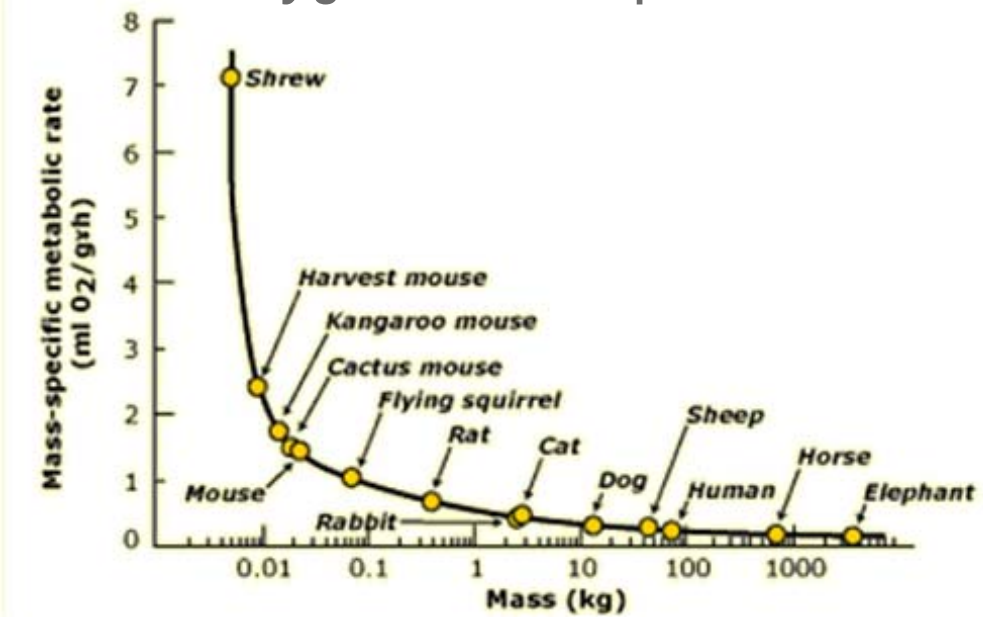
REGULATING THE RATE OF CELLULAR RESPIRATION

