



# 3-2 Energy Flow





**Where does the energy for life processes come from?**

# Producers

Without a constant input of energy, living systems cannot function.



**Sunlight is the main energy source for life on Earth.**

In a few ecosystems, some organisms obtain energy from a source other than sunlight.



**Some types of organisms rely on the energy stored in inorganic chemical compounds.**

Only plants, some algae, and certain bacteria can capture energy from sunlight or chemicals and use that energy to produce food.

These organisms are called **autotrophs**.

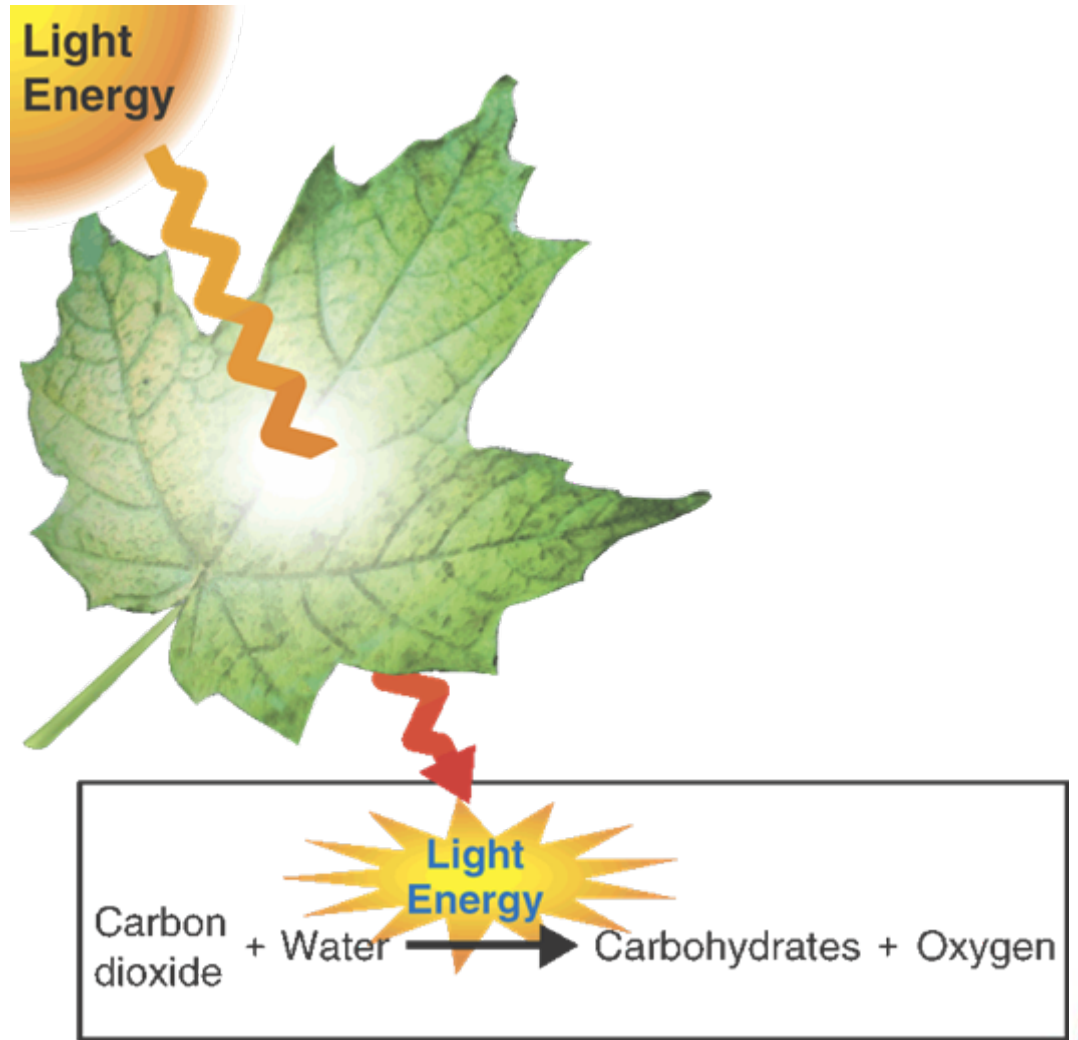
Because they make their own food, autotrophs are called **producers**.

## Energy From the Sun

The best-known autotrophs harness solar energy through a process known as photosynthesis.

