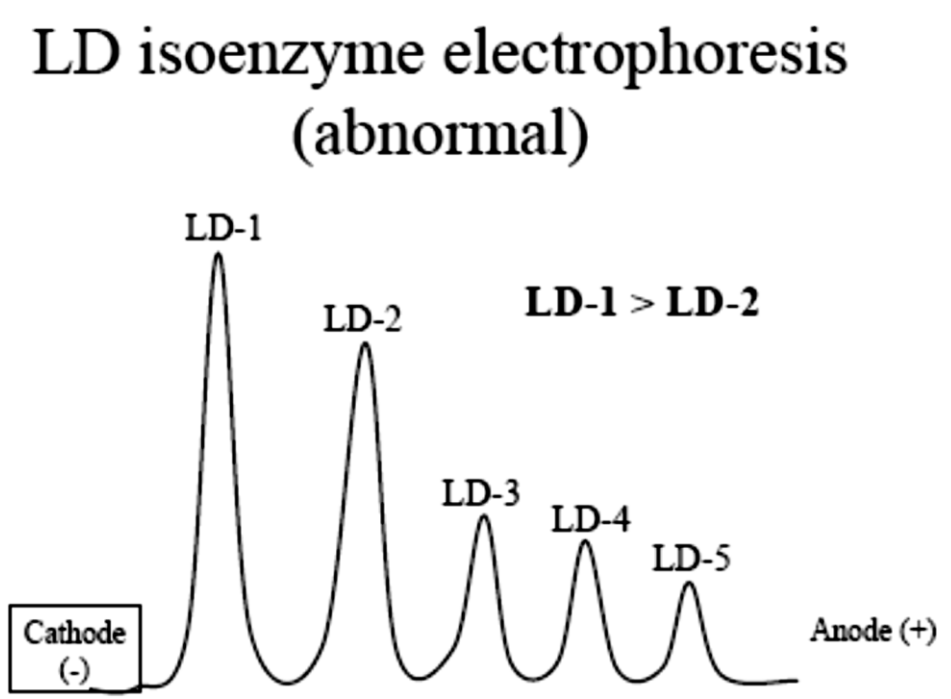
Protein profile in myocardial infarction



LDH

- LDH-1/LDH-2 ratio is diagnostic for myocardial infarction (heart attacks)
- Normally, this ratio is less than 1
- Following an acute myocardial infarct, the LDH ratio will be more than 1





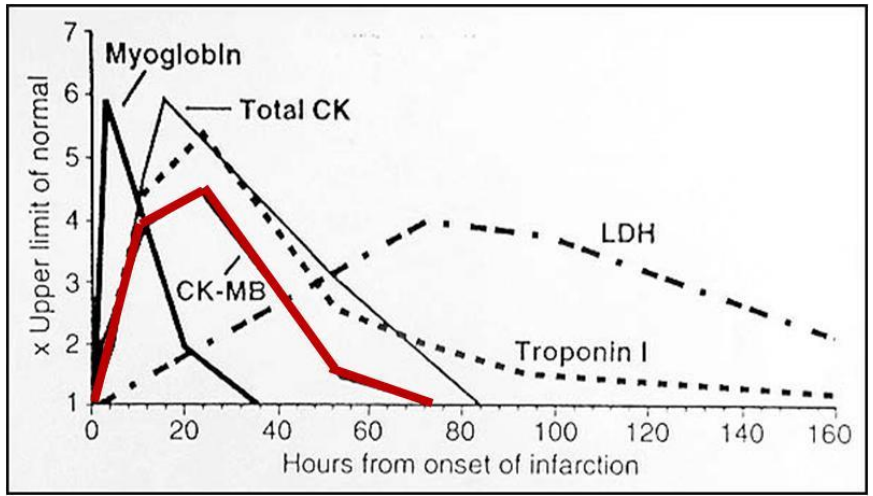
CPK

- Heart, skeletal muscles, & brain
- Like LDH, there are tissue-specific isozymes of CPK:
  - CPK3 (CPK-MM): the predominant isozyme in muscle
  - CPK2 (CPK-MB): accounts for ≈35% of CPK activity in cardiac muscle, but less than 5% in skeletal muscle
  - CPK1 (CPK-BB) is the characteristic isozyme in brain and is in significant amounts in smooth muscle

