



INTRODUCTION TO METABOLISM

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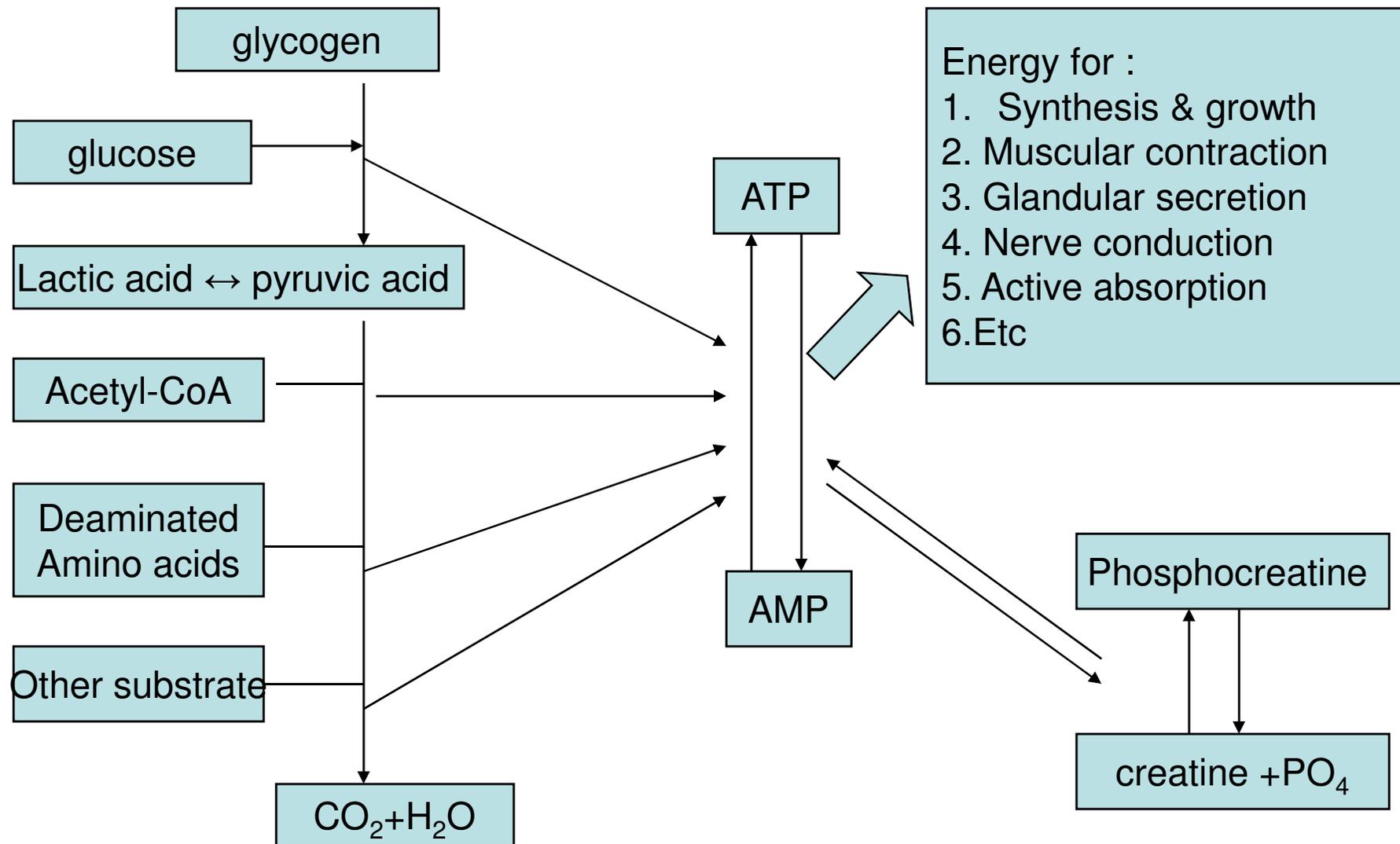
Metabolism

- ALL CHEMICAL REACTIONS NECESSARY TO MAINTAIN LIFE
- Anabolic reactions – synthesis of larger molecules from smaller ones
- Catabolic reactions – hydrolysis of complex structures into simpler ones

Metabolism

- Cellular respiration – **food** fuels are broken down within cells and some of the energy is captured to **produce ATP**
- Enzymes shift the high-energy phosphate groups of ATP to other molecules
- These phosphorylated molecules are activated to perform cellular functions

