

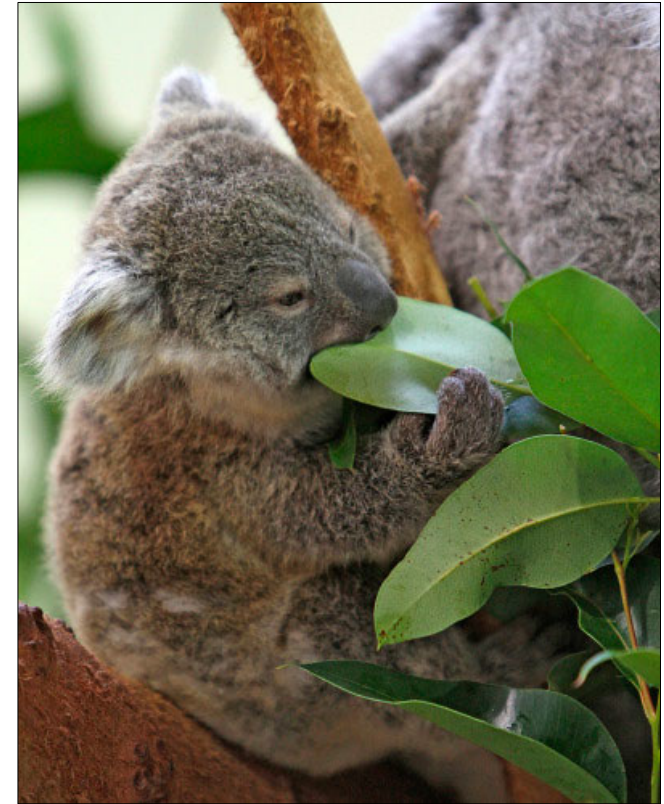
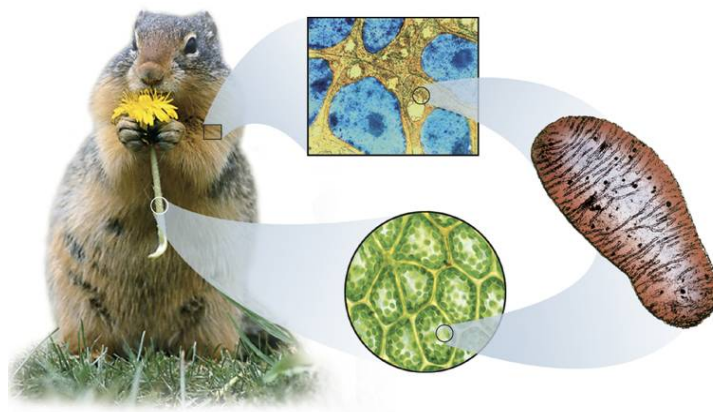


9-1 Chemical Pathways

Energy in Food

Energy in Food

- **Food** is the main source of energy for cells in the body.
- How is this energy measured?



Energy In Food

- Energy in food molecules is measured in the form of calories.
- **Calorie** = the amount of energy needed to raise the temperature of 1g of water by 1°C.



Calorie-Burning Chart for Various Activities			
<i>Approximate calories burned, per hour, by a 150-pound woman</i>			
Exercise	Calories/hour	Exercise	Calories/hour
Sleeping	55	Water Aerobics	400+
Eating	85	Skating/blading	420+
Sewing	85	Dancing, aerobic	420+
Knitting	85	Acrobatics	450+
Sitting	85	Bicycling, moderate	450+
Standing	100	Jogging, 5mph	500+
Driving	110	Gardening, digging	500+
Office Work	140	Swimming, active	500+
Housework, moderate	60+	Cross country ski machine	500+
Golf, with trolley	180	Hiking	500+
Golf, without trolley	240	Step Aerobics	550+
Gardening, planting	250	Rowing	550+
Dancing, ballroom	260	Power Walking	600+
Walking, 3mph	280+	Cycling, studio	650
Table Tennis	290+	Squash	650+
Gardening, hoeing etc.	350+	Skiing with rope	700+
Tennis	350+	Running	700+

