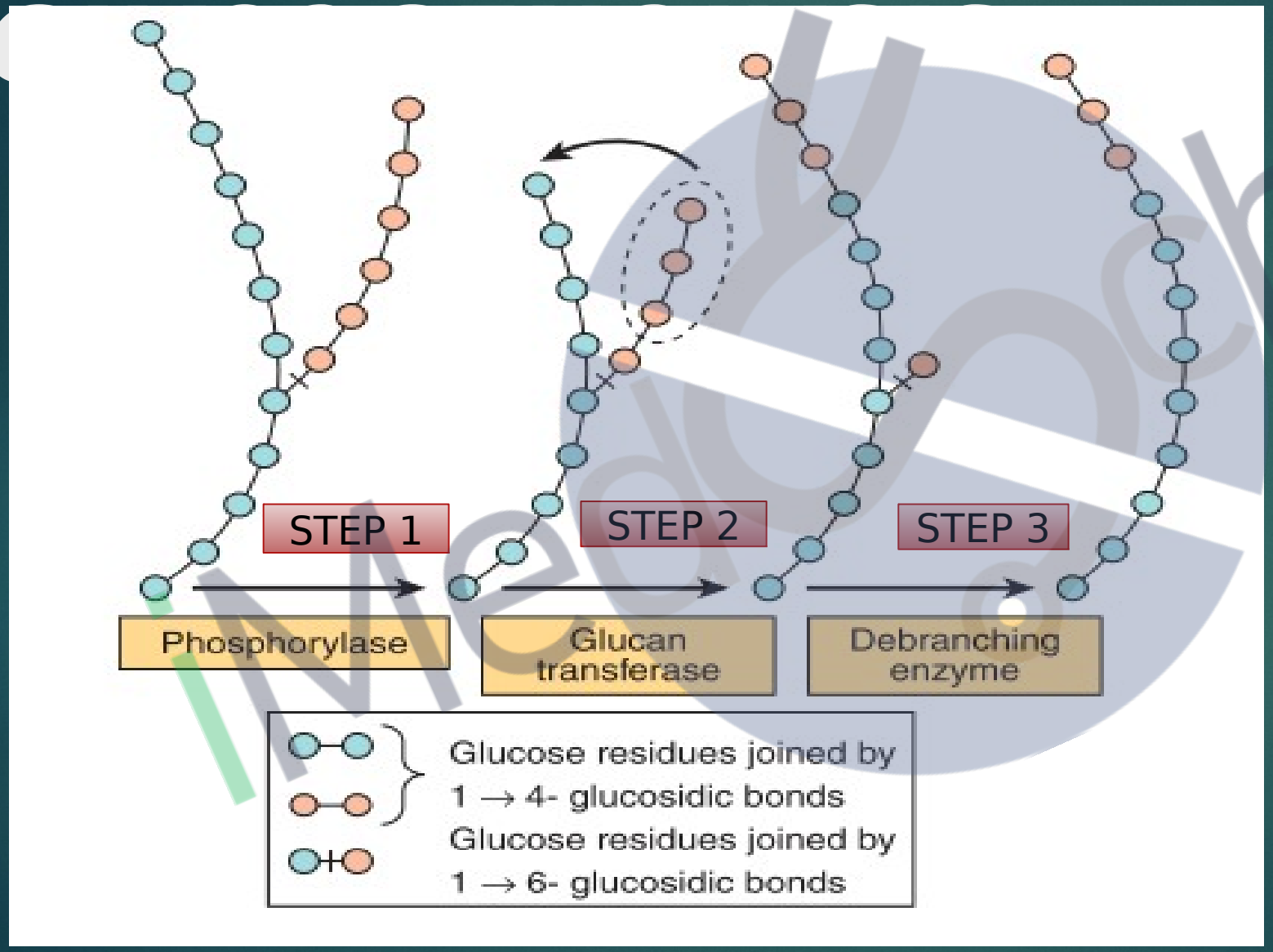
GLYCOGENOLYSIS

INTRODUCTION

- ***Process of Degradation of stored glycogen.***
- ***Occurs mainly in liver and muscles.***
- ***Glycogenolysis is NOT the reversal of glycogenesis.***

