Animals Unit

Week 3 – What happens inside animal cells?

Waterford Biology

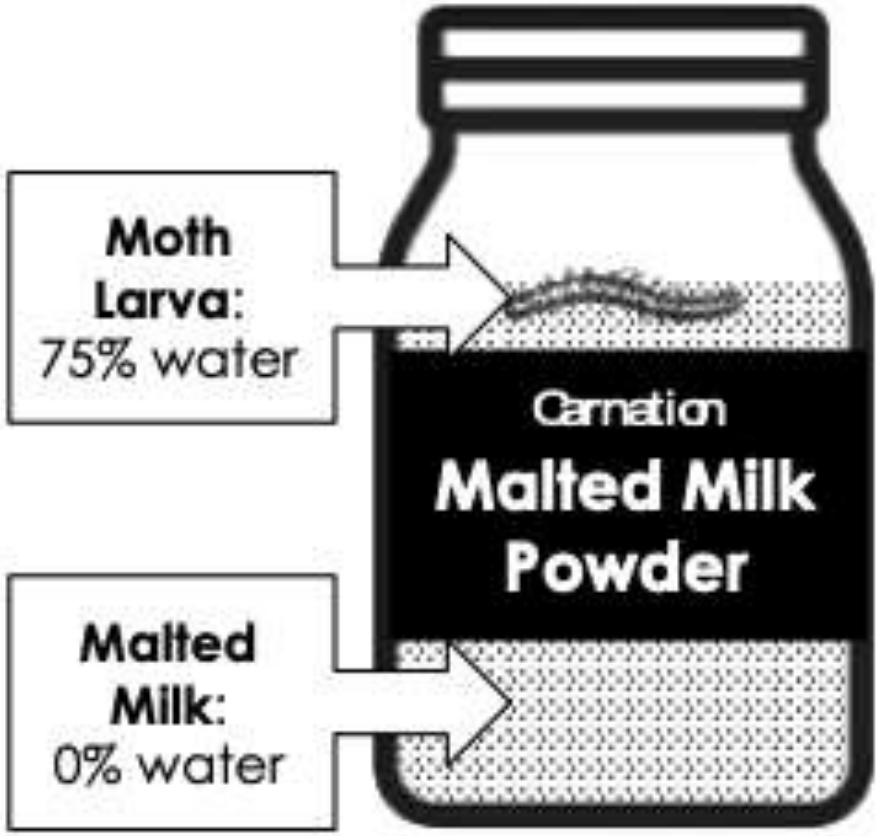
Animals Unit – W3 Driving Question

- **This week's driving question: What happens inside animal cells?**
- How do the cells of animals use food for energy to move and function?
- How do the cells of animals use food to grow and mature?

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

Part 1 Recap

- Earlier we learned about a moth larva that Dr. Babcock found in a jar of malted milk.
- How could something that is mostly made of water exist in a completely dry environment?