Nutrition Facts	
Serving Size ½ cup (114g)	
Servings Per Container 4	
Amount Per Serving	
Calories 90	Calories from Fat 30
% Daily Value*	
Total Fat 3g	5%
Saturated Fat 0g	
0%	
Cholesterol 0mg	0%
Sodium 300mg	13%
Total Carbohydrate 13g	4%
Dietary Fiber 3g	
12%	
Sugars 3g	
Protein 3g	
Vitamin A 80%	Vitamin C 60%
Calcium 4%	Iron 4%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your caloric needs:	
	Calories: 2,000 2,500
Total Fat	Less than 65g 80g
Sat Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	



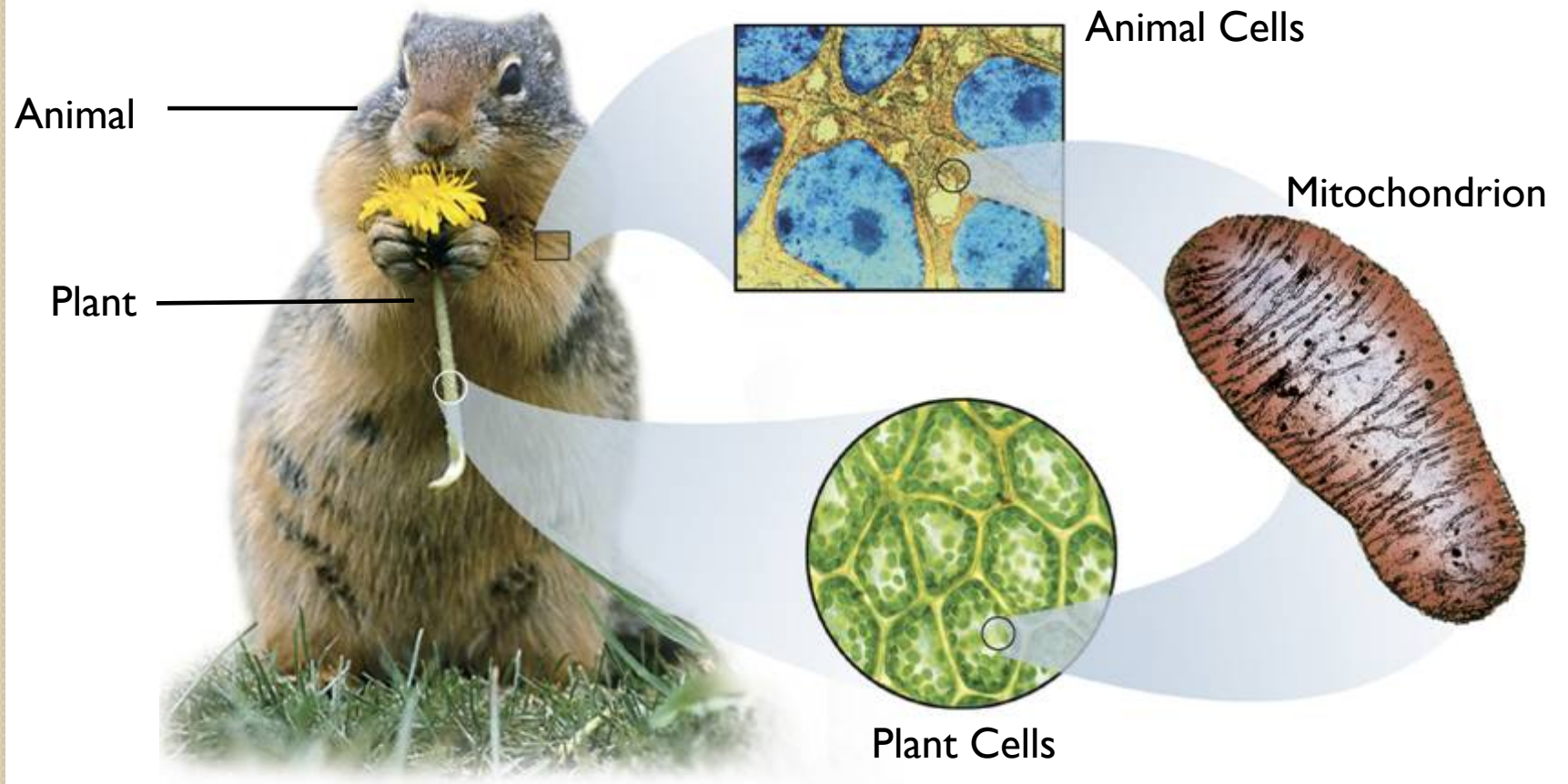
Energy in Food

- How does the energy in the food get broken down for cells to use?

