

Chapter 55

Ecosystems

PowerPoint® Lecture Presentations for

Biology

Eighth Edition

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Overview: Observing Ecosystems

- An **ecosystem** consists of all the organisms living in a community, as well as the abiotic components with which they interact
- Ecosystems range from a microcosm, such as a roach stomach, to a large area such as a lake or forest
- Regardless of an ecosystem's size, its dynamics involve two main processes: **energy flow** and **chemical cycling**
- Therefore, ecologists study the transformations of energy and matter within ecosystem

Conservation of Energy and Mass (matter)

- Energy enters an ecosystem as solar radiation, is conserved, and is lost from organisms as heat
- The **law of conservation of mass** states that matter cannot be created or destroyed
- Chemical elements are continually recycled within ecosystems

Energy, Mass, and Trophic Levels

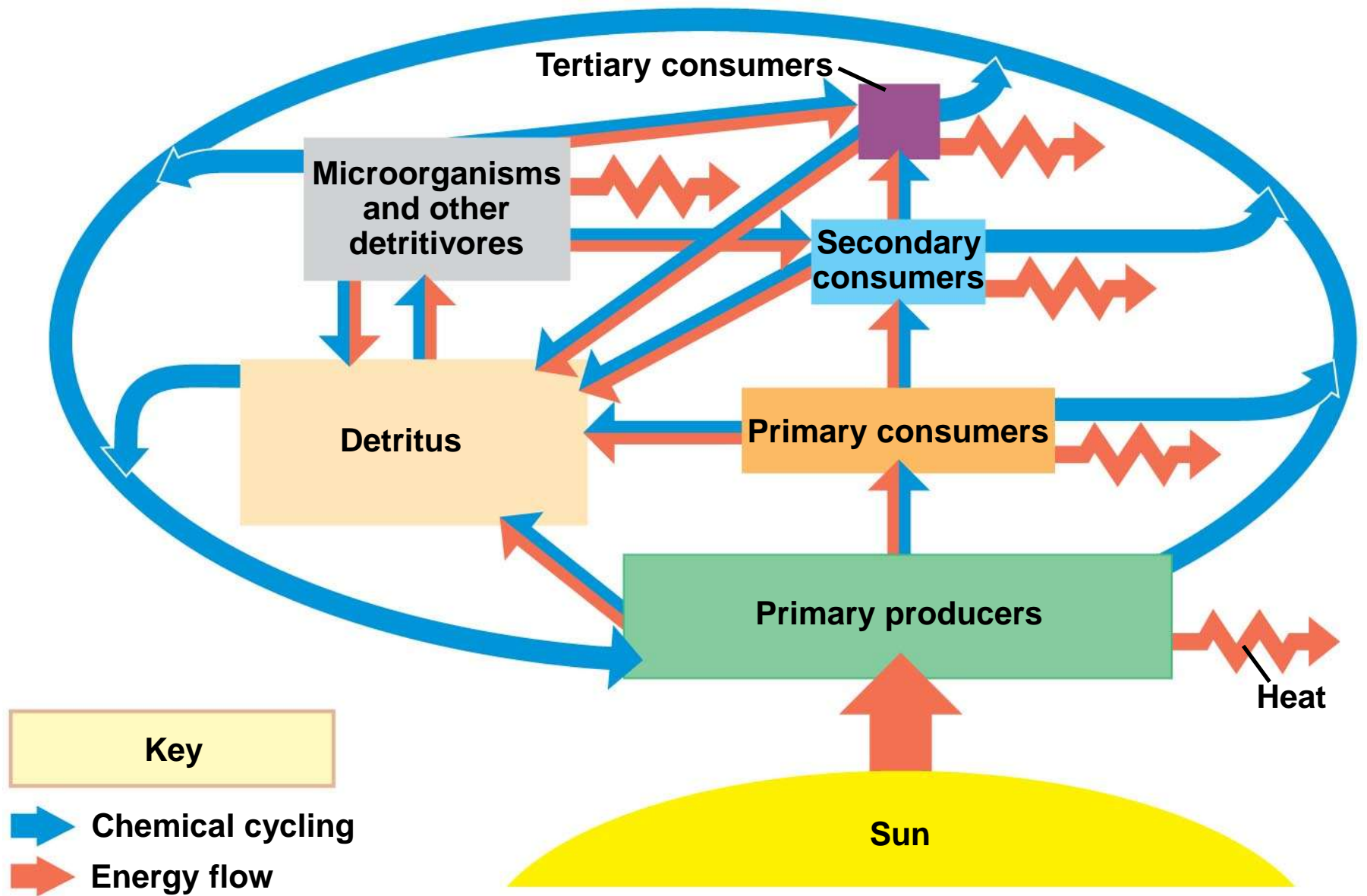
- Autotrophs build molecules themselves using photosynthesis or chemosynthesis
heterotrophs depend on the biosynthetic output of other organisms
- Energy and nutrients pass from **primary producers** (autotrophs) to **primary consumers** (herbivores) to **secondary consumers** (carnivores) to **tertiary consumers** (carnivores that feed on other carnivores)

