

# WUHS Biology: Animals Unit

Packet 3 – What  
happens inside animal  
cells?



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# Animals Unit – Packet 3 Driving Question

- **Driving Question: What happens inside animal cells?**
- How and where does cellular respiration occur?
- How and where does biosynthesis occur?
- How do animals acquire more cells and gain mass?
- **Part 1 Recap – Thirsty Moth:** how could a moth larva survive in a container of malted milk powder without any water? Where did water in its body come from?



Source: <https://www.piqsels.com/en/public-domain-photo-fmlyd>

# Recap of Packet 2

In digestion, macromolecules in food are broken into smaller individual molecules and absorbed into blood.

Enzymes are specialized proteins that assemble, disassemble, or rearrange molecules.

Once macromolecules have been broken into smaller molecules, they are absorbed into the bloodstream and transported to cells.

Cells use carb's for chemical energy, and use fat and protein to build and repair cells.

During cellular respiration, cells acquire chemical energy by rearranging atoms in glucose & oxygen to form  $\text{CO}_2$  &  $\text{H}_2\text{O}$ .

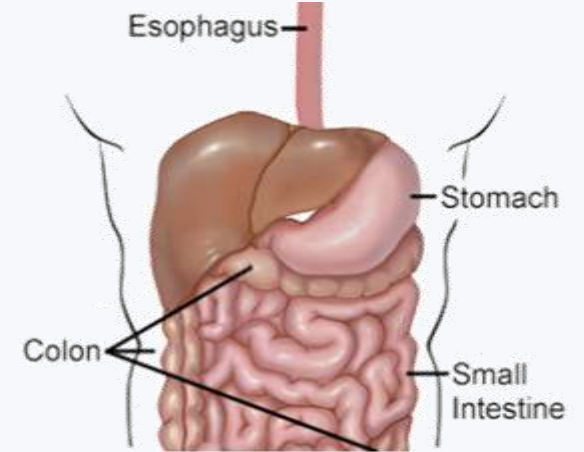


Image Source

*The digestive tract's primary purpose is to break apart macromolecules so that they can be absorbed.*

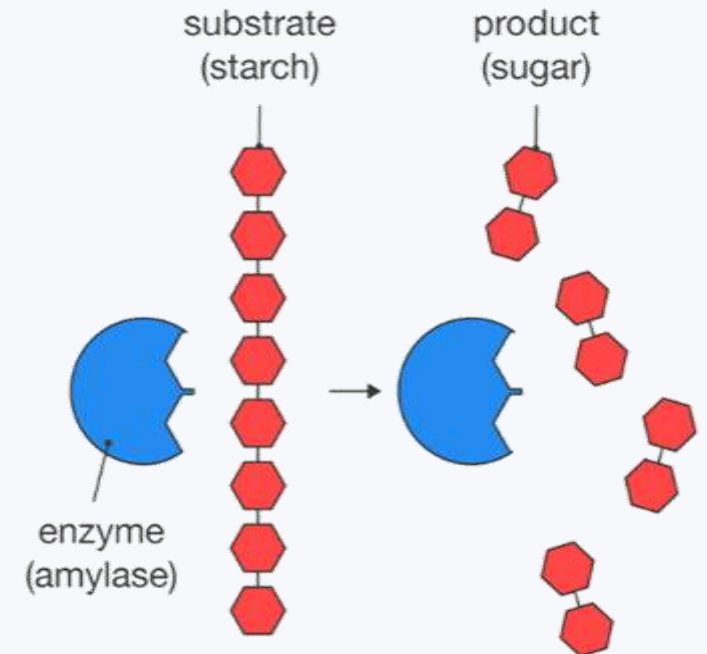


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*Proteins called enzymes can break macromolecules into individual molecules.*

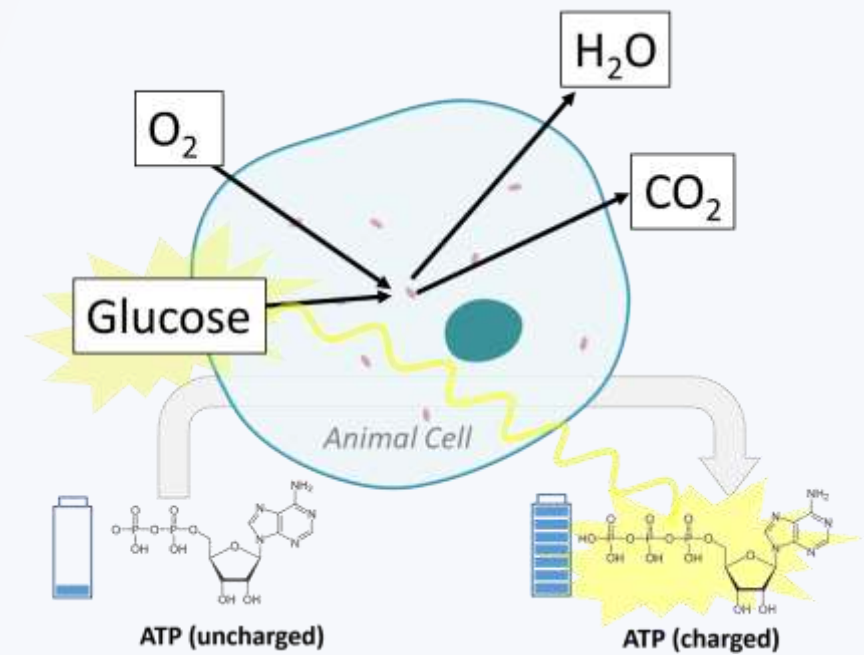
# Recap of Packet 2

The chemical energy in the high energy bonds of glucose is moved to ATP during cellular respiration.

