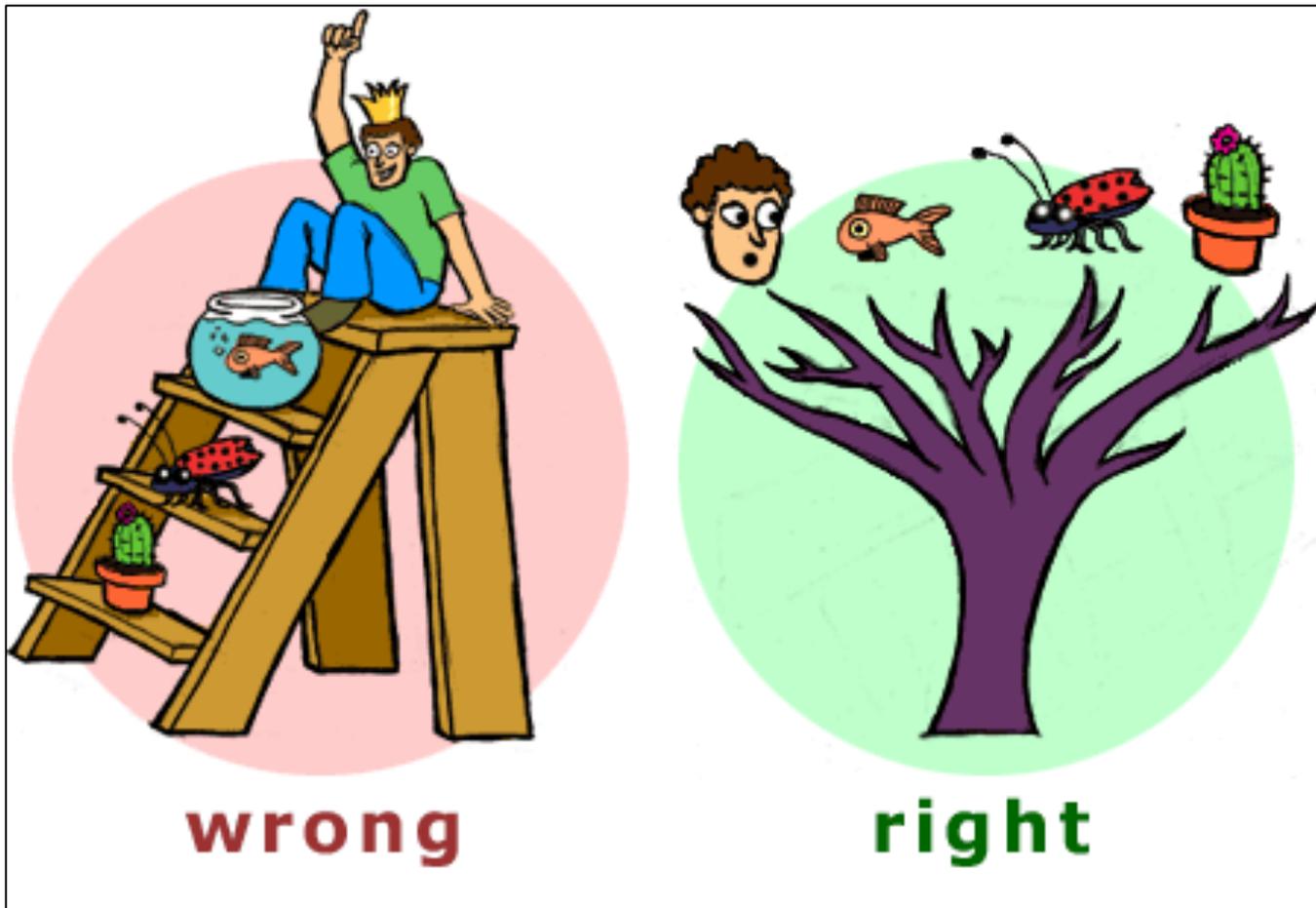


Review Session #5

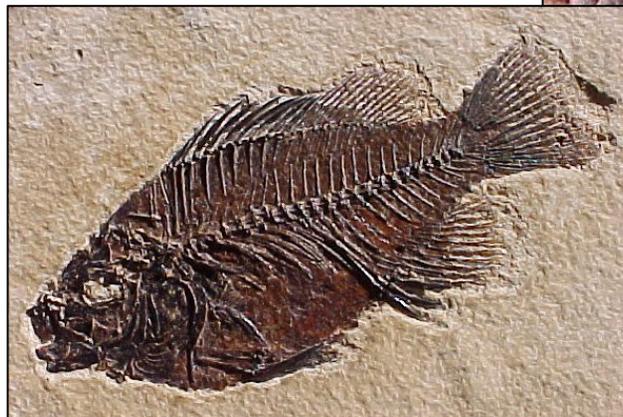
Evolution
Ecology

The theory of EVOLUTION states that existing forms of life on earth have arisen from earlier forms over long periods of time.