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- **Detritivores**, or **decomposers**, are consumers that derive their energy from **detritus**, nonliving organic matter
 - **Decomposition connects all trophic levels**

Fig. 55-3



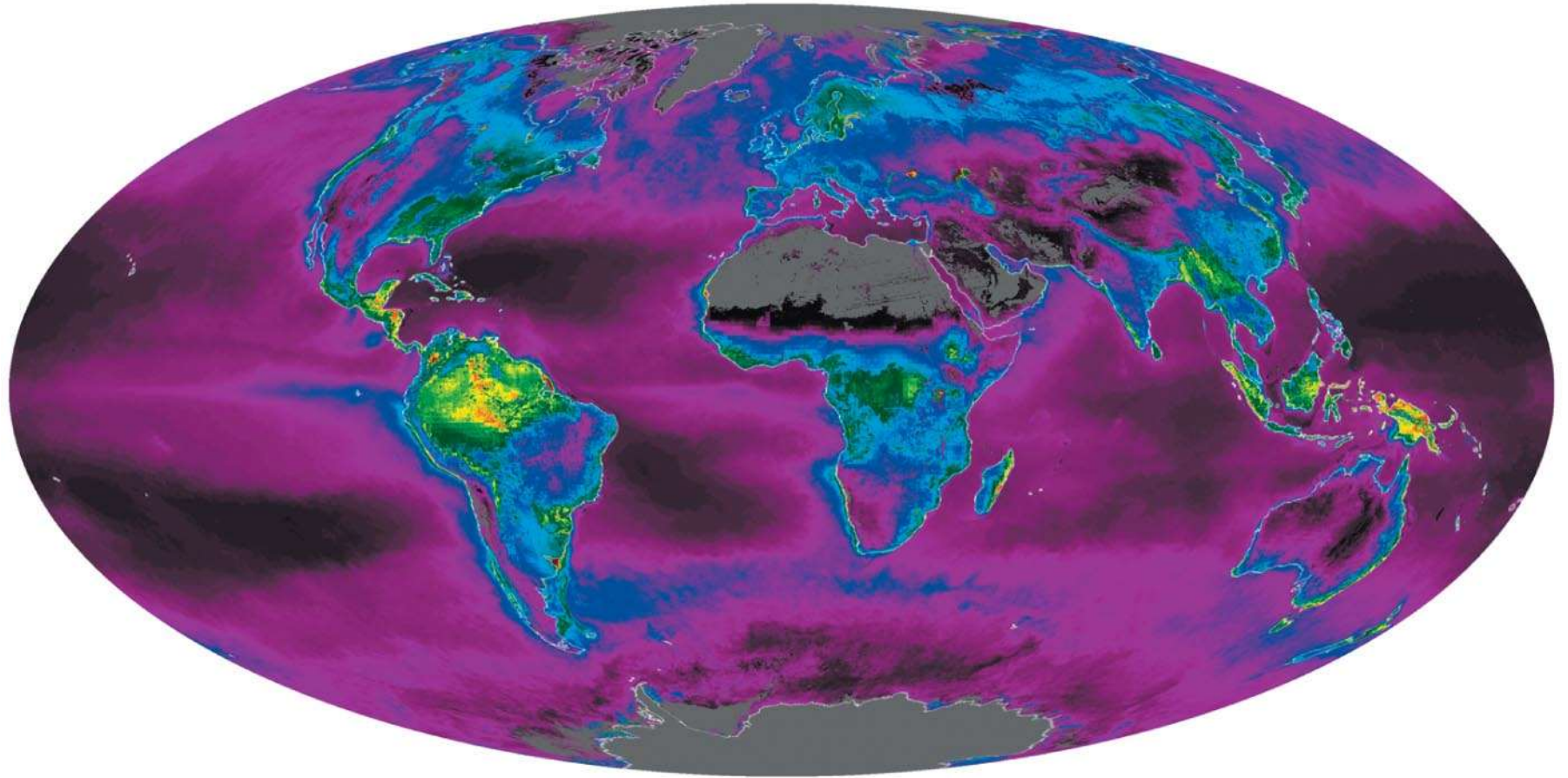
Fig. 55-4



Concept 55.2: Energy and other limiting factors control primary production in ecosystems

