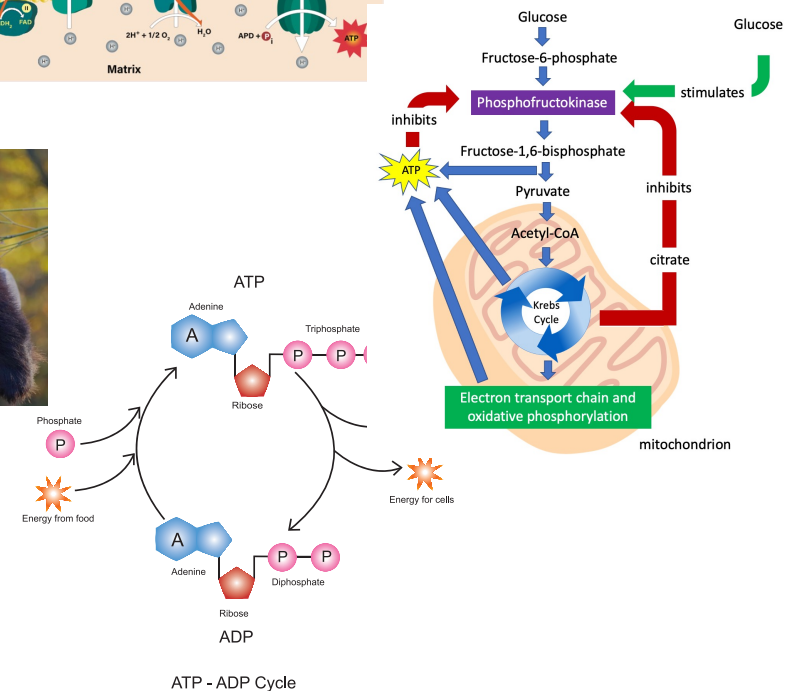
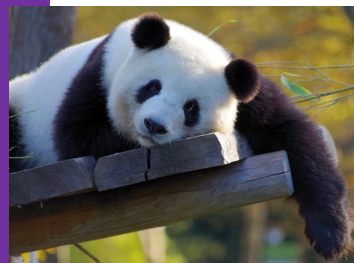
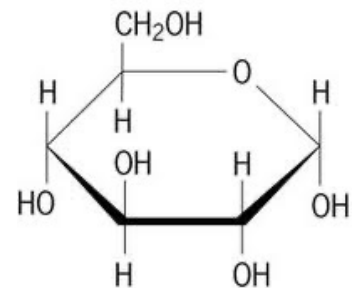
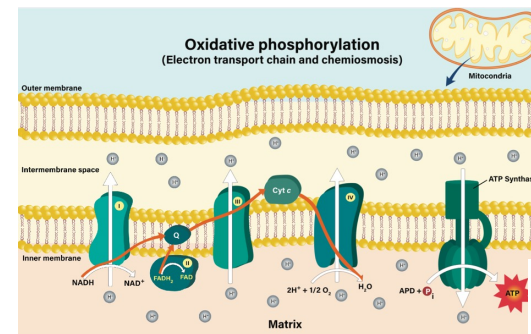


Efficiency and Regulation of Cellular Respiration

- How much ATP do we make?
- The Efficiency of Aerobic Respiration
- Metabolic rates
 - BMR
- Regulating Cellular Respiration
- Alternatives to Glucose



