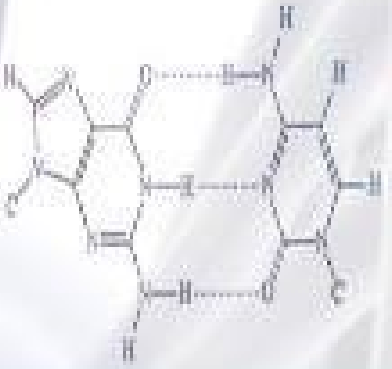
Medical Committee
The University of Jordan

SLIDE SHEET

SLIDE : 2- Glycolysis

Biochemistry

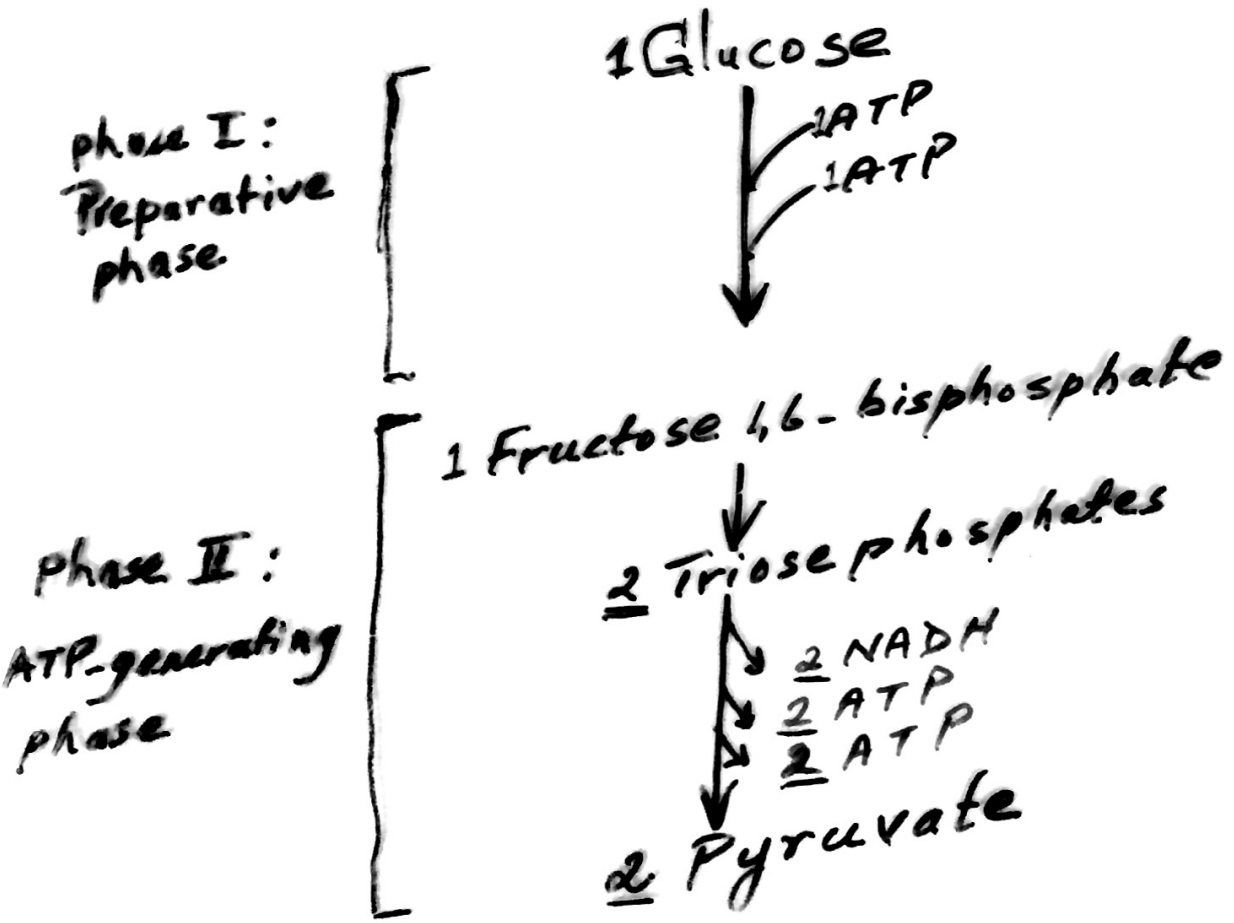
DR.NAME: Dr. Nayef



Majida Al-Foqaraa'