ATP functions : “energy currency” in metabolism

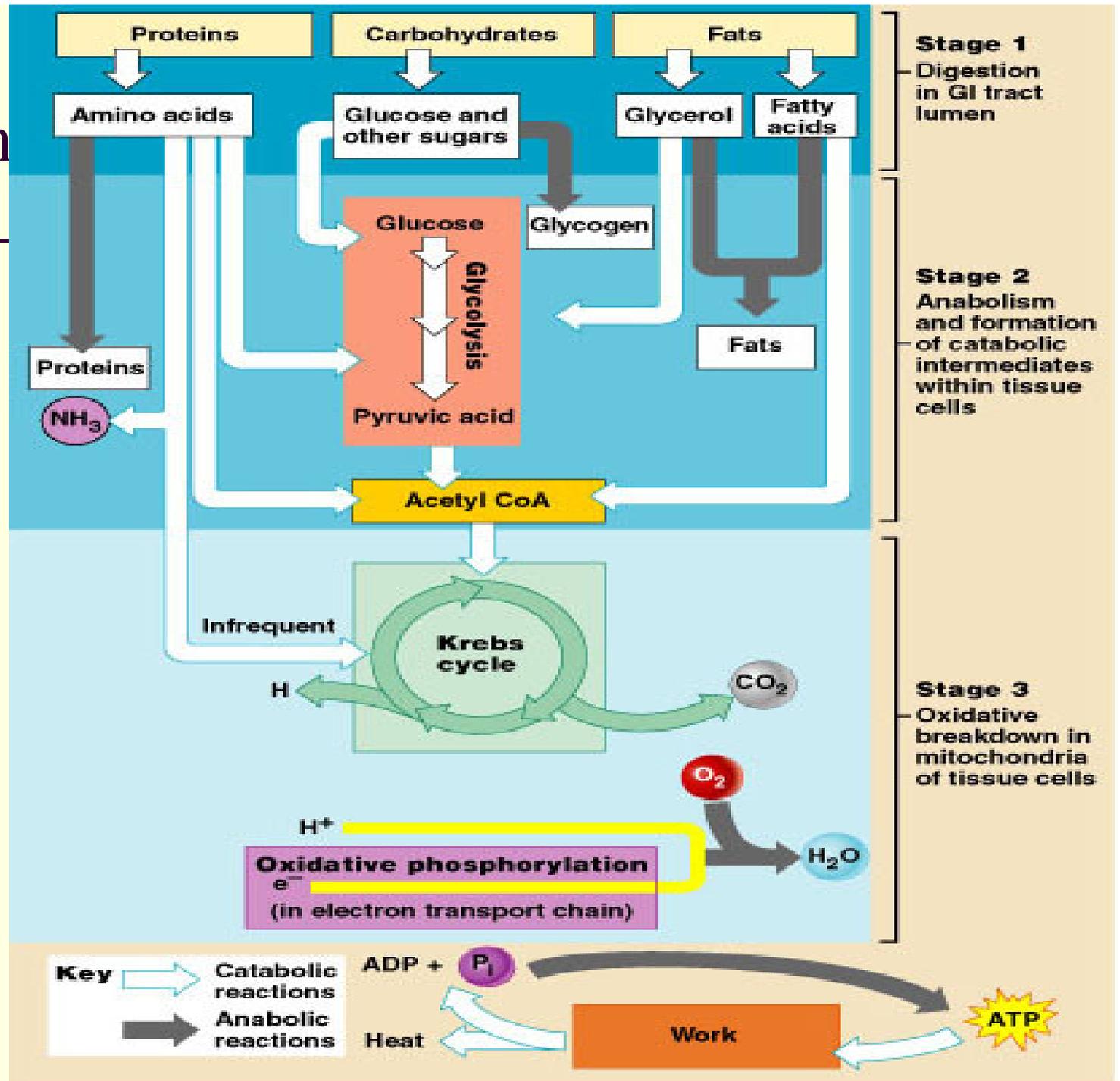


Stages of Metabolism

Energy-containing nutrients are processed in three major stages :

- **Digestion** – breakdown of food; nutrients are transported to tissues
- **Anabolism and formation of catabolic intermediates** where nutrients are:
 - Built into lipids, proteins, and glycogen
 - Broken down by catabolic pathways to pyruvic acid and acetyl CoA
- **Oxidative breakdown** – nutrients are catabolized to carbon dioxide, water, and ATP