Preview File

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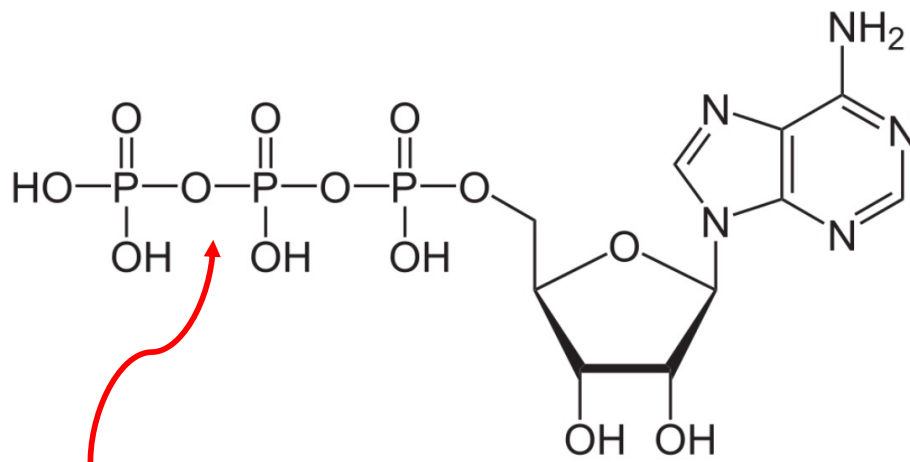
- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
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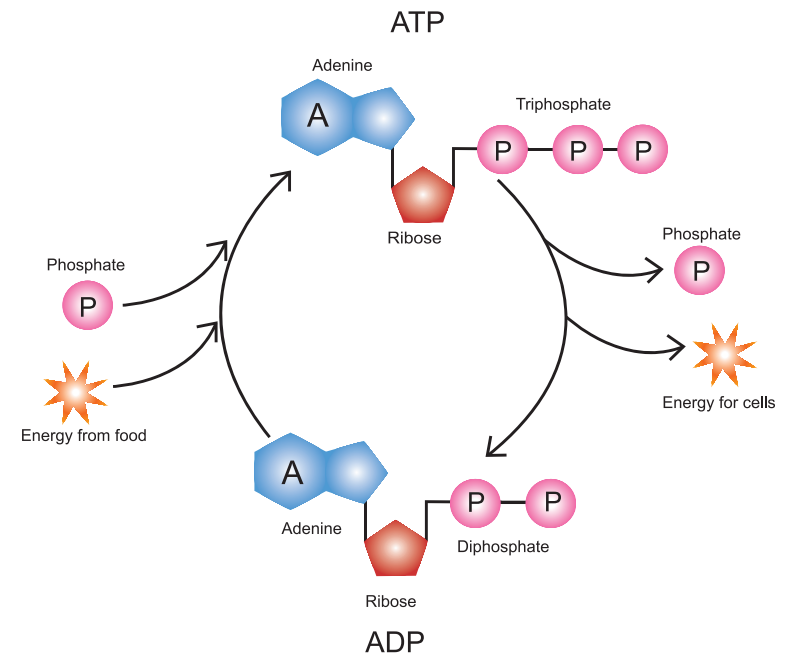


Making ATP

- How good are we at making ATP?
- How much more ATP do we make through aerobic respiration than from anaerobic respiration?



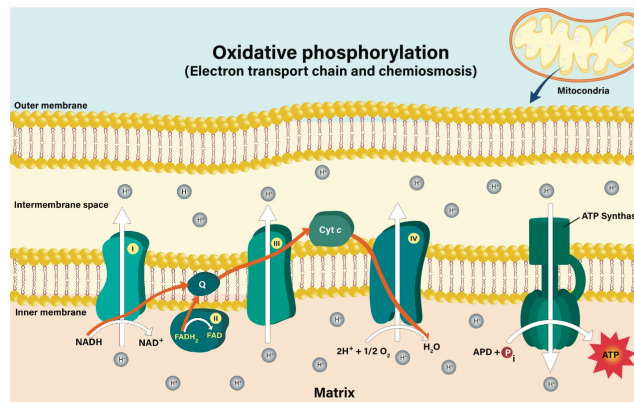
High-energy bond



ATP - ADP Cycle

How much ATP do we make?