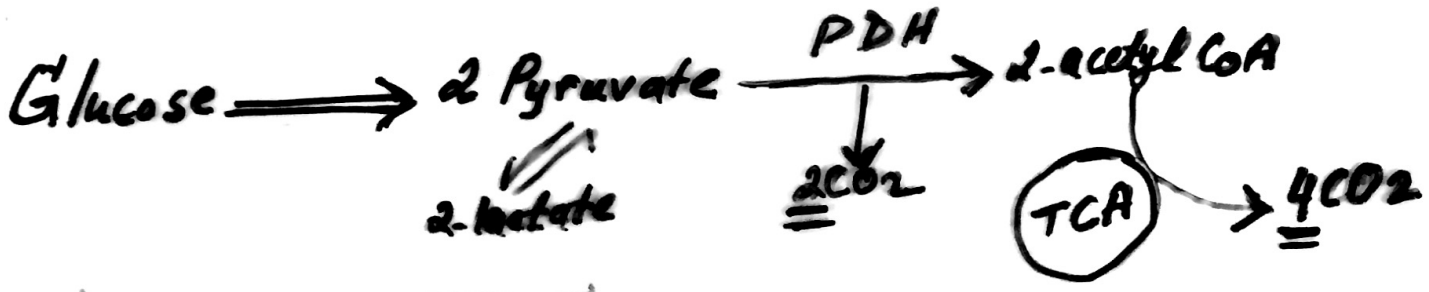
GLYCOLYSIS

- Universal Pathway in all cell types
- Generation of ATP with, and without, O_2
- Anabolic Pathway → biosynthetic precursors
- Phases of the glycolytic Pathway



GLYCOLYSIS :-

. Occurs in all Human Cells



No O_2-requirement for glycolysis- anaerobic fermentation

$Glu + 2ADP + 2Pi \rightarrow 2ATP + 2\text{-lactate}$

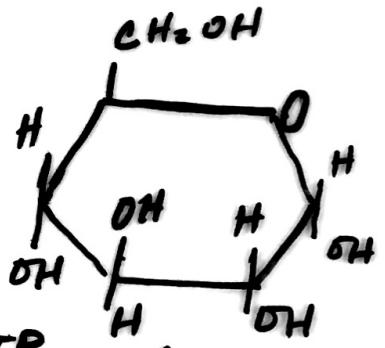
O_2-requirement for PDH & TCA activity

$Glu + 6O_2 + 38ADP + 38Pi + 38H^+ \rightarrow 6CO_2 + 6H_2O + 38ATP$

. Tissues that have an Absolute Requirement for Glucose

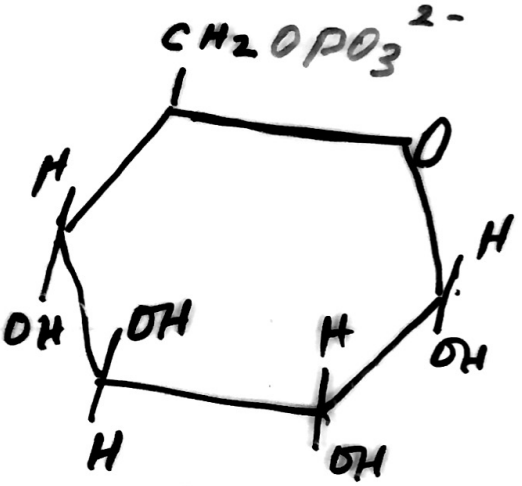
- . Brain
- . Red Blood Cells
- . Cornea, lens and retina
- . Kidney Medulla, testis, leukocyte and white muscle fibers

Glucose-6-phosphate Metabolism



ATP → ADP

Hexokinase
Glucokinase (liver)