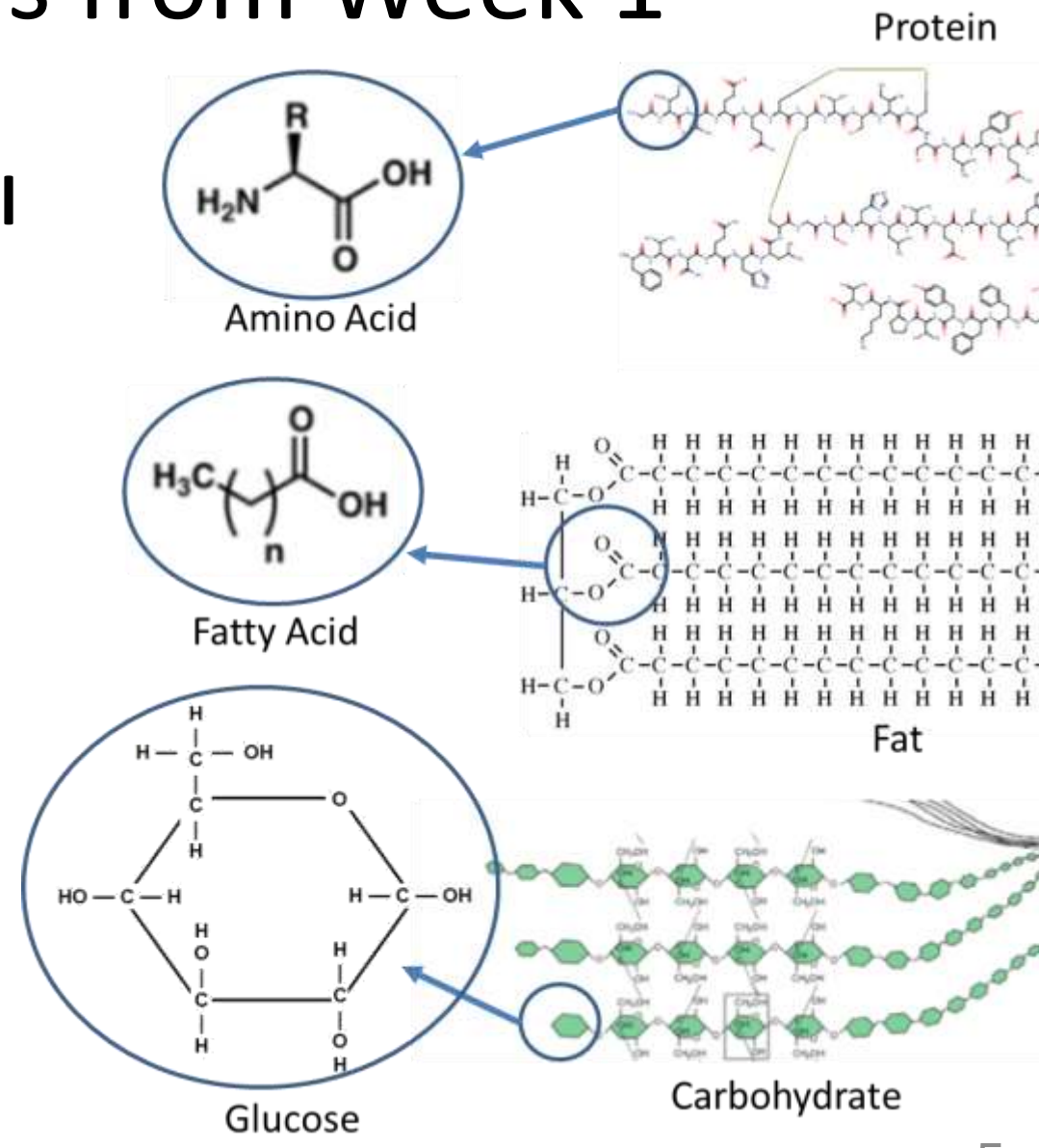


- What claims can we make based on what we know?

REMINDERS FROM EARLIER WEEKS

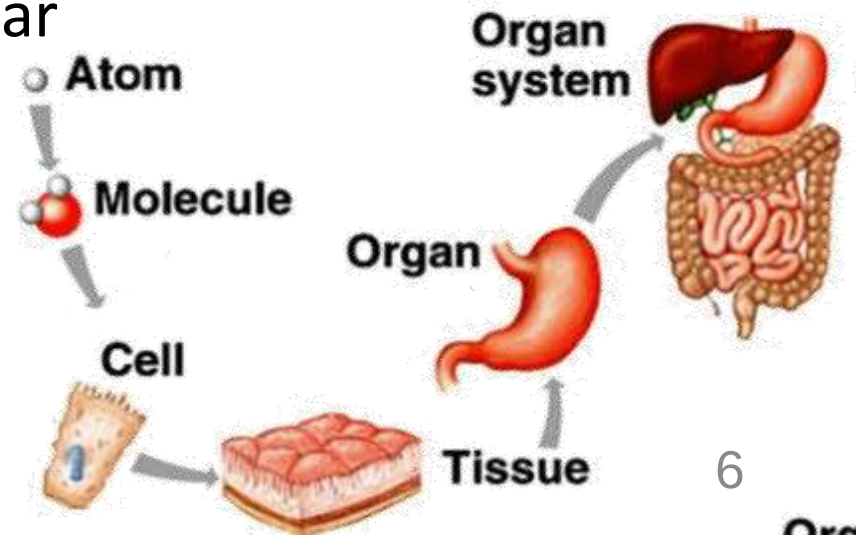
Reminders from Week 1

- **A <u>macromolecule</u> is a long chain of individual molecules bonded together.**
  - Macromolecules do all the work of cells.
- **Examples of macromolecules include proteins, fats, & carbohydrates.**
  - These all include high-energy bonds.



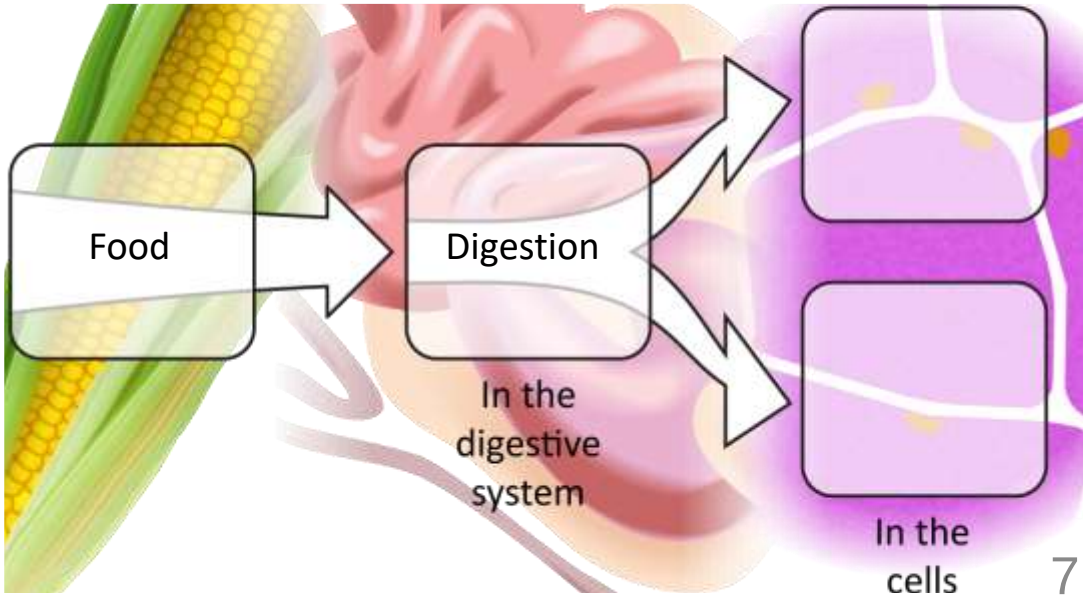
Reminders from Week 1

- **Cells are organized at four different levels to create a functioning organism.**
  - Cells & organelles are made from macromolecules.
  - A group of similar cells form tissues.
  - Organs are comprised of different kinds of tissues (muscle, nerves, connective tissue, and lining).
  - Different organs with a similar function form a system.
  - A collection of systems comprises an individual organism.