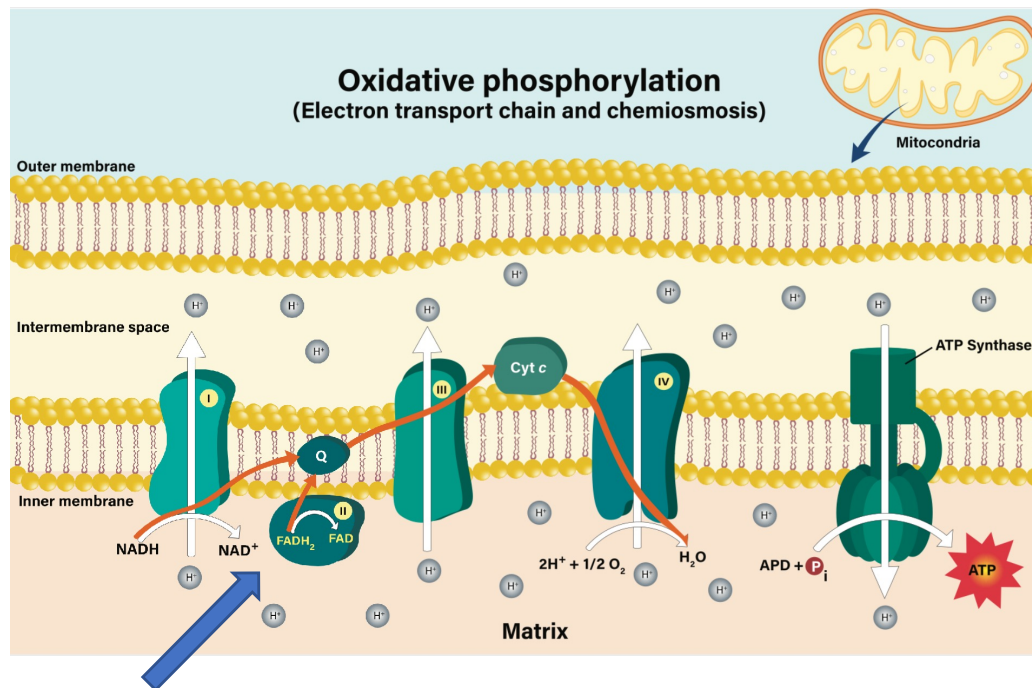
- In Cellular Respiration our energy carriers are NADH and FADH_2
- _____
- _____
- Therefore, at most 3 ATP are made for every NADH oxidized by the electron transport chain



How much ATP do we make?

- Since the oxidation of FADH_2 bypasses the proton-pumping complex I, it does not lead to as many protons being pumped across the membrane

• _____



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For Each Molecule of Glucose

Process	Energy Carrier Created			
	ATP	NADH	FADH ₂	
Total	4	10	2	10

How many ATPs will that produce?

10 NADH X 3 ATP = 30 ATP

2 FADH₂ X 2 ATP = 4 ATP

The total maximum ATP produced per glucose molecule oxidized in cellular respiration can be added as follows:

Glycolysis 2 ATP

Krebs Cycle 2 ATP

Electron Transport Chain 34 ATP Total = 38 ATP

The Efficiency of Aerobic Respiration

- How efficient is aerobic respiration at extracting the energy from glucose and converting it into ATP?
- The hydrolysis of ATP to ADP and P_i yields about

- Assuming that complete glucose oxidation produces 38 ATP, the total energy stored through ATP production would be 1178 kJ/mol:

The Efficiency of Aerobic Respiration

- Glucose contains exactly 2870 kJ/mol of energy
- The efficiency of aerobic respiration can be calculated as follows:

$$\frac{1178 \text{ kJ/mol}}{2870 \text{ kJ/mol}} \times 100\% = 41.0 \%$$

Therefore,

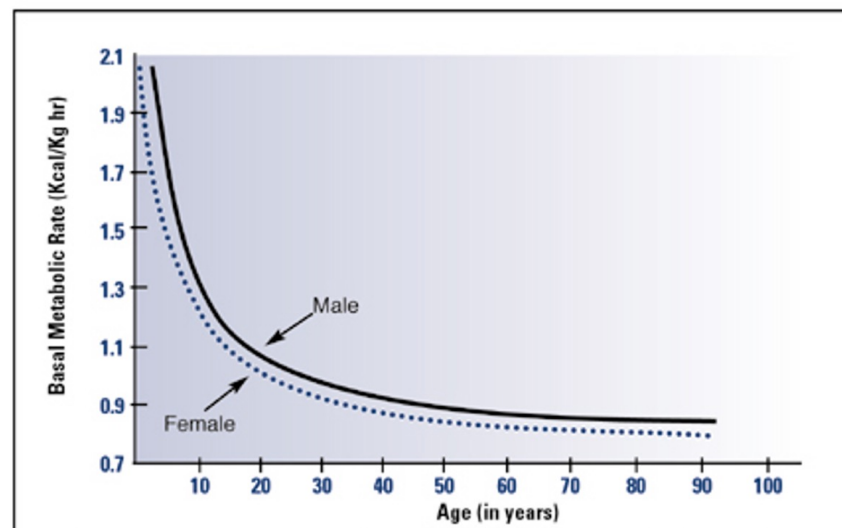
- _____
- The rest is lost as heat – this heat keeps us warm
- In contrast, cars only convert about 25% of the energy from fuel into motion
- An