Cellular respiration is the process that releases energy by breaking down glucose and other food molecules in the presence of oxygen.

Cellular Respiration

- Occurs in the mitochondria.



Cellular Respiration

- The equation for cellular respiration is:

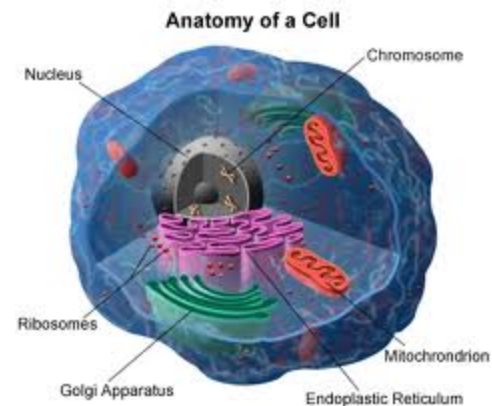
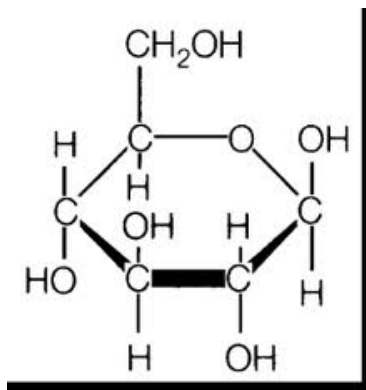


oxygen + glucose \rightarrow carbon dioxide + water + Energy (ATP)

- Before cellular respiration starts, glucose must be broken down (**GLYCOLYSIS**).
- After glycolysis, the cell enters either **cellular respiration** OR **fermentation**.

Step 1: Glycolysis

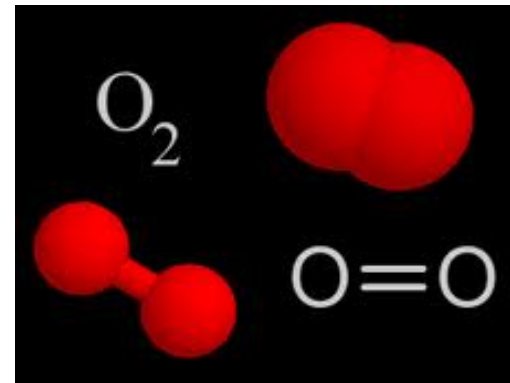
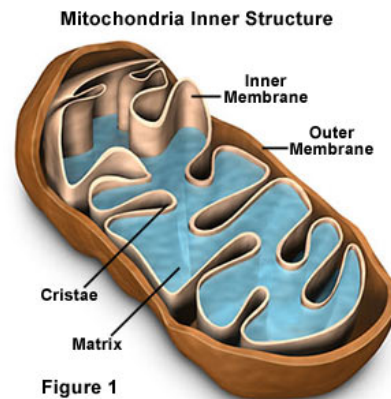
- One molecule of glucose is **broken down** into smaller molecules called **pyruvic acid**.
- This **releases** energy and stores it in the form of ATP.
- A net gain of **2 ATP molecules** are produced.



- Glycolysis occurs **in the cytoplasm** of the cell.