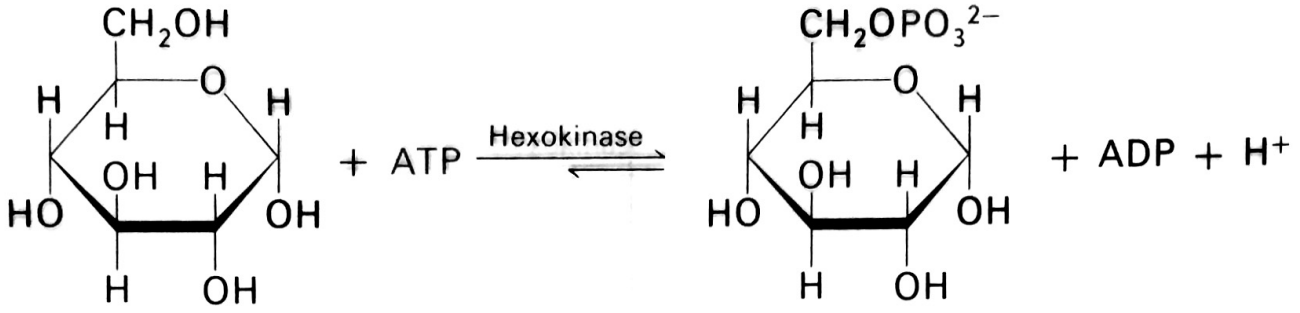


Glu-6-P

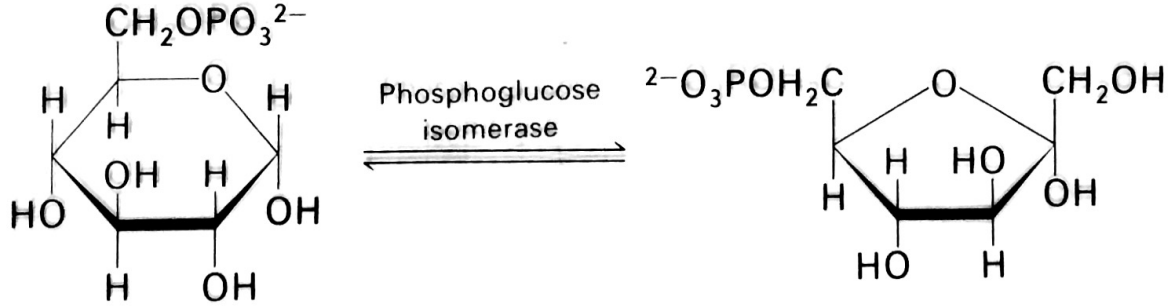
- Other Pathways
- Glycolysis
- Pentose phosphate pathway
- Glycogen Synthesis

	HK	GK
Occurrence	in all tissues	in Liver
Km	< 0.02 mM	10 – 20 mM
Sp.	Glu, Fru, Man, Gal	Glu + others
Induction	Not induced	↑ insulin, Glu
Function	Even low blood glu	only > 100 mg/dl