OVERVIEW OF

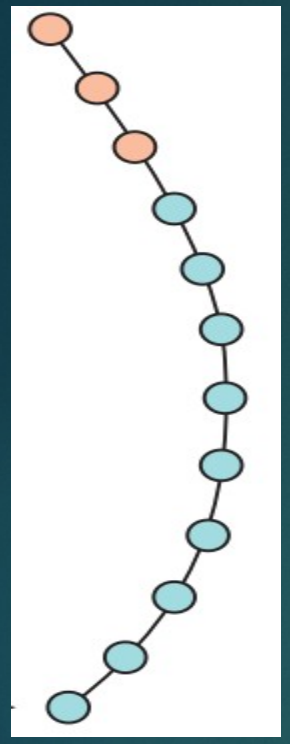


DEBRANCHING ENZYME

BIFUNCTIONAL ENZYME

GLUCAN TRANSFERASE ACTIVITY

GLYCOSIDASE ACTIVITY



PHOSPHORYLASE

STEP 4

GLCOSE-1-PHOSPHATASE

PHOSPHOGLUCO MUTASE

STEP 5

GLUCOSE-6-PHOSPHATE

GLUCOSE-6-PHOSPHATASE

STEP 6

GLYCOLYSIS

GLUCOSE

DETAILS OF EACH STEP

STEP 1:

- *Enzyme- **glycogen phosphorylase** (rate limiting enzyme).*

- ***Different isoenzymes present in liver, muscle, and brain, encoded by different genes.***
- ***requires pyridoxal phosphate as coenzyme.***
- ***Phosphorolytic cleavage of the 1 → 4 linkages of glycogen to yield glucose 1-phosphate.***

- ***T**he terminal glucosyl residues from the outermost chains of the glycogen molecule are removed sequentially until approximately four glucose residues remain on either side of a 1 → 6 branch.*

STEP 2:

- ***glucan transferase*** transfers a trisaccharide unit from one branch to the other, exposing the 1 → 6 branch point.

STEP 3:

- **1,6-glycosidase** catalyzes hydrolysis of the 1 → 6 glycoside bond to liberate free glucose.

STEP 4:

- Further **PHOSPHORYLASE** action.

STEP 5:

The reaction catalyzed by ***phosphoglucomutase*** is reversible, so that glucose-6-phosphate can be formed from glucose 1-phosphate.

STEP 6:

- In liver, but not muscle, ***glucose-6-phosphatase*** catalyzes hydrolysis of glucose-6-phosphate, yielding glucose that is exported, leading to an increase in the blood glucose concentration.

