Chapter 4 Cells & Energy

How do we get energy? How do plants get energy?

- Organisms get energy from the food they eat and plants get energy from the sunlight.
- Review: What ORGANIC molecules are required for chemical processes??—Chapter 2

1. Carbohydrates
2. Lipids
3. Nucleic Acids
4. Proteins

Chapter 4 is all about METABOLISM

- Metabolism: all the chemical processes that build up or break down materials
- Metabolism can be divided into 2 types

Metabolic Processes

Synthetic

- Builds up material and store energy
- Examples:

Photosynthesis, Chemosynthesis

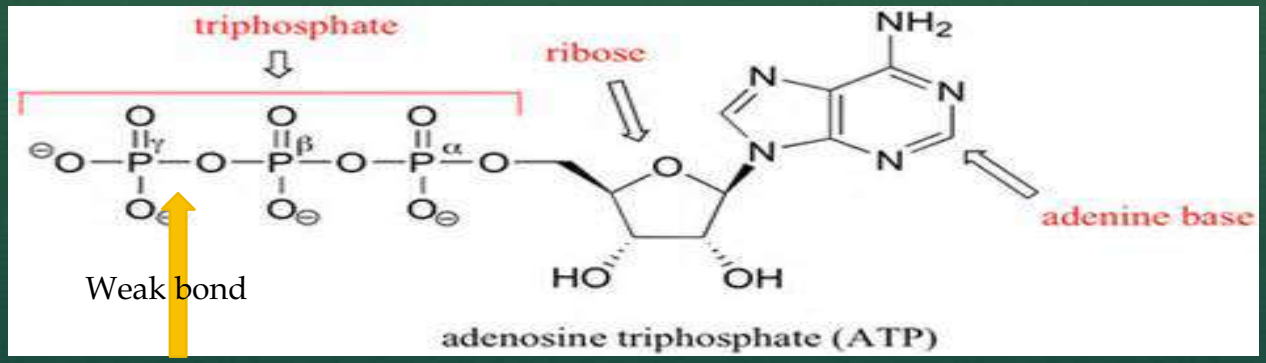
Catabolic

- Breaks down material and releases energy
- Examples:

Cellular Respiration, Fermentation

4.1 Chemical Energy & ATP

- Energy comes from food as we discussed, but not directly. The molecules in the food are broken down first in order to produce energy.
- ATP =Major energy carrier Food can be converted into ATP.
- ATP=adensine triphosphate (3 phosphate groups)

