

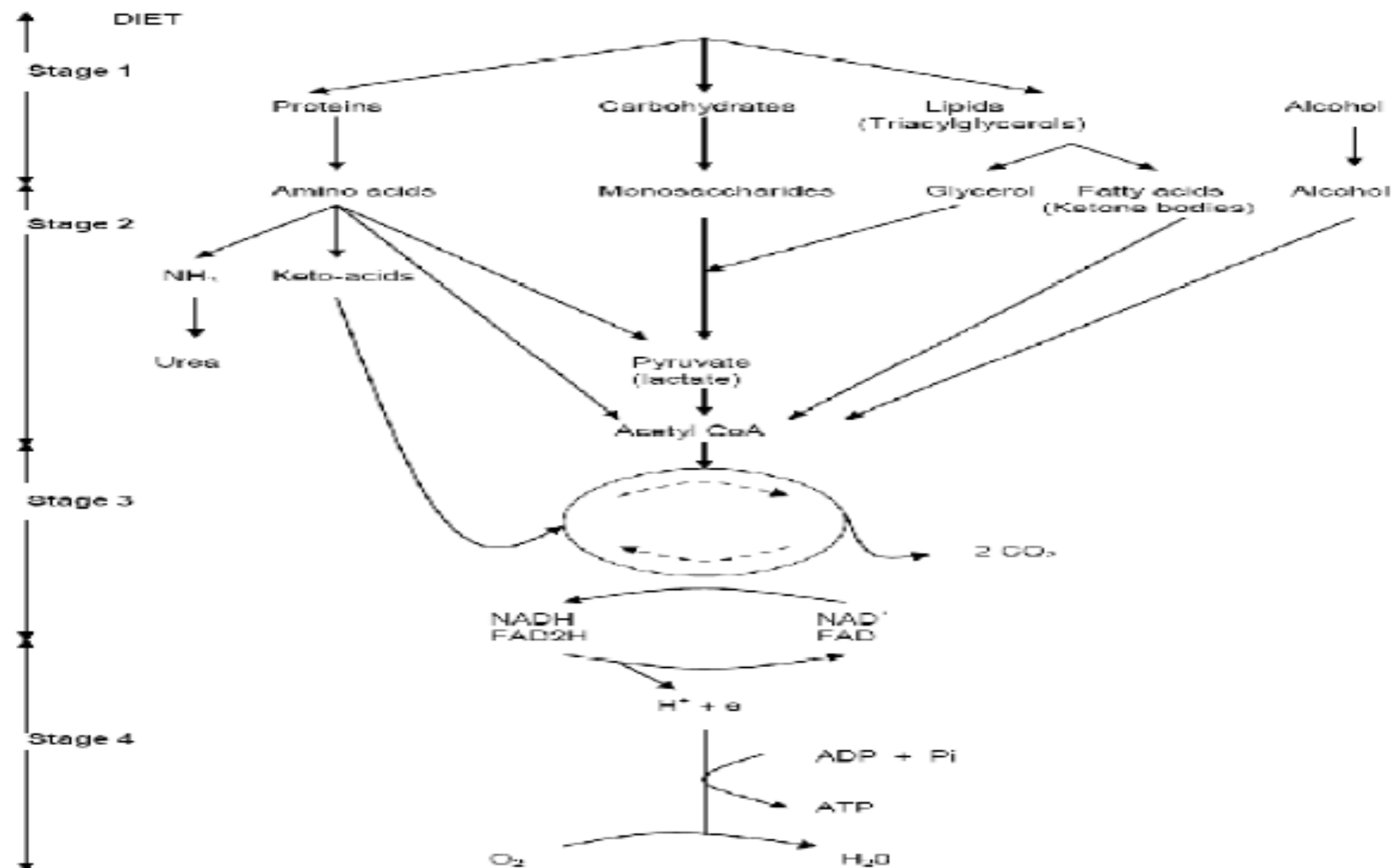
Session 1

Lecture 1

Carbohydrate

Dr. Abdullah Ali

Overview of Catabolism



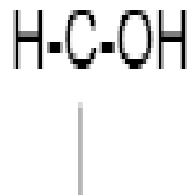
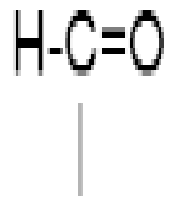
Dietary carbohydrates