During **photosynthesis**, these autotrophs use light energy to convert carbon dioxide and water into oxygen and energy-rich carbohydrates.

Photosynthesis is responsible for adding oxygen to—and removing carbon dioxide from—Earth's atmosphere.



PHOTOSYNTHESIS IN PLANTS

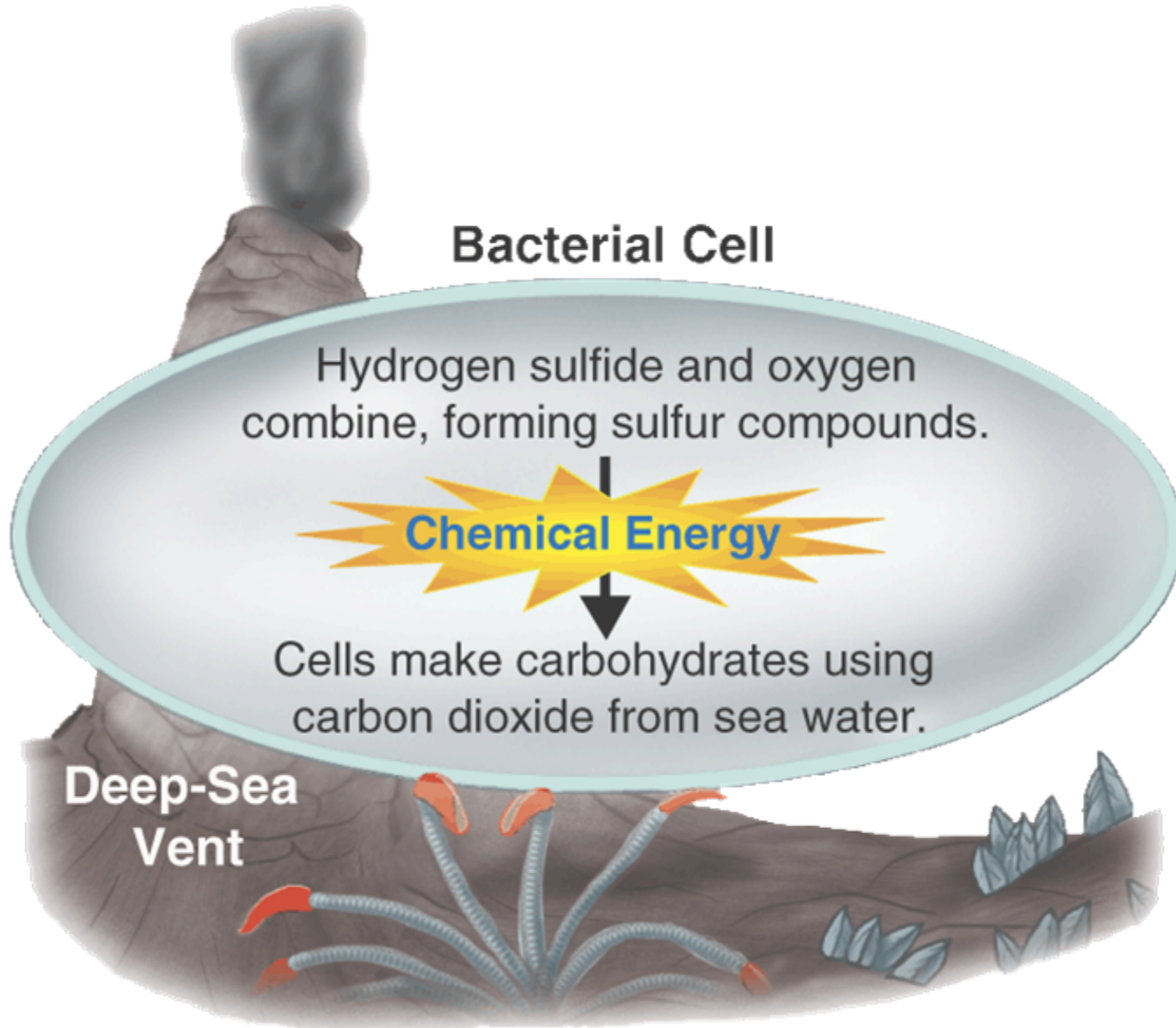


## Life Without Light

Some autotrophs can produce food in the absence of light.