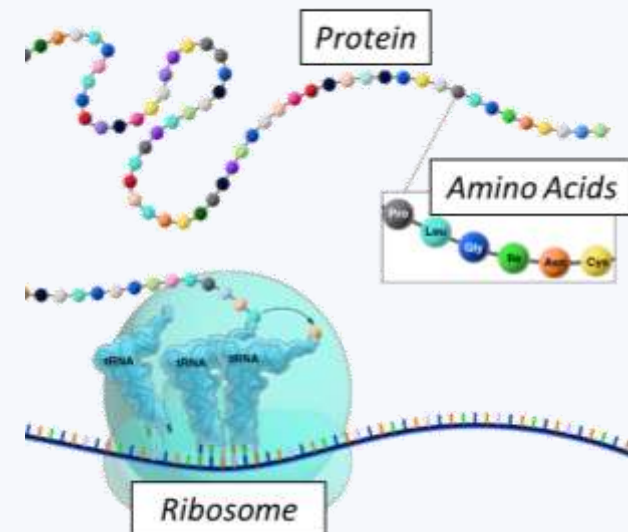
Most matter in consumed food is either breathed out as  $\text{CO}_2$  &  $\text{H}_2\text{O}$  or lost as feces (waste).

A small portion of the atoms in consumed food is added to the animal's body.

Biosynthesis is the process in which organisms use molecules they consume to make the macromolecules needed for their own cells.



During cell respiration, glucose and  $\text{O}_2$  are rearranged to form  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . Chemical energy is moved from glucose to ATP.



Cells assemble proteins from amino acids consumed in food.