Carbohydrates

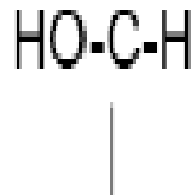
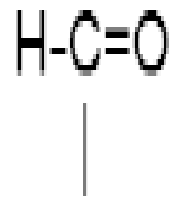
- They have the formula $(\text{CH}_2\text{O})_n$
- Contain $-\text{CHO}$ or $-\text{C}=\text{O}$ groups and several $-\text{OH}$ groups
- Classified as mono, di and poly carbohydrates
- Constitutes the major part of our diet

Monosaccharides

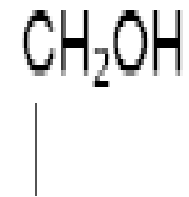
- May be trioses, pentoses, hexoses or others



D-glyceraldehyde



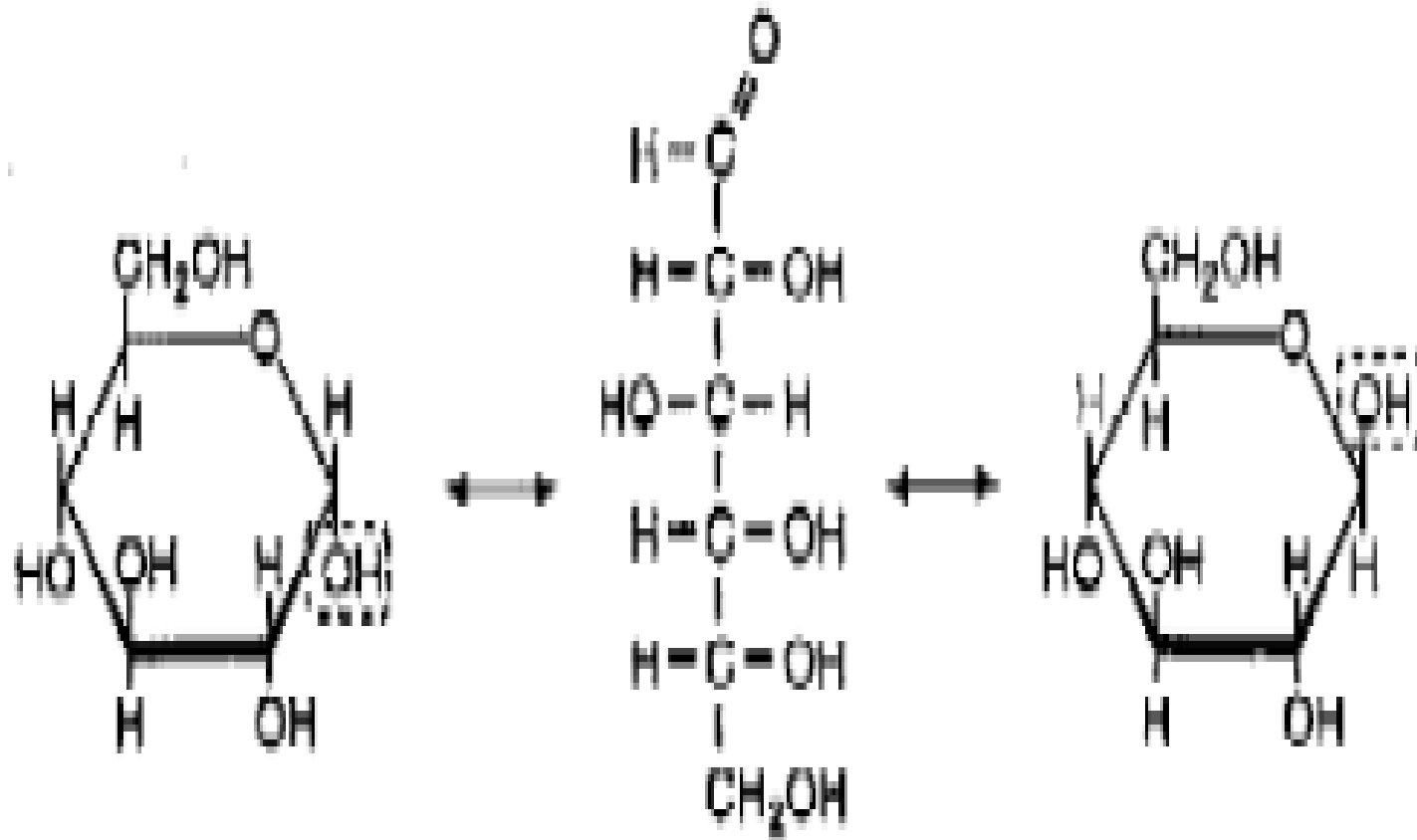
L-glyceraldehyde



dihydroxyacetone

Monosaccharides

- They have at least one asymmetric carbon atom, accordingly they are classified into D and L isomers
- May contain 3, 4, 5, 6, 7, 8 or 9 carbon atoms
- Form ring structures
- Hydrophilic, do not readily cross cell membran
- May be partially oxidized, need less O₂



α -D-glucose (ring)

D-glucose (open chain)

β -D-glucose (ring)

Most important Saccharides for human

- Monohexoses
Glucose, Fructose and Galactose
- Disaccharides
Maltose, Lactose and Fructose
- Polysaccharides
Starch and Glycogen

Stage 1 of Carbohydrate metabolism: (Digestion and absorption)

Digestion

- Start in oral cavity by salivary amylase
- Continued in the duodenum by pancreatic amylase
- Completed in duodenum and jejunum by maltase, lactase, isomaltase and others

Absorption

- It is carried out from the gut to the absorptive cells by active transport
- From the absorptive cells to other cells by facilitated diffusion Which need glucose transporters (GLUT 1 to 5)
- Synthesis of some transporters are is enhanced by insulin (GLUT 4) in muscles and adipose tissues

Stage 2 of Carbohydrate Metabolism

Starts with glycolysis

It is characterized by:

- Ten reactions
- In the cytosol
- The function of glycolysis is to produce energy (ATP) and provide cells with essential metabolites, in particular trioses.