When organisms use chemical energy to produce carbohydrates, the process is called **chemosynthesis**.

### 3-2 Energy Flow → Producers



## CHEMOSYNTHESIS IN SULFUR BACTERIA

# Consumers

Many organisms cannot harness energy directly from the physical environment.

Organisms that rely on other organisms for their energy and food supply are called **heterotrophs**.

Heterotrophs are also called **consumers**.

There are many different types of heterotrophs.

- **Herbivores** eat plants.
- **Carnivores** eat animals.
- **Omnivores** eat both plants and animals.
- **Detritivores** feed on plant and animal remains and other dead matter.
- **Decomposers**, like bacteria and fungi, break down organic matter.



**How does energy flow through living systems?**

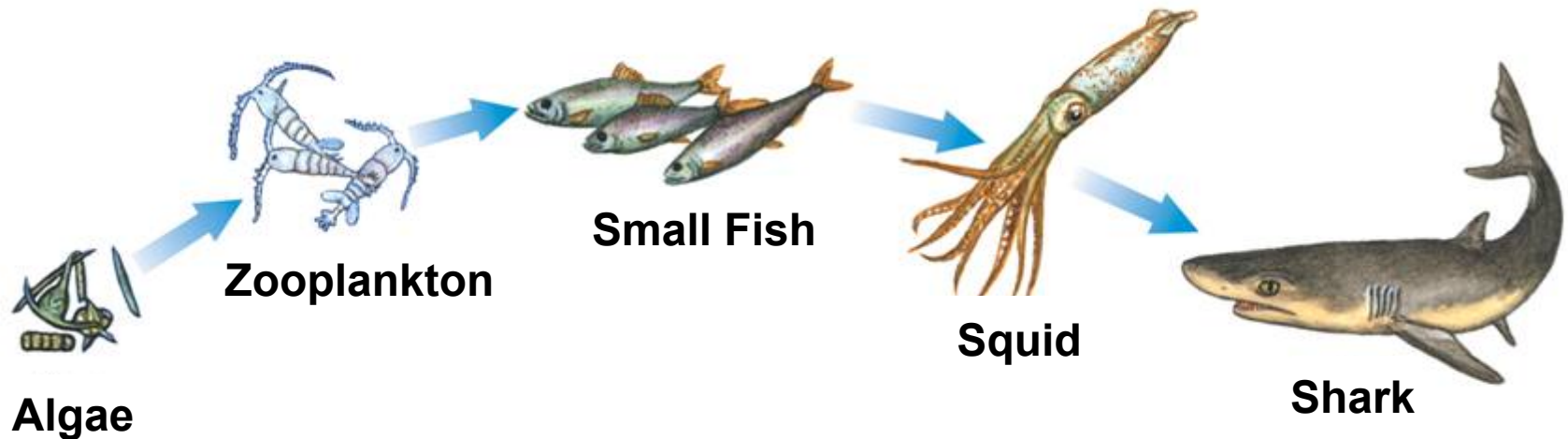


**Energy flows through an ecosystem in one direction, from the sun or inorganic compounds to autotrophs (producers) and then to various heterotrophs (consumers).**

## Food Chains

A **food chain** is a series of steps in which organisms transfer energy by eating and being eaten.

In some marine food chains, the producers are microscopic algae and the top carnivore is four steps removed from the producer.