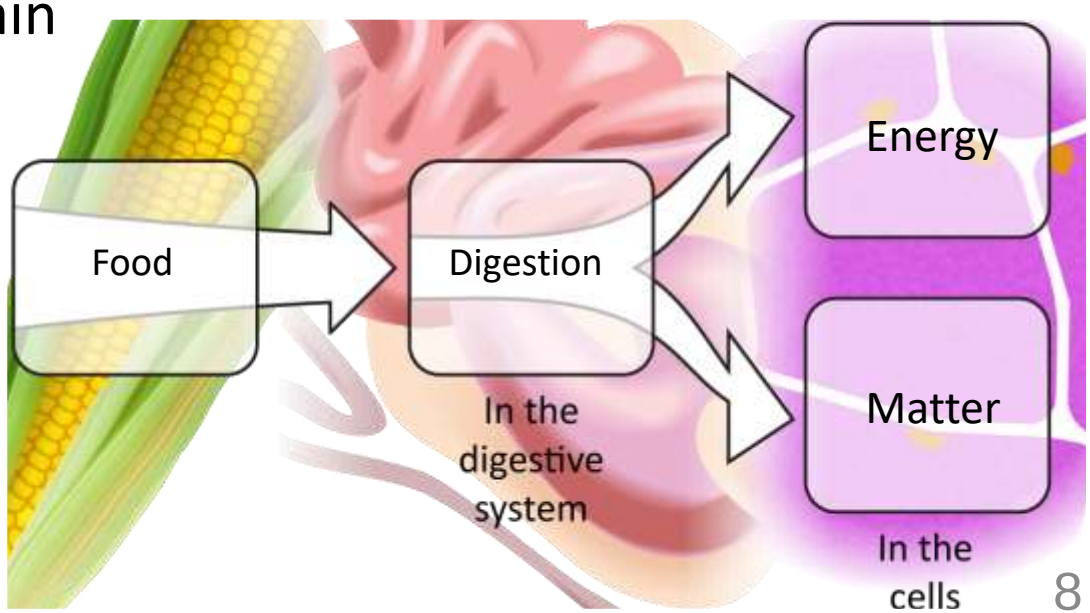
Reminders from Last Week

- **Digestion is the process of breaking food into smaller and smaller pieces.**
  - Large macromolecules (fats, protein, and carbohydrates) are eventually broken into individual molecules (fatty acids, amino acids, and glucose).
  - These molecules then are absorbed into the blood and are transported to individual cells.



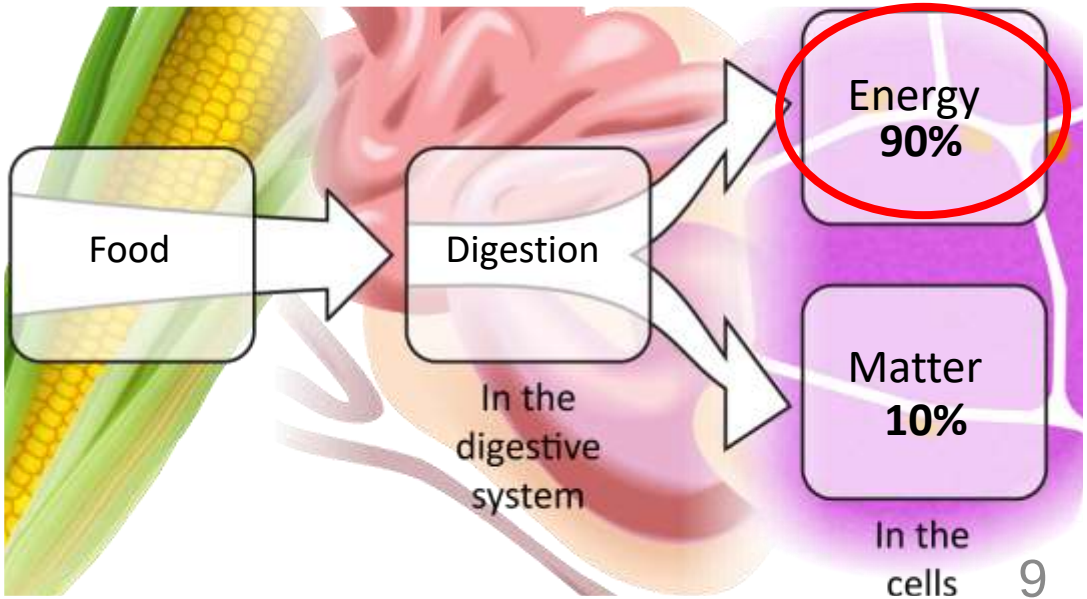
Reminders from last week

- **The food that animals consume provides either 1) energy or 2) matter.**
  - 1) Food can provide an animal with the energy it needs to function. Molecules in food have lots of C-C and C-H bonds.
  - 2) Food can provide matter (the atoms) that animals need to create and maintain their cells (*all the mass of an animal comes from the food they eat*).