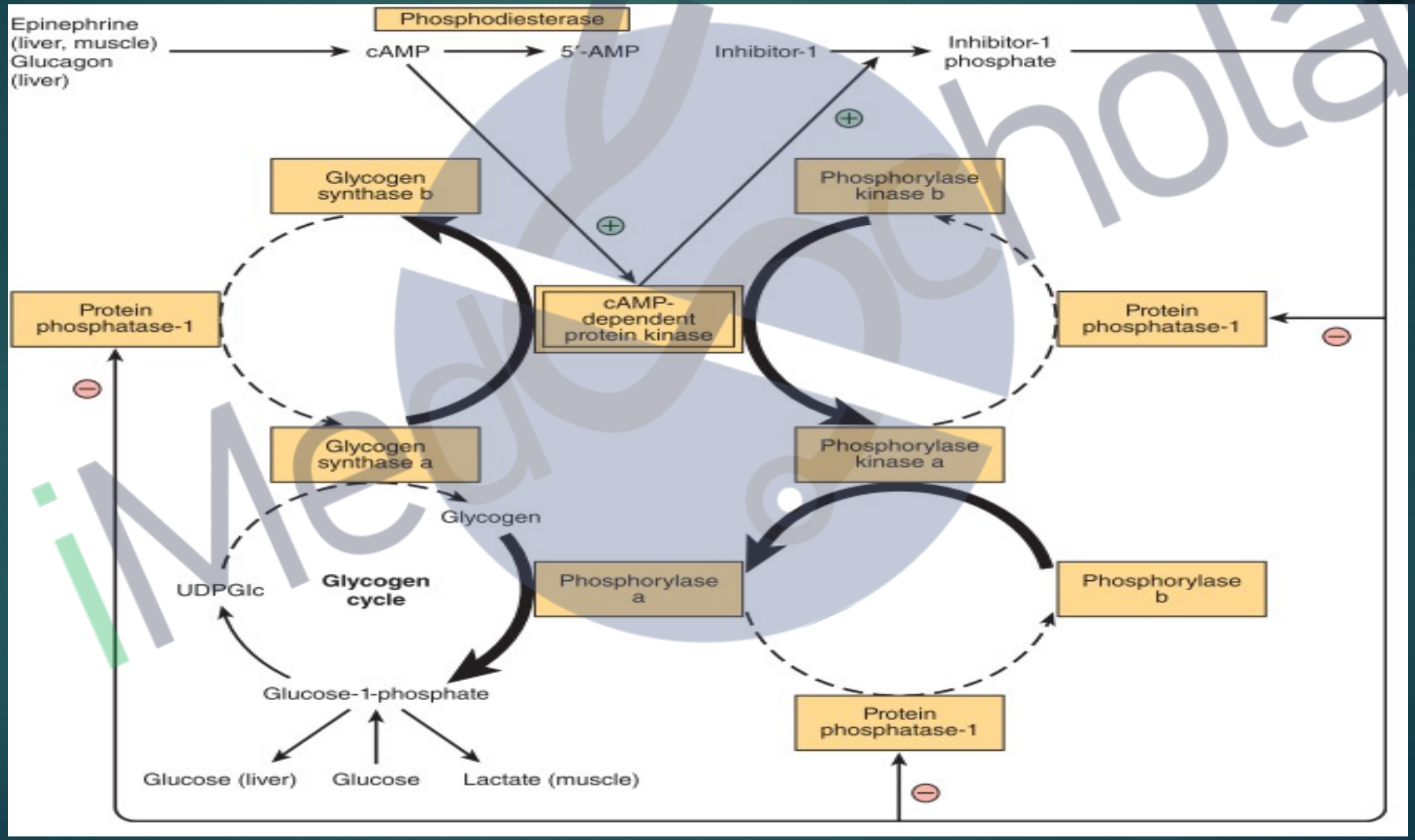
APPLIED

- ***TYPE 1b GLYCOGEN STORAGE DISEASE:***
  - genetic defects of the glucose-6-phosphate transporter.
  - Clinical features-Glycogen accumulation in liver and renal tubule cells; hypoglycemia; lactic acidemia; ketosis; hyperlipemia,neutropenia and impaired neutrophil function leading to recurrent infections.
- ***Type II GLYCOGEN STORAGE DISEASE(Pompe disease)***
  - ***Lysosomes-*** acid maltase catalyzes the hydrolysis of glycogen to glucose. Important in glucose homeostasis in neonates**.**
  - Clinical features-Accumulation of glycogen in lysosomes: juvenile onset variant, muscle hypotonia, death from heart failure by age 2; adult onset variant, muscle dystrophy.