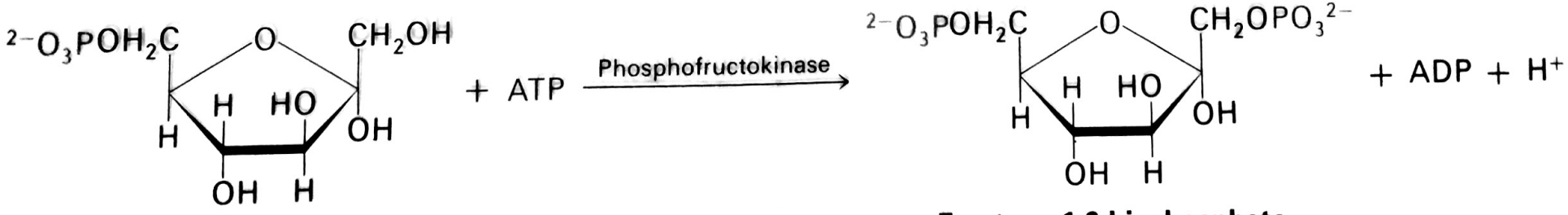
Reactions of GLYCOLYSIS



Glucose **Glucose 6-phosphate**

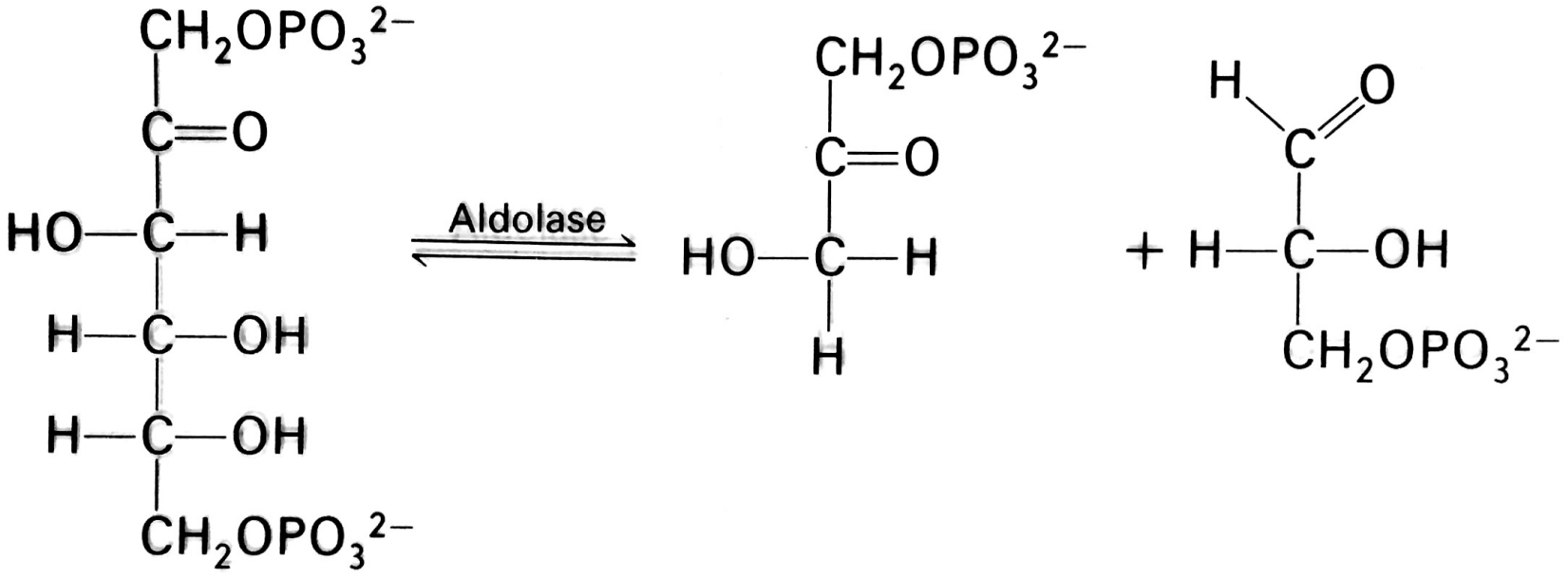


Glucose 6-phosphate **Fructose 6-phosphate**



Fructose 6-phosphate **Fructose 1,6-bisphosphate**

Assorted figures from pages 486 and 487



Fructose 1,6-bisphosphate | **Dihydroxyacetone phosphate** | **Glyceraldehyde 3-phosphate**