Stages of Metabolism



Absorptive and Postabsorptive States

Metabolic controls equalize blood concentrations of nutrients between two states

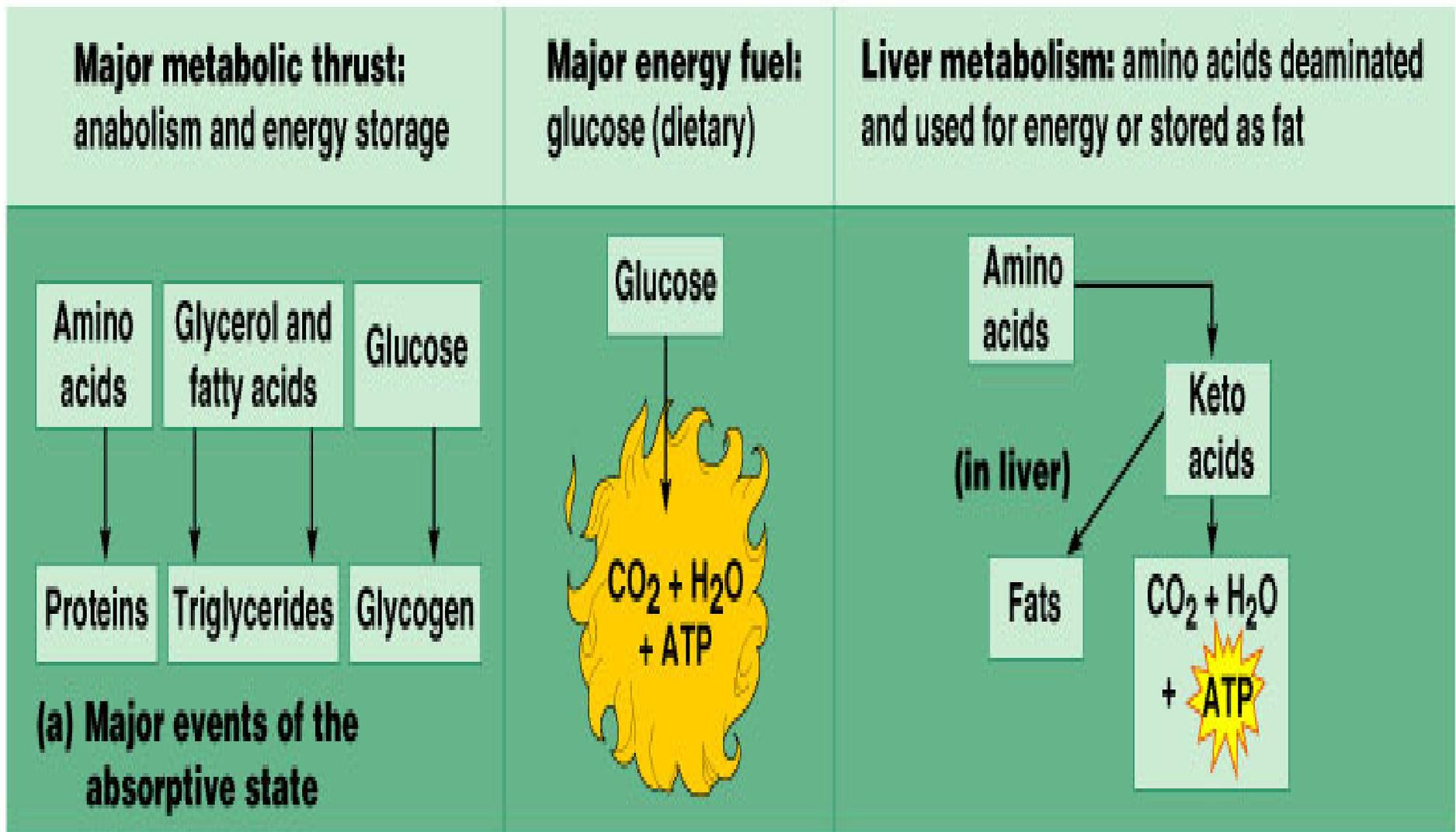
□ Absorptive

- The time during and shortly after nutrient intake

□ Postabsorptive

- The time when the GI tract is empty
- Energy sources are supplied by the breakdown of body reserves