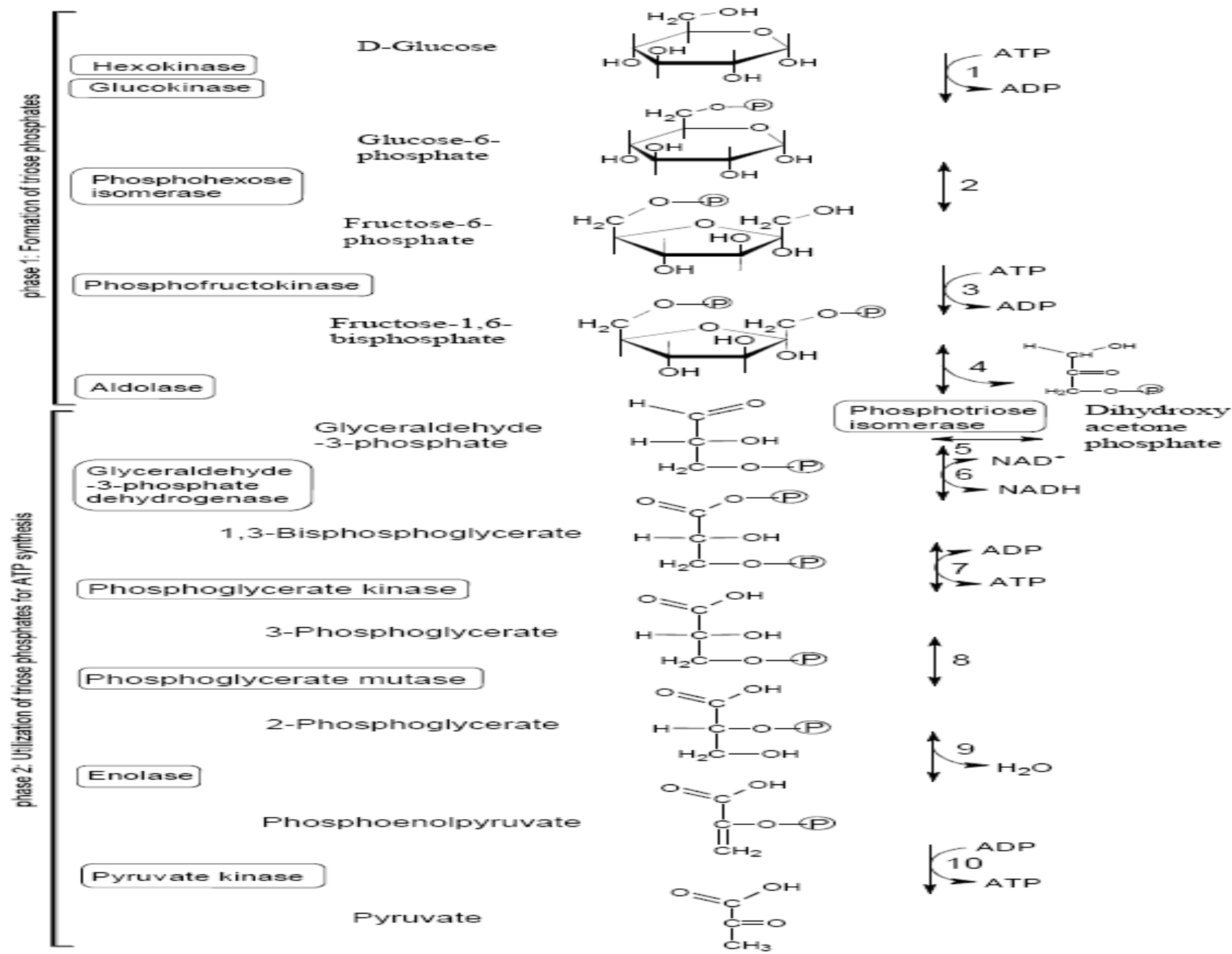


Fig 1: Glycolysis

Glycolysis

- Three of them are irreversible, 7 reversible
- May be aerobic or anaerobic
- Conversion of glucose to G-6-P is achieved by 2 enzymes

Glucokinase in liver

Hexokinase in other tissues

Glycolysis

- Phosphorylation of glucose is important step due to
 - Makes glucose anionic
 - Increase the reactivity of sugare
 - Makes high energetic compounds

Glycolysis

- Insulin Induces glucose uptake in several tissues in particular muscles and adipose tissues, in other it could not do so
- In red blood cells, the first site of ATP formation may be bypassed. 1,3- bisphosphoglycerate is converted to 2,3-BPG by BPG mutase. 2,3-BPG can bind to hemoglobin, decreasing its affinity for oxygen, and making it available to tissues in some circumstances for example high altitude areas.

Control of glycolysis

- HK is inhibited by G-6-P
- PFK is inhibited by citrate and by normal cellular concentration of ATP (negative allosteric effector), and induced by 5-AMP (positive allosteric effector). It is also regulated hormonally in liver (insulin stimulates and glucagon inhibits). Reaction 3 is the first reaction unique to glycolysis. It is known as the committing step since it commits glucose to metabolism by glycolysis.
- PK is regulated by covalent modification, thus phosphorylation deactivates this enzyme.

Significance of lactate production

