



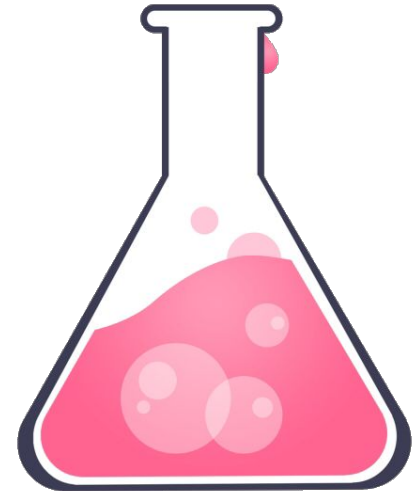
MED439
KING SAUD UNIVERSITY



BIOCHEMICAL MARKERS FOR DIAGNOSIS OF DISEASE AND FOLLOW UP

Color Index :

- original content
- **Important**
- Notes
- Extra information



OBJECTIVES

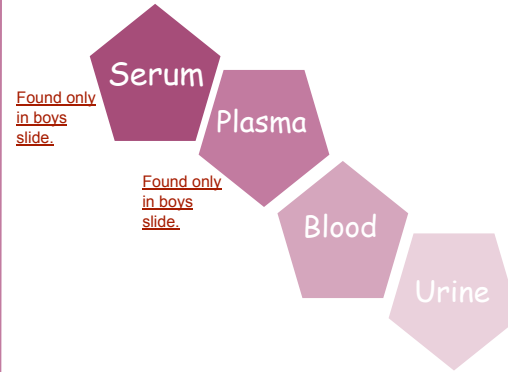
- ◇ Define biomarkers and its criteria
- ◇ Recognize different types of biochemical markers
- ◇ Demonstrate the clinical applications of biomarkers in diagnosis of various diseases
- ◇ Comprehend the importance and diagnostic qualities of various biomarkers
- ◇ Understand the importance of different biomarkers in the diagnosis, treatment and follow up of a disease.
- ◇ Recognize the types of biomarkers and their use in specific diseases such as heart, cancer, liver, kidney and pancreatic diseases

WHAT IS A BIOMARKER?

A biological molecule found in **blood**, other **body fluids**, or **tissues** that indicates a normal or abnormal process such as a disease or a condition .

- A biomarker is measured to follow up a disease or treatment Found only in boys slide.

MOST COMMON BODY FLUIDS FOR MEASUREMENT OF BIOMARKERS ARE:



Biomarkers are either

Plasma-specific

Tissue-specific

DIAGNOSIS AND PROGNOSIS

Identification of a disease from its signs and symptoms

Diagnosis

Diagnosis vs prognosis

Prognosis

The future outcome of a disease

Tissue inflammation, example:
ALT in liver disease (e.g. acute hepatitis)
*Amylase in acute pancreatitis

Ischemia → hypoxia → infarction →
↑ plasma [Troponins] in myocardial infarction

Tissue specific biomarker

- 1- Present **inside the cell**
- 2- A low concentration can be detected in plasma due to cellular turnover
- 3- If released into the body fluids in high conc. -due to:
1- cell damage, 2- defective cell membrane)
2>Found only in boys slide.

Biomarker are either

Plasma specific biomarker

- 1- Normally present in plasma
- 2- Perform their functions in blood
- 3- High level of activity in plasma than in tissue cells

Examples: blood clotting enzymes (thrombin), cholinesterase, etc.
Found only in boys slide.

For example when your patients troponin I and T levels are high this usually indicates a heart failure (a biological marker)

Note:
ALT = alanine aminotransferase

CRITERIA OF A GOOD BIOMARKER ASSAY:

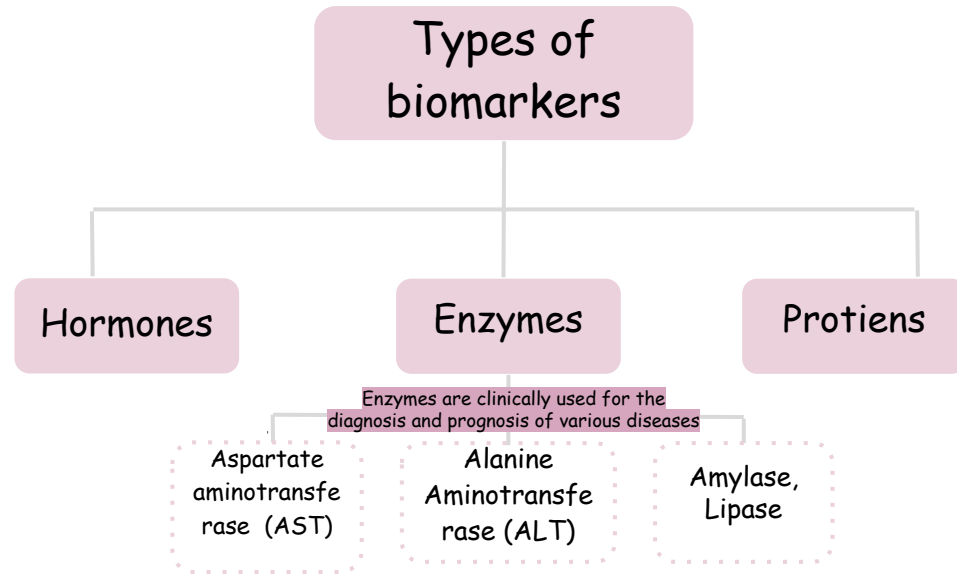
Sensitive: **Sensitivity** ability of an assay to detect small quantities of a marker

Specific: **Specificity** ability of an assay to detect only the marker of interest

Robust to produce fast results

[Found only in girls slide.](#)

Note : you have to know what is specific, what is sensitive & what is not.



A good biomarker should be:

- 1- Able to accurately diagnose a disease
- 2- Able to accurately predict prognosis of a disease
- 3- Compliant with treatment follow up
- 4- Easily obtainable from blood, urine, etc.

[Found only in boys slide.](#)

ENZYMES AS BIOMARKERS: AMYLASE VS LIPASE

Amylase (not specific)

- Elevated serum amylase level is a diagnostic indicator of **acute pancreatitis**
 - Amylase level greater than **10 times** the upper limit indicates acute pancreatitis
- The test has **low specificity** because elevated serum amylase level is also present in other diseases
 - Amylase appears in the serum within 2- 12 hours after abdominal pain and returns to normal in 3-5 days

Lipase

- Serum lipase has higher specificity than serum amylase (elevated only in acute pancreatitis)
- It appears in plasma within 4-8 hours and remains for 8-14 days

ENZYMES AS BIOMARKERS: AST & ALT

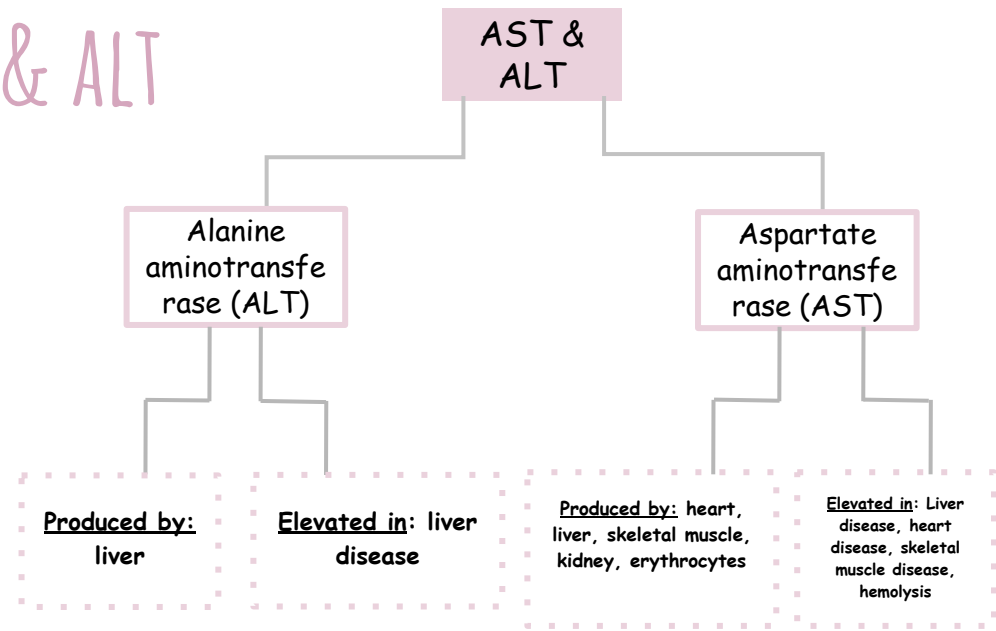
Alanine aminotransferase (ALT)

- Mostly present in liver
- Small amounts in heart
- More specific for liver disease than AST
- Major diagnosis: liver disease