Bottom figure, page 487

Glyceraldehyde 3-P dehydrogenase

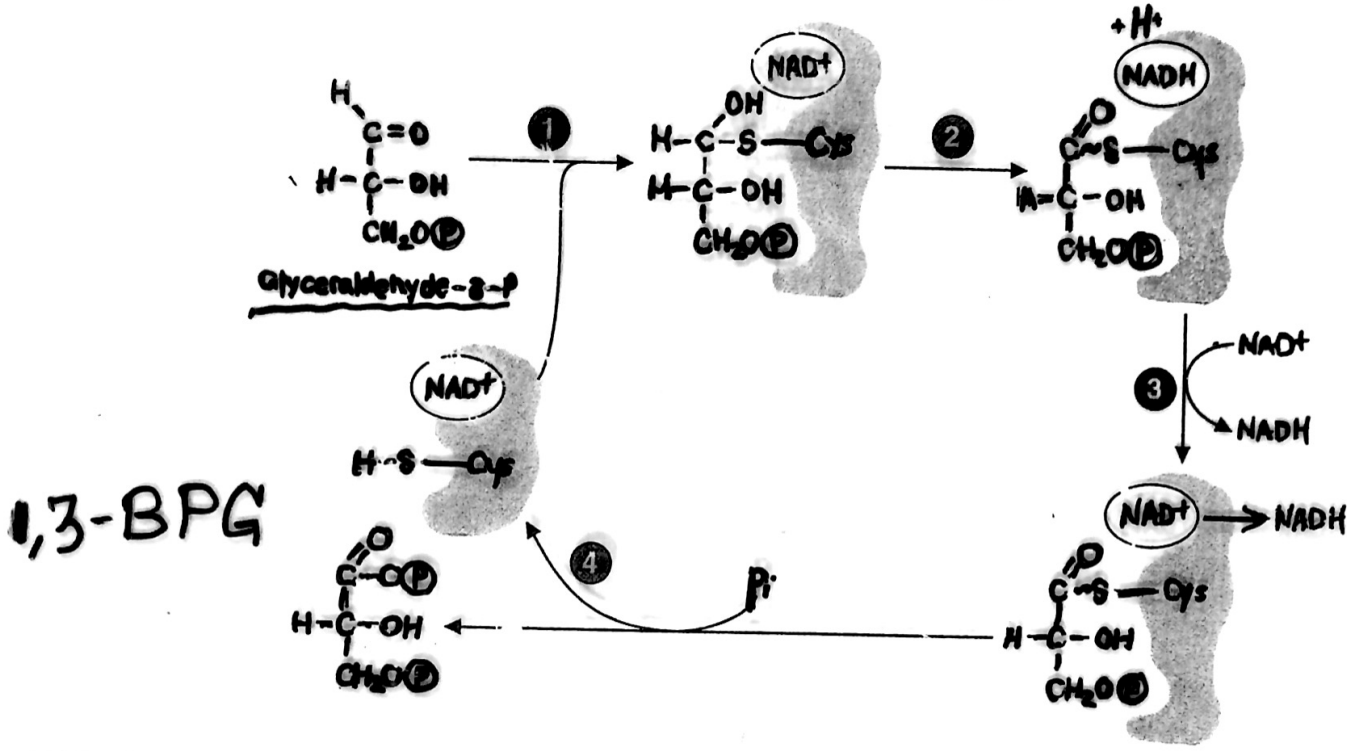
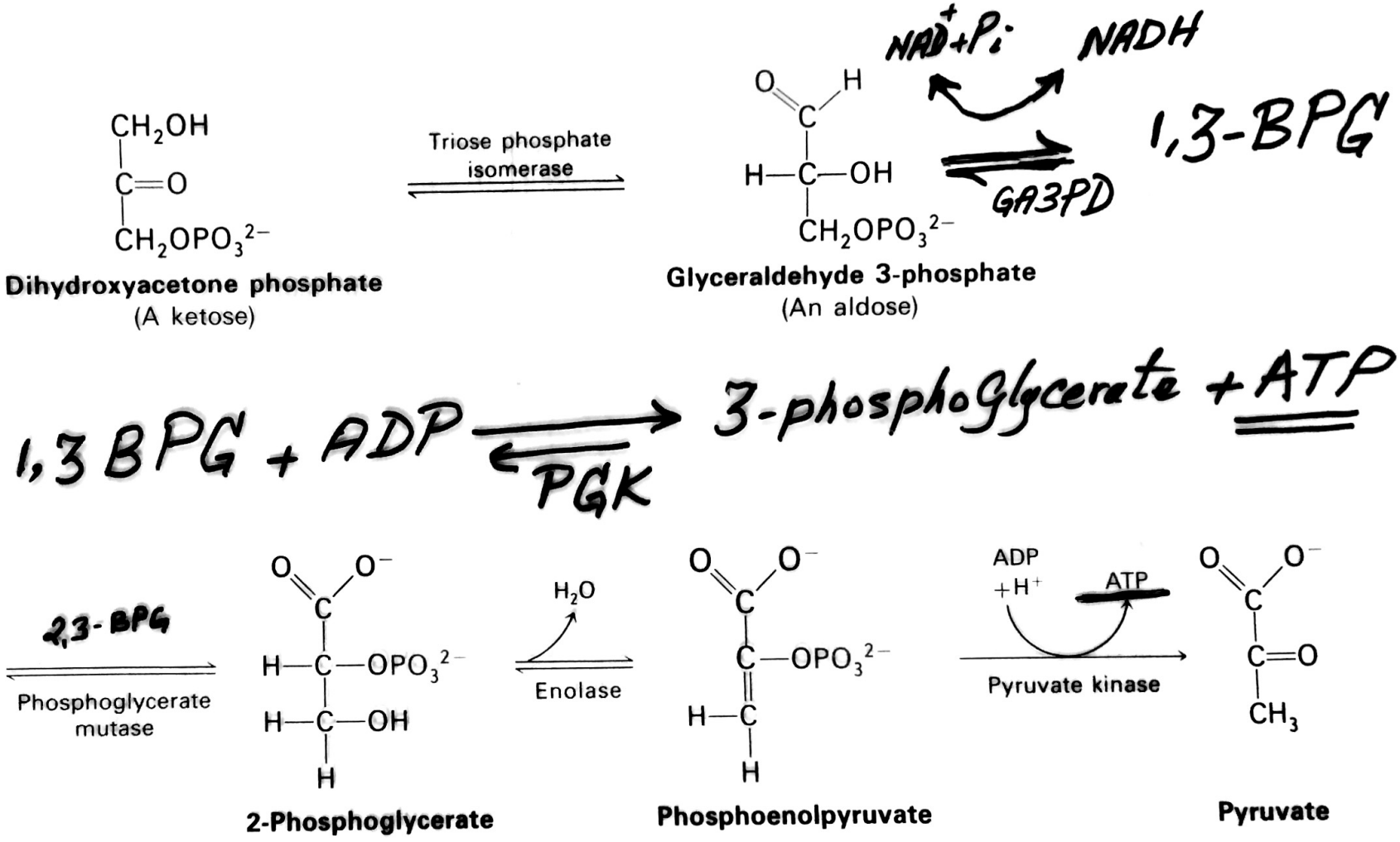