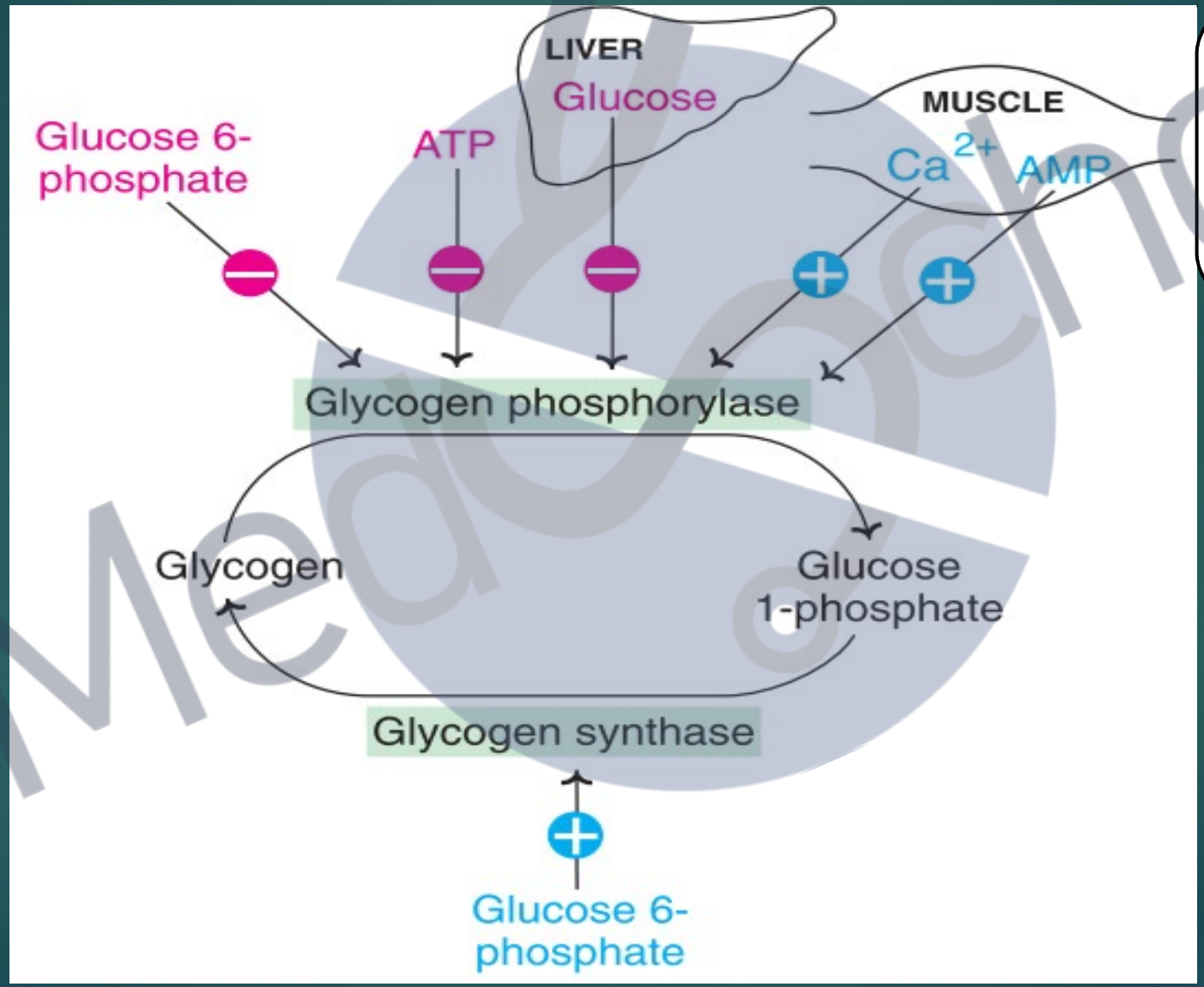
REGULATION

- In Glycogen metabolism— glycogen phosphorylase and glycogen synthase—are regulated in opposite directions.
- Via allosteric regulation covalent modification by reversible phosphorylation and dephosphorylation of enzyme in response to hormone action.
- Phosphorylation of glycogen phosphorylase increases its activity; phosphorylation of glycogen synthase reduces its activity.
- For,better understanding analyse the diagram in next slide.