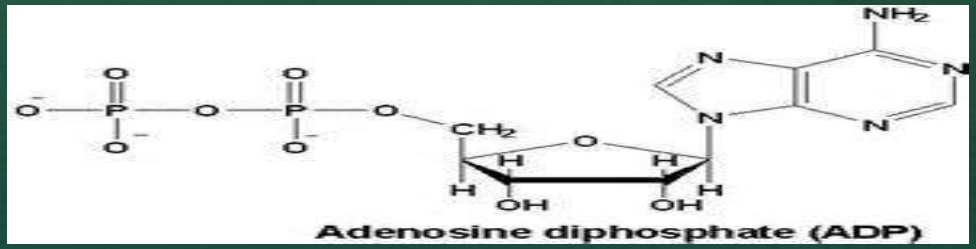


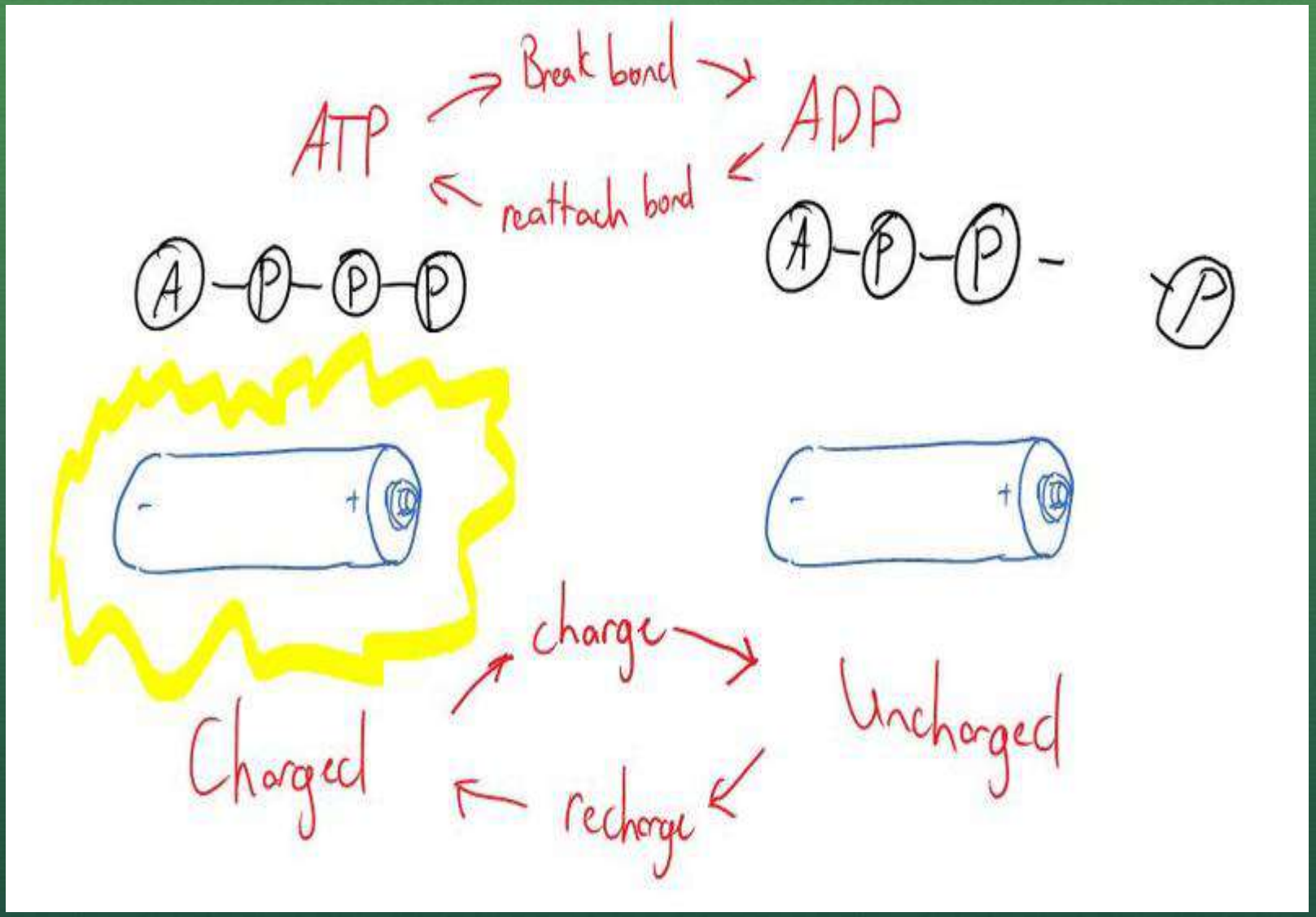
ATP continued…

- ATP is like a rechargeable battery!
- Energy is released from ATP by removing

a phosphate group. Breaking the weak bond, releases energy, but now it is <u>ADP !</u>

- ADP is rechargeable too. We will talk about how it gets "recharged" later in the week. (it's different for plants & animals)




ATP
Break bond
ADP
reattach bond
A P P P
A P P
P
charge
Charged
Uncharged
recharge

Where does ATP come from?

- FOOD! All food is not created equally in terms of energy
- Food does NOT contain ATP—it is digested so the molecules can be used to make ATP.
- The number of ATP molecules produced depends on the type of molecule broken down-carbs, lipids, or proteins.

Food and Energy Chart

Molecule	Calories	ATP
Carbohydrates	4 calories/mg	36 ATP/glucose molecule
Lipids (store 80% of energy!)	9 calories/mg	146 ATP/trigylceride
Protein (not usually used for energy, but to make more protein)	4 calories/mg	36 ATP

What processes are used to get ATP?

Plants

- Photosynthesis AND Cellular Respiration

Animals

- Cellular Respiration ONLY!

- Some microorganisms in places that never get sunlight (deep in the ocean) use Chemosynthesis.
- Chemosynthesis: some organisms use chemical energy instead of light energy to make energy. Examples- bacteria at bottom of the ocean.

Wrap-up

1. What is ATP?
2. What is ADP?
3. What type of molecule yields the most ATP? Least? Why?
4. How are chemosynthetic organisms and plants similar?

Warm-up Questions

- What is the difference between ATP and ADP?
- What molecules are broken down to make ATP?
- Which molecules yield the most ATP when broken down?
- How are some organisms able to survive without sunlight and photosynthesis?
- How do plants get ATP? Animals?