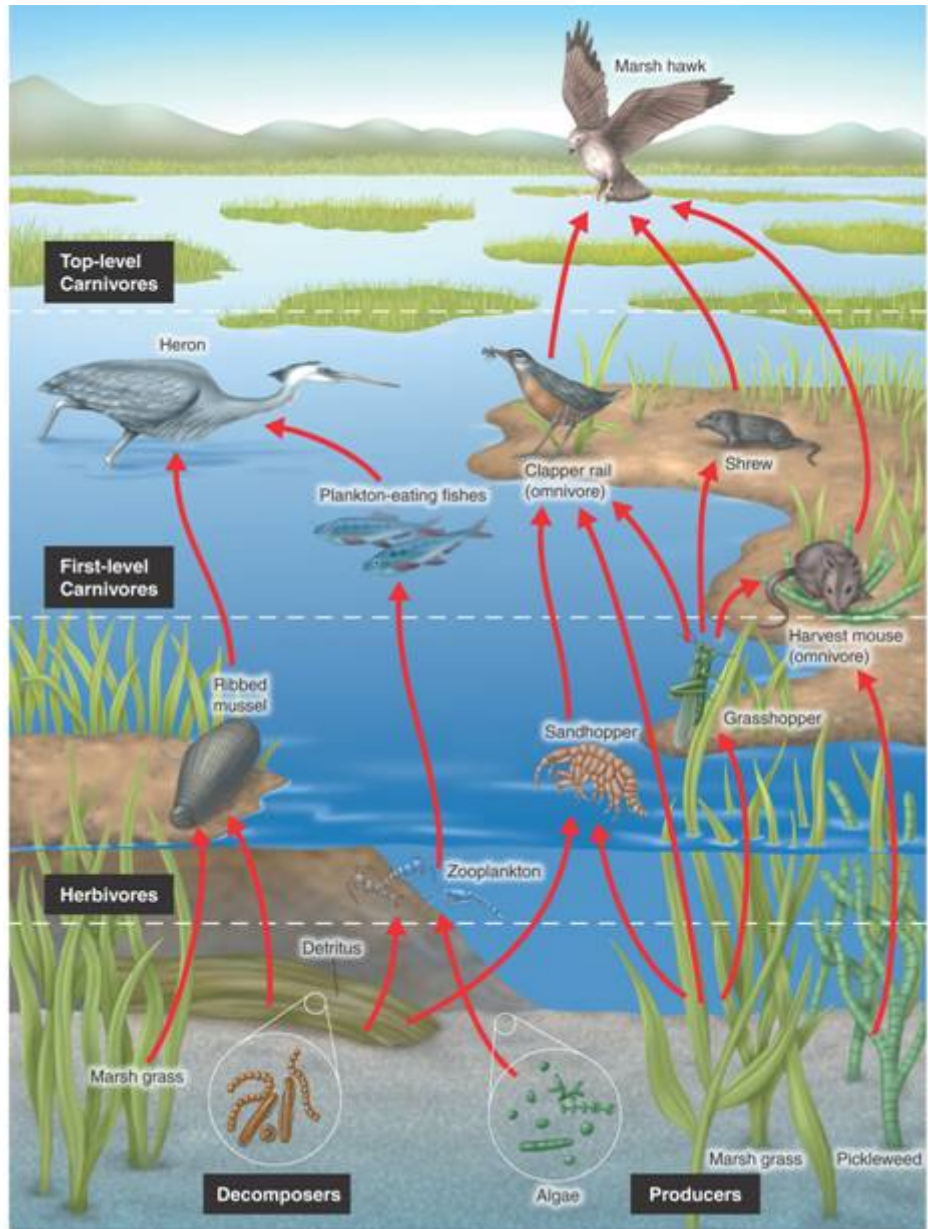
## Food Webs

Ecologists describe a feeding relationship in an ecosystem that forms a network of complex interactions as a **food web**.

A food web links all the food chains in an ecosystem together.

## 3-2 Energy Flow → Feeding Relationships

This food web shows some of the feeding relationships in a salt-marsh community.



## Trophic Levels

Each step in a food chain or food web is called a **trophic level**.

Producers make up the first trophic level.

Consumers make up the second, third, or higher trophic levels.

Each consumer depends on the trophic level below it for energy.



**How efficient is the transfer of energy among organisms in an ecosystem?**



**Only about 10 percent of the energy available within one trophic level is transferred to organisms at the next trophic level.**

## Ecological Pyramids

The amount of energy or matter in an ecosystem can be represented by an ecological pyramid.

An **ecological pyramid** is a diagram that shows the relative amounts of energy or matter contained within each trophic level in a food chain or food web.