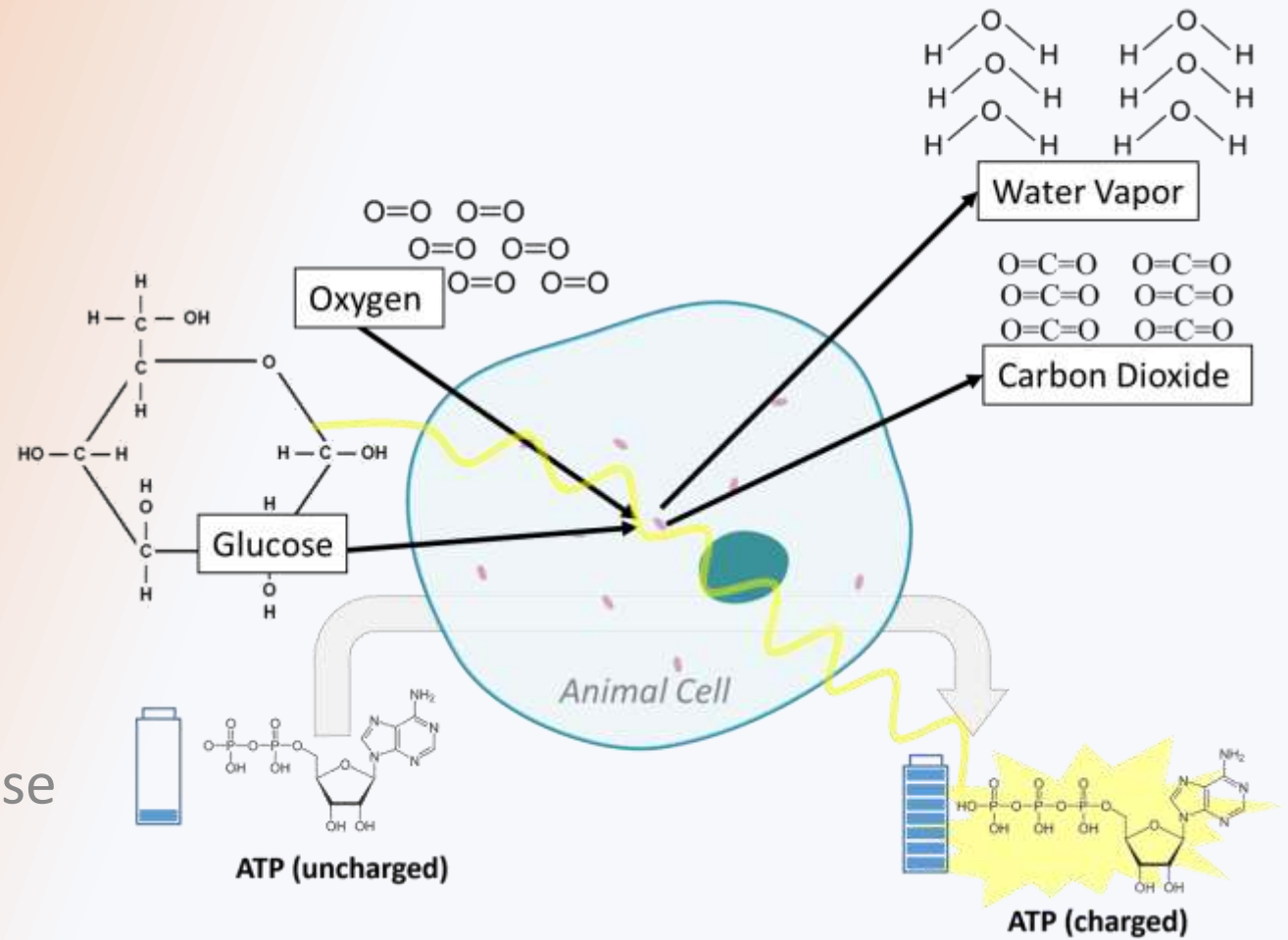
# Cell Processes & Macromolecules

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- **We know that there are two main processes that change food molecules.**
  - Cellular respiration: food molecules and oxygen are rearranged to form  $\text{CO}_2$  and  $\text{H}_2\text{O}$  in order to recharge ATP with more chemical energy.
  - Biosynthesis: food molecules are reassembled into the macromolecules needed by the cell.
- **Food molecules are primarily used in two key ways.**
  - Fat and protein are mostly used for biosynthesis to provide atoms to build and repair cells.
  - Carbohydrates are mostly used for cellular respiration to provide a quick source of chemical energy.