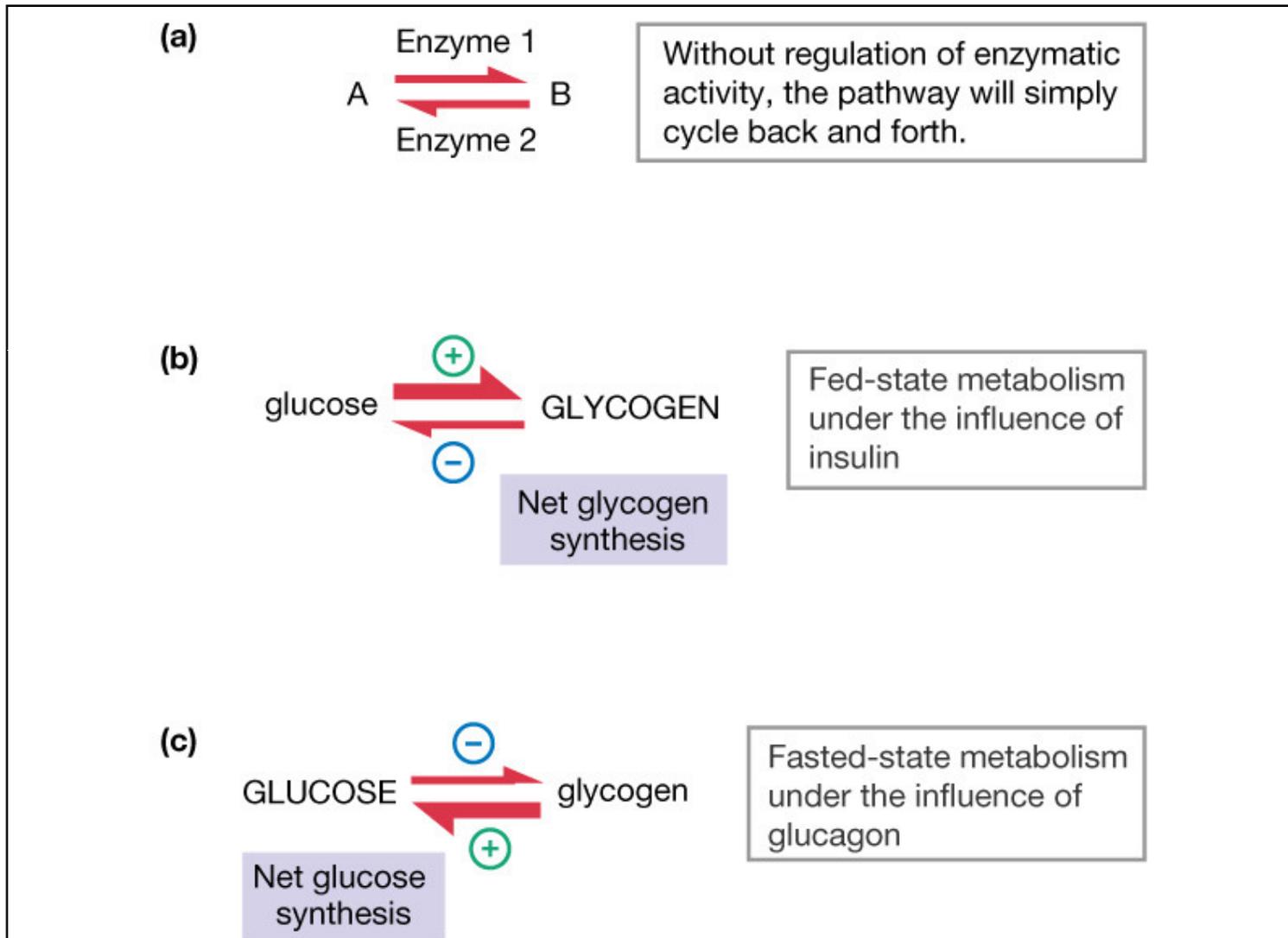
Absorptive State , “Fed State” : Anabolic Processes