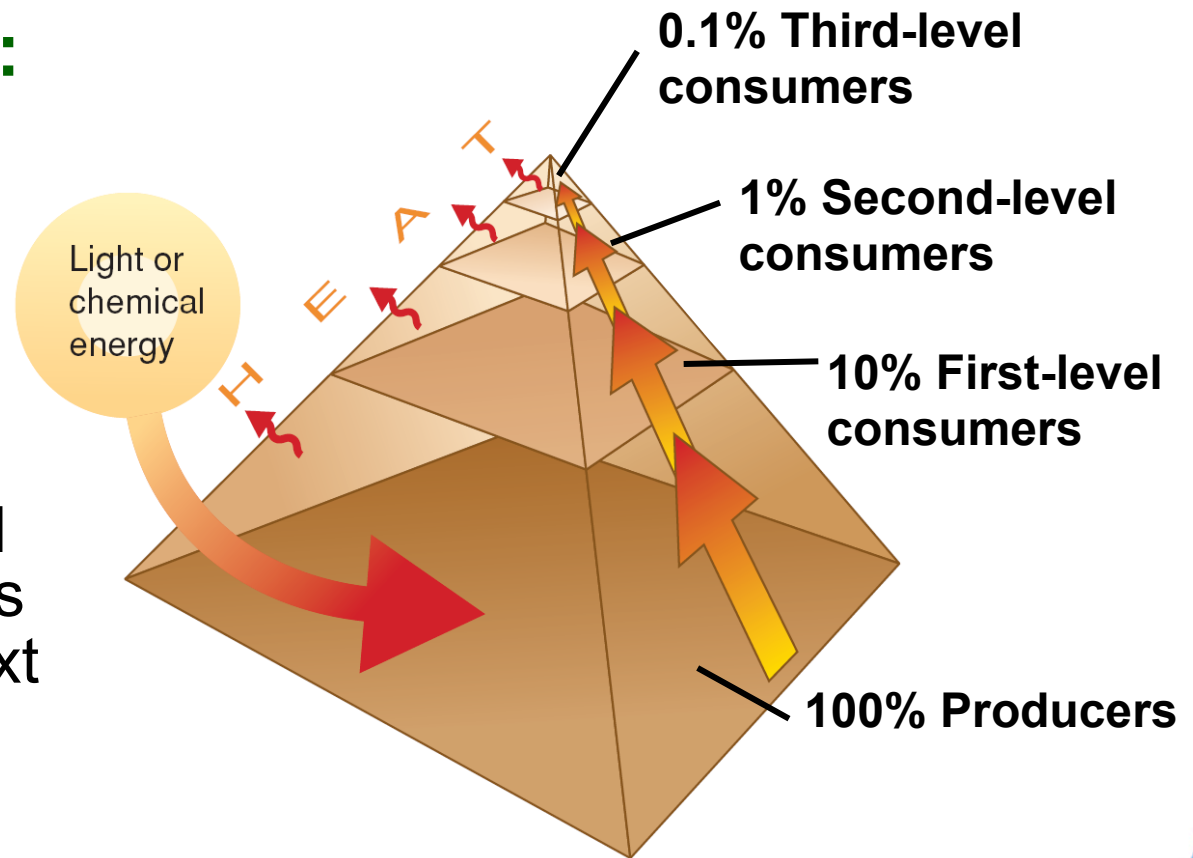
Ecologists recognize three different types of ecological pyramids:

- energy pyramids
- biomass pyramids
- pyramids of numbers

## Energy Pyramid:

Shows the relative amount of energy available at each trophic level.