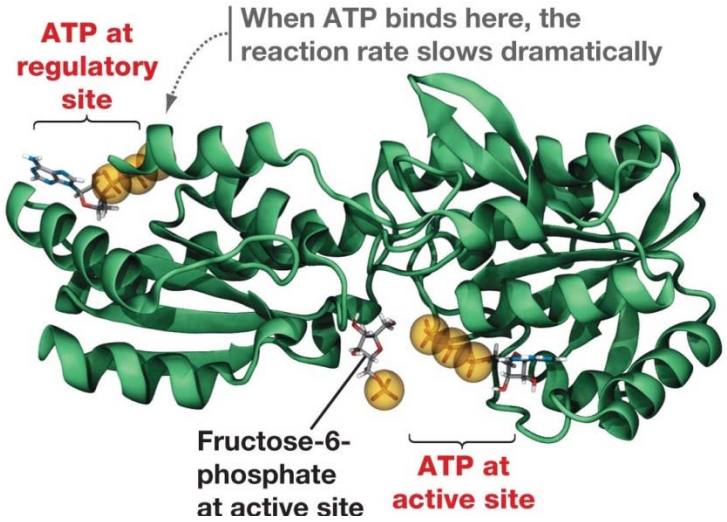
RATE OF CELLULAR RESPIRATION

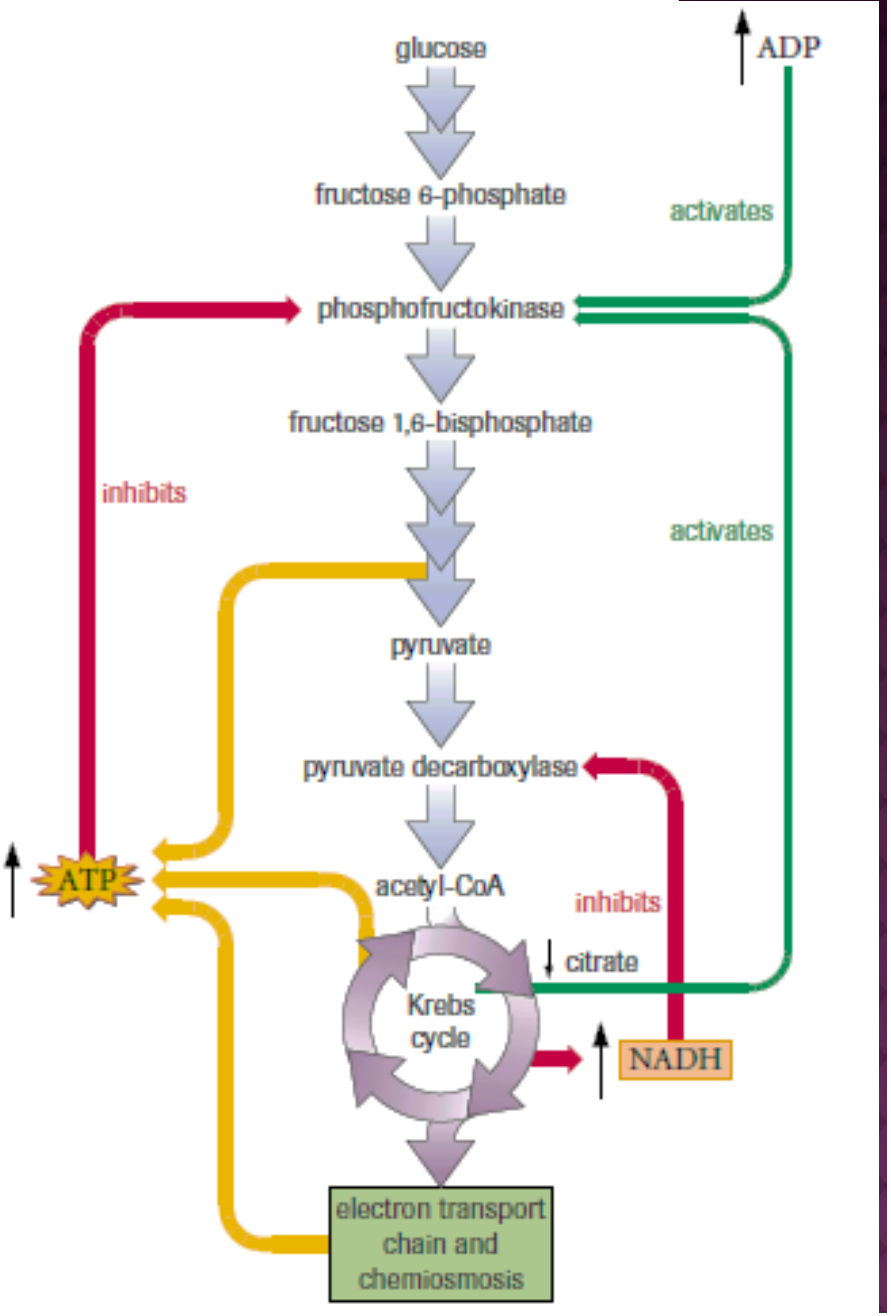
- Due to Supply and Demand
  - High demand when working / Low when resting
- Basal metabolic rate:
  - Amount of energy expended per unit time at rest
  - Measured in oxygen consumption



REGULATING CELLULAR RESPIRATION: 1) FEEDBACK

- Enzymes often controlled by **FEEDBACK**
- **Phosphofructokinase (PFK)** most important
  - Build-up of **ATP** inhibits PFK
  - Decrease in **citrate** activates PFK
  - Increase in **ADP** activates PFK

