

# Chapter 1: The Web of Life

## Biology Lecture 1.1 and 1.2

### Section 1-1: Organisms Interact With Organisms They Eat

What is an organism?

Living things affect one another in many ways:

Examples: crowding, protection, poisoning, shelter, mate w/ each other, or eat each other.

1) Consider the following food chain: (see fig. 1.1 on page. 6)

*Plant* → *grasshopper* >> jumps to a new plant >> grasshopper gets stuck in a spider's web >> spider injects poison into the grasshopper → *spider* liquefies the grasshopper → *microorganisms* (decompose grasshopper) >> nutrients are recycled and is used by the plants

Question??

1. Organisms are connected to one another in the web of life by their need for what resource?

Answer: Food (energy) needed to grow & reproduce

2. Animals eat plants or other animals or both for energy!

Question?

Where do plants get their energy from if they do not eat other organisms?

Example: (see fig. 1.2 on page 7)

Sun >> yellow daisies >> animal eats the daisies >> animal eats other animals >> animals die and decompose >> nutrients goes into the soil

Question?

1. Where in the above example is the energy from the plants being directly transferred?
2. Where in the above example is the energy from the plants being indirectly transferred?

**\* Without the supply of energy, the organism dies. Just as the spider's web must be repaired if it is broken or the spider can't get food (energy).**

**\* Remember: the smallest change (direct or indirect), in a food web can have major effects on other connected organisms!!**

**2) Factors that can change relationships between organisms:**

- 1. competition among orgs. (food, shelter, mates)**
- 2. increase in rain, ie. Flooding**
- 3. decrease in rain, ie. Drought**
- 4. sunlight availability**
- 5. temperature**

**Biotic factors – living factors (#1)**

**Abiotic factors – nonliving factors (#2-5)**

**Ecology – a sub-study of biology; the study of the living and nonliving parts of the environment and how they interact.**

**Eg. An ecologist might study the effects of acid rain on lakes & streams in Canada.**

**Section 1-2: All Living Orgs. Make Up A Food Chain**

**(See fig. 1.7 on page 9)**

**A big thorny raspberry bush can be .....**

- 1. shelter & food for rabbit**
- 2. food for bird**

**Food Chain example:**

**raspberry bush >> rabbit >> hungry fox >> feces/ rabbit flesh >> decomposers**

**Definitions:**

**1. Food chain – shows the connections between orgs. W/ respect to obtaining energy. “what eats what”**

**Note: the arrow points to what organisms is doing the eating!**

**A) Types of organisms in a food chain:**

- 1. Decomposers/ microorganisms – eat dead & decaying flesh. Egs, fungi, maggots, bacteria. They are consumers!**
- 2. Producers – green organisms, ie, photosynthetic orgs. They use sun light to make their own energy.**
- 3. Consumers – any org. that is not able to directly use sun light for energy. A nonproducer. Egs, animals**
- 4. Community – all of the decomposers, producers, & consumers that interact w/ one another in the same area (habitat).**

**Egs. Coastal chapparel community**

- 5. Food web – when all the food chains in a community are connected. ie, food webs are many food chains connected together – very complex.**
  - Food webs & food chains keep living populations in balance.**
  - “A Balance of Nature” – all organisms are kept in check; consider the following question:**
  - What two processes help keep populations in balance?**

**?? Imagine what would happen to the above community if the rabbit population was not kept in check by its predators(fox) feeding on them.**

## **Biology Lecture 1.3, 1.4 & 1.5**

### **Section 1.3: All Biological Activity Requires Energy**

**Question??**

**Food chains & food webs are based on what? ie, what do they show?**

**Answer: the flow of matter and energy from one org. to another.**

**I. All organismal activities require energy:**

**Egs: running , thinking, sleeping, growing nails??**

**A) Chemical energy – “energy from food”; the energy in food is stored in the food molecules. The energy is released when you digest your food!**

- the energy from food is used by your body cells, and some is lost as heat to the atmosphere.