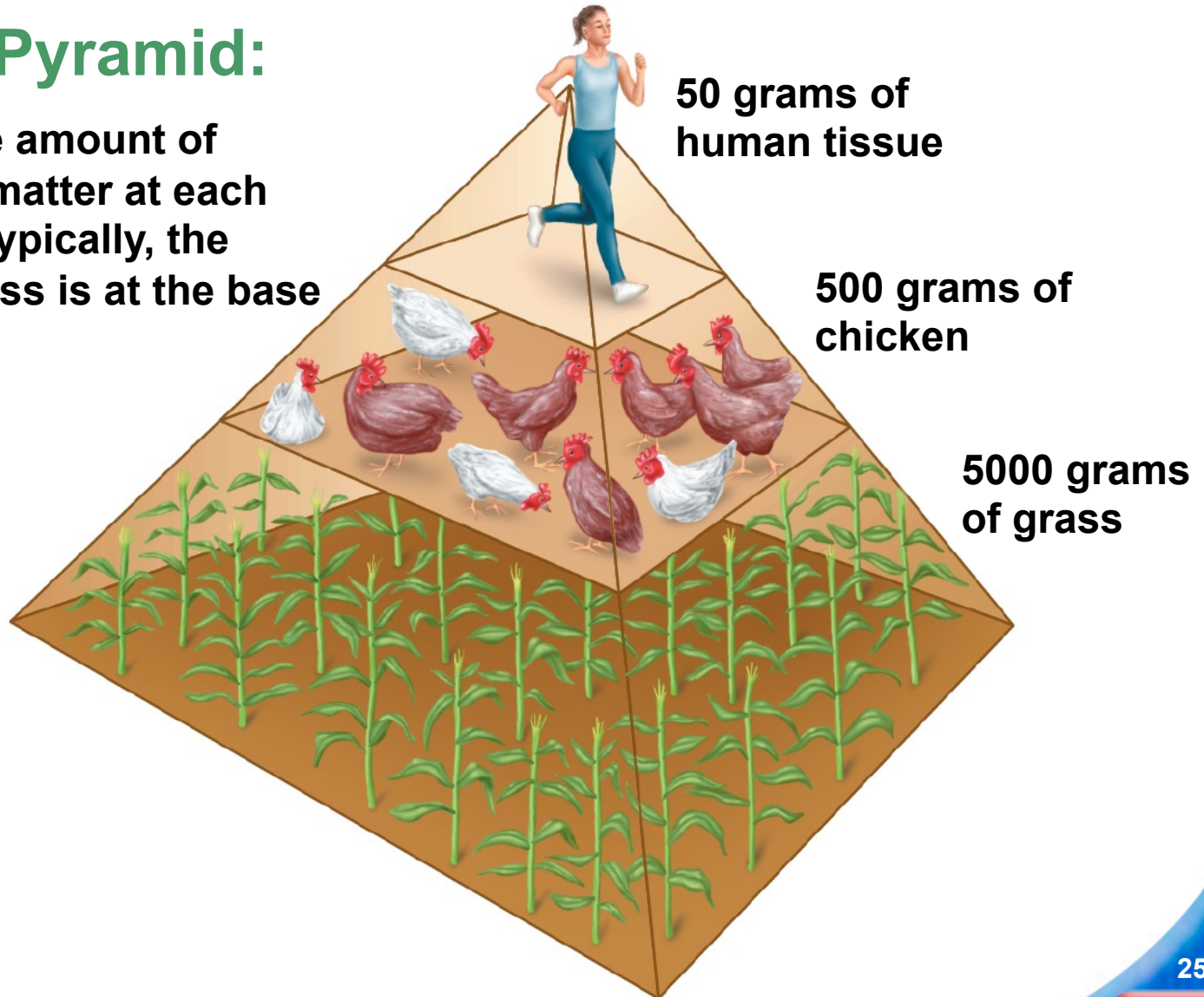
Only part of the energy that is stored in one trophic level is passed on to the next level.