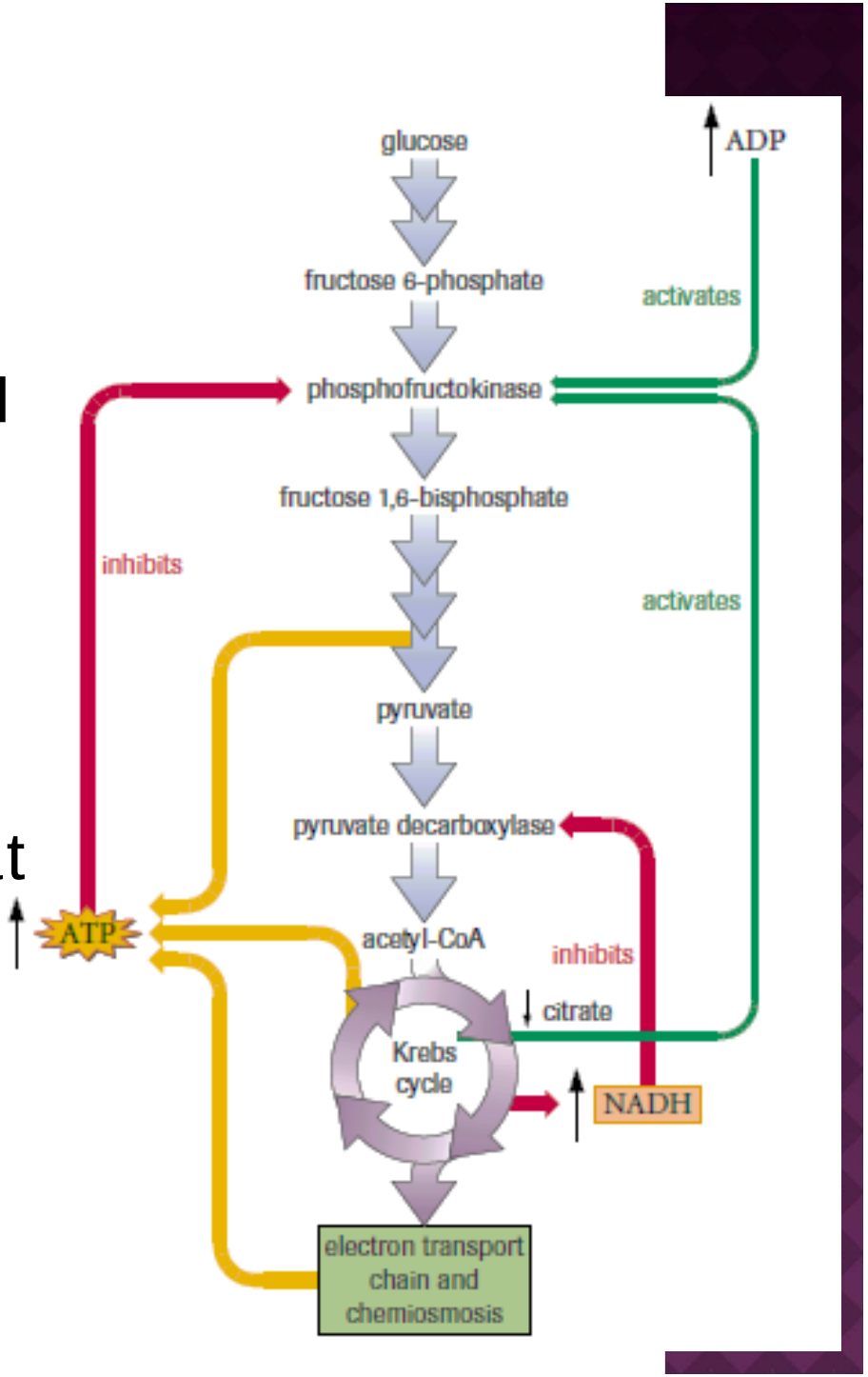




MORE FEEDBACK

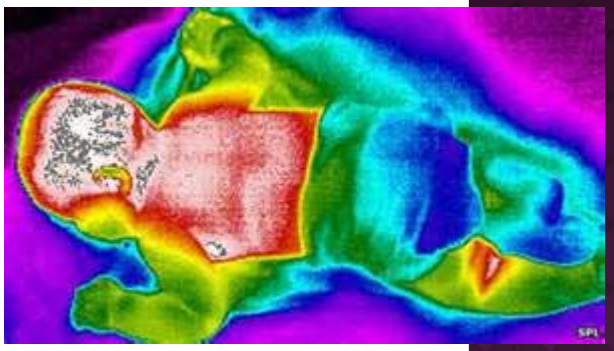
- **Pyruvate decarboxylase** inhibited by increase in NADH