Some of the strongest evidence to support evolution is found in the fossil record.

FOSSILS are the preserved remains or traces of organisms from the past.



Geologists estimate the age of the earth to be
4.5 - 5 billion years.

This estimate is based on radioactive dating of the
oldest rocks from the earth's crust.



The oldest rocks on Earth are found in Canada.
They are almost 5 billion years old.



Fossils of intact organisms have been found preserved in ice, in tar, and in amber.



But most fossils are found in sedimentary rock.



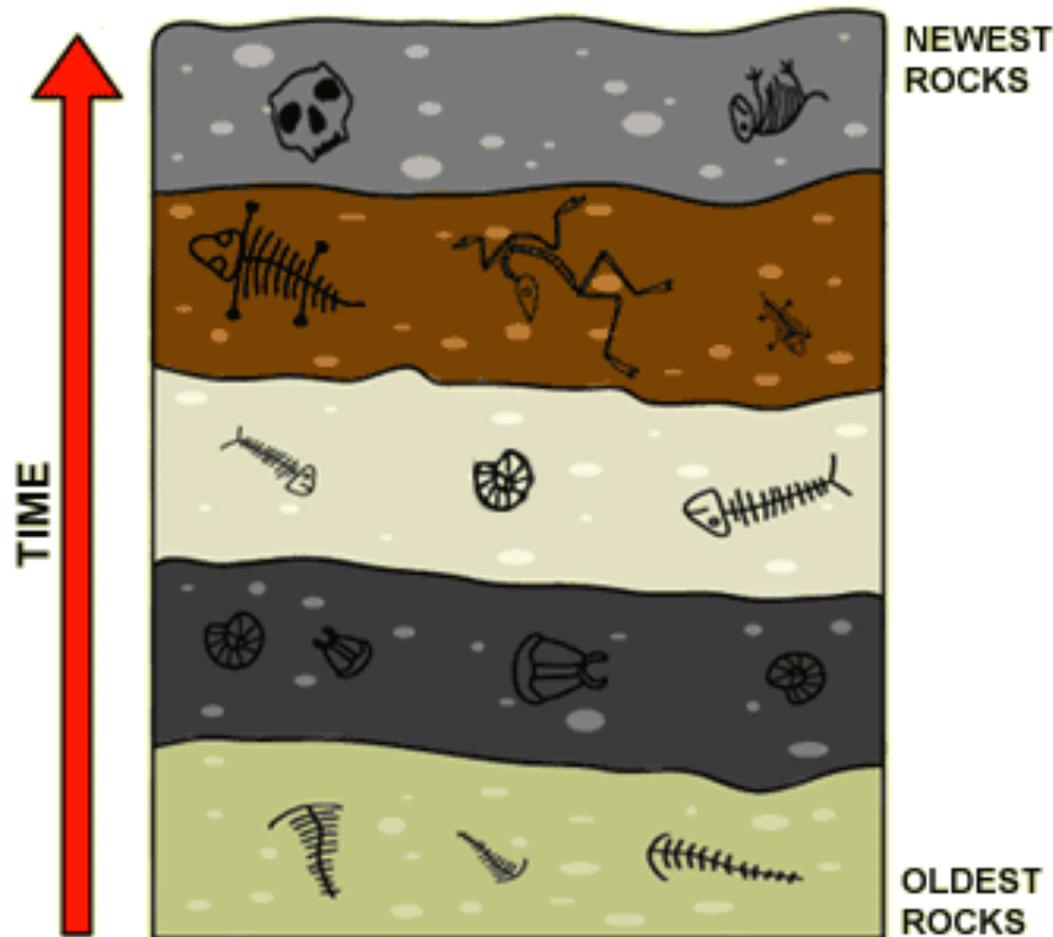
When the remains of dead organisms are covered by sediment and the layers of sediment harden, traces of the buried organisms are preserved in the rock.