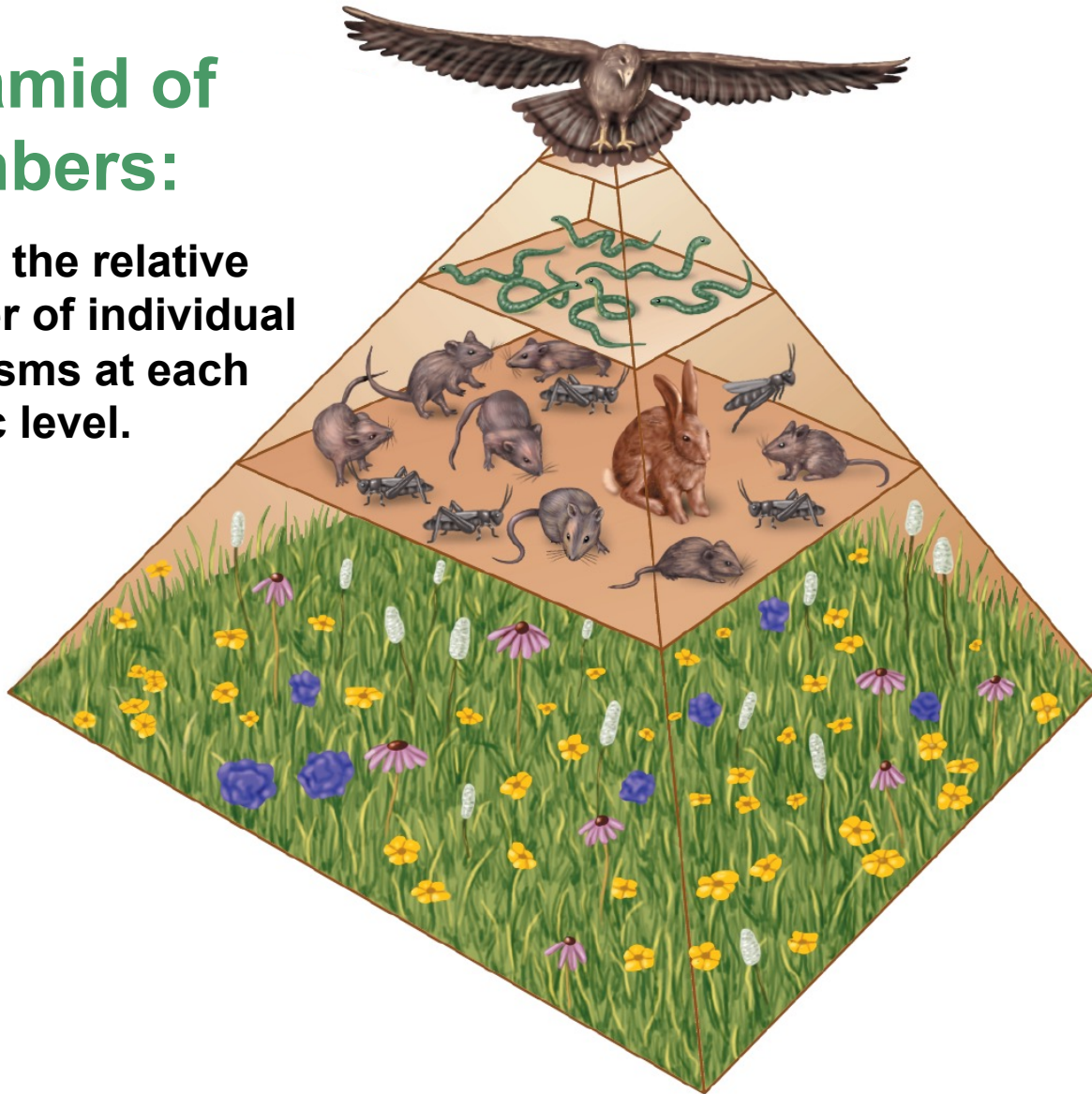
## Biomass Pyramid:

Represents the amount of living organic matter at each trophic level. Typically, the greatest biomass is at the base of the pyramid.



## Pyramid of Numbers:

Shows the relative number of individual organisms at each trophic level.



## 3-2 Section QUIZ

Continue to:

**Section QUIZ**

- or -

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## 3-2 Section QUIZ

- 1 The main source of energy for life on Earth is
- a. organic chemical compounds.
  - b. inorganic chemical compounds.
  - c. sunlight.
  - d. producers.

## Section QUIZ

# Create an E.O.C. Question

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- b. inorganic chemical compounds.
- c. sunlight.**
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- Rewrite this question to a higher level
- Choose a Power Starter...
  - Discuss
  - Describe
  - Illustrate
  - Classify
  - Examine
  - Distinguish
  - Interpret
  - Verify
  - Assess
  - Invent

## 3-2 Section QUIZ

**2** Organisms that feed on plant and animal remains and other dead matter are

- a. detritivores.
- b. carnivores.
- c. herbivores.
- d. autotrophs.

## Section QUIZ

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## 3-2 Section QUIZ

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- a. A food web contains a single series of energy transfers.
  - b. A food web links many food chains together.
  - c. A food web has only one trophic level.
  - d. A food web shows how energy passes from producer to consumer.



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## 3-2 Section QUIZ

- 4 In a biomass pyramid, the base of the pyramid represents the mass of
- a. heterotrophs.
  - b. primary consumers.
  - c. producers.
  - d. top level carnivores.

## Section QUIZ

# Create an E.O.C. Question

4. In a biomass pyramid, the base of the pyramid represents the mass of

a. heterotrophs.

b. primary consumers.

c. producers.

d. top level carnivores

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## 3-2 Section QUIZ

- 5** The amount of energy represented in each trophic level of consumers in an energy pyramid is about
- a. 10% of the level below it.
  - b. 90% of the level below it.
  - c. 10% more than the level below it.
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## Section QUIZ

# Create an E.O.C. Question

5. The amount of energy represented in each trophic level of consumers in an energy pyramid is about

**a. 10% of the level below it.**

**b. 90% of the level below it.**

**c. 10% more than the level below it.**

**d. 90% more than the level below it.**

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**END OF SECTION**