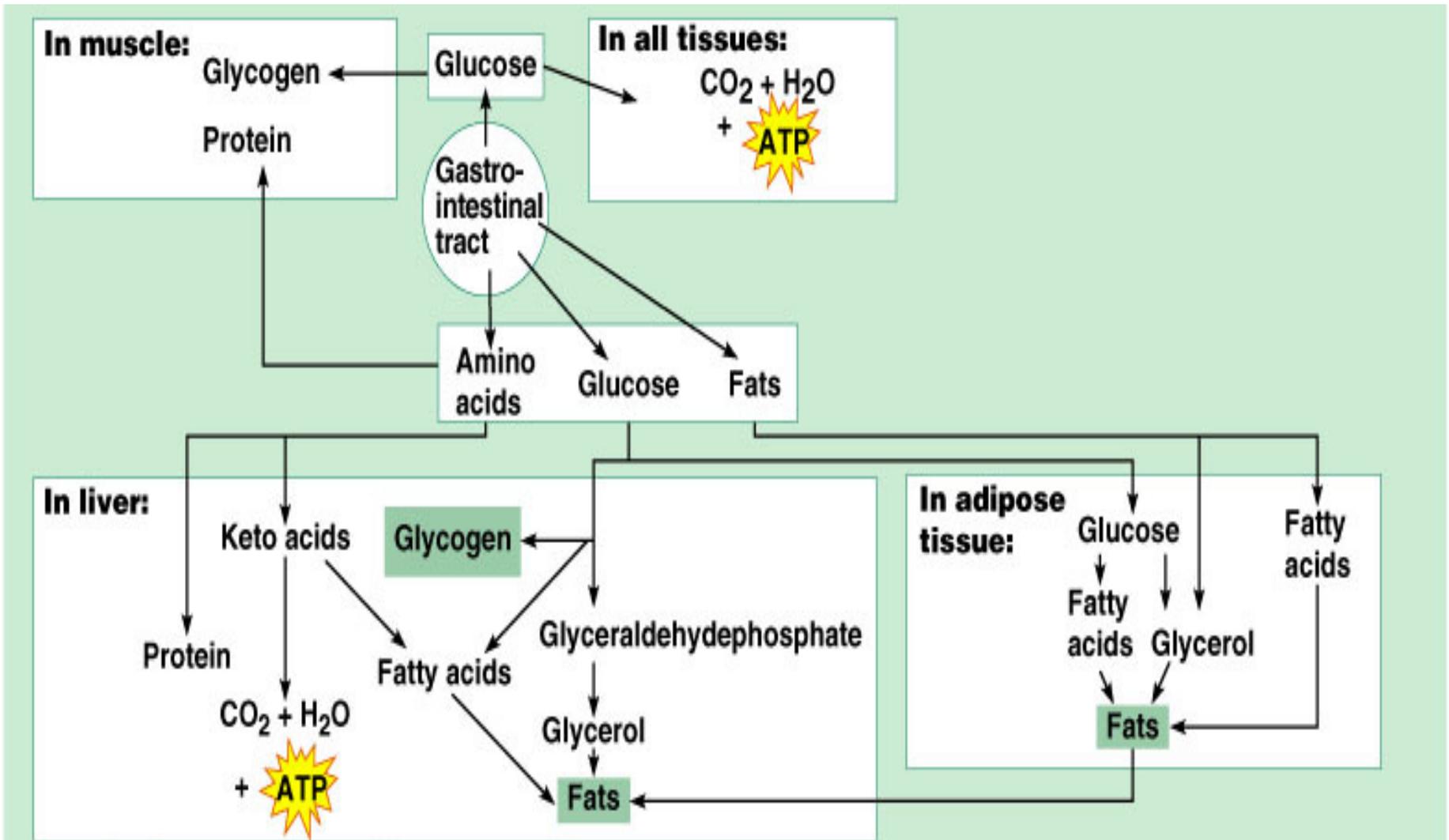
Absorptive State

- The major metabolic thrust is anabolism and energy storage
 - Amino acids become proteins
 - Glycerol and fatty acids are converted to triglycerides
 - Glucose is stored as glycogen
- Dietary glucose is the major energy fuel
- Excess amino acids are deaminated and used for energy or stored as fat in the liver