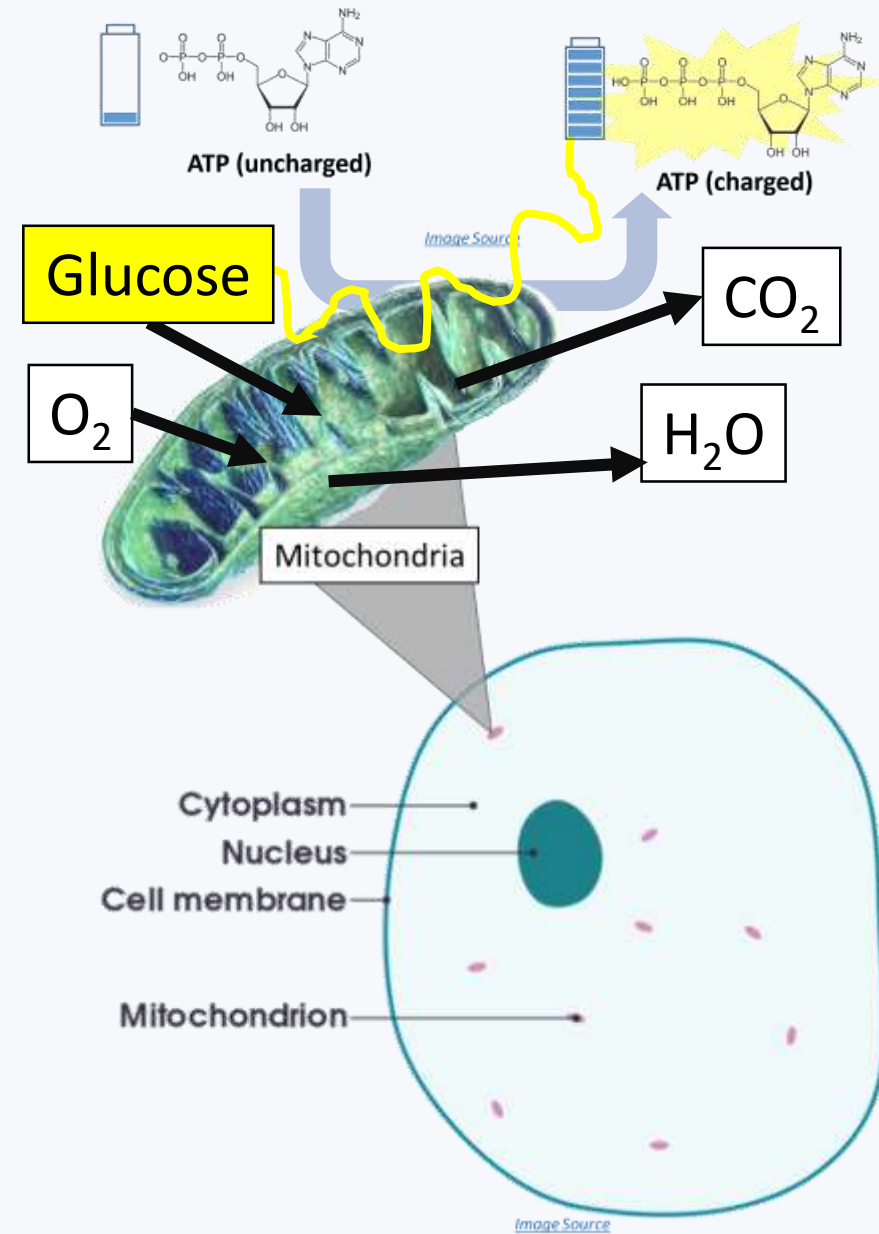
# Cellular Respiration

Acquiring chemical energy from glucose



# Cellular Respiration

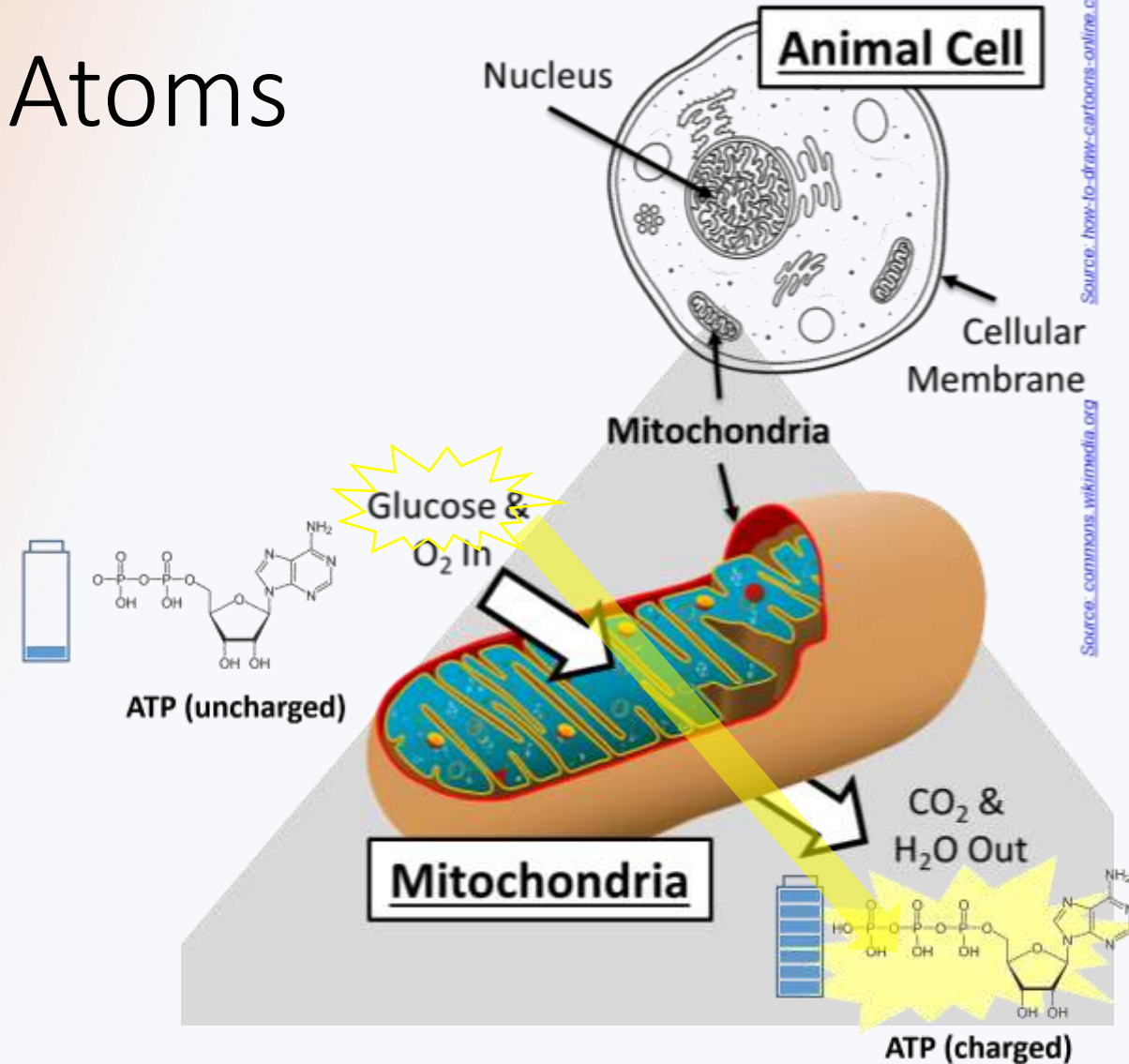
- **Mitochondria** are the organelles where cellular respiration occurs and where ATP is 'recharged'.
  - This is where atoms in food molecules & oxygen are rearranged to form  $\text{CO}_2$  &  $\text{H}_2\text{O}$ .
  - This process is how ATP is "recharged" with energy.
    - *Mitochondria = plural; mitochondrion = singular*
- **Glucose (from carbohydrates)** is most frequently used for cellular respiration.
  - Cells can also use fatty acids as a source of chemical energy during cellular respiration (*for example, if someone is on a diet, their body will break down body fat as a source of chemical energy to recharge ATP*).
  - Dietary protein is only used for cellular respiration if there are too few carbohydrates and fat in the diet.



*The mitochondria is where cellular respiration occurs in order to recharge ATP.*

# Oxygen & Exhaling Food Atoms

- **As cellular respiration occurs,  $\text{CO}_2$  and  $\text{H}_2\text{O}$  are released from the cell into the bloodstream.**
  - The bloodstream transports  $\text{CO}_2$  and  $\text{H}_2\text{O}$  to the lungs, and these molecules are exhaled.
- **When you see your breath on a cold day, you see water vapor that formed from atoms from food and inhaled oxygen.**
  - Animals need oxygen because it removes leftover atoms from food molecules after cellular respiration.