**Question?** What kinds of food have a lot of stored energy?

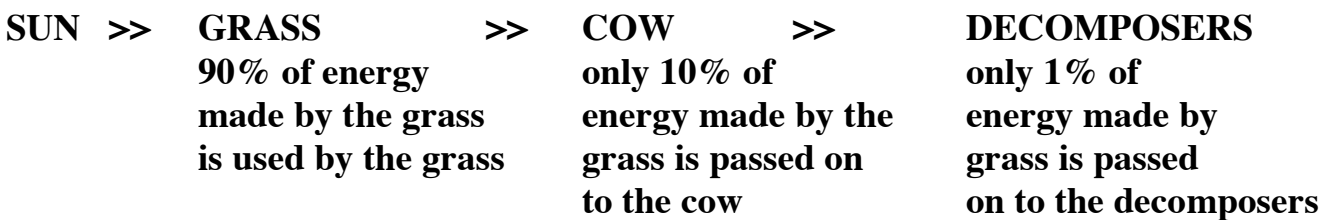
**a) Other forms of energy:**

- 1) electrical energy
- 2) heat “ \*\*\* energy can be converted from one
- 3) light “ form to another!
- 4) mechanical “
- 5) nuclear
- 6) chemical “

Section 1.4: Photosynthesis Supplies Food Energy

- I. Photosynthesis – plants absorb light energy (sun) & convert it to chemical energy found in fats, sugars, & proteins.
  - the plant uses the chem. energy it makes to grow & reproduce; we happen to come along & eat the plants for energy!

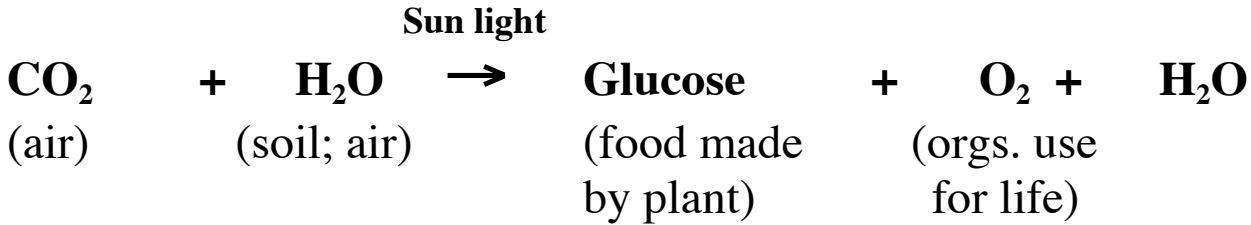
Eg. Food Chain Showing the Flow of Energy:



- **the flow of energy through a food chain/web is NOT efficient; when an org. breaks down its food, some energy escapes as heat to the atmosphere!! eg. Feel the temp. of your arm**
- Energy **MUST** continually enter a community or the community will die! Therefore; energy flows one-way through a food chain.

Question?? At what level does energy enter a food web??

Answer: Plants/producers/photosynthesizers



\* Note: less complex molecules are converted to complex molecules!

? **Questions:** See fig. 1.10 on page 12:

Why is it **impossible** for organisms to recycle(reuse) energy?

Answer: Their activities use some of the energy & change some to heat energy which is lost to the atmosphere.

### Section 1.5: Matter Is Used to Build Living Things

1. Matter – anything that takes up space; it is made of atoms.

Egs. tires, hair, food, and YOU! (see definitions below).

- **See figure 1.12, page 14**
- Matter is recycled (reused) through in a food web from one org. to another (unlike energy flow)! **See figure 1.13, page 14**
- All living orgs. get their matter from the earth & air.

Matter is made up of:

A) Atoms– smallest particle of matter; make up specific elements.

B) Elements – made of one type of atom. Egs. Cu, C, H, O<sub>2</sub>

C) Molecule/Compound – two or more atoms chemically combined. Egs. H<sub>2</sub>O, NaCl



**\*See figure 1.11, page 13**

\*note: there is stored chemical energy in the bonds between the atoms!

**Question?:** How is energy released from molecules?

- All living orgs. are made up of different combinations of atoms and molecules!
- Organisms eat food molecules, break them down to get energy for growth & maintenance; and rearrange the molecules to make body parts.

## **Biology Lecture 1.6 & 1.7**

**Section 1.6:** The Biosphere is Home to All Living Things

**Question?:** How or by what 2 factors are organisms tied to one another or interconnected to one another on earth?

- 1) Biosphere – the thin layer of life that surrounds the nonliving world. It includes all the orgs. in the air to the orgs. deep in the oceans.
2. All orgs. in the biosphere interact w/ one another because they're part of the food web.
3. Some interactions are obvious (direct) and others are not so obvious (indirect).