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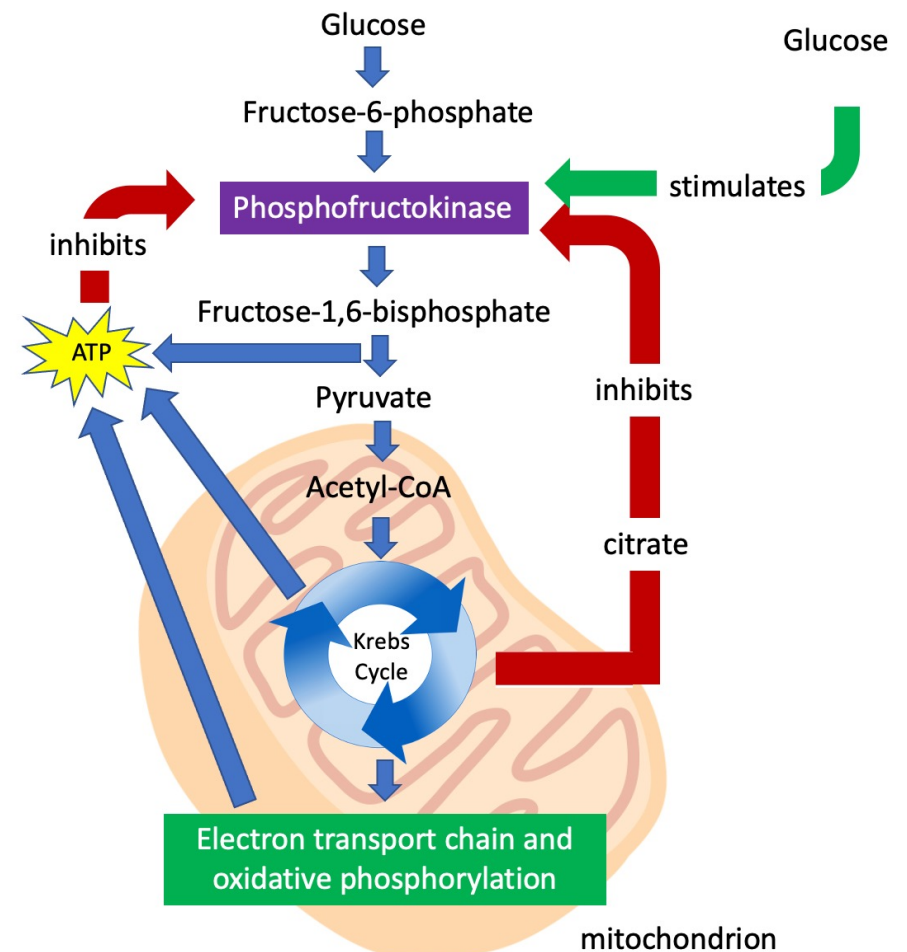
BMR

- _____
- Therefore, a higher percentage of body fat reduces the metabolic rate
- Your BMR decreases with age and is higher in males than females due to female's higher fat percentage



Regulating Cellular Respiration

As with most enzyme activity, cellular respiration is regulated through a feedback mechanism which prevents the body from making more ATP than it needs (shown in red).