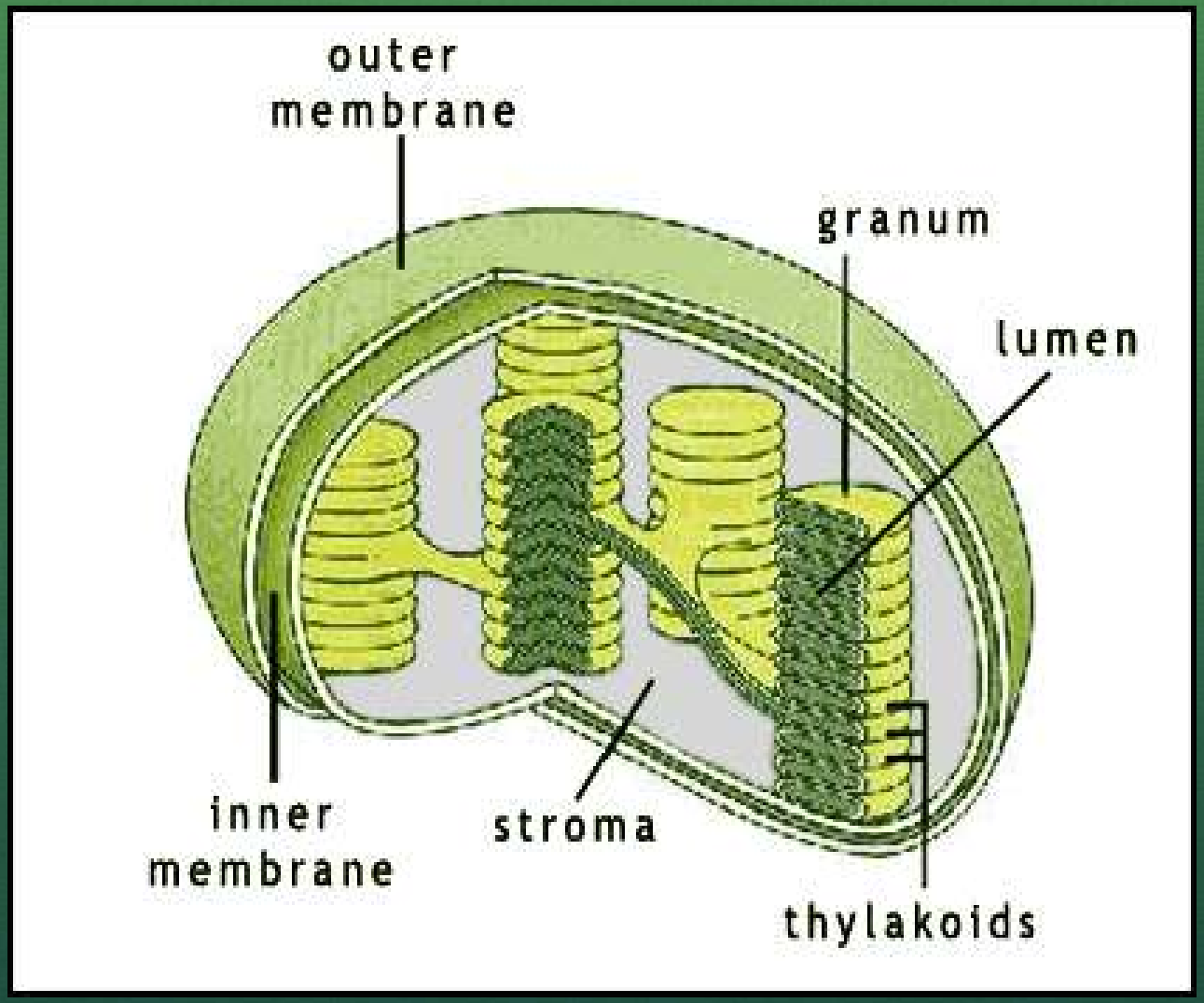
4.2 Overview of Photsynthesis

- This section will introduce photosynthesis. It is just a "snapshot" of what we will cover next week.
- It is pertinent that you understand the general idea of photosynthesis before we cover the in depth details!!!!
- Review: plants get energy directly from the sun, but organisms must consume food (organic molecules).
- ATP is made from the breakdown of sugars. (plants capture energy from sun light and change into energy stored in sugar)

Photosynthesis

- Producers- produce their own energy. (plants, some bacteria, some protists)
- Photosynthesis- the process that most producers use to capture energy from the sun and make sugar, which stores chemical energy.
- Chlorophyll- captures energy from the sun, absorbing blue/red wavelengths of light and reflects green
- Chloroplasts- organelle where photosynthesis takes place.