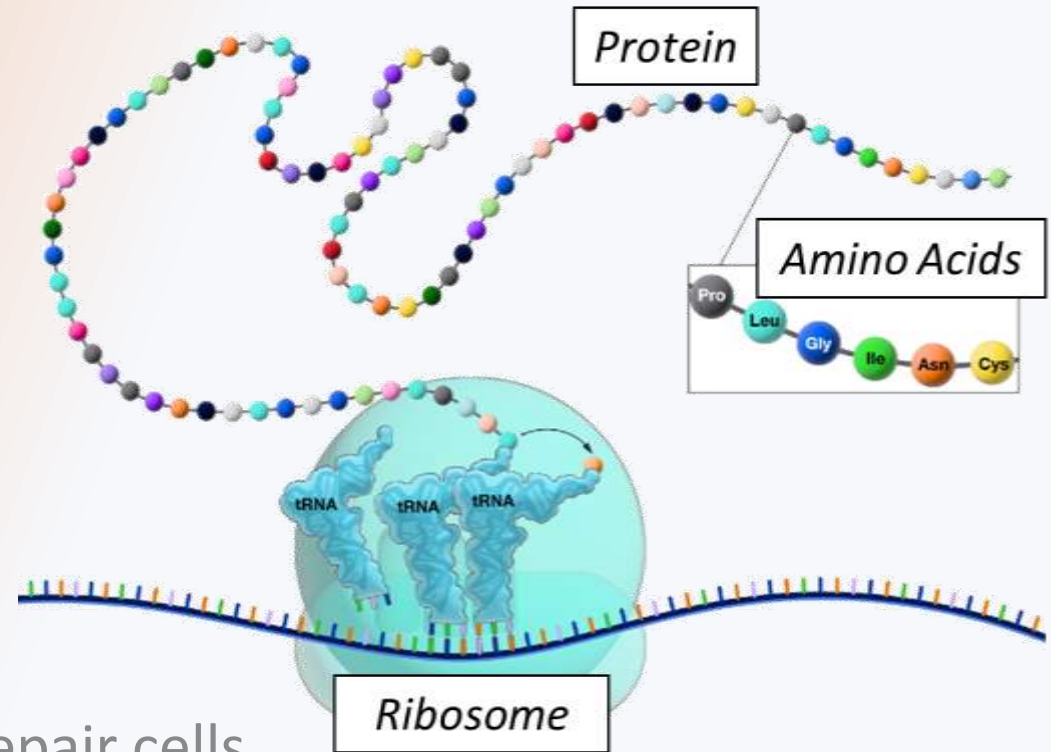


*The mitochondria is the “powerhouse of the cell” because it is where cellular respiration occurs. During this process, chemical energy is moved from food molecules (like glucose) to ATP.*