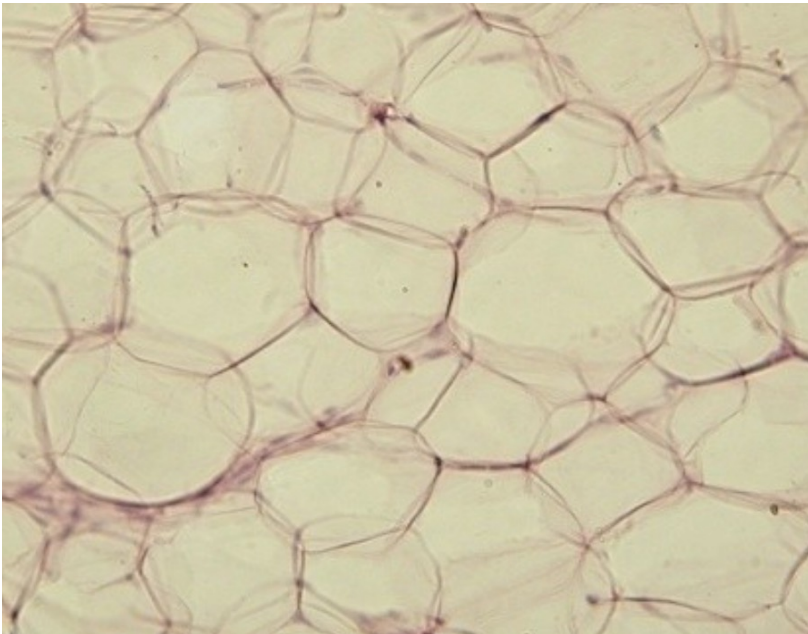


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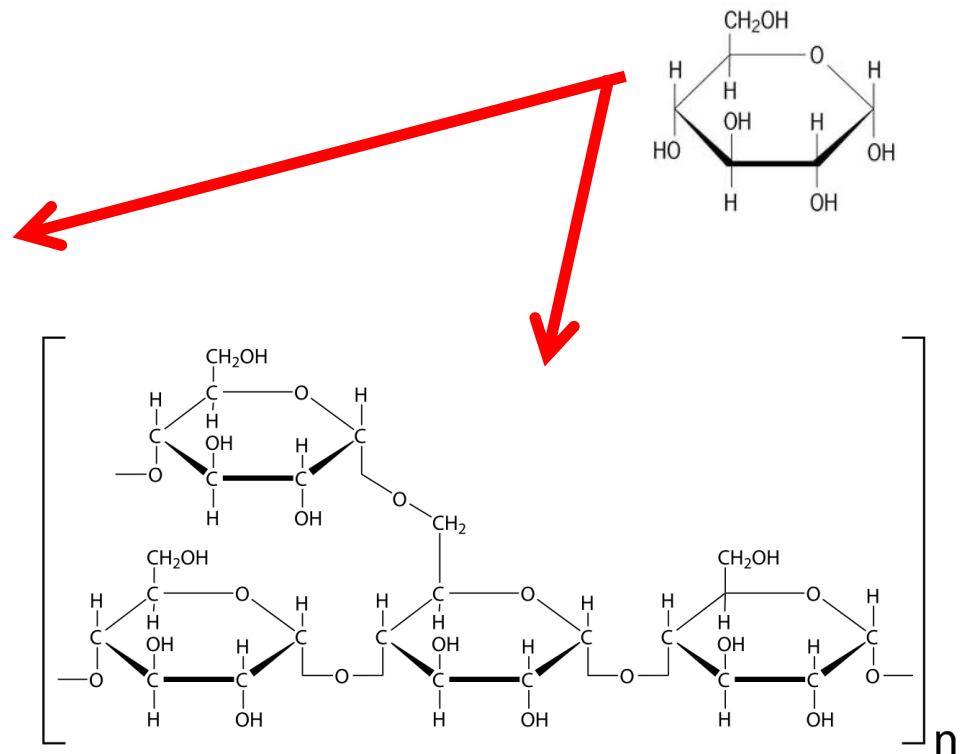
Excess Sugars

- What happens to excess sugars, such as glucose, when they are not needed for metabolism?