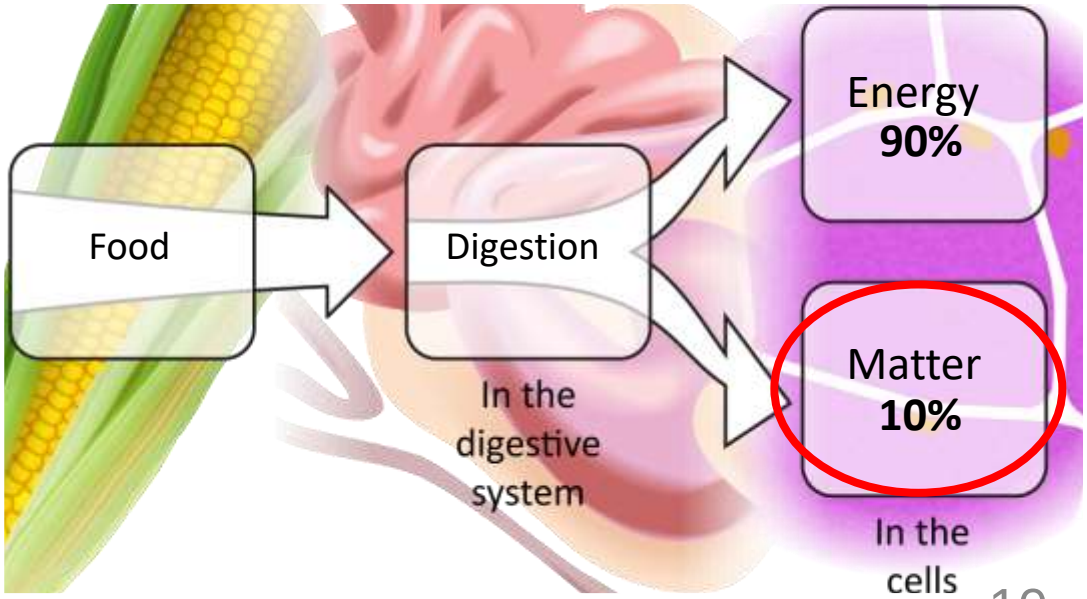
Reminders from last week

- **Most food is used for energy (especially carbohydrates).**
  - For example, corn is broken down into individual glucose molecules. These enter the bloodstream.
- **Cells absorb glucose and oxygen from the bloodstream**.
  - Cells rearrange the atoms on glucose and oxygen to make carbon dioxide and water vapor.
  - These are released back into blood and are exhaled from the lungs.
  - Chemical energy remains in the cell.



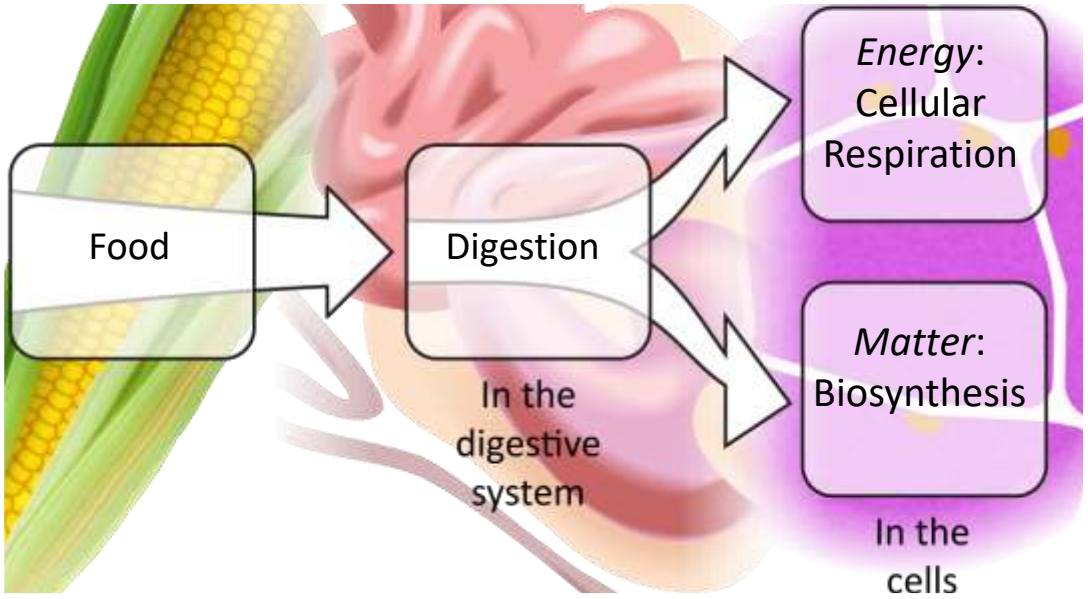
Reminders from last week

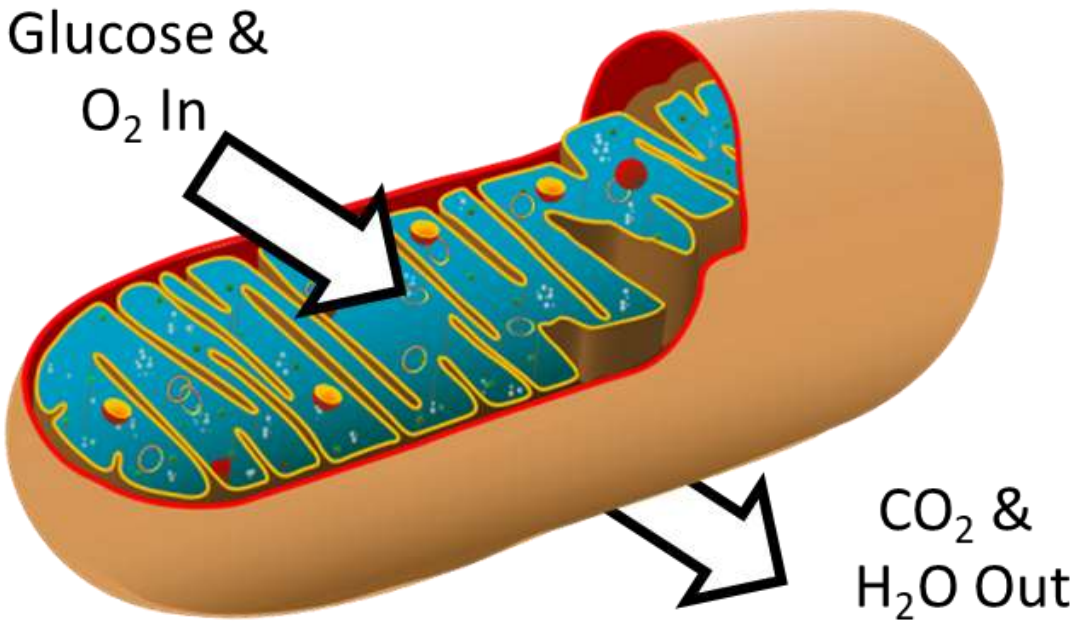
- **Some food is used for its matter (especially protein).**
  - All molecules found in animal cells comes from molecules in food.
- **During digestion, macromolecules (fat, protein, or carbs) are broken into individual molecules (fatty acids, amino acids, or glucose).**
  - These molecules then enter the blood and are absorbed by cells.
  - Cells assemble these molecules into new macromolecules.
  - Chemical energy remains in the high energy bonds of the new molecules.



