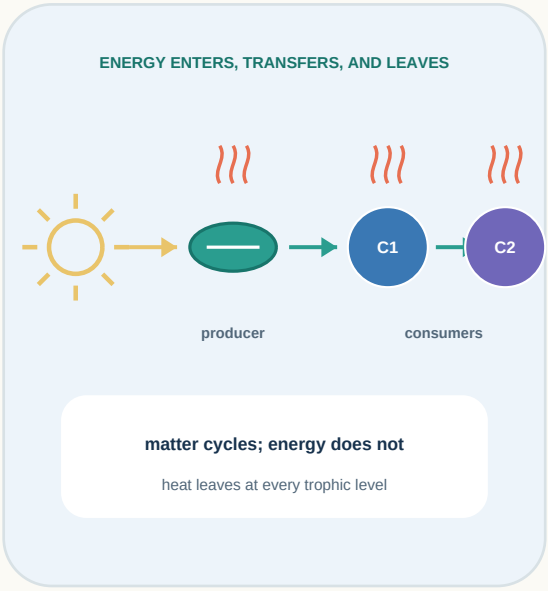
AP BIOLOGY | UNIT 8

TOPIC 8.2

Energy Flow Through Ecosystems

Energy is continually supplied, transformed, and released as heat, while matter is reused through biogeochemical cycles.



THE ONE-WAY ENERGY PATH

SOURCE
light or chemicals

→

AUTOTROPH
captures energy

→

HETEROTROPHS
consume organic matter

→

HEAT
leaves the ecosystem

BY THE END, YOU SHOULD BE ABLE TO...

1. Distinguish autotrophs from heterotrophs.
2. Explain why less energy is available at higher trophic levels.
3. Contrast one-way energy flow with matter cycling.

CENTRAL IDEA

Energy is transformed rather than recycled: organisms use chemical energy for life processes, and every transfer releases some energy as heat.

1 Energy availability narrows up the food chain

Only part of the chemical energy at one trophic level becomes new biomass available to the next level.

HOW ORGANISMS ACQUIRE ENERGY

AUTOTROPH

ENERGY SOURCE

Captures light energy or chemical energy and builds organic molecules.

EXAMPLES

plants, algae, cyanobacteria, chemosynthetic microbes

HETEROTROPH

ENERGY SOURCE

Obtains chemical energy and matter by consuming organic material.

EXAMPLES

animals, fungi, many protists and bacteria

AN ENERGY PYRAMID



Illustrative ~10% transfer example; actual ecological efficiency varies.

ENERGY BUDGET

Energy in food -> cellular work + growth + reproduction + heat + waste. Only energy stored in biomass can transfer to a consumer.

WHY TROPHIC CHAINS ARE LIMITED

Because usable energy decreases at each transfer, high trophic levels support less biomass and often fewer individuals. A continual external energy supply is required.

2 Matter is reused; energy is continually supplied

Atoms move between organisms and abiotic reservoirs, but usable energy decreases as biological work and heat release occur.

DO NOT CONFUSE FLOW WITH CYCLING

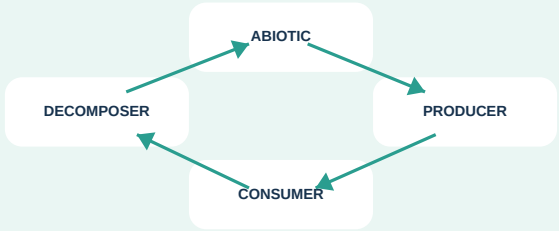
ENERGY FLOWS

SOURCE → PRODUCER → CONSUMER → HEAT

Energy enters, changes form, and eventually disperses as heat. It must be supplied again.

one-way movement

MATTER CYCLES



atoms are reused

CARBON | NITROGEN | PHOSPHORUS | WATER

THERMOREGULATION CHANGES AN ORGANISM'S ENERGY BUDGET

ENDOTHERM

TEMPERATURE CONTROL

Uses metabolic heat to maintain body temperature.

ENERGY CONSEQUENCE **higher food demand**

ECTOTHERM

TEMPERATURE CONTROL

Relies more on external heat and behavioral regulation.

ENERGY CONSEQUENCE **lower metabolic demand**

WHEN ENERGY AVAILABILITY CHANGES

INDIVIDUAL	growth, homeostasis, and reproductive output may change
POPULATION	birth rates, survival, and population size may shift
ECOSYSTEM	food-web structure and ecosystem stability may be altered