Coordinated control of glycogenolysis and glycogenesis

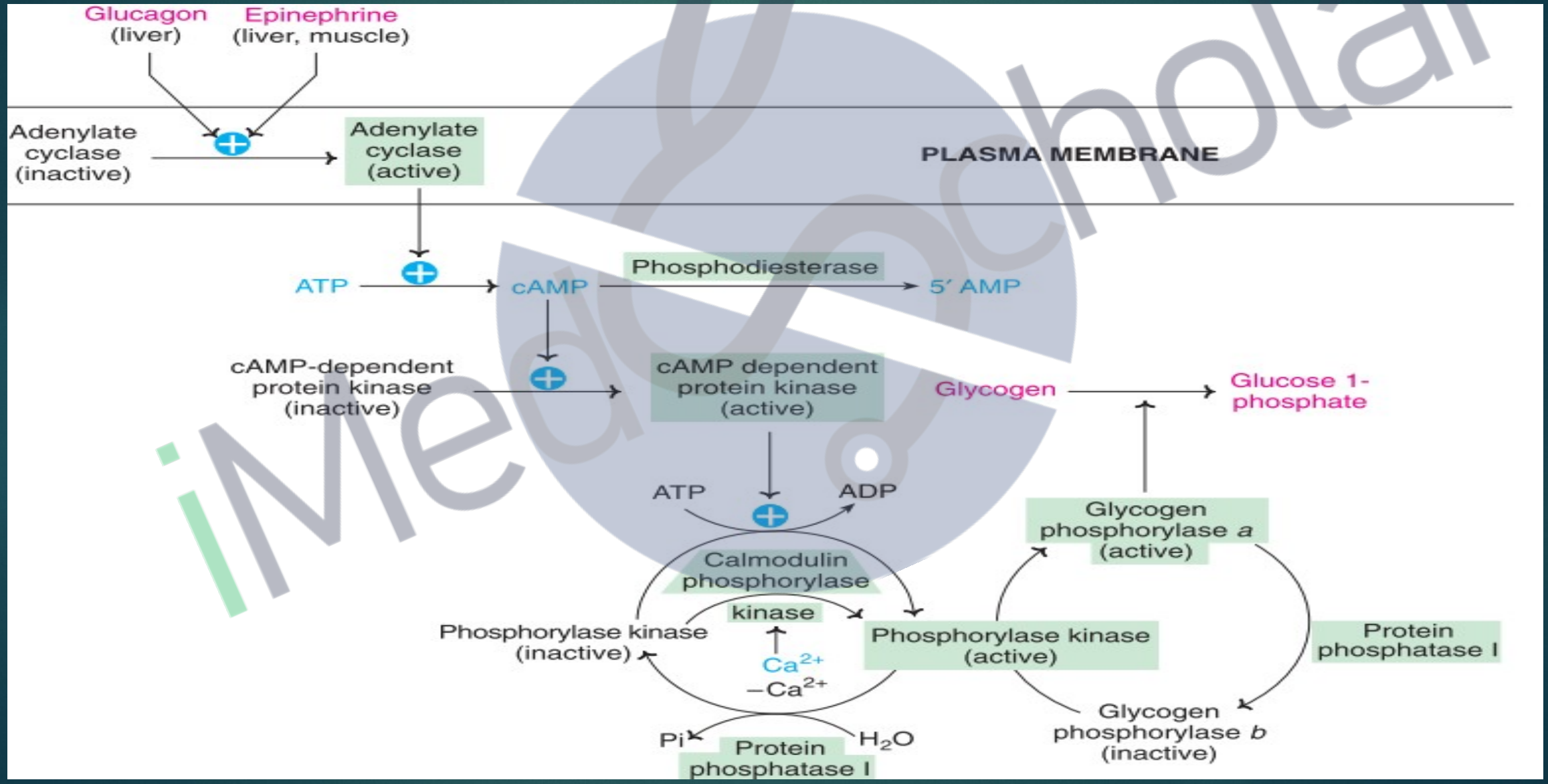


ALLOSTERIC REGULATION



Ca2+ Synchronizes the Activation of Glycogen Phosphorylase With Muscle Contraction

HORMONAL REGULATION



THANK YOU

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