Adding details

- **We can refer to these processes using specific names.**
  - Cellular respiration is the process in which glucose and oxygen molecules are rearranged into CO_2 and H_2O to acquire chemical energy.
  - Biosynthesis is the process in which organisms use molecules they consume to make the macromolecules needed for its cells.
- **These processes are what enable cells to function.**
  - Cell respiration is what provides cells with chemical energy.
  - Biosynthesis is what provides organisms with matter to repair and build cells and bodily tissue.



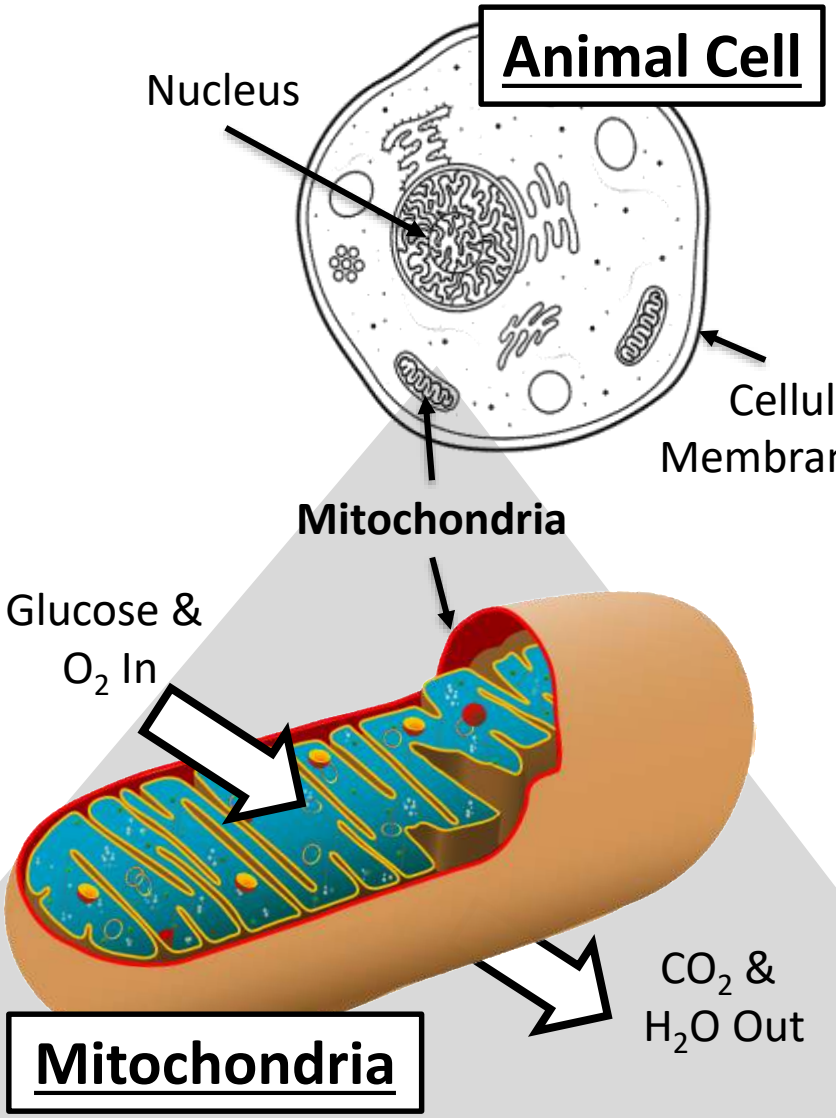


CELLULAR RESPIRATION

The process in which glucose and oxygen molecules are rearranged into CO_2 and H_2O to acquire chemical energy.

Cellular Respiration & Mitochondria

- **Cellular respiration primarily occurs in the mitochondria of cells.**
  - Mitochondria: organelles in the cells of most living organisms that provide chemical energy to power cellular activities.
- **Mitochondria rearrange atoms in glucose and oxygen molecules into CO_2 and H_2O.**
  - CO_2 and H_2O molecules leave the cell and diffuse into the blood.
  - CO_2 and H_2O molecules are then released into the lungs and are exhaled.