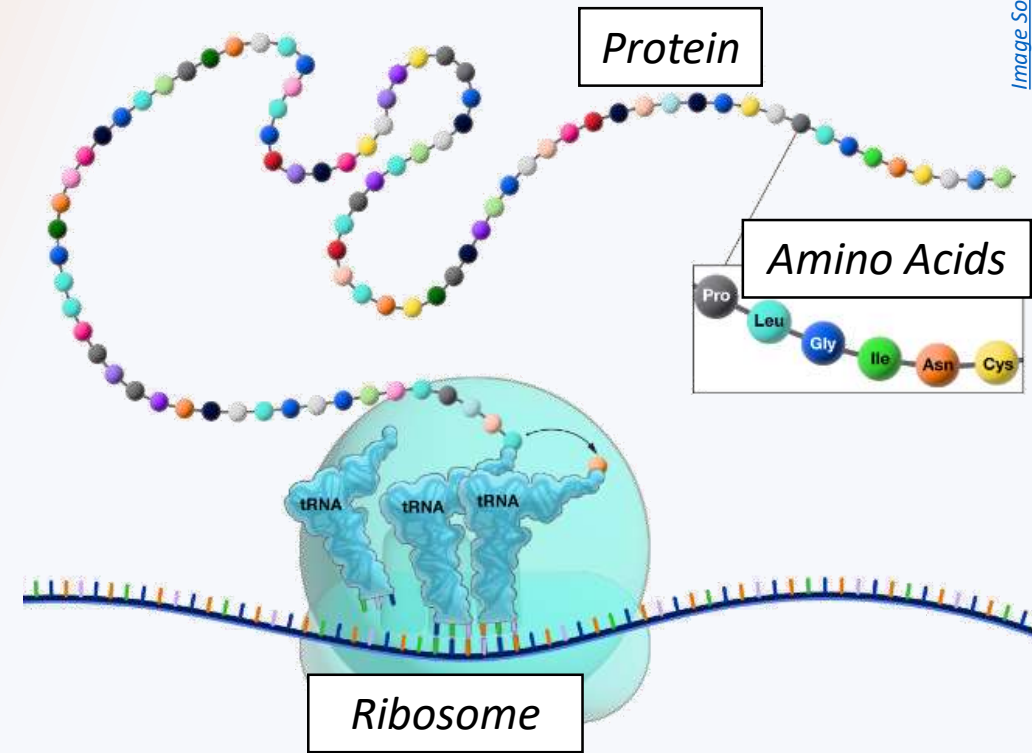
# Biosynthesis

Acquiring the atoms needed to build and repair cells

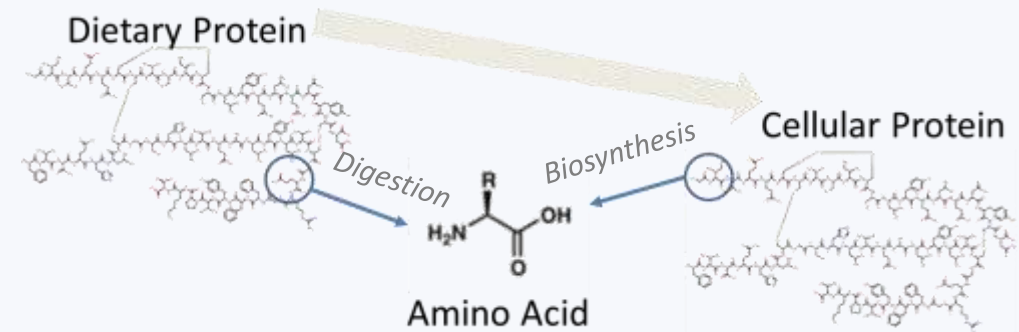


# Protein Biosynthesis

- **Multiple forms of biosynthesis occur inside animal cells.**
  - Biosynthesis occurs anytime a cell assembles new molecules using atoms consumed in food.
- **Protein assembly is one of the most common forms of biosynthesis.**
  - Structures called ribosomes are where proteins are assembled using amino acids from food.
- **During protein biosynthesis, amino acids from food are connected into long chains.**
  - Eventually these amino acid chains form the proteins needed for the cell to function.



*Ribosomes are organelles that assemble the amino acids from food into the proteins used by cells.*



# Fat Biosynthesis

- **Cells can also use fatty acids from the diet to assemble the fats needed by the cell.**
  - Fat biosynthesis occurs in the *cytoplasm* of the cell (cytoplasm = the jelly-like liquid inside the cell).
  - Fats are used for membranes and for energy storage.
- **Fat biosynthesis occurs in two different ways.**
  - Cells use enzymes to assemble fats from fatty acids consumed in the diet.
  - Cells can also use enzymes to rearrange atoms in other molecules (such as glucose) to make new fatty acids.
- **If an animal consumes too much food, those food molecules will be converted into fats for long-term energy storage.**



Image Source

*An animal's body can rearrange food molecules into fat molecules for long-term energy storage in fat cells (e.g., this occurs in bears before hibernation).*

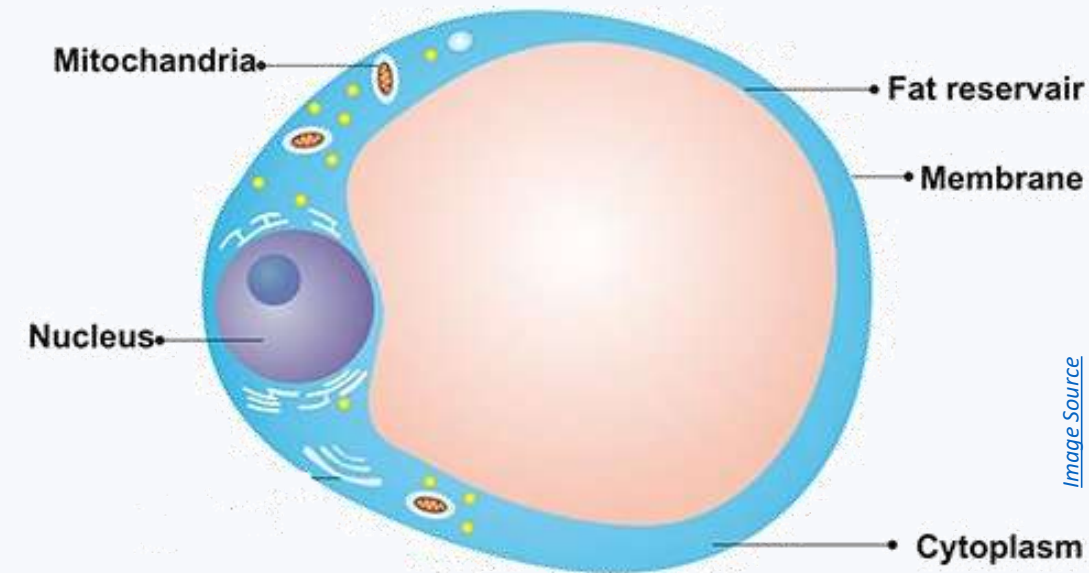
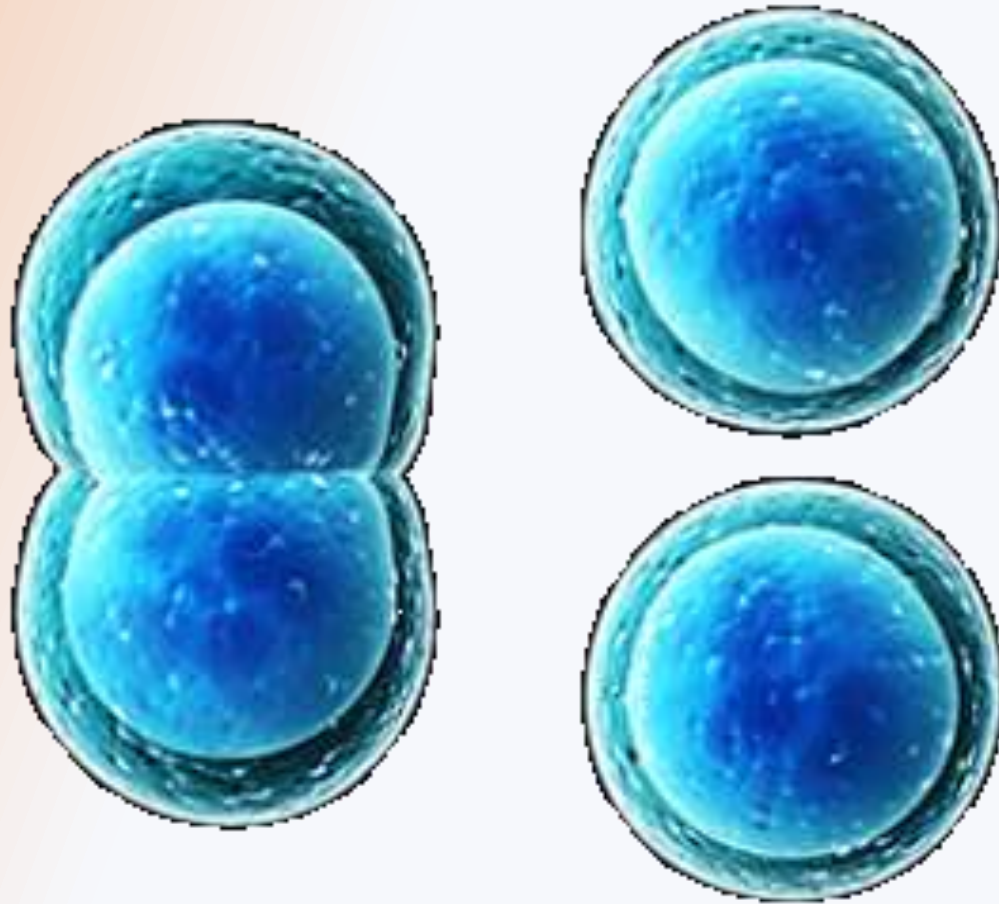


