Enzymes in Clinical Diagnosis

Spring Semester
Course Name: Advance Clinical Biochemistry II
Stage: Grade 4 (WK 14)
Lecture/Assistant: Dr. Jaafaru/ Mr. Tolaz Kadhim
Learning Objectives

- Students are to understand:
  - The role of enzymes in clinical diagnosis.
  - The general classification of enzymes.
  - The techniques used for measuring enzymes’ activity and their concentration.
Introduction

- Enzymes are proteins whose function is to catalyze biochemical reactions in the body.

- These biochemical reactions include metabolism, digestion, and the synthesis of macromolecules such as proteins, nucleic acids, and carbohydrates.

- Enzymes have a significant role in clinical diagnosis as pathological conditions can result in an alteration in the concentration and activity of enzymes in blood, urine, or other tissues.
Classifications of Enzyme

- Enzymes are classified based on their function, location & specificity.

- There are six major categories of enzymes based on their function, and they include:
  - Hydrolases
  - Oxidoreductases
  - Transferases
  - Isomerases
  - Ligases
  - Lyases
Hydrolases: These enzymes catalyze hydrolysis reactions, where water is used to break down complex molecules into simpler ones.

Examples of hydrolases include proteases, lipases, and nucleases.

Oxidoreductases: These enzymes catalyze reactions that involve the transfer of electrons between molecules.

Examples of oxidoreductases include dehydrogenases, reductases, and oxidases.
• Transferases: These enzymes catalyze the transfer of functional groups between molecules.

✓ Examples of transferases include kinases, transaminases, and glucosyltransferases.

• Isomerases: These enzymes catalyze reactions that involve the rearrangement of atoms within a molecule.

✓ Examples of isomerases include epimerases, racemases, and mutases.
• Ligases: These enzymes catalyze the joining of two molecules, often requiring energy from ATP.

✓ Examples of ligases include synthetases, carboxylases, and DNA ligases.

• Lyases: These enzymes catalyze the removal or addition of a group from or to a molecule without hydrolysis or oxidation-reduction.

✓ Examples of lyases include decarboxylases, deaminases, and aldolases.
Enzymes can also be classified based on their location within the cell.

- Intracellular enzymes are found within the cell, while extracellular enzymes are found outside the cell.

- Finally, enzymes can be classified based on their specificity, where they can be either non-specific or specific to a particular substrate.
Methods for Measuring Enzyme Activity and Concentration

- There are several techniques available for measuring enzyme activity and concentration.

- These techniques vary depending on the type of enzyme being measured, the sample being analyzed, and the desired level of sensitivity.

- Spectrophotometry
- Electrophoresis
- Immunoassays
- Chromatography
Spectrophotometry:

- This technique measures changes in color or light absorption caused by the enzymatic reaction.

- The amount of light absorbed or transmitted through the sample is measured at a specific wavelength, and the amount of enzyme activity is calculated using Beer’s law.
Electrophoresis:

- This technique uses an electric field to separate proteins based on their size and charge.

- Enzymes can be identified and measured by their movement in a gel matrix or by staining the gel with a specific substrate.
Immunoassays:

- This technique uses antibodies that bind specifically to the enzyme of interest.
- The enzyme-antibody complex can then be detected using a variety of methods, such as radioisotopes, enzymes, or fluorescence.
Chromatography:

This technique separates molecules based on their chemical properties, such as size, polarity, and affinity.

Enzymes can be identified and measured by their separation from other molecules in the sample.
Enzymes play a significant role in clinical diagnosis due to their sensitivity to changes in cellular function and damage.

The level of enzyme activity or conc. in a patient’s samples can provide crucial information about the presence of a disease and its severity.

Some common enzymes measured in clinical diagnosis include:

- Alanine aminotransferase (ALT)
- Aspartate aminotransferase (AST)
- Creatine kinase (CK)
- Alkaline phosphatase (ALP)
Enzymes in Clinical Diagnosis

• Alanine aminotransferase (ALT): This enzyme is primarily found in the liver and is released into the bloodstream when there is liver damage. Elevated levels of ALT can indicate liver disease, such as hepatitis or cirrhosis.

• Aspartate aminotransferase (AST): This enzyme is found in the liver, heart, and skeletal muscle. Elevated levels of AST can indicate liver or heart disease, muscle injury, or other conditions.
Enzymes in Clinical Diagnosis

- **Creatine kinase (CK):** This enzyme is found in muscle and is released into the bloodstream when there is muscle damage. Elevated levels of CK can indicate muscle injury, such as in muscular dystrophy or rhabdomyolysis.

- **Alkaline phosphatase (ALP):** This enzyme is found in the liver, bones, and placenta. Elevated levels of ALP can indicate liver or bone disease, or pregnancy.
Enzymes are proteins that catalyze biochemical reactions in the body, and they play a significant role in clinical diagnosis due to their sensitivity to changes in cellular function and damage.

There are six major categories of enzymes, and they can be classified based on function, location, and specificity.

Techniques for measuring enzyme activity and concentration include spectrophotometry, electrophoresis, immunoassays, and chromatography.

Enzymes measured in clinical diagnosis include ALT, AST, CK, and ALP.
Enzymes play a crucial role in clinical diagnosis, and their measurement can provide critical information about cellular function and damage.

Enzymes can be classified based on their function, location, and specificity, and several techniques are available for measuring enzyme activity and concentration.

Some common enzymes measured in clinical diagnosis include ALT, AST, CK, and ALP.

Accurate measurement of enzyme levels can aid in the diagnosis and monitoring of many diseases, leading to better patient outcomes.
1. What are the six major categories of enzymes based on their functions?

2. What is the difference between intracellular and extracellular enzymes?

3. What techniques are available for measuring enzyme activity and concentration?

4. What are the enzymes commonly measured in clinical diagnosis?

5. How do enzymes provide crucial information about the disease and its severity in clinical diagnosis?

Take home message

1. What are the six major categories of enzymes based on their functions?

2. What is the difference between intracellular and extracellular enzymes?

3. What techniques are available for measuring enzyme activity and concentration?

4. What are the enzymes commonly measured in clinical diagnosis?

5. How do enzymes provide crucial information about the disease and its severity in clinical diagnosis?
QUESTIONS/ COMMENTS?

THANK YOU

SEE YOU IN THE NEXT CLASS