Structure of Chloroplast



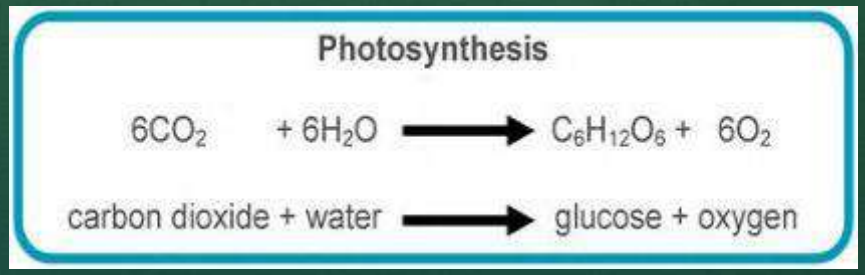
2 major parts of photosynthesis……

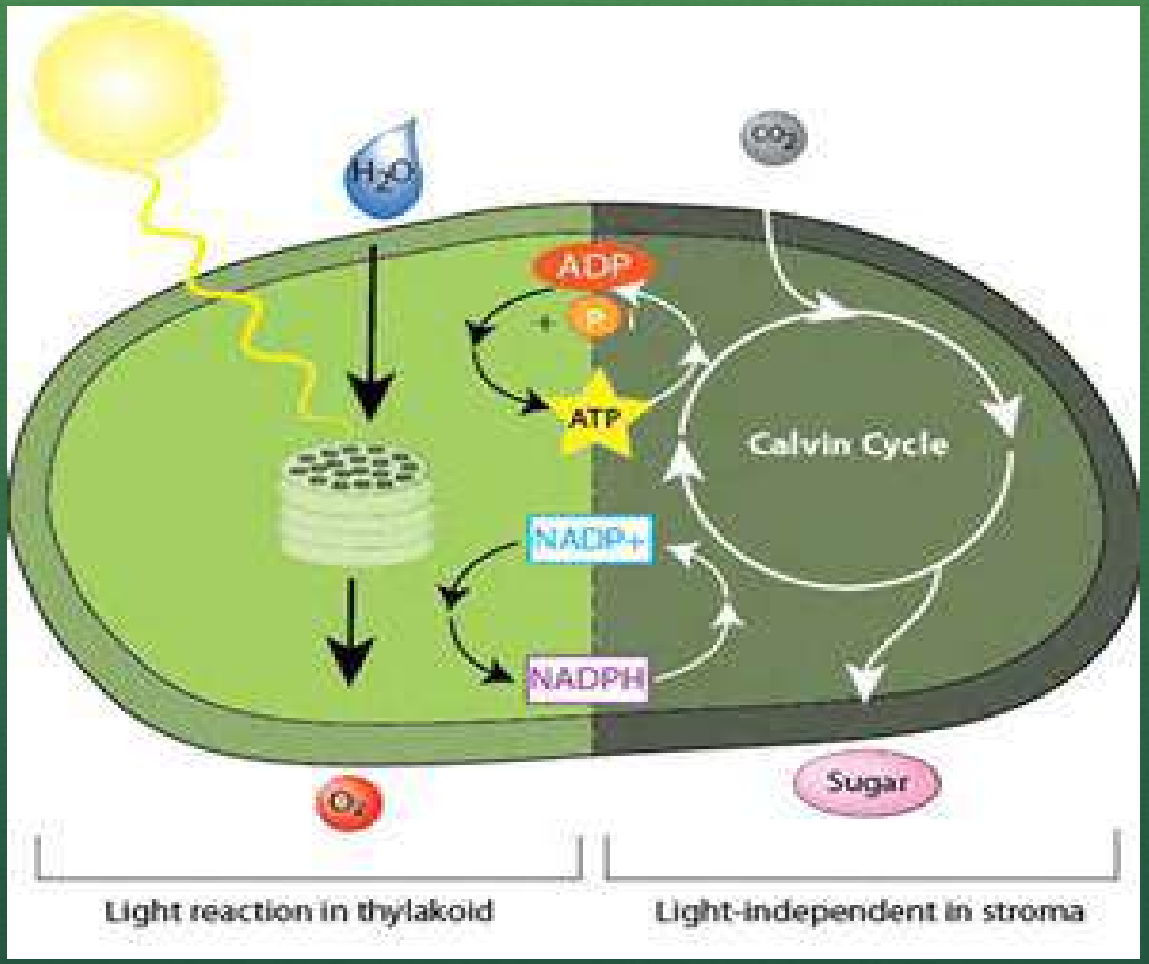
Light Dependent Reactions

- **Main purpose: capture energy from sun & make energy carriers**
- Needs light
- Uses water
- Releases oxygen

Light Independent Reactions (calvin cycle)

- **Main purpose: use energy carriers to make sugar**
- **Does NOT need light**
- **Uses carbon dioxide**
- **Produces sugar C6H12O6**




H_2O
CO_2
ADP
P
ATP
Calvin Cycle
NADP+
NADPH
O_2
Sugar
Light reaction in thylakoid
Light-independent in stroma

Parts of a chloroplast:

- Thylakoid= the stacked coin-shaped compartments. The membrane of thylakoid contains chlorophyll and other light-absorbing materials, and proteins
- Several thylakoids stacked together=grana
- Stroma= fluid that surrounds the grana inside a chloroplast.