Bones, shells, and other hard parts of ancient organisms are most often found.

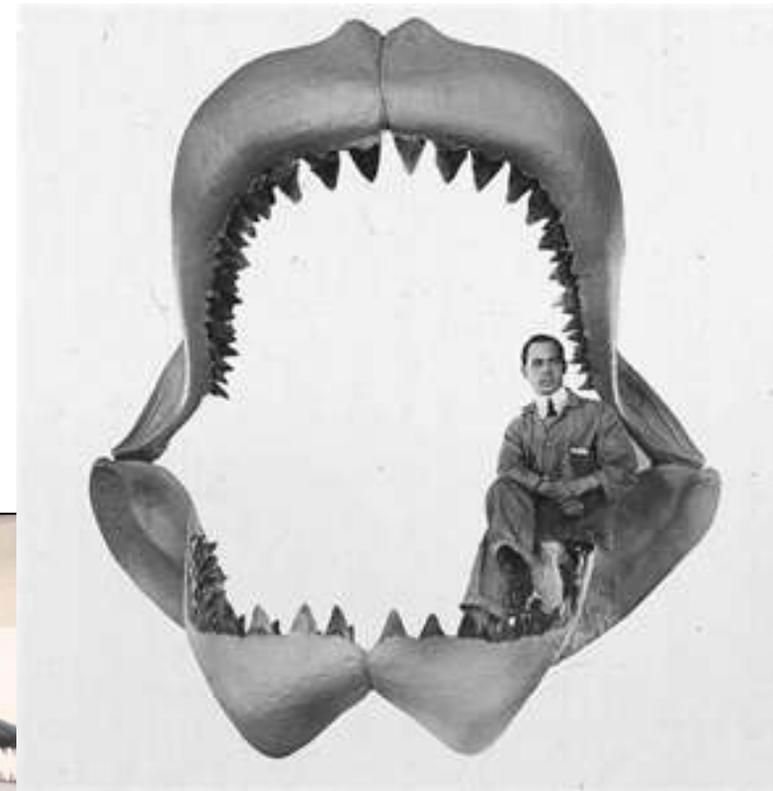
The soft parts generally decay in a short time.



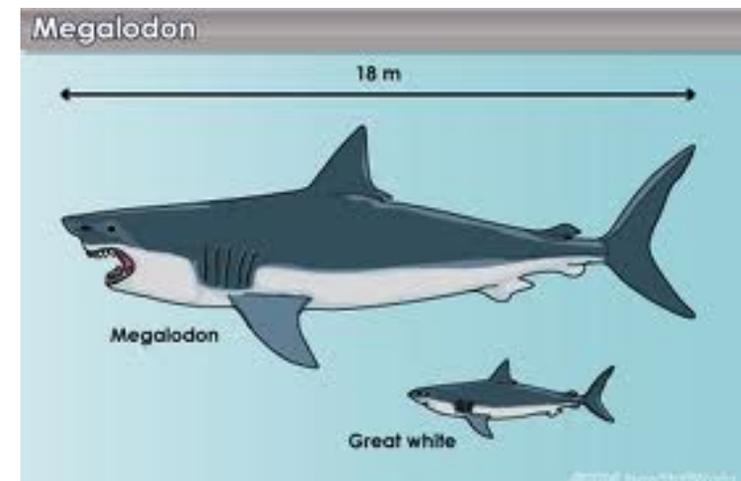
Fossils in the upper layers of rock are generally more complex than fossils in the lower layers.