- Excess glucose stored as glycogen or converted into fat



2) UNCOUPLING OF ETC

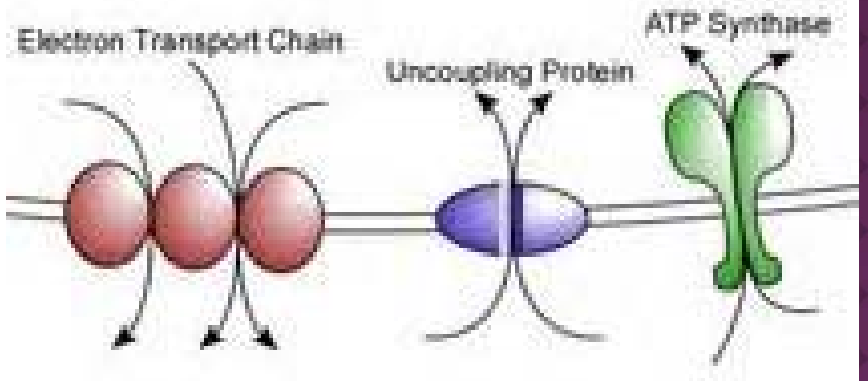
- Certain tissues – brown adipose
- Alternate pathway for H^+ from intermembrane space into matrix
- **No** ATP produced
- Thermal energy released
- Aids in maintaining body temperature



Ex. hibernating animals (bears)

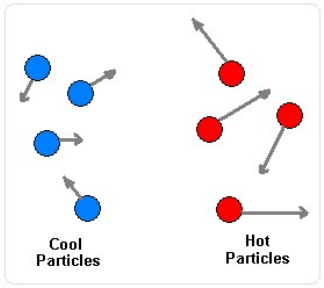
some species of birds

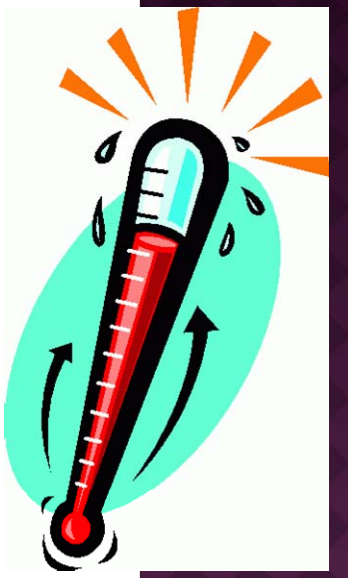
human babies

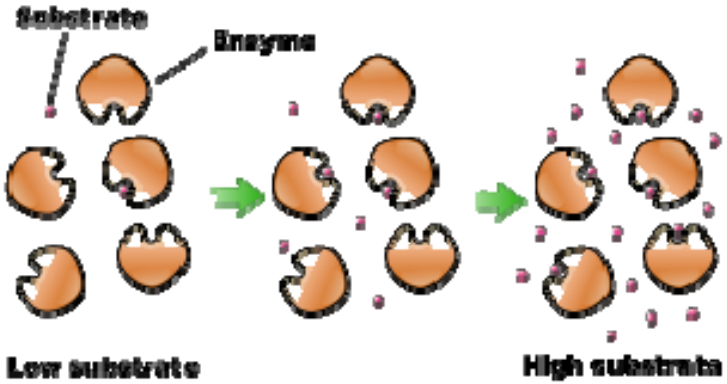


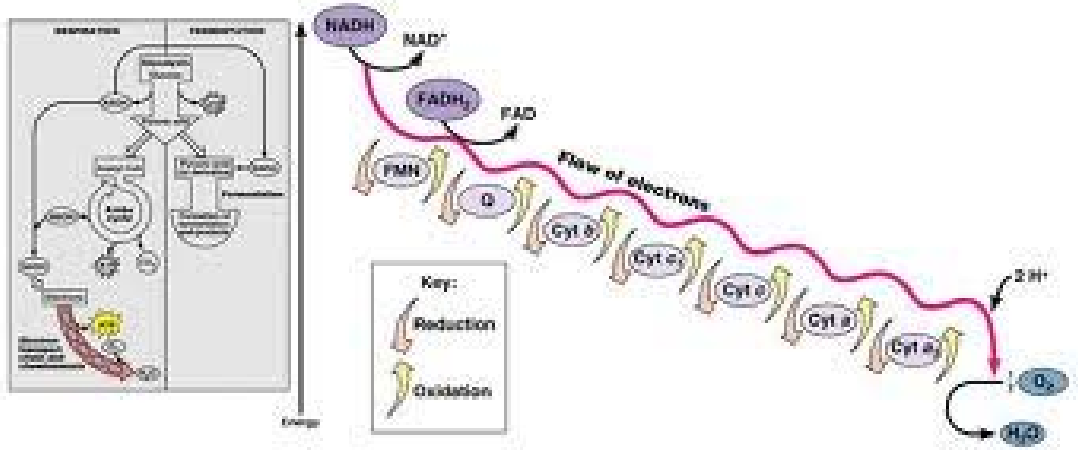
3) OTHER FACTORS AFFECTING RATE OF CELLULAR RESPIRATION

- Temperature
  - Higher temp, faster reactions move
- Concentration of nutrients
  - Higher concentration, faster reaction moves
- Availability of oxygen



