

Biology Notes Chapter 3

Characteristics of Living Organisms

- Movement – ability to move from point A to point B
- Growth – ability to increase in size
- Reproduction – ability to create more of it's own kind
- Metabolism – the sum of all the chemical changes taking place in an organism
- Respiration – the exchange of gases
- Response – ability to respond to changes in the environment
- Communication – ability to communicate with others of the same species
- Excretion – Waste disposal
- Containing Coded instructions - DNA
- More complex and organized compared to non living organisms

All Life Processes require energy

Energy – Defined as the capacity to do work. **Free Energy** – NRG usable by cells.
Animals use chemical energy, plants use light energy

Types of work

- Chemical Work – metabolism** – the breaking up and forming of compounds
- Transport** – movement of raw materials within the cell
- Mechanical** – physical moving of the cell from point A to point B

Autotrophs – Producers - organisms that produce their own food – plants, some microbes, use photosynthesis

Heterotrophs – Consumers - organisms that feed off other organisms. All animals, fungi, microbes

- Herbivores** – plant eaters
- Carnivores** – meat eaters
- Omnivores** – both meat and plant eaters
- Decomposers** – eats decaying material

Cellular Respiration – Carbohydrates + Protein + Fats \rightarrow ATP

ATP – a small unit of NRG used by cells. All nutrients eventually become ATP

- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 38ATP$
- Mitochondria** – Power cell of the cell – makes ATP.

Food Chain – a linear visual of the transfer of food and energy from 1 trophic level to the next

- Trophic Level** – Feeding Level
- Producers \rightarrow 1st order consumers \rightarrow 2nd order consumers \rightarrow 3rd order consumers
- Only 4 – 5 levels due to 10 % law

10% law – when energy is transformed from one form to another, 90% of NRG is lost as heat.

Food Web – Shows ALL feeding relationships in a ecosystem, a collection of Food Chains

Energy Flows and Matter Cycles – Energy is changed from one form to another, matter is recycled
Energy is infinite, matter is finite

System – A confined place where reactions take place. When burning a log, the log is the system

Surroundings – Everything but the system

Biotic – living

Abiotic – Non-living

Ecosystem – the interaction of the biotic and abiotic components of a particular place, with many habitats

Biosphere – the living Earth, place where life exists

Biomes – Climatic region with certain characteristics made of small ecosystems

Community – all the living organisms in an ecosystem, contains the population

Population – made of species

Species – organisms so close they can reproduce and produce fertile offspring

Habitat – Where an organism lives – home

Niche – What you do to live, “Profession”

Environment – your surroundings

Bioenergetics – the study of energy flow in life

1st Law of Bioenergetics – Energy cannot be created or destroyed, only transformed

Similar to the Law of Conservation of Energy in physics

2nd Law of Bioenergetics – Natural processes tend to increase Entropy, or ΔS

Entropy – randomness, “spreadioudiness” ΔS

Natural organisms have a tendency to become less organized, NRG needed to keep organized