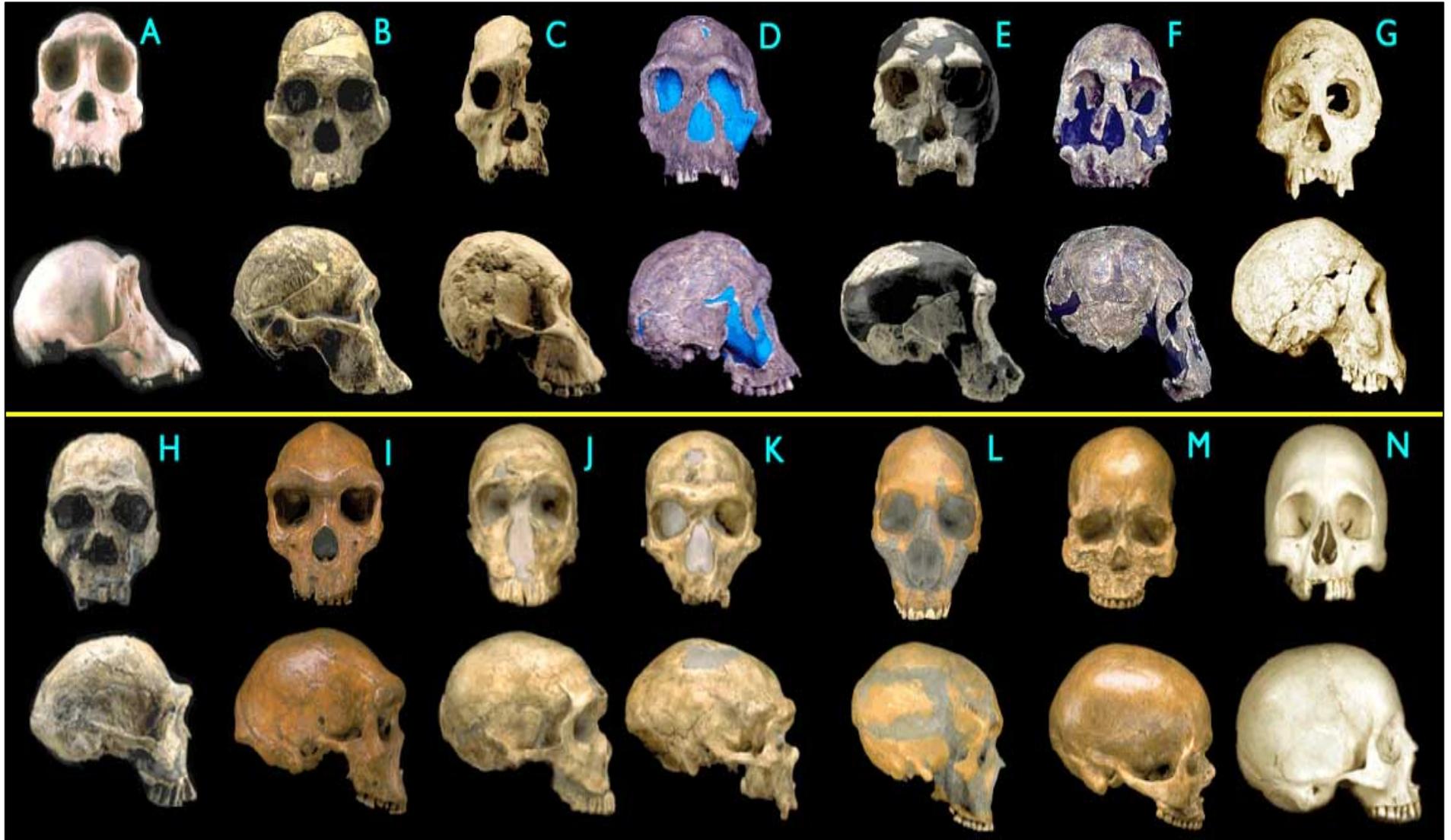
Some fossils in older layers are unlike any modern living things.
This suggests that some organisms have died out, or become
EXTINCT.