Image Source

*Fat cells expand to store more fat macromolecules.*

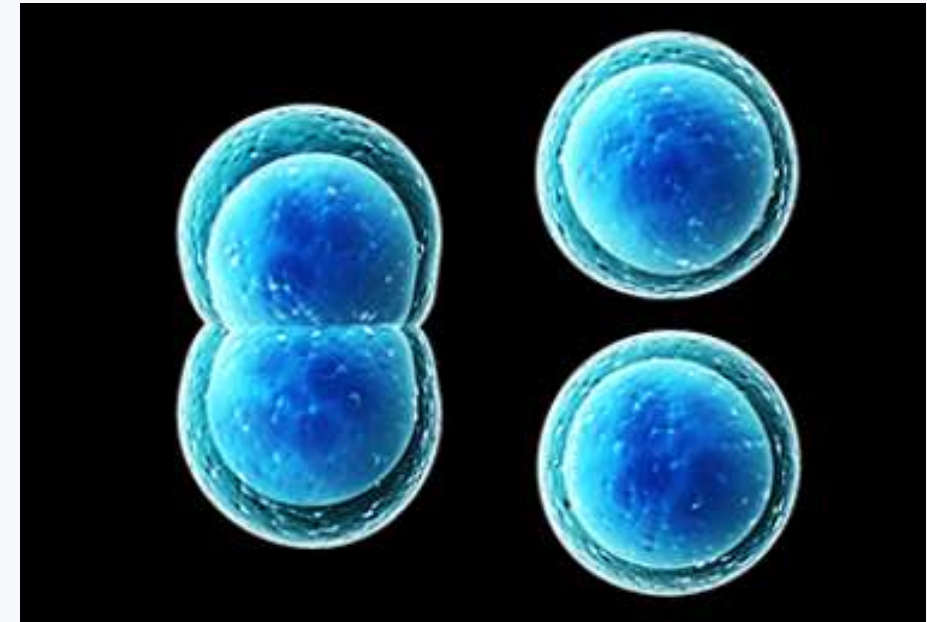
# Mitosis

Creating more and more cells.



# Mitosis

- **As cells assemble new fat & protein macromolecules, they grow larger.**
  - If a cell produces enough fat and protein macromolecules, it can divide in half.
- **Mitosis is the process of dividing one large cell into two smaller cells.**
  - Cell growth and division is important for enabling animals to grow larger.
  - Mitosis is what enables an organism to significantly increase in size.
  - Mitosis is also important for building and repairing bodily tissue (such as healing wounds or increasing muscle mass).