□ Reversible pathways shift to anabolic processes



Principal Pathways of the Absorptive State



(b) Principal pathways of the absorptive state



Principal Pathways of the Absorptive State

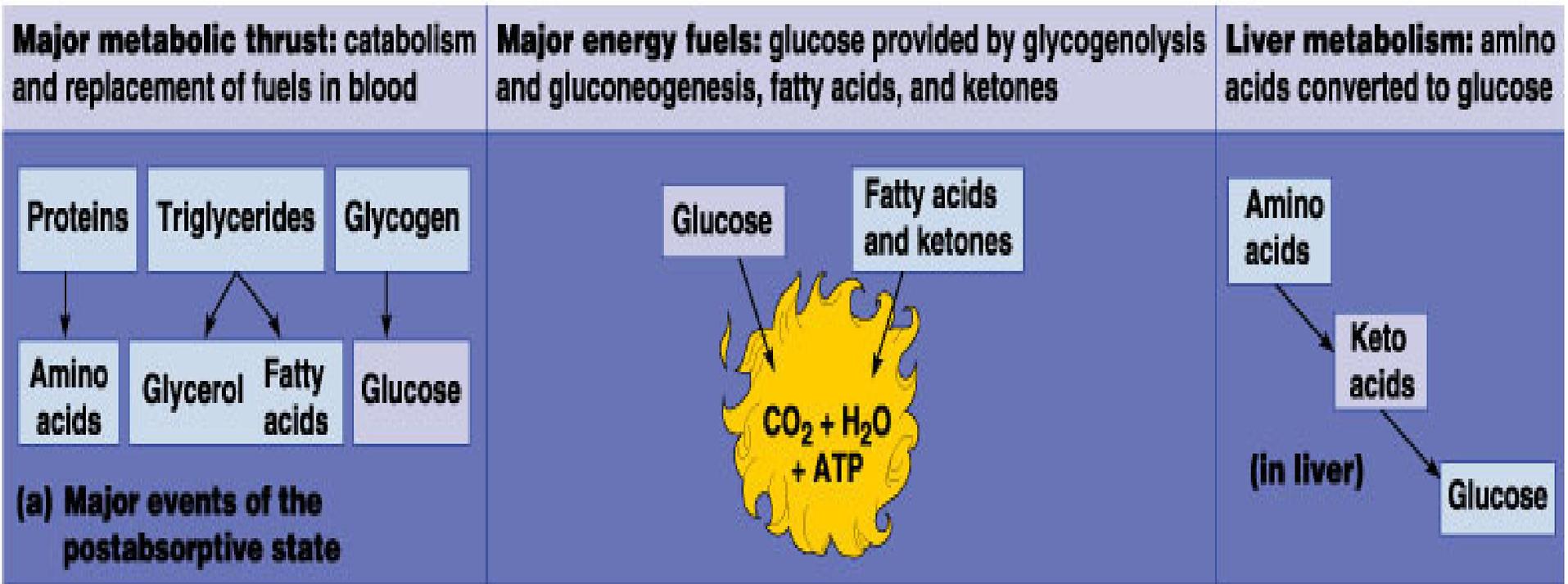
- In muscle:
 - Amino acids become protein
 - Glucose is converted to glycogen
- In the liver:
 - Amino acids become protein or are deaminated to keto acids
 - Glucose is stored as glycogen or converted to fat



Principal Pathways of the Absorptive State

- In adipose tissue:
 - Glucose and fats are converted and stored as fat
- All tissues use glucose to synthesize ATP

Postabsorptive State, “Fasted State” : Catabolic



Postabsorptive State,

- The major metabolic thrust is catabolism and replacement of fuels in the blood
 - Proteins are broken down to amino acids
 - Triglycerides are turned into glycerol and fatty acids
 - Glycogen becomes glucose