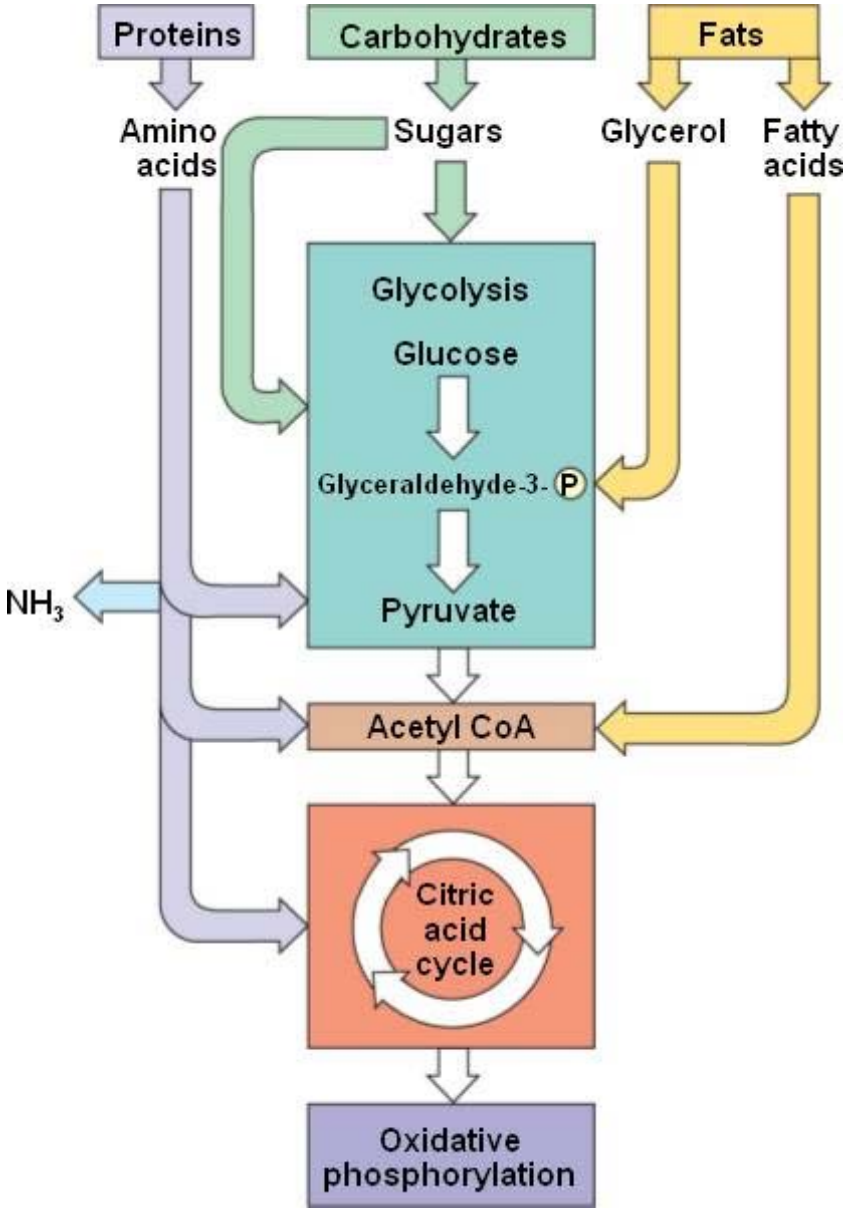




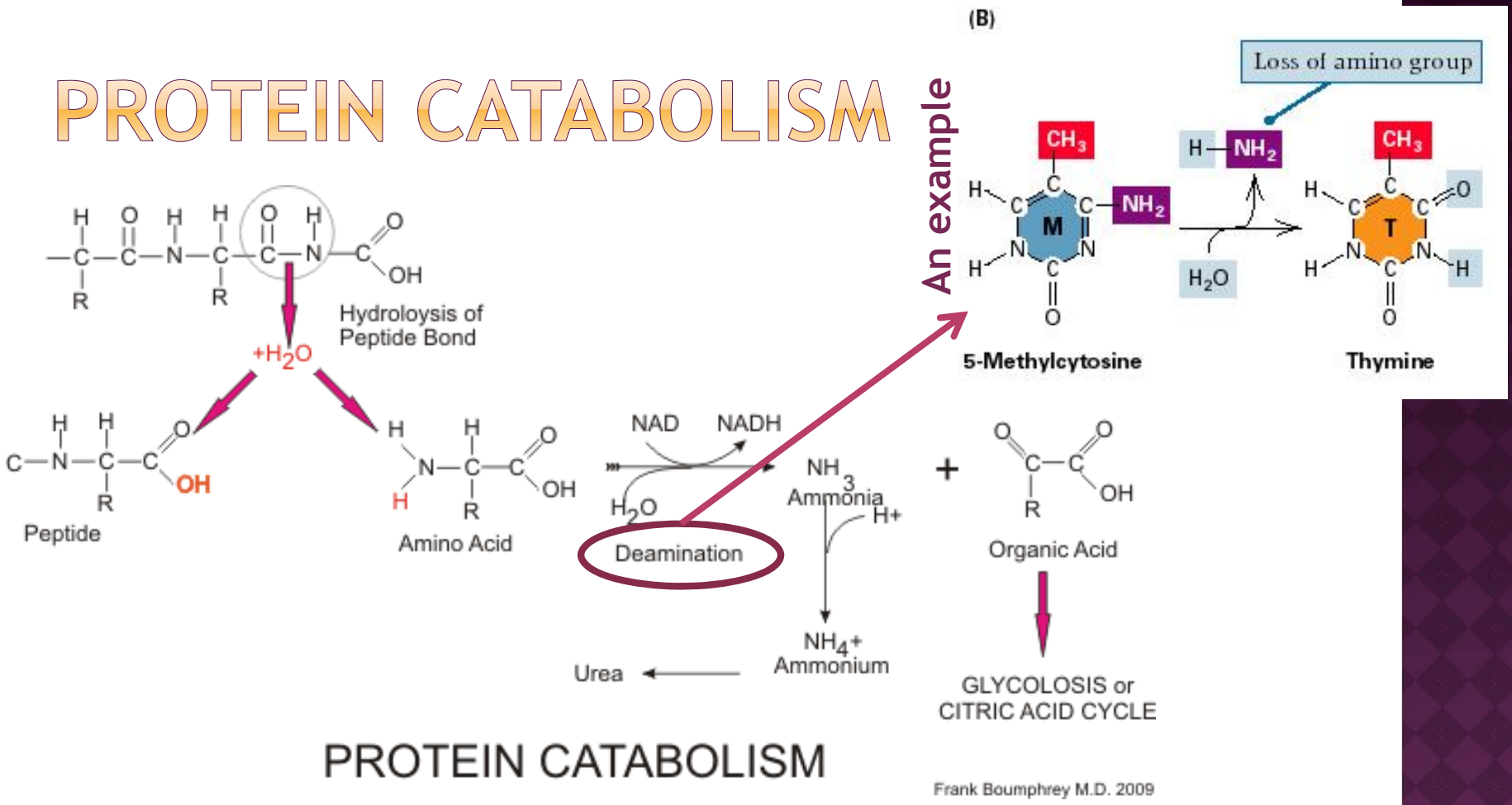


ALTERNATIVES TO GLUCOSE CATABOLISM

- Carbohydrates
- Proteins
- Lipids (Fats)



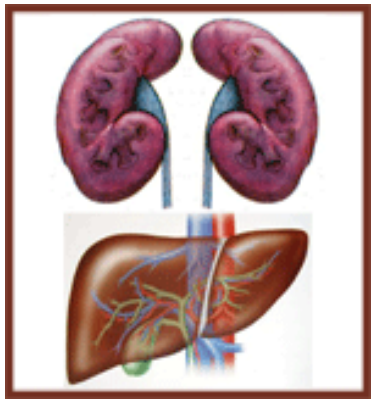
PROTEIN CATABOLISM



- Breaks Protein into amino acids
- **Deamination** – Removal of the amino group (NH_2) of an amino acid as ammonia (NH_3)

