# Ecology

AP Biology ▪ Unit 8

AP Biology

# What we will cover

1. Responses to the environment
2. Energy flow
3. Population growth
4. Density factors
5. Community ecology
6. Biodiversity and disruptions

# Responses to the environment

Organisms react to survive and keep **homeostasis** 稳态:

- **innate** 先天的 (built in) vs learned behaviour
- a **tropism** 向性: growth toward a cue (light, gravity)
- **signals** 信号 coordinate a group (the bee dance)

> A lizard basks then shades to hold its temperature – behaviour protecting homeostasis.

*Tropisms bend growth toward useful cues*

# Energy flow

Energy enters through **producers** 生产者 and climbs the **trophic levels** 营养级.

- **consumers** 消费者 eat others
- **decomposers** 分解者 recycle nutrients

> Only $\sim 10\%$ passes up each level – the 10% rule – so food chains stay short.

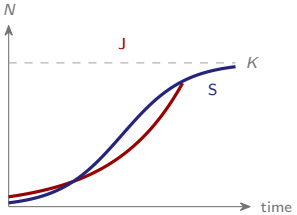
*Energy enters at producers; chains stay short*

# Population growth

Two growth models:

- **exponential** 指数增长: a J-curve, $\frac{dN}{dt} = rN$
- **logistic** 逻辑斯谛增长: an S-curve, slowed by resources

> Growth levels off at the **carrying capacity** 承载力 $K$: $\frac{dN}{dt} = rN\frac{K-N}{K}$.



# Density factors

What limits a population splits by whether crowding matters:

- **Density-dependent 密度制约** – competition, predation, disease
- **Density-independent 非密度制约** – floods, fire, frost


*Crowding intensifies density-dependent limits*

Together they make a population rise and fall around $K$ rather than sitting still.

# Community ecology

A **community** 群落 is all the species interacting in one area. **Symbiosis** 共生 sorts by who benefits:

- **mutualism** 互利共生: both win $(+/+)$
- **commensalism** 偏利共生: one wins $(+/0)$
- **parasitism** 寄生: one harmed $(+/-)$

A **keystone species** 关键种 (sea otter) holds up the whole community.

*Mutualism: both partners gain*

# Biodiversity and disruptions

**Biodiversity** 生物多样性 makes an ecosystem stronger:

- more **stability** 稳定性 and recovery
- free **ecosystem services** 生态系统服务 (clean water, pollination)

**Invasive species** 入侵物种, **habitat** 栖息地 loss, and **climate change** 气候变化 ripple far through food webs.

*Habitat loss ripples through food webs*

# Biodiversity and disruptions

ecosystem diversity

species diversity

genetic diversity (within a species)

# Unit 8 – key takeaways

**1 Energy flow**

producers up the trophic levels; only $\sim$10% passes on

**2 Growth**

J exponential vs S logistic; levels off at $K$

**3 Limits**

density-dependent vs independent factors around $K$

**4 Community**

symbiosis $+/+, +/0, +/-$; keystone species; biodiversity

# Check yourself

1. About how much energy passes to the next trophic level?
2. Which growth curve is J-shaped?
3. Is a drought density-dependent or independent?
4. Name the symbiosis where both species benefit.

**Answers** **1.** about 10% **2.** exponential **3.** density-independent **4.** mutualism