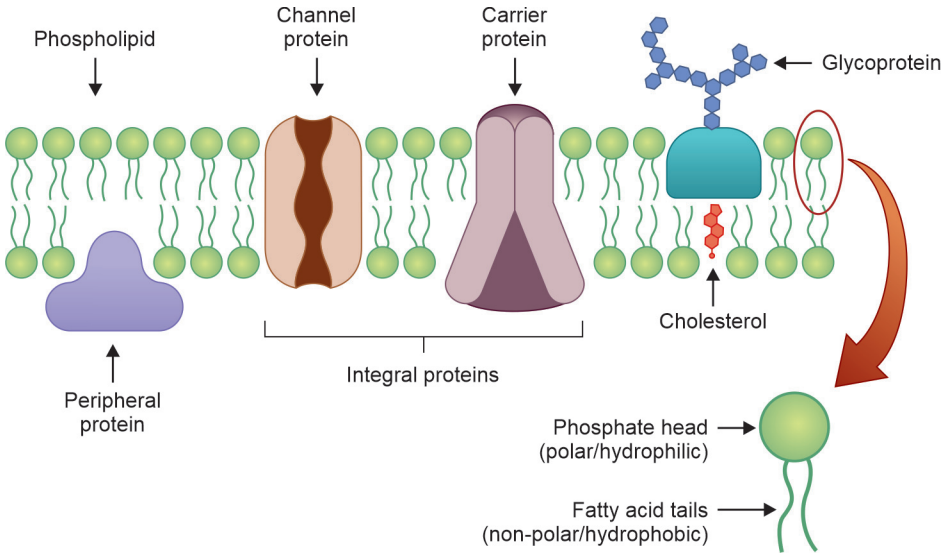


Functions of the Cell Membrane

1. Provides support and shape to the cell
2. Allows only specific molecules to pass through semipermeability
3. Membrane proteins are integral to functions such as signal transmission.
4. Aids in exocytosis and endocytosis

2. Classify the transport mechanisms across the membrane. Describe the characteristics of facilitated diffusion with example. (2 + 3 marks)

- Transport mechanisms across the membrane are classified into:
  1. Passive transport
  2. Active transport.

Passive Transport

- Further subclassified into simple diffusion, facilitated diffusion, ion channels
- It is driven by concentration gradient
- Does not require energy.

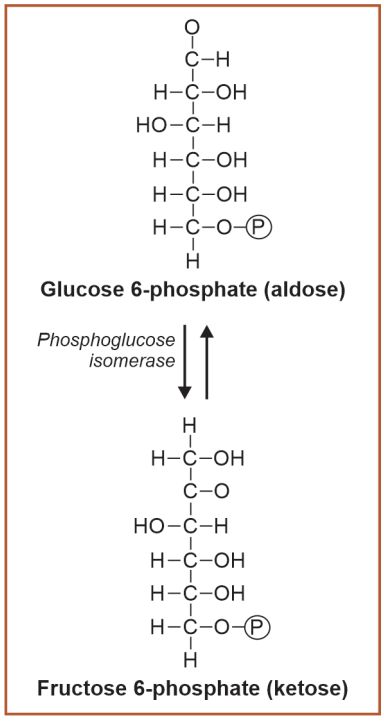
Active Transport

- This required energy
- Unidirectional
- Requires integral proteins called transporters
- Transporters saturated at higher concentrations.

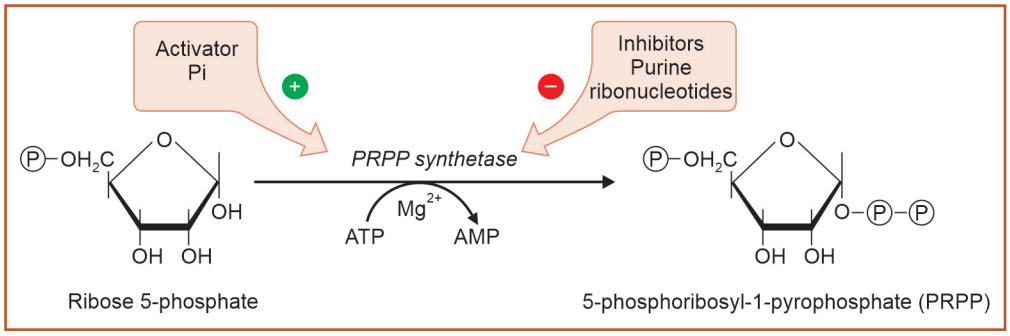
Facilitated Diffusion

- It is a carrier mediated process
- Carrier mechanism is saturable
- Competitive inhibition of structurally similar solutes, thus entry into the cells are inhibited
- It can operate in both directions (bidirectional)
- Facilitated diffusion does not require energy, the rate of transport across the membrane is more rapid than simple diffusion.