Aspartate aminotransferase (AST)

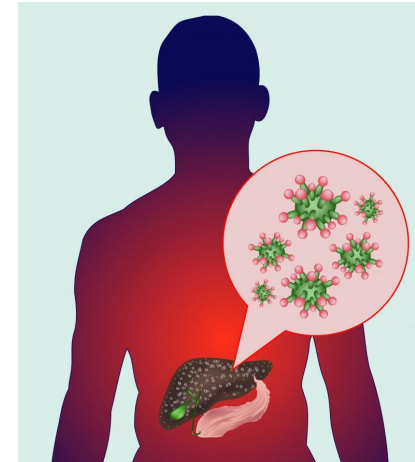
- Widely distributed in heart, liver, skeletal muscle, kidney
- Small amounts in erythrocytes
- High serum activity of AST found in:
 - Liver disease, heart disease, skeletal muscle disease, hemolysis (so it's not specific)
- Major diagnosis: liver and muscle disease

Note : this slide is very important



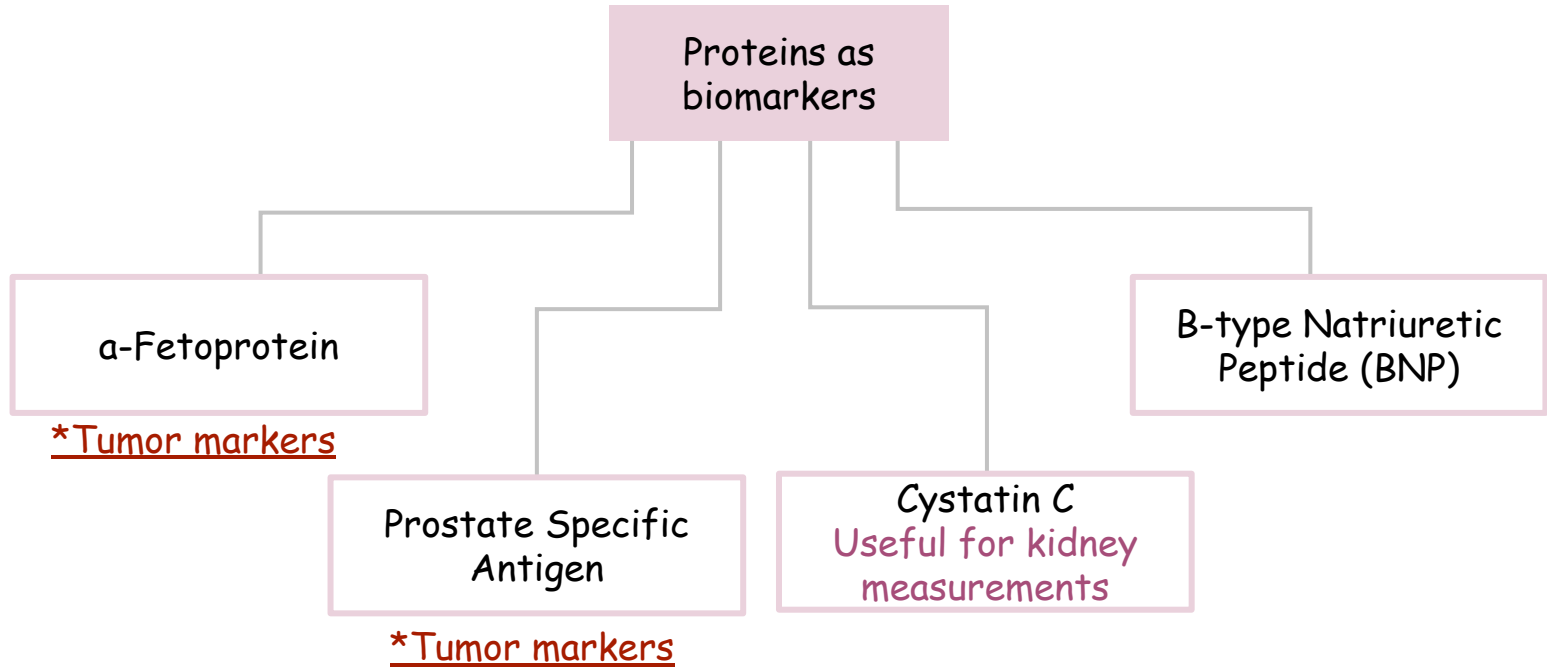
CASE:

A GP was called to see a 21-year-old female student who had been complaining a flu-like illness for two days, with symptoms of fever, vomiting and abdominal tenderness in the right upper quadrant. On examination she was jaundiced, moreover; the liver was enlarged and tender. A blood was taken for liver function tests which **showed elevated ALT** (alanine aminotransferase) and **AST** (aspartate aminotransferase)



- ❖ **What is the most likely diagnosis?** Acute Hepatitis because high levels of ALT and AST are both indicators of liver diseases, but what made us sure is ALT (more specific than AST)

PROTEINS AS BIOMARKERS:



tumor markers : A molecule secreted by a tumor that is measured for diagnosis and management of tumor:

PROTEINS AS BIOMARKERS: α -FETOPROTEIN & PSA

- **α -Fetoprotein:**

- "It is produced by the fetal liver, and falls until term→ In newborn babies,

- α -fetoprotein levels are very low.

- It remains low under normal conditions.

- High conc. are not always suggestive of a tumor

- High conc. are observed in: [Found only in boys slide.](#)

- hepatocellular carcinomas (hepatoma)
- testicular carcinomas
- GI tract carcinomas

- It is a non specific marker

however, high serum levels are also found in benign (non-cancerous) conditions e.g. hepatitis
[Found only in boys slide.](#)

- **Prostate Specific Antigen (PSA)**

- Produced by prostate gland

- PSA level is used as a tumor marker to aid diagnosis and for monitoring in patients with **prostatic cancer**.

- High serum levels are also observed in: (**less specific**)

- **benign prostatic hypertrophy (BPH) (enlarged prostate gland)**
- **Prostatic inflammation/infection**

PROTEINS AS BIOMARKERS: CYSTATIN C & BNP

Cystatin C

- A **cysteine** protease inhibitor mainly produced by all nucleated cells of the body
- Useful biomarker for measuring glomerular filtration rate (GFR) in assessing kidney function and failure
- Unlike creatinine, its serum conc. is independent of gender, age or muscle mass
- Abnormally high serum levels of cystatin C indicates early renal disease "kidney failure"
- Clinically useful marker for detecting:
 - early kidney disease
 - monitoring kidney transplantation

B-type natriuretic peptide (BNP)

- A peptide secreted mainly in the cardiac ventricles in response to cardiac expansion and pressure overload
- High serum levels are observed in congestive heart failure
- It can be used to differentiate patients whose symptoms are due to heart failure from those whose symptoms are due to other causes such as pulmonary disease.

During transplantation of kidney, if the cystatin C levels were found high this means that his or her body is rejecting the new kidney

HORMONES AS BIOMARKERS: ANTI-MULLERIAN HORMONE (AMH)

Anti-Mullerian hormone (AMH)

Low levels in women with ovarian dysfunction

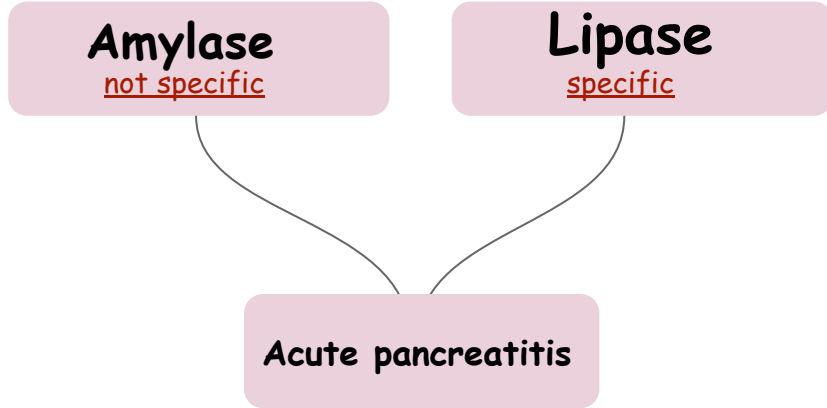
High levels in women with Polycystic ovarian syndrome (PCOS)

Pronounced as (Pe Koz)