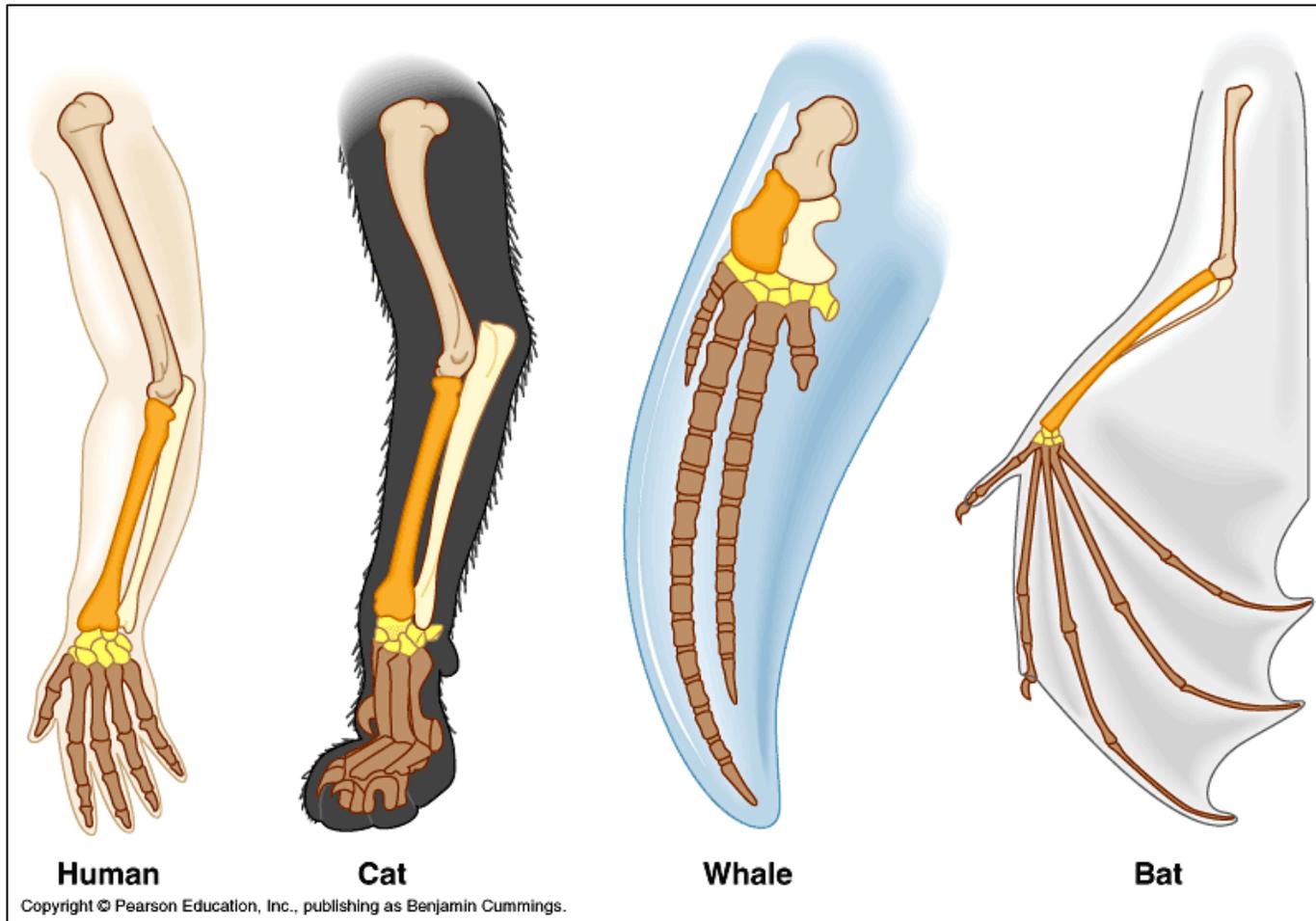
On the other hand, some fossils are very similar to modern life forms, which suggests that some organisms have undergone little evolutionary change.