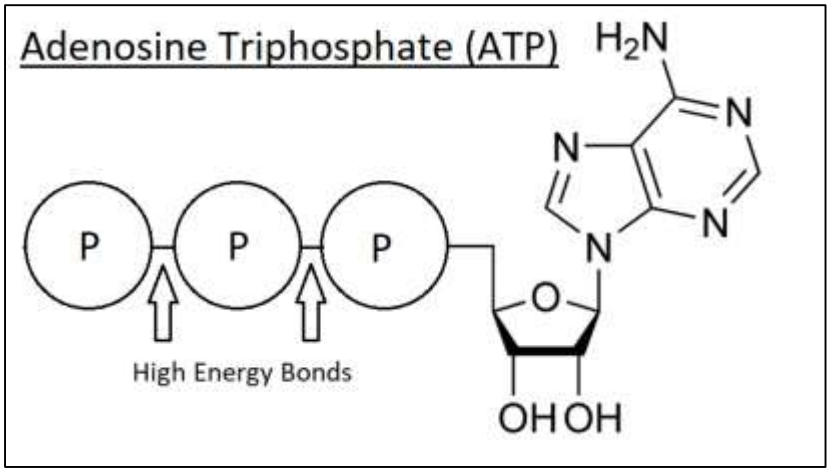


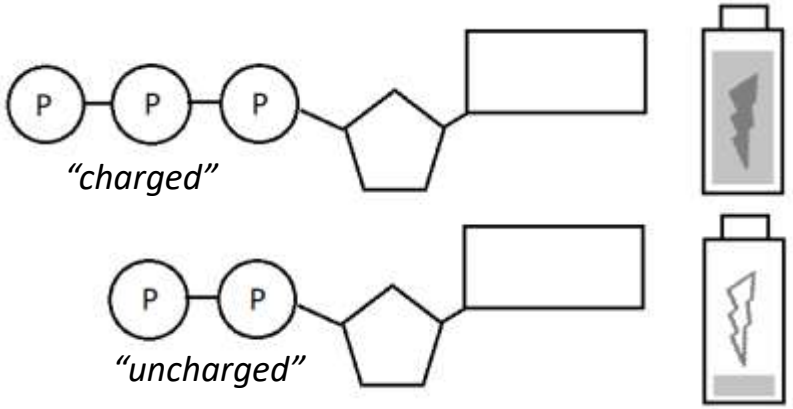
Source: how-to-draw-cartoons-online.com

Source: commons.wikimedia.org

ATP – Molecular Batteries

- **The chemical energy in the C-C & C-H bonds of glucose is moved to ATP molecules during cellular respiration.**
  - ATP is a molecule that can efficiently deliver chemical energy to power cellular activity.
- **ATP is sort of like a molecular rechargeable battery.**
  - The mitochondria are like battery chargers.
  - The chemical energy from a single glucose molecule can "recharge" dozens of ATP molecules.
- **ATP powers most cellular activity using its high energy bonds.**