- **Primary production** in an ecosystem is the amount of light energy converted to chemical energy by autotrophs during a given time period

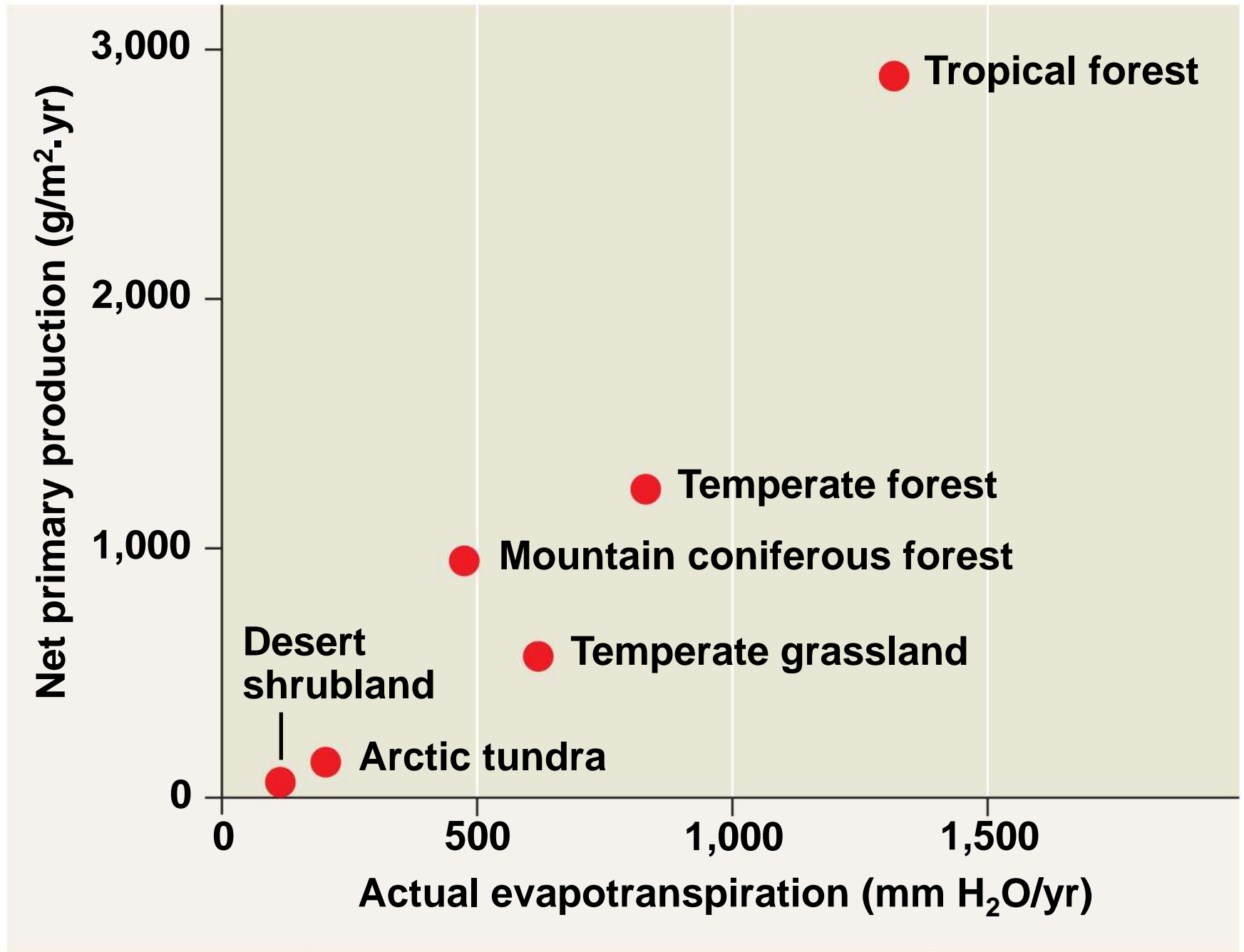
Fig. 55-6



Net primary production (kg carbon/m².yr)