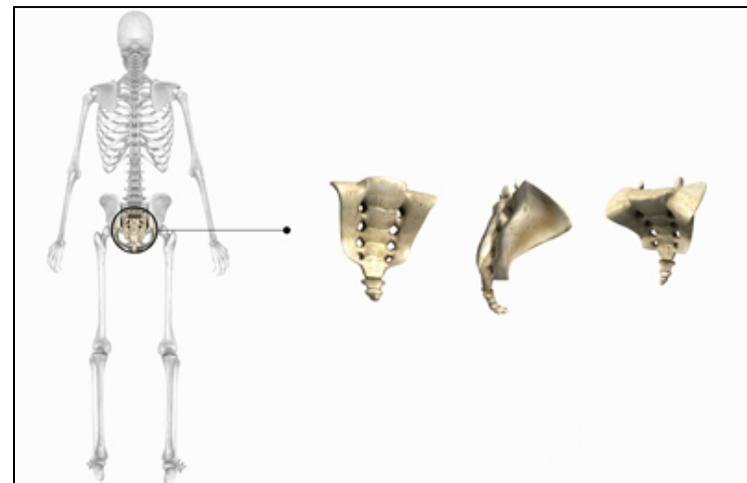
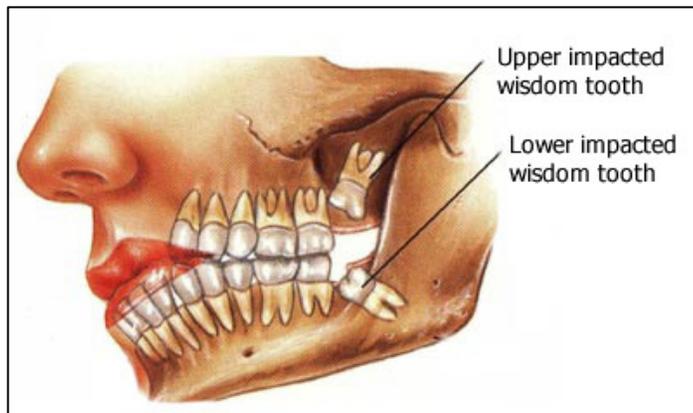
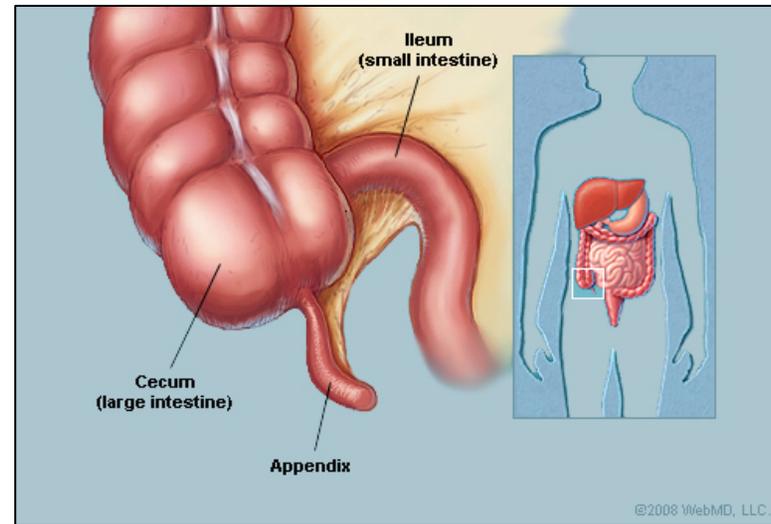
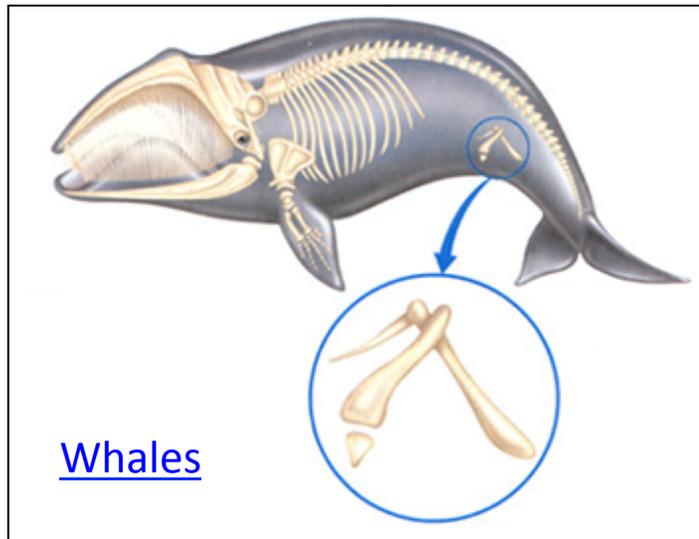
More evidence for evolution comes from observations of basic structural similarities between organisms.