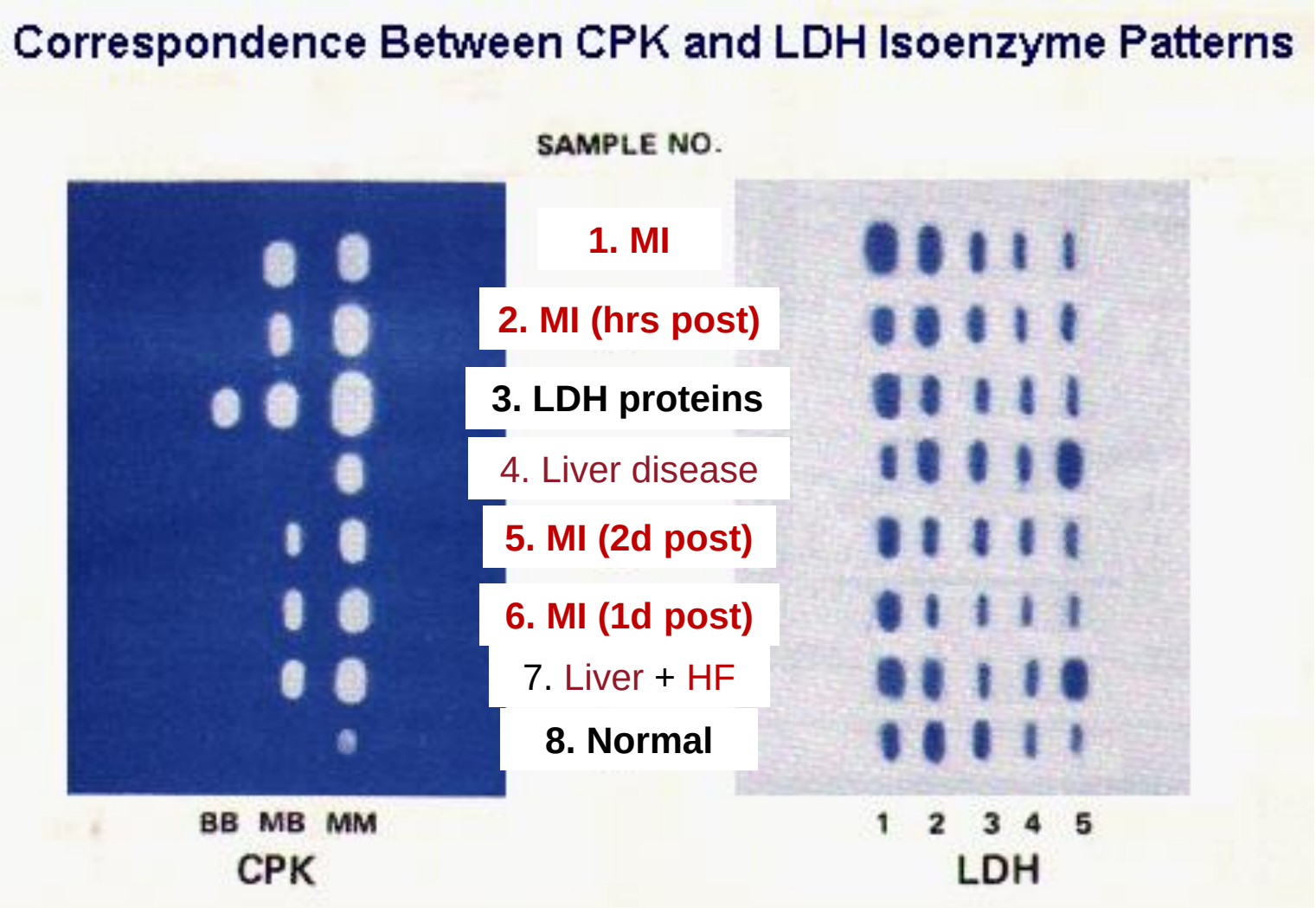
Serum	Skeletal Muscle	Cardiac Muscle	Brain
0 trace BB <6% MB >94% MM	0 trace BB 1% MB 99% MM	0% BB **20% MB** **80% MM**	97% BB 3% MB 0%MM

CPK and myocardial infarction

- Most of released CPK after MI is CPK-MB
- Increased ratio of CPK-MB/total CPK may diagnose acute infarction, but an increase of total CPK in itself may not
- The CPK-MB is also useful for diagnosis of reinfarction because it begins to fall after a day and disappears in 1 to 3 days, so subsequent elevations are indicative of another event



Example


Correspondence Between CPK and LDH Isoenzyme Patterns
SAMPLE NO.
1. MI
2. MI (hrs post)
3. LDH proteins
4. Liver disease
5. MI (2d post)
6. MI (1d post)
7. Liver + HF
8. Normal
BB MB MM
CPK
1 2 3 4 5
LDH

Interpretation

- Sample #3 represents results for a control.
- Sample #8 results are from a normal specimen.
- Sample# 1 MI patient. The specimen was collected at a time when the activity of both LDH and CK were elevated. Note the LDH flip and the high relative activity of the MB isoenzyme.
- Sample# 2 MI patient who experienced chest pain only several hours previously. Total CK is significantly elevated with a high relative MB isoenzyme activity.
- Sample# 6 MI patient (the 1st day post MI); CK activity is definitely elevated with a high relative MB isoenzyme activity and the LDH flip is evident.
- Sample# 5 MI patient (2 days post MI) so that CK has almost returned to normal activity and the LDH flip is definite.
- Sample# 7 MI patient with complications of heart failure and passive liver congestion or the patient was involved in an accident as a consequence of the MI, and suffered a crushing muscle injury.
- Sample# 4 a patient with liver disease. Although the LDH isoenzyme pattern is indistinguishable from muscle disease or injury, the absence of at least a trace of CK-MB isoenzyme is inconsistent with the muscle CPK isoenzyme distribution as is the apparently normal total activity.