5. **Isomerases**
   - Intramolecular transfers (racemases, epimerases)



6. **Ligases**
   - ATP dependent condensation of two molecules (acetyl CoA carboxylase, PRPP synthetase)



4. Define metalloenzymes and metal activated enzymes. Enumerate any TWO metalloenzymes and metal activated enzyme. (2 + 3 marks)

Metalloenzymes

- Some of the enzymes need metal ions for its catalytic activity.
- Metal is tightly bound to the enzyme
- Examples
  - Copper is tightly bound to tyrosinase
  - Copper in cytochrome C
  - Zinc in superoxide dismutase

Metal Activated Enzymes

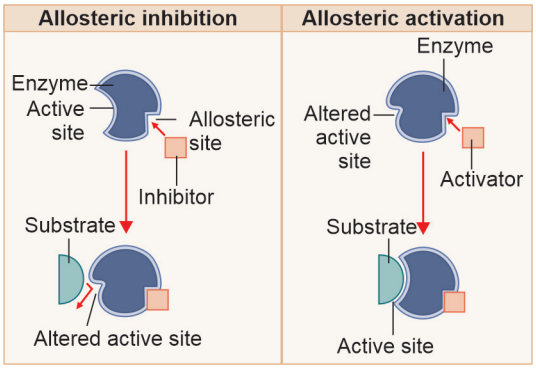
- In the presence of metal ions the rate of reaction is enhanced
- Examples
  - Calcium ions increase the catalytic activity of lipase
  - Magnesium for the enzyme enolase

5. Explain regulation of enzymes under following headings.

A. Mechanism of allosteric regulation. (3 marks)

Allosteric Regulation

- Enzyme has another site called allosteric site and allosteric substances (activator or deactivator) bind and catalyze the enzyme action
- Allosteric activator/ positive modifier: Binds to the allosteric site and increases the rate of reaction by enhancing the binding of substrate to enzymes
  - Example: Acetyl-CoA is an allosteric activator of pyruvate carboxylase
- Allosteric inhibitor/negative modifier: Binds to the allosteric site and decreases the rate of a reaction
  - Example: Cholesterol is an allosteric inhibitor of HMG-CoA reductase



Significance

1. Characteristic of an enzyme and reflects the affinity of that enzyme for the substrate
2. Michaelis constant does not vary with enzyme concentration
3. Rate of reaction is directly proportional to enzyme concentration at all substrate concentrations
4. Order of reaction may be determined from the equation.

BI 2.4 Describe and discuss enzyme inhibitors as poisons and drugs and as therapeutic enzymes

LONG ESSAY

1. **A 45-year-old man awoke from sleep with a painful and swollen right great toe. On the previous night he had eaten a meal of fried liver. After which he met with his poker group and drank a number of beers. Following day on investigation, his serum uric acid level showed 8 mg.**

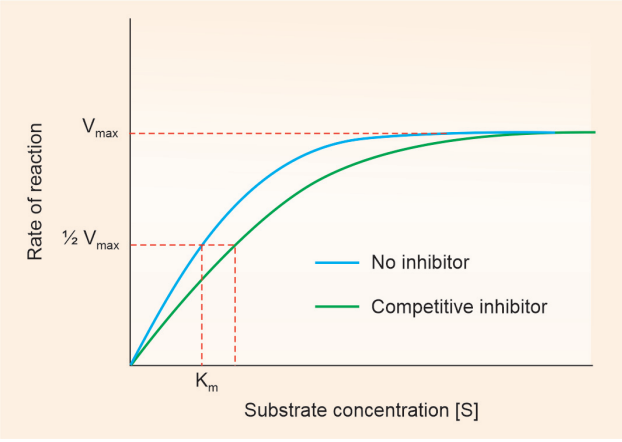
A. Suggest the probable diagnosis
B. Which drug is used as competitive inhibitor in the treatment and inhibits which enzyme?
C. Describe competitive inhibition with a graph showing the effect of competitive inhibitor on K_m and V_{max}
D. Give any two examples for competitive inhibition

Answers

A. Gout
B. Allopurinol is used as competitive inhibitor in the treatment and inhibits xanthine oxidase enzyme
C. In competitive inhibition, inhibitor is structurally similar to substrate, competes with the active site of enzyme and binds to the active site of the enzyme.

Michaelis-Menten Saturation Curve

Competetitive Inhibitors



V_{max} is not changed as there is still a substrate concentration where full enzyme activity can be achieved.

K_m is incareased as it takes a higher substrate concentration to react V_{max}