Energy flows in one direction, unidirectional

Metabolism

Types of Metabolic Reactions

Synthesis – building of molecules – Also known as **Biosynthesis**

Photosynthesis – building of glucose

Protein Synthesis – building of proteins

Decomposition – break down of organic compounds to release chemical energy

Also known as **degradation**

Cellular Respiration – Decomposition of Glucose using O_2 to form ATP

ATP – Adenosine TriPhosphate – the Energy Currency of Life

Adenine + Ribose + 3 phosphates

Glucose contains 100 kcal/mol of energy, ATP contains 7.3 kcal/mol

$ATP \rightleftharpoons ADP + P + 7.3 \text{ kcal NRG}$

$ADP \rightleftharpoons AMP + 2P + 14.6 \text{ kcal NRG}$

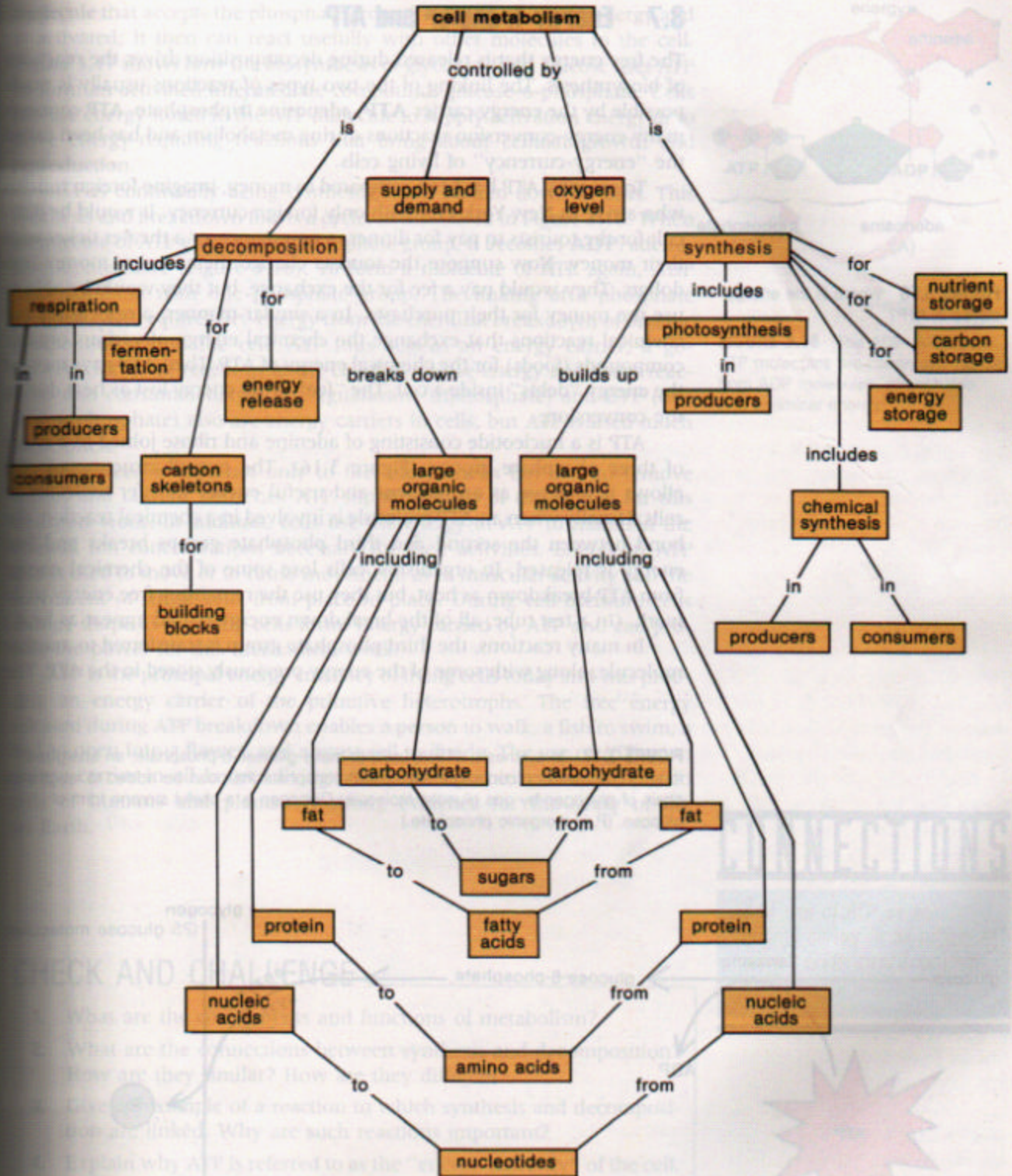


FIGURE 3.15 A concept map for cell metabolism. The map shows that synthesis includes biosynthesis reactions and stores energy, whereas decomposition includes degradation reactions and releases energy. Note how synthesis and decomposition are linked by simple molecules, which are the building blocks of macromolecules.