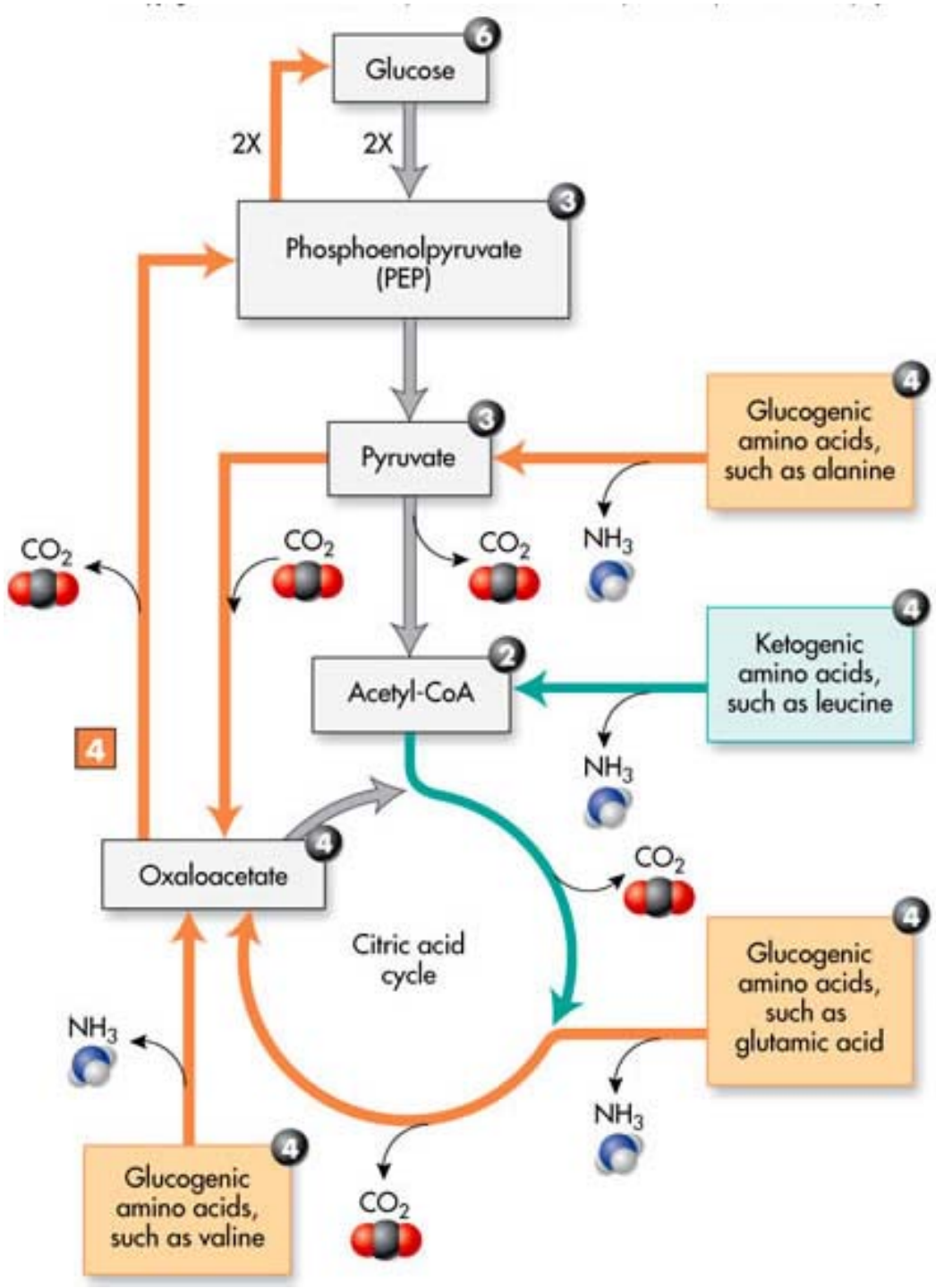
PROTEIN CATABOLISM

- Remaining amino acids converted into components that fit into glycolysis or Krebs cycle
  - *Leucine → acetyl-CoA*
  - *Alanine → pyruvate*
  - *Proline → a-ketoglutarate*