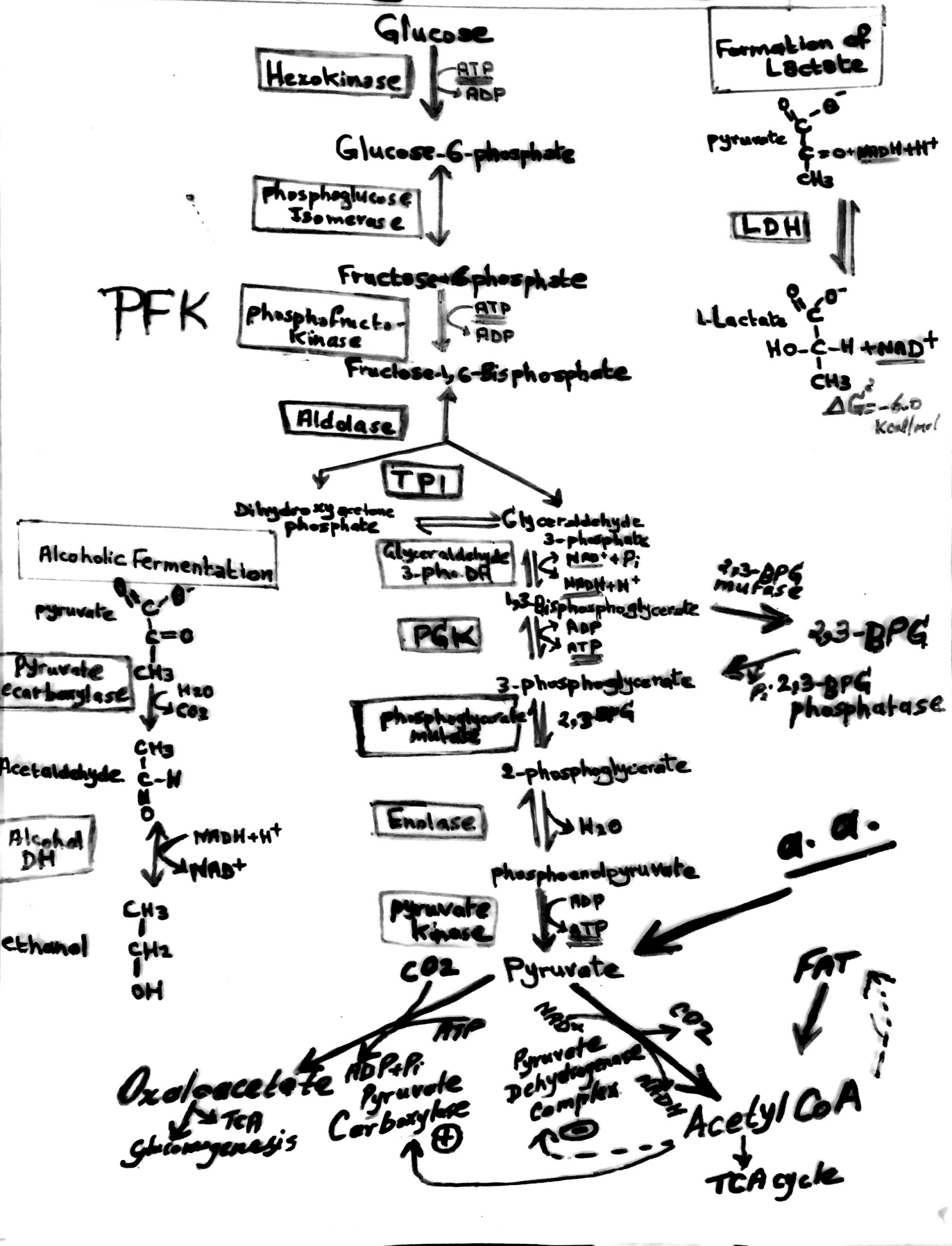
Fig. 22.17. Mechanism of the glyceraldehyde 3-phosphate dehydrogenase reaction. 1. The enzyme forms a covalent linkage with the substrate, using a cysteine group at the active site. The enzyme also contains bound NAD^+ close to the active site. 2. The substrate is oxidized, forming a high-energy thioester linkage (in blue), and NADH. 3. NADH has a low affinity for the enzyme and is replaced by a new molecule of NAD^+. 4. Inorganic phosphate attacks the thioester linkage, releasing the product 1,3 bisphosphoglycerate, and regenerating the active enzyme in a form ready to initiate another reaction.