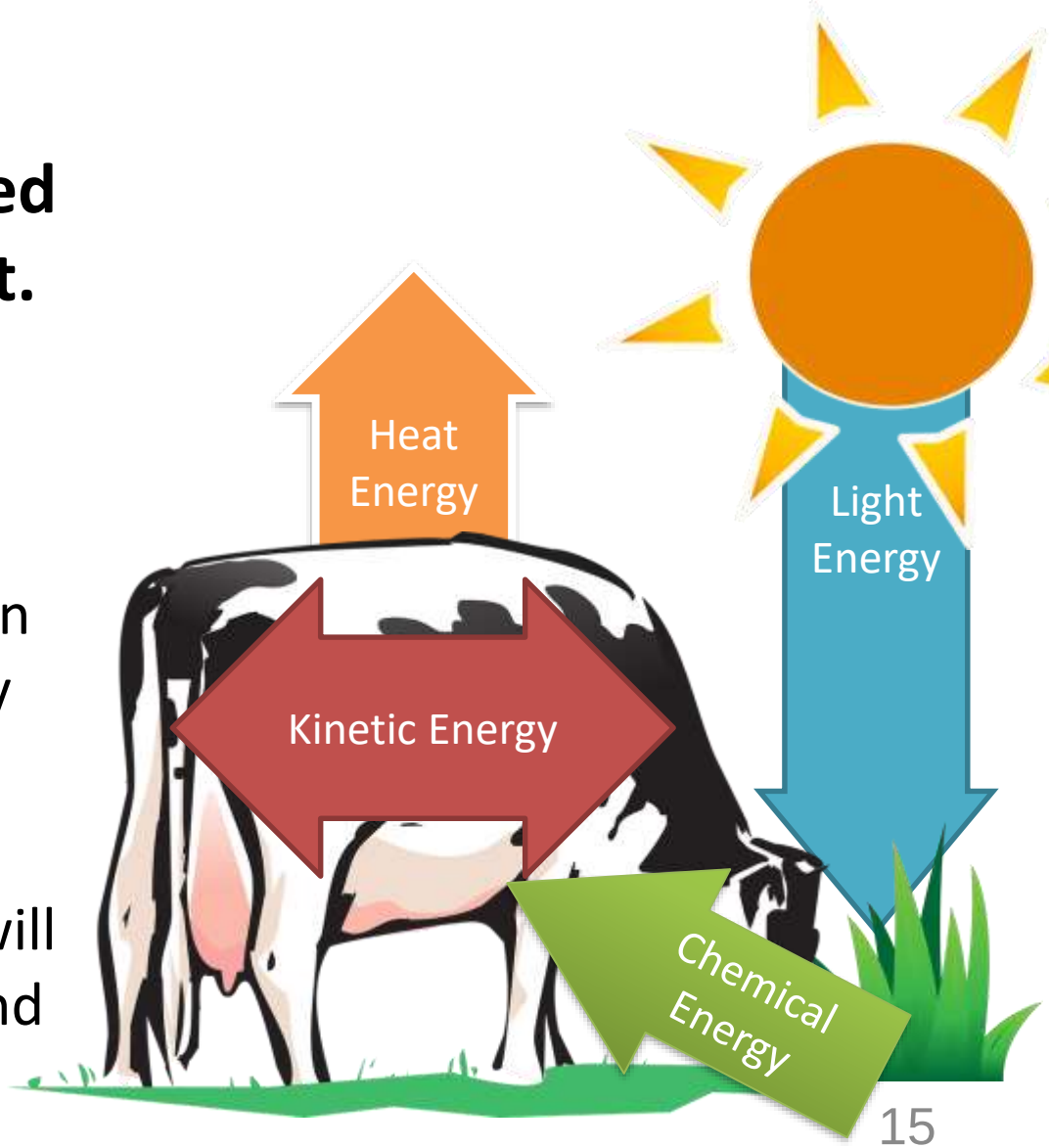




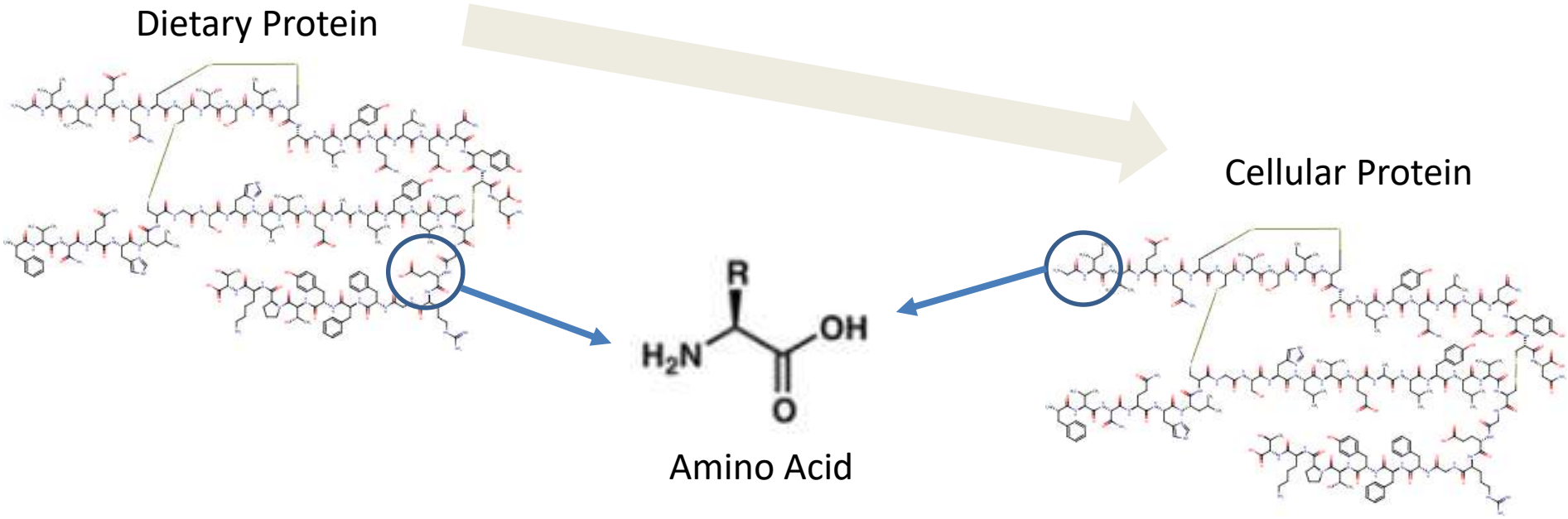
After ATP powers cellular activity, it loses a phosphate molecule, and must be "recharged" in the mitochondria.

What Happens To Energy?

- **Most chemical energy stored in ATP is converted to motion and then heat.**
  - Motion causes friction, which transforms kinetic energy into heat energy.
  - Some chemical energy can also be converted directly into heat, particularly in warm-blooded animals.
  - Most consumed energy will be converted into heat and lost from the body.