- Occurs in Liver, ammonia removed excreted in urine

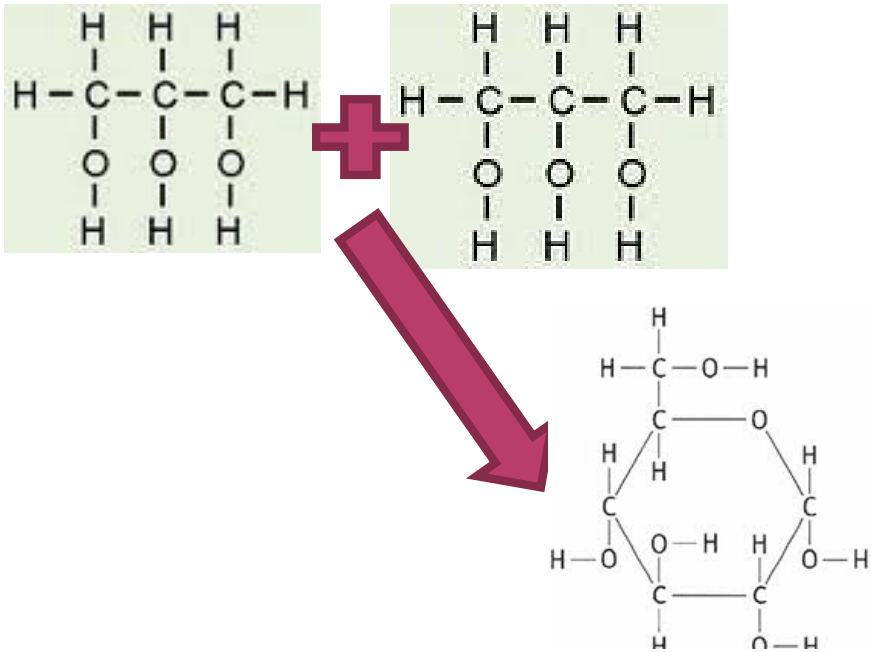
FYI

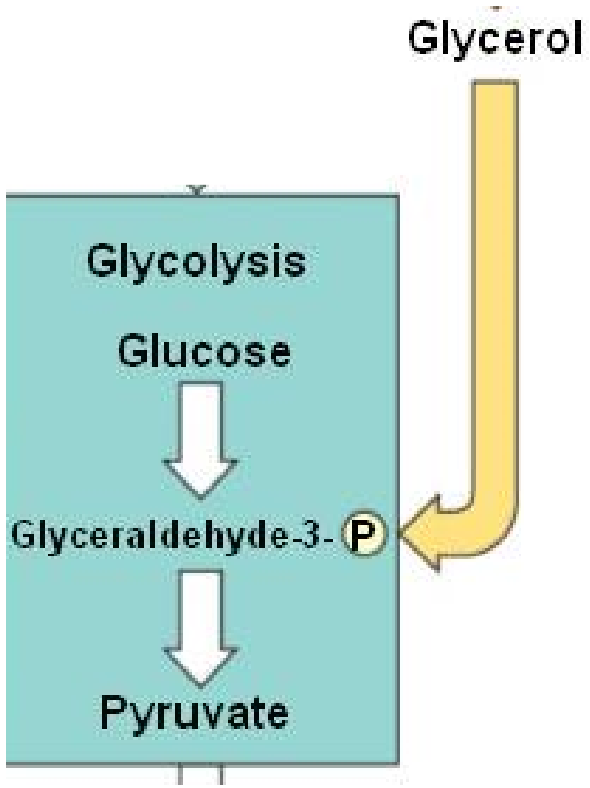

Glucose
6
2X
2X
Phosphoenolpyruvate (PEP)
3
Pyruvate
3
Glucogenic amino acids, such as alanine
4
CO_2
CO_2
CO_2
NH_3
Ketogenic amino acids, such as leucine
4
Acetyl-CoA
2
NH_3
4
Oxaloacetate
4
CO_2
Citric acid cycle
Glucogenic amino acids, such as glutamic acid
4
NH_3
NH_3
Glucogenic amino acids, such as valine
4
CO_2

LIPID CATABOLISM

- Triglycerides broken down into glycerol and fatty acids
- 2 **glycerol** molecules can combine to form
  - glucose (via gluconeogenesis)

    OR
  - DHAP (and in turn G3P)





LIPID CATABOLISM

- **Fatty acids** enter the mitochondrial matrix & undergo **ß-oxidation** to become acetyl-CoA
  - 2 carbon acetyl group removed & binds with CoA
  - *Ex. 12-C fatty acid could produce 6 acetyl-CoA molecules*

- Each cleavage:
  - Uses 1 ATP
  - Produces 1 NADH & 1 $FADH_2$