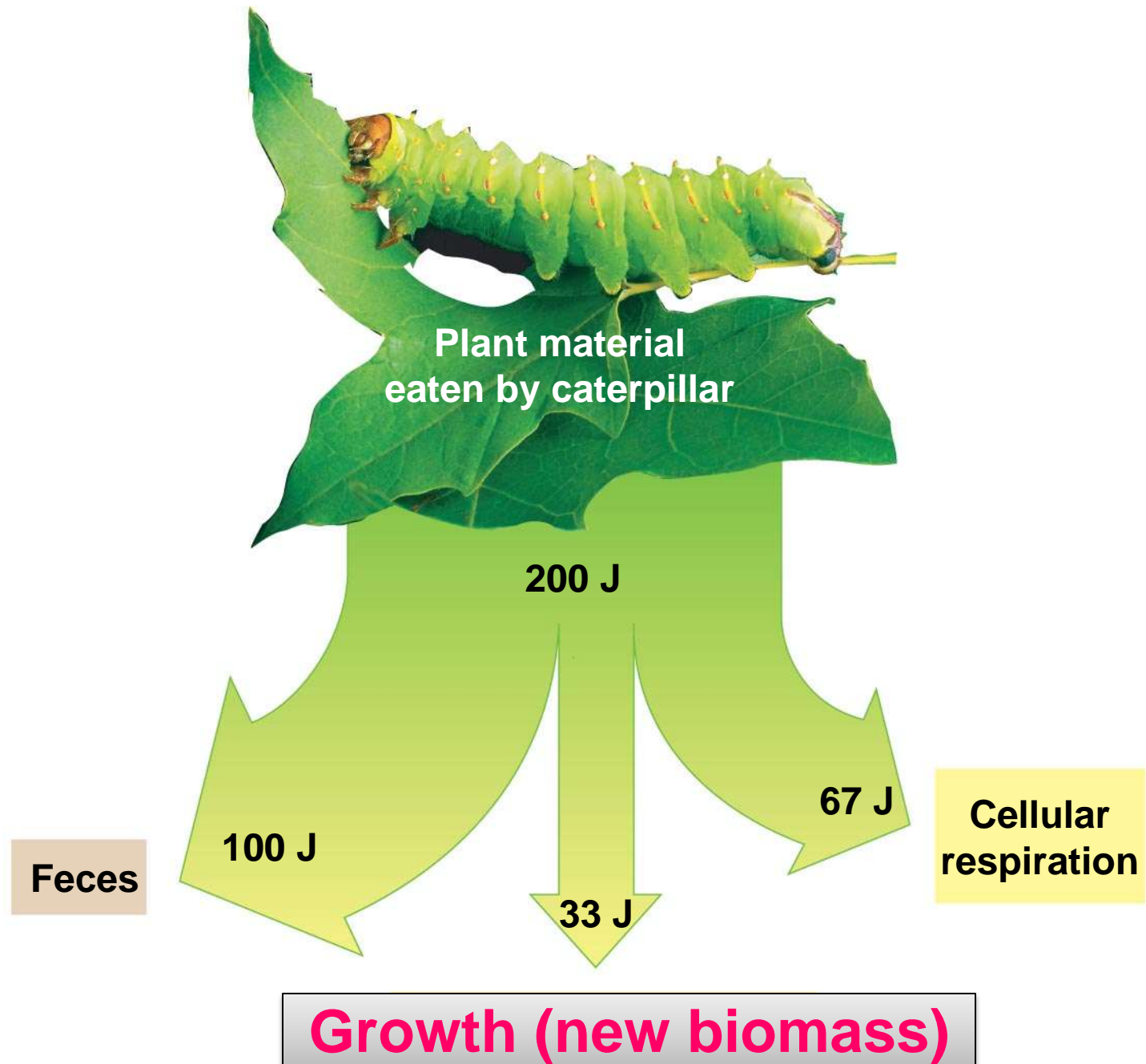
Fig. 55-8



Concept 55.3: Energy transfer between trophic levels is typically only 10% efficient

- **Secondary production** of an ecosystem is the amount of chemical energy in food converted to new biomass during a given period of time

Fig. 55-9



Trophic Efficiency and Ecological Pyramids

- **Trophic efficiency** is the percentage of production transferred from one trophic level to the next
- It usually ranges from 5% to 20%

Fig. 55-10

Tertiary consumers



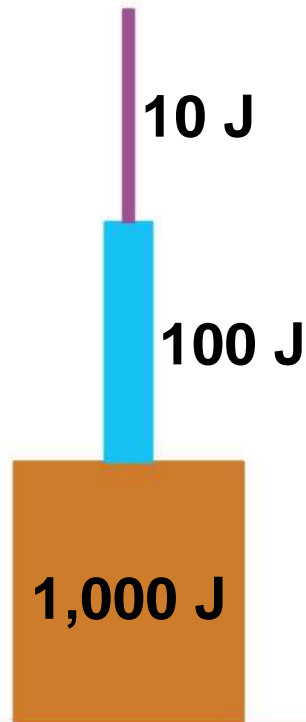
Secondary consumers



Primary consumers



Primary producers



Approximately **0.1%** of chemical energy fixed by photosynthesis reaches a tertiary consumer