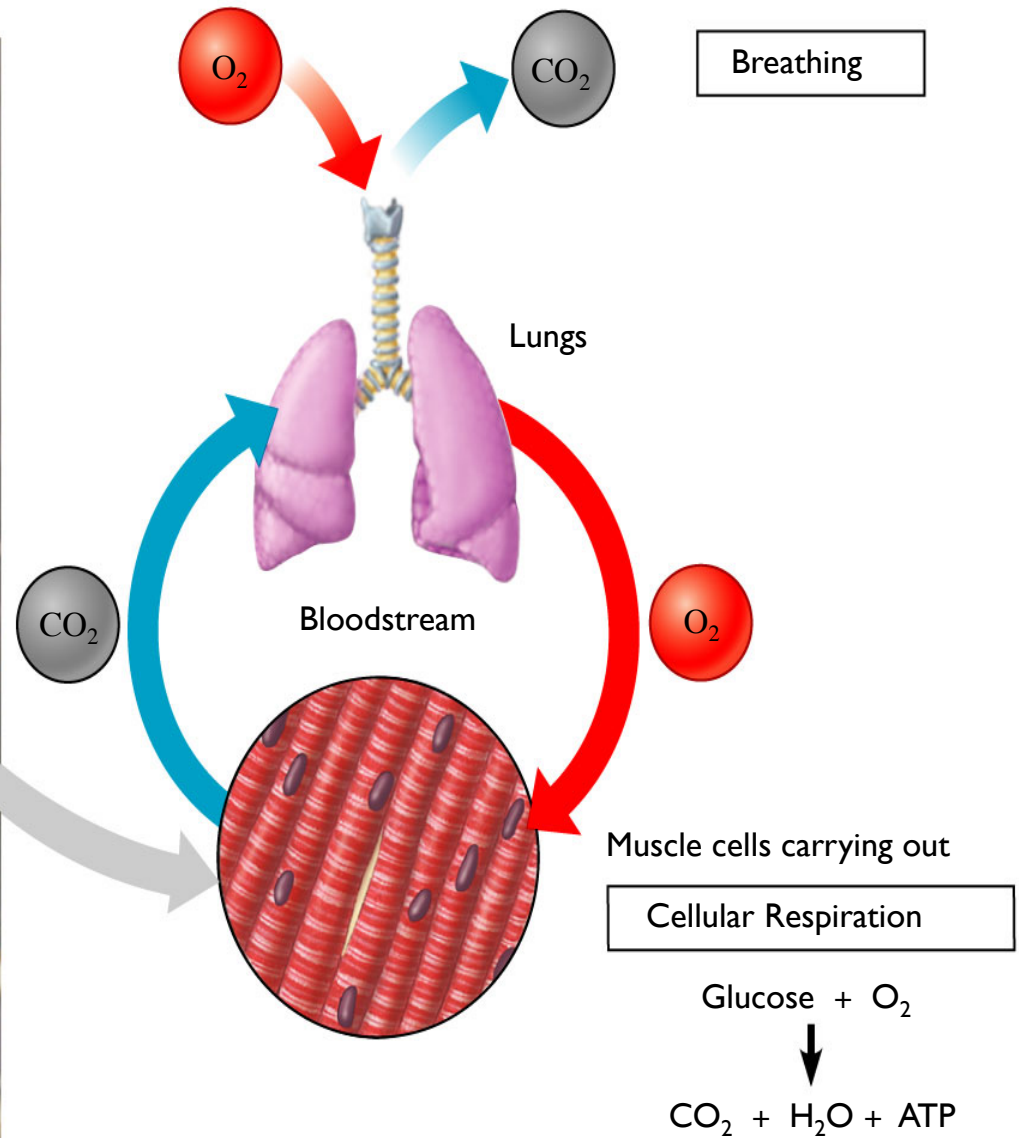
Step 2: Cellular Respiration

- When OXYGEN IS PRESENT: the cell enters cellular respiration (**aerobic process**).
- Pyruvic acid enters the mitochondria and undergoes cellular respiration.



- Cell breaks down the pyruvic acid (from glucose) and release energy - an additional **34 ATP molecules** are released.

Breathing and Cellular Respiration



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Cellular Respiration

- Between glycolysis and cellular respiration, a total of **36 ATP** are produced.
 - Glycolysis (cytoplasm): **2 ATP**
 - Cellular Respiration (mitochondria): **34 ATP**

Fermentation

- When OXYGEN IS NOT PRESENT: the cell enters fermentation (**anaerobic process**).
- Pyruvic acid is converted into another molecule.
- Energy is released, **but not nearly as much** as during cellular respiration.



Fermentation

- 2 types of fermentation:
 - Alcoholic fermentation – produces ethanol and carbon dioxide
 - Lactic acid fermentation – produces lactic acid (the stuff that causes muscle cramps)



Yeast

- Yeast are unicellular fungi that are versatile laboratory microorganisms.
- They grow really quickly.
- They use BOTH cellular respiration & alcoholic fermentation to make ATP.
- They use the process of glycolysis to produce energy in the form of ATP.
- Alcoholic fermentation makes alcohol and CO_2 – used to make breads, alcohol.