- _____



Fat Cells



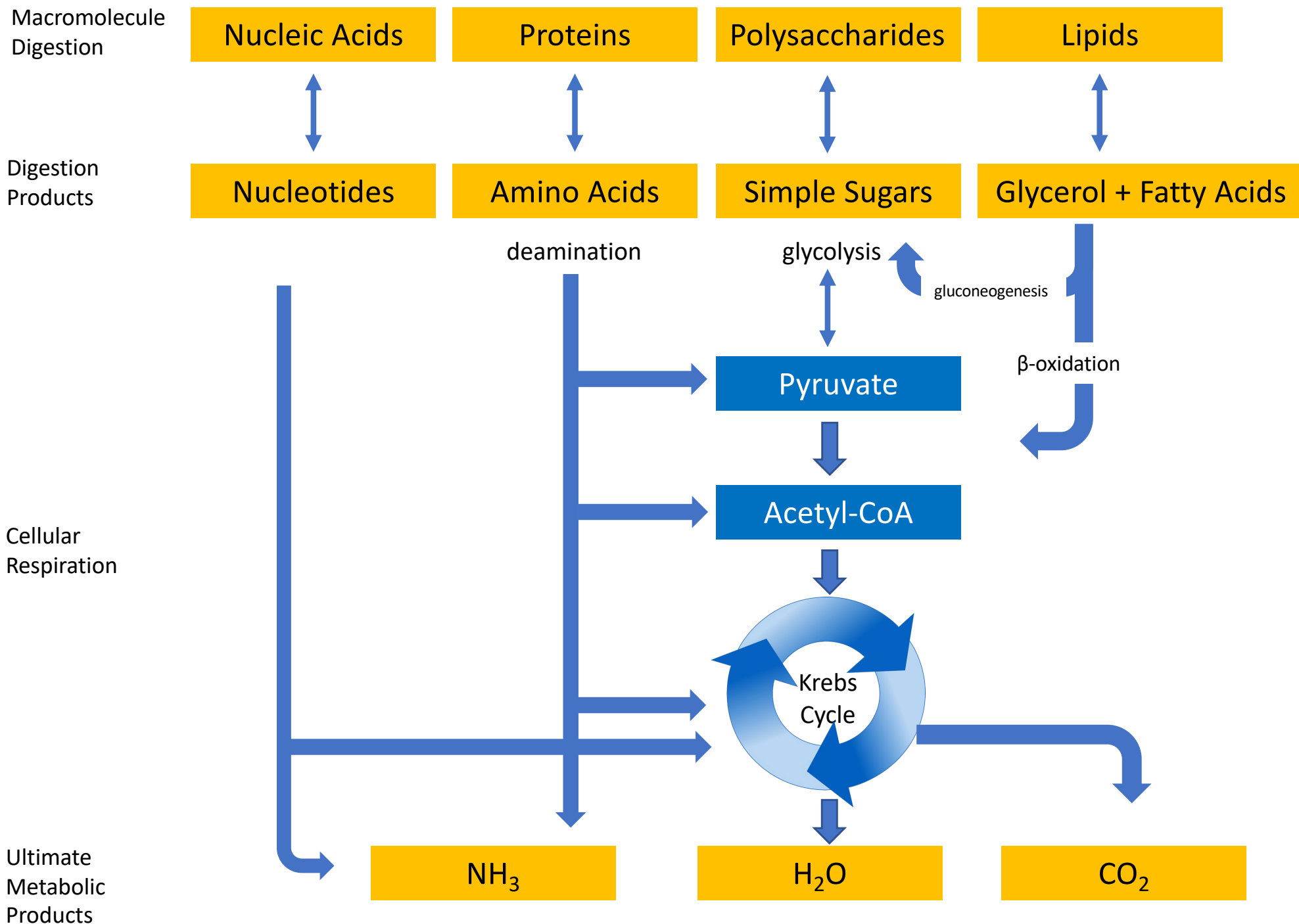
Glycogen

Alternatives to Glucose

- The reactions leading from glycolysis through pyruvate oxidation can use glucose and other 6-carbon sugars, as well as fats and proteins
- They enter the cellular respiratory pathway at various points

Type of food	Energy density (kJ/g)
Carbohydrates	17
Fats	37
Proteins	17

Energy Content of Different Foods



Alternatives to Glucose

- _____
- If glucose isn't present, the body is forced to break down fat cells to obtain glycerol and fatty acids and muscle to obtain the amino acids necessary to synthesize the required ATP
- The body can also create simple sugars such as glucose from other macromolecules via gluconeogenesis
- The glucose can then be used to create ATP

**CLICK THE LINK AND IMAGE IN SLIDESHOW
MODE TO ACCESS THE QUIZ/VIDEO**



Building Blocks

- Although macromolecules such as glucose and fats can be used

For example:

- _____

- Fatty acids can be oxidized to acetyl-CoA, and excess acetyl-CoA can be used to synthesize the fatty acids needed for a range of cellular processes.