- Glucose is provided by glycogenolysis and gluconeogenesis

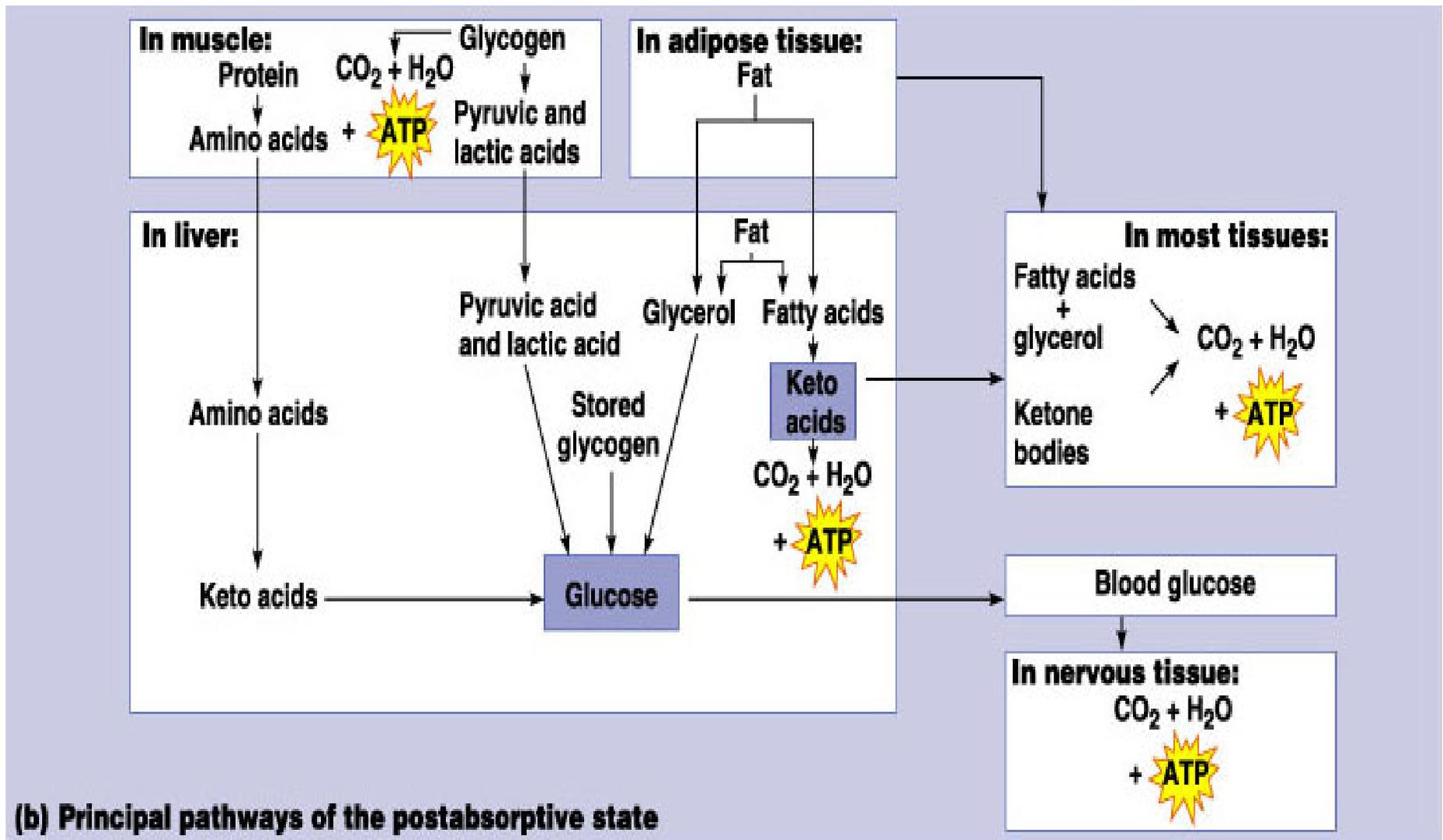
- Fatty acids and ketones are the major energy fuels

- Amino acids are converted to glucose in the liver

- Pathways shift to maintain energy for metabolism

- Storage → glucose in blood → organs in need

Principle Pathways in the Postabsorptive State



(b) Principal pathways of the postabsorptive state



Principle Pathways in the Postabsorptive State

- In muscle:
 - Protein is broken down to amino acids
 - Glycogen is converted to ATP and pyruvic acid (lactic acid in anaerobic states)
- Glucose from the liver is used by the nervous system to generate ATP