**Questions:**

1. Write an example of a direct relationship that you have w/ another organism.

2. Write an example of an indirect relationship that you have w/ another organism.

3. **See figure 1.14** on page 15 and read the caption.

How does human behavior fit into the biosphere?

4. Humans have had devastating (direct/indirect) effects on our environment in a short period of time!

5. Human activities are straining and destroying the biosphere.

6. What you do affects the rest of the biosphere for many years to come!

**HEY! How do your actions affect the biosphere???**

7. Examples:

3) *Exxon Valdez* oil spill disaster. > 10 million gallons spilled

4) Various types of pollution.

5) Human population explosion; over 6 billion people as of 2001

6) Deforestation – increases CO<sub>2</sub> into the atmosphere.

7) Burning of fossil fuels - increases CO<sub>2</sub> into the atmosphere.

8. Both 5 & 6 contribute to “Global Warming”

8) Depletion of the ozone layer

9) Poaching of furs

- Pollutants affect the recycling of matter throughout the food web by “tying up” matter that would normally cycle between living orgs. and their environment.

\* Data collected on these various activities show that our planet is in trouble!

## **Section 1.7: A Hypothesis Explains an Observation**

### **I. The Nature of Science – to investigate the world.**

- Science uses general principles (rules) for examining **testable observations; observations that are measurable.**

- The rules of science DO NOT come from politics, religion, or personal beliefs. eg. numerology or astrology

## II. How do scientists work?

- **They are** like detectives **who wish to find answers to questions/problems.**
- **Scientists make** observations and interpretations **about what they see.**
- Scientists use the **scientific method** to test one's interpretation or hypothesis. (see page 19 in text)

### 1. Observations- (2 types of data)

a. *Qualitative* – color, shape, smell, non-numerical data.

- eg. The color of the sky is **red** on smoggy days.

b. *Quantitative* – numerical data.

- **eg. The ozone measures 20 ppm on smoggy days.**

### 2. Interpretations - one's explanation of their observation.

- **eg. The sky is red because the smog particles in the air reflect the red wavelength.**

### 3. Hypothesis (Ho.)- a proposal that explains one's interpretation.

**eg Ho:** *The larger the snail the faster it will travel because they have more muscles than small snails.*

### 4. Experimentation- a procedure that explains one's Ho.

**Example Situation: 2 doors that you face are closed.**

#### Hypothesis (Ho.) #1:

- There is a tiger behind the door on the left.

#### Alternative Ho. #2:

- There is a tiger behind the door on the right.

#### Alternative Ho. #3:

- There is no tiger behind either of the two doors.



\* Note: an experiment will eliminate one or more of the above hypotheses!

Test a hypothesis: (experimental procedure):

- eg. You open the door on the right.

Observation: The tiger leaps out at you and you're eaten!

### Question?

What is the result of the experiment? In other words, which hypothesis has been eliminated?

Note: a successful experiment is one in which one or more of the alternative Ho's are demonstrated to be inconsistent with experimental observations, and thus rejected.

**“Scientific progress is made in much the same way a marble statue is... by chipping away at unwanted marble.”**

5. Variables: (2 types) – factors that are being tested in an experiment.  
eg. snail size versus speed of a snail.

a. *independent* (X) – “the cause”

- Causes a change in the other variable (Y), eg. snail size

b. *dependent* (Y) – “the effect”

- Gets changed by the cause (X), eg. speed of a snail

6. Controls - factors that are the same throughout the testing procedure.

Provides certainty that results are due to chance.

- eg. The surface that all snails being tested will travel on such as a flat, wet, smooth surface.
- eg. All snails will have 5 minutes to travel during testing.

7. Experimental group- the variable that is being tested.

Example: **The 10 snails traveling in 5 minutes.**

6. NOTE: Control & experimental groups allow for one to see the difference between the 2 outcomes (results).

**7. See sample Ho. on overhead!!**

\*\*The **scientific method** is a tool used to test one's interpretation or hypothesis.

## **The Scientific Method**

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**(7 steps)**

**1) Identify the Problem**

**2) Collect Background Information about the Problem**

**3) Make a Hypothesis**

**4) Test the Hypothesis**  
**(design an experimental procedure)**

**5) Make and Record Observations (results)**  
**(collect data)**

**6) Make Conclusions about What You Found**  
**(respond to your hypothesis)**

**7) Revise the Hypothesis or Procedure**  
**(only if the data does not support the hypothesis)**