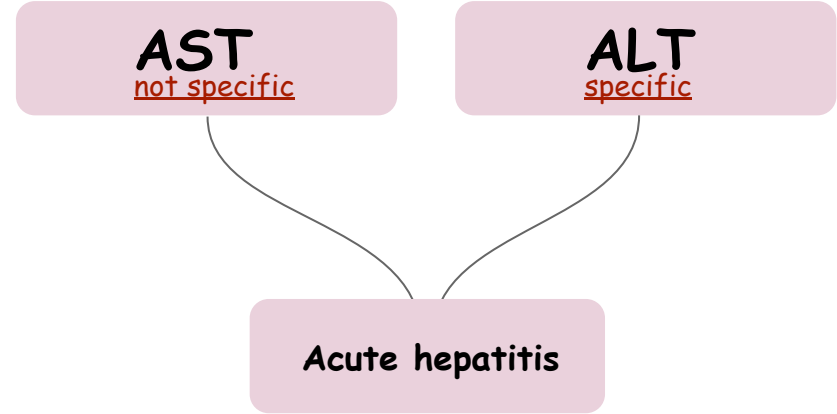
- In females it is produced by ovaries
- Appears to be a best marker for estimating egg cell reserve in the ovaries (ovarian reserve testing)
- only growing follicles produce AMH
- Plasma AMH levels strongly correlate with number of growing follicles

TO SUMMARIZE

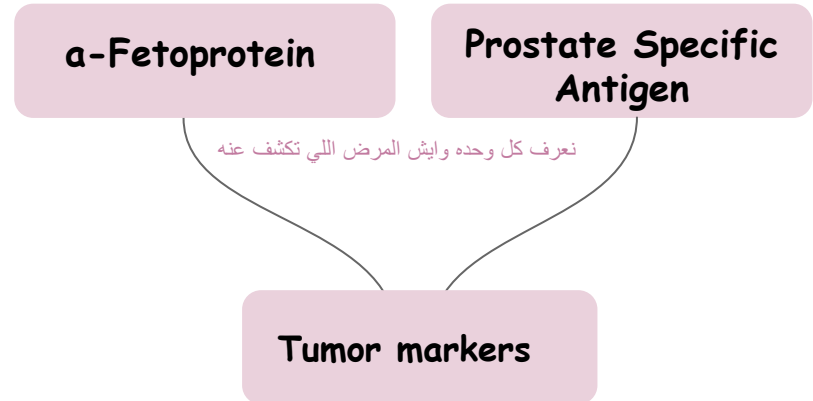
Enzymes



Enzymes



Proteins



TAKE HOME MESSAGE

- ◆ Biochemical markers are essential accurate and non-invasive laboratory tools offering the treating physicians fast means for better management.
- ◆ They could be proteins, enzymes, or hormones.
- ◆ Biomarkers are used for diagnosis, prognosis and follow up of diseases
- ◆ A biomarker should exhibit good diagnostic and prognostic values
- ◆ Examples of biomarkers used in different disease will help understand their qualities and limitations

QUIZ

THANK YOU #MED439, WE WERE HAPPY TO CONTRIBUTE IN HELPING ALL OF YOU

MCQs

Q1: Amylase & lipase are biomarkers of

- A) congestive heart failure B) pregnancy C) pancreatitis D) Polycystic ovarian syndrome

Q2: Specific test for liver

- A) AST B) ALT C) a- Fetoprotein D) AMH

Q3: A non-specific biomarker seen in hepatoma & produced in high levels

- A) Amylase B) a- Fetoprotein C) lipase D) AST

Q4: what do we call the ability of a biomarker assay to detect small quantities of the marker

- A) Sensitivity B) specificity C) خلصت الخيارات



D) اخر محاضره بايو بهالبلوك
رفعناها

SAQ

Q1 : What is a biomarker?

Q2: Which enzyme is more specific for pancreatitis?

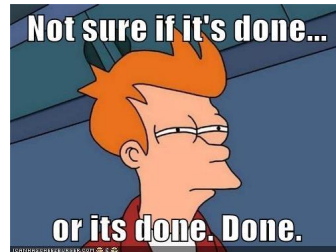
Q3: what can cause liver enzyme to be elevated?

MCQs answers

- A (4)
B (3)
B (2)
C (1)

SAQ answer:

Slide 3.Slide 6Slide 8



TEAM MEMBERS



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- Reema Alomar
- Reem Alqahtani
- Renad Alhumaidi
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- Shaden Alobaid
- Budoor Almubarak
- Somow Abdulrahman
- Noura Alsalem
- Lama Alahmadi
- Sadem Alhazmi
- Nuha Alkudsi
- Norah Alsheikh
- Muneerah Alssdhan
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- Hassan alshurafa
- Abdulrahman almebki
- Mohammed alsayyari
- Abdullaziz alomar
- Ahmed Alkhayat
- Bander alharbi
- Abdulaziz alrabiah
- Saud alrasheed
- abdullah almazroo
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