*A cell splits into two cells via mitosis.*

# Revising Our Claims

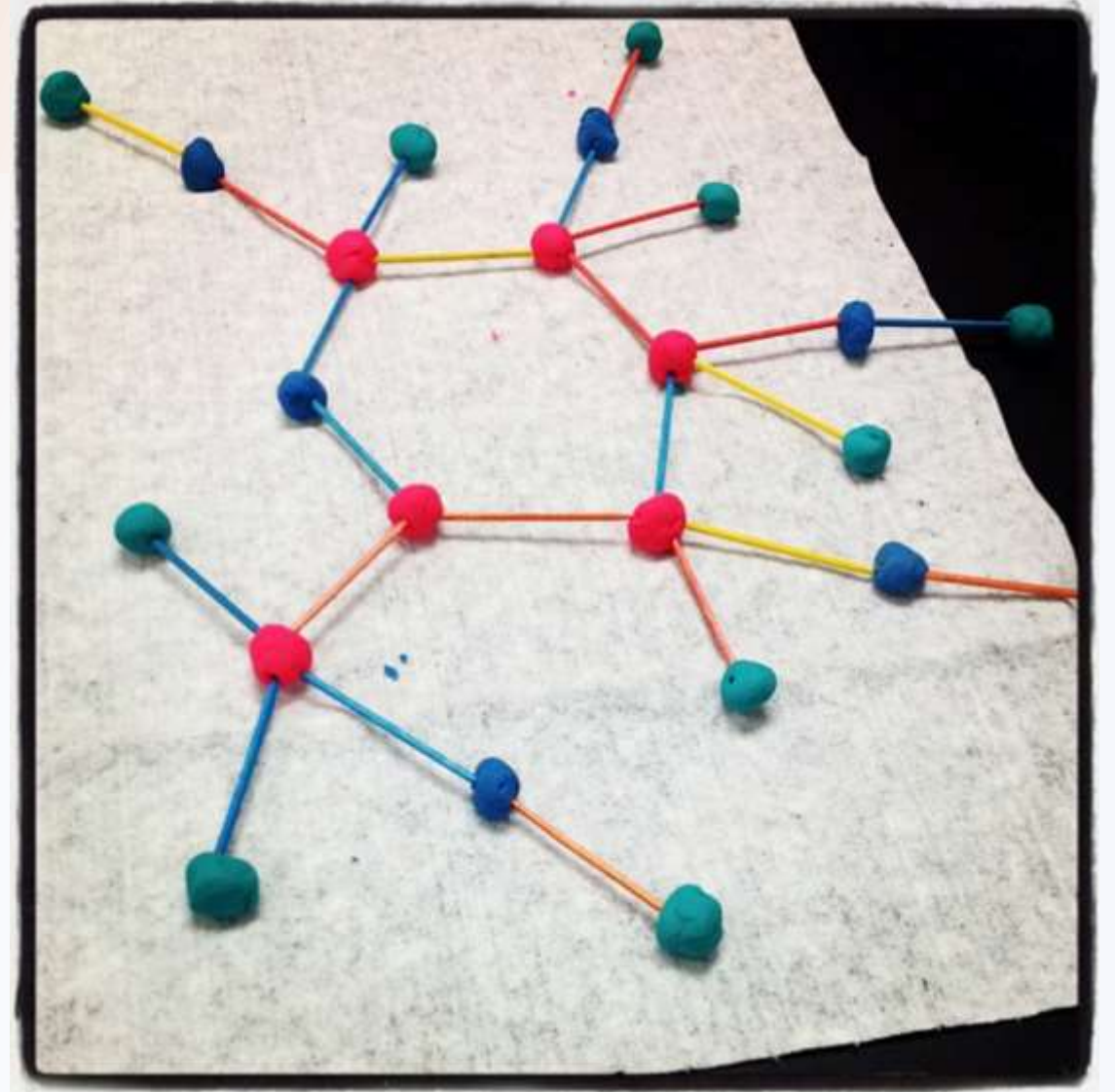
- **Revisit your ideas from Part 1.**
  - How could you improve your responses to our Driving Questions?
- **Driving Question: What happens inside animal cells?**
- How and where does cellular respiration occur?
- How and where does biosynthesis occur?
- How do animals acquire more cells and gain mass?



Source: <https://www.piqsels.com/en/public-domain-photos/114214/>

# Looking Ahead: Part 3 Investigation

- In Part 3A, you will use modeling clay to create molecular models of glucose and oxygen. You will then use these models to show your understanding of cellular respiration.
- In Part 3B, you will develop your own protocol for using modeling clay to show your understanding of how molecules change during biosynthesis.



# Key Points

- **Fat and protein are mostly used for biosynthesis. Carbohydrates are mostly used for cellular respiration.**
- **Mitochondria are the organelles where cellular respiration occurs.**
  - This is where ATP is 'recharged' by rearranging atoms in food molecules & oxygen to form  $\text{CO}_2$  &  $\text{H}_2\text{O}$ .
- **Glucose (from carbohydrates) is most frequently used for cellular respiration.**
  - Cells also can use fat as a source of chemical energy during cellular respiration.
- **As cellular respiration occurs,  $\text{CO}_2$  and  $\text{H}_2\text{O}$  are released from the cell into the bloodstream and are eventually exhaled.**



# Key Points

- **Multiple forms of biosynthesis occur inside animal cells.**
  - Biosynthesis occurs anytime a cell assembles new molecules using atoms from food.
- **Structures called ribosomes are where proteins are assembled using amino acids from food.**
  - During protein biosynthesis, amino acids from food are connected into long chains that form cellular proteins.
- **Cells can also use fatty acids from the diet to assemble the fats needed by the cell in the cytoplasm (the jelly-like liquid in the cell).**
  - Fats can be assembled from fatty acids from the diet; enzymes in the cell can also rearrange the atoms in other food molecules to make fat.
- **As cells assemble new fat & protein macromolecules, they grow larger.**
  - Mitosis is the process of dividing one large cell into two smaller cells.
  - Mitosis enables organisms to grow larger, heal wounds, and gain tissue like muscle.

# Key Vocab

- **Mitochondria** are the organelles where cellular respiration occurs and where ATP is 'recharged'.
  - *Mitochondria = plural; mitochondrion = singular*
- Structures called **ribosomes** are where proteins are assembled using amino acids from food.
- **Cytoplasm** is the jelly-like liquid inside the cell.
- **Mitosis** is the process of dividing one large cell into two smaller cells.