1,000,000 J of sunlight

Concept 55.4: Biological and geochemical processes cycle nutrients between organic and inorganic parts of an ecosystem

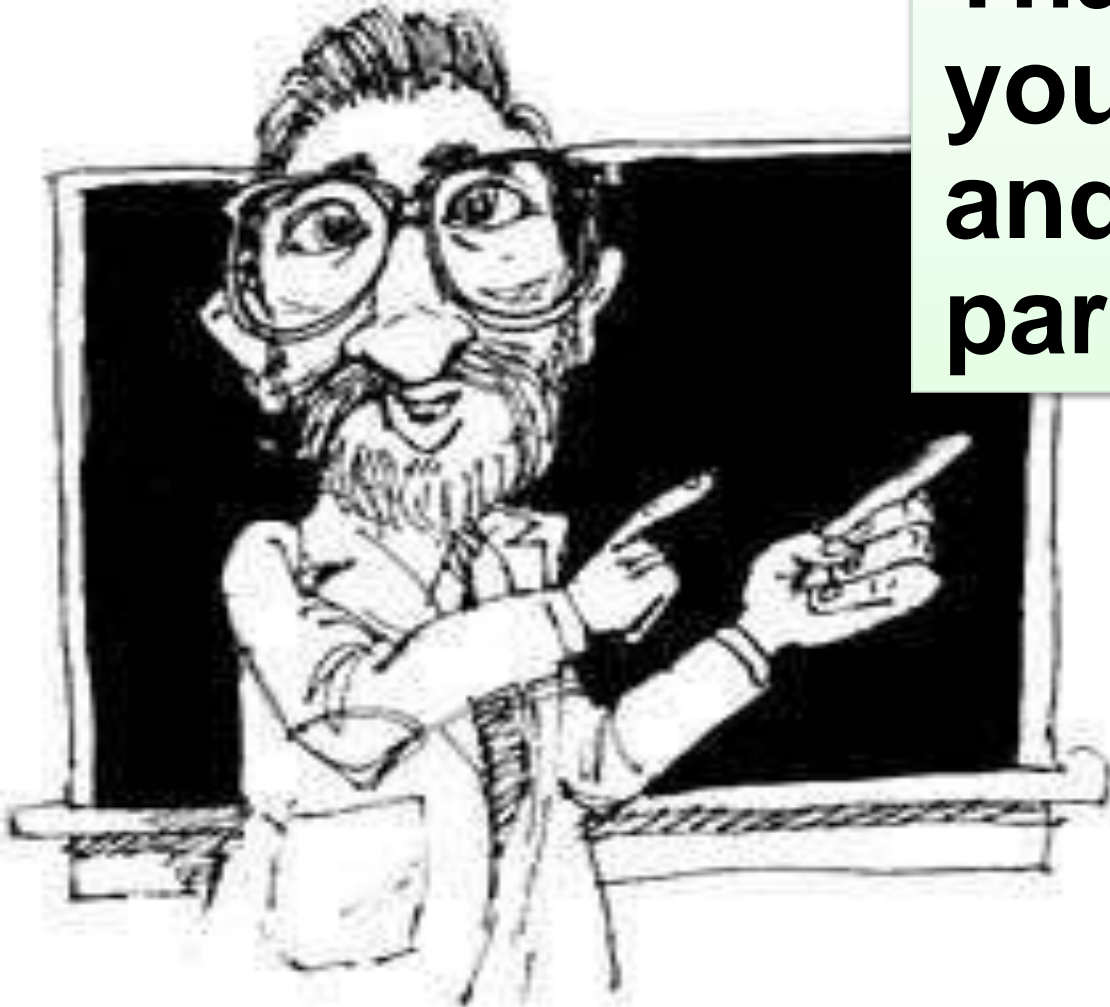
- Life depends on recycling chemical elements
- Nutrient circuits in ecosystems involve biotic and abiotic components and are often called **biogeochemical cycles**
- The most important parts of biogeochemical cycles are:
 - **Water cycle**
 - **Carbon cycle**
 - **Nitrogen cycle**
 - **Phosphorous cycle**



Questions?

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**Thank you for
your attention
and
participation!**



You should now be able to:

1. Define and compare primary production, secondary production, and trophic efficiency
2. Explain energy flow and nutrients cycle within an ecosystem
3. Distinguish between primary and secondary production
4. List four major biogeochemical cycles on the Earth