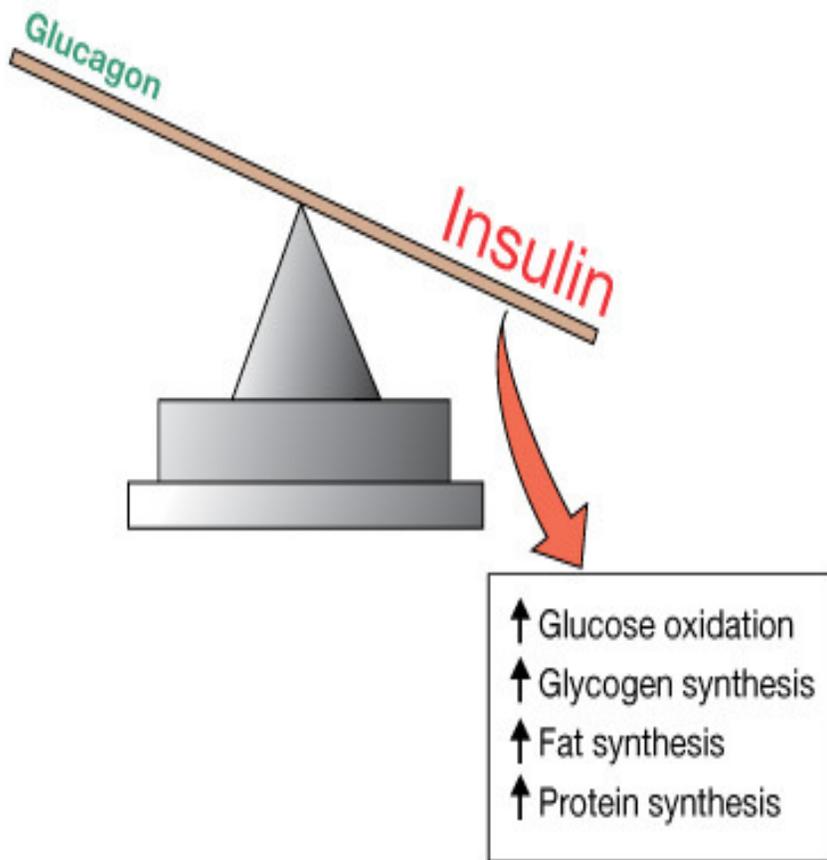


Principle Pathways in the Postabsorptive State

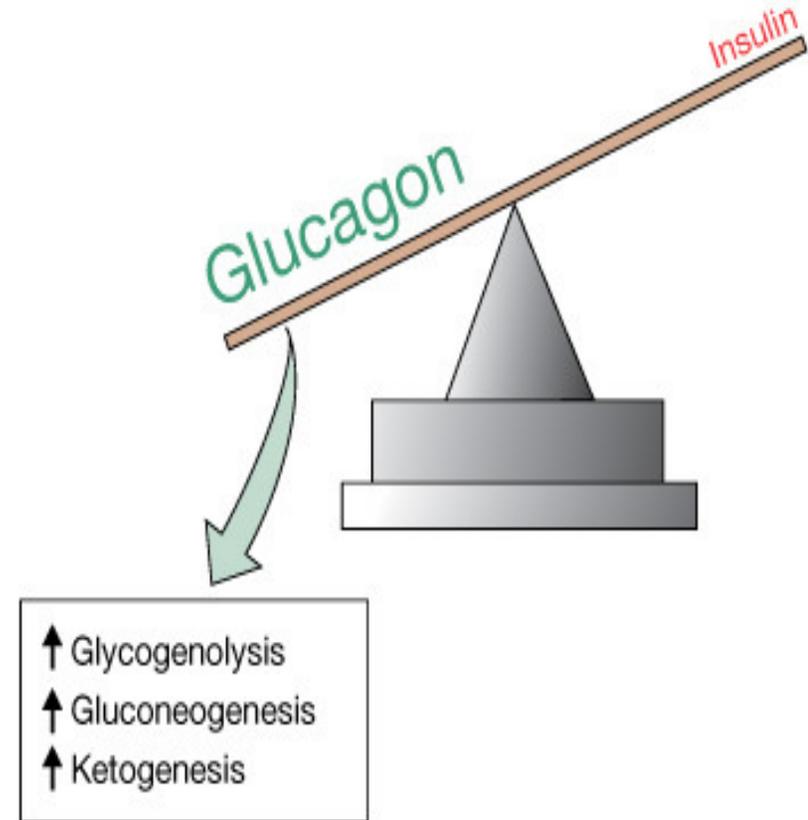
- In the liver:
 - Amino acids, pyruvic acid, stored glycogen, and fat are converted into glucose
 - Fat is converted into keto acids that are used to make ATP
- Fatty acids (from adipose tissue) and ketone bodies (from the liver) are used in most tissue to make ATP

DOMINATION OF INSULIN & GLUCAGON IN METABOLIC INTERACTION

(a) Fed state: insulin dominates



(b) Fasted state: glucagon dominates



Regulation by other hormones

- Adrenalin , Cortisol
- Growth hormone
- Testosterone
- Thyroid hormones



Thank you