Source: Pixabay

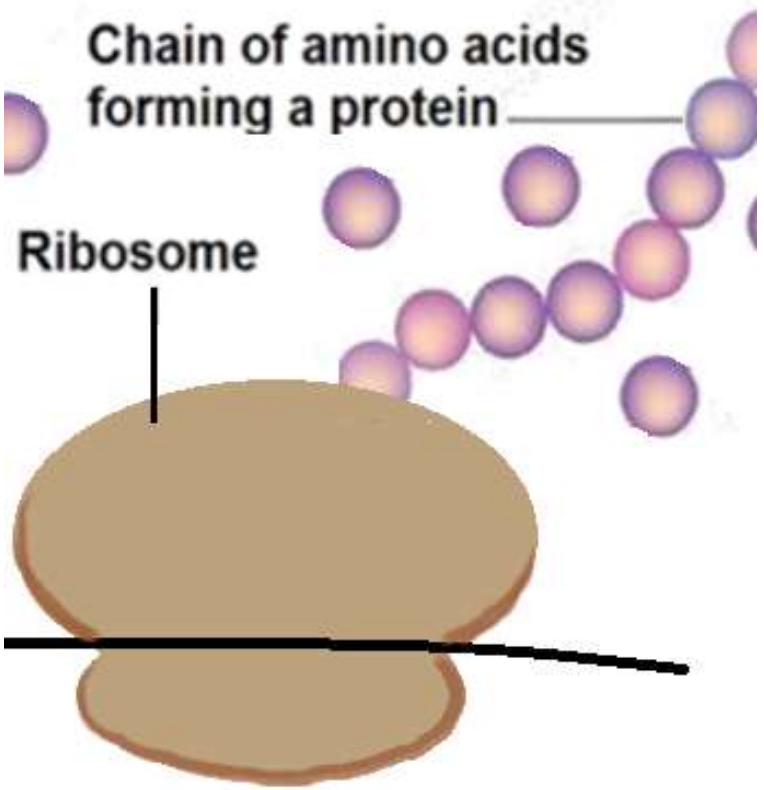


BIOSYNTHESIS

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

Biosynthesis

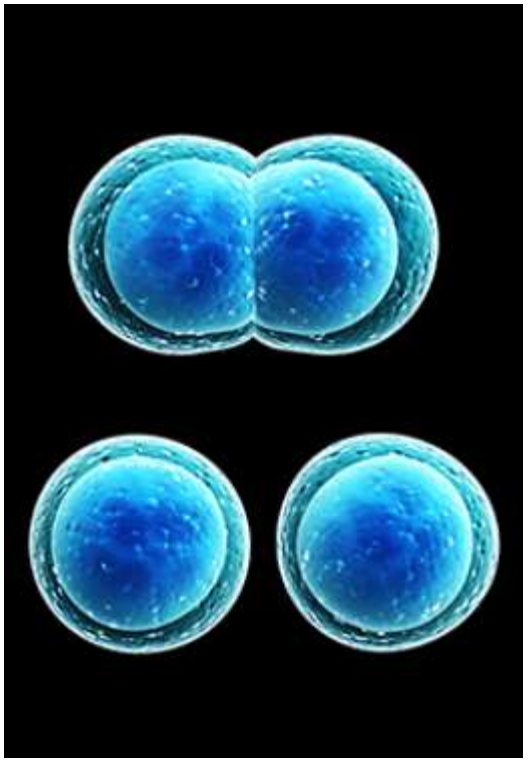
- **Biosynthesis begins with digestion.**
  - Large macromolecules (like proteins) are broken into individual molecules (such as amino acids).
  - These enter the blood and travel to cells.
- **Biosynthesis primarily occurs in cells.**
  - Cells first absorb individual molecules from the blood.
  - Structures inside the cell then assemble individual molecules into macromolecules like proteins.



Cellular structures called *ribosomes* assemble proteins inside the cell using amino acids that have been consumed in dietary protein.

Mitosis

- **As a cell assembles macromolecules, the cell grows bigger.**
  - Eventually, the cell may grow large enough to divide in half as it produces more and more macromolecules.
- **The process of dividing one large cell into two smaller cells is called <u>mitosis</u>.**
  - 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).

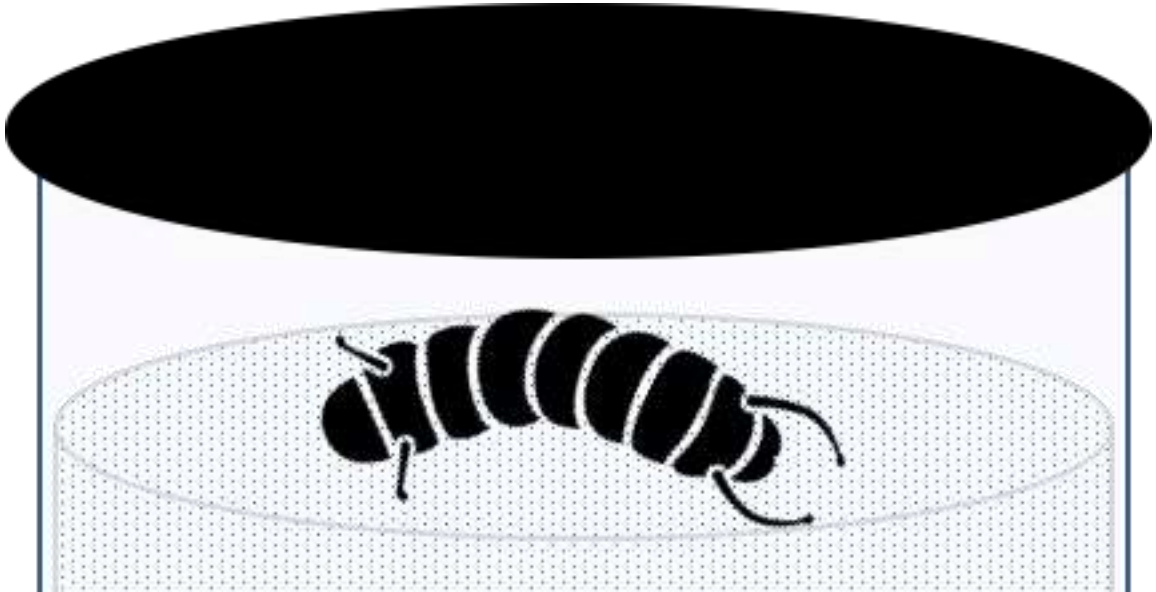


A cell splits into two cells via mitosis.

Image Source: https://www.sciencenewsforstudents.org/article/scientists-say-mitosis

Revising Our Thirsty Moth Claims

- Re-visit your ideas about the thirsty moth larva.
- Revise your explanation using the following terms: *Cell respiration, biosynthesis, mitochondria, O_2, CO_2 & H_2O, organelle, high-energy bonds, motion, heat.*
- Draw a diagram to show the path of all matter & energy that goes into and out of the moth larva.



Looking Ahead: Part 3 Investigation

- In Part 3, you will be conducting the Molecular Modeling investigation.
- You will create models of glucose, oxygen, carbon dioxide, and water molecules.
- You will then use these models to guide your reasoning.