Glycolytic reactions, pages 488, 489

Stryer: *Biochemistry*, Fourth Edition

The Glycolytic Pathway



Lactate is produced anaerobically to meet the following demands

1. Cells with low energy demand

2. To cope with increased energy demands in vigorously exercising muscle
   Lactate level is increased 5 to 10-fold

3. Hypoxia
   to survive brief episodes of hypoxia
   - but mixed blessings

Lactic Acidosis:- → lactate > 5mM (Ref. range 0.4 – 1.8mM)
→ pH < 7.2 (7.35 – 7.45)
is the most common cause of metabolic acidosis

→ • increased production of lactic acid
  • decreased utilization

Most common cause is impairment of oxidative metabolism resulting from
Collapse of Circulatory System:-
- Impaired O_2 transport
  e.g. myocardial infarction
- Respiratory Failure
  e.g. Pulmonary embolism

- Uncontrolled hemorrhage
- Direct inhibition of Oxidative-phosphorylation

Other Causes:-

- Hypoxia in any tissue
- Alcohol intoxication → ↑↑ NADH/NAD

V. rare

- ↓ gluconeogenesis
- ↓ Pyruvate dehydrogenase
  e.g. inherited deficiency
  .thiamine deficiency
- ↓ TCA activity
- ↓ Pyruvate Carboxylase deficiency