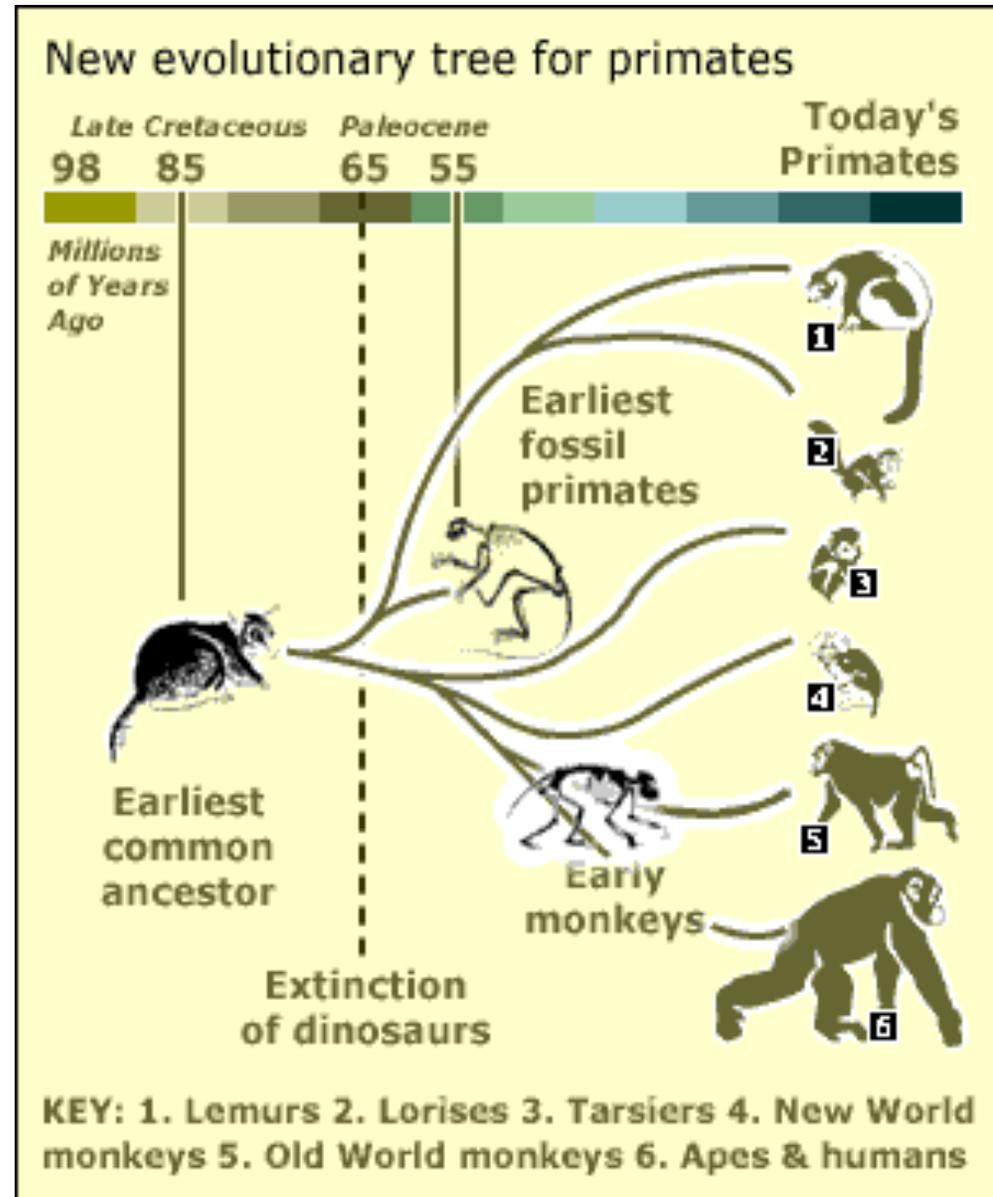
HOMOLOGOUS STRUCTURES are organs that has similar structure but different jobs.

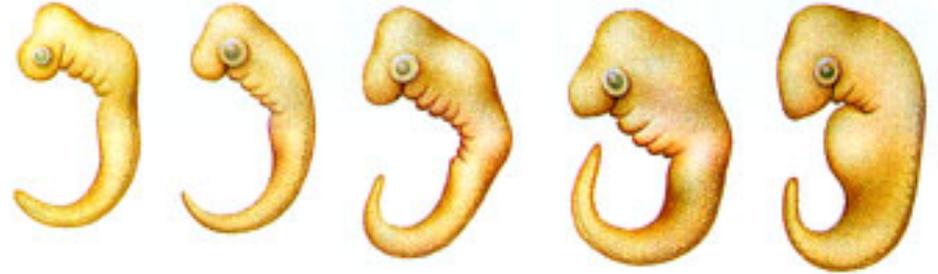


VESTIGIAL STRUCTURES are structures that once had a purpose.



If there are homologous and vestigial structures it suggests that an organism has evolved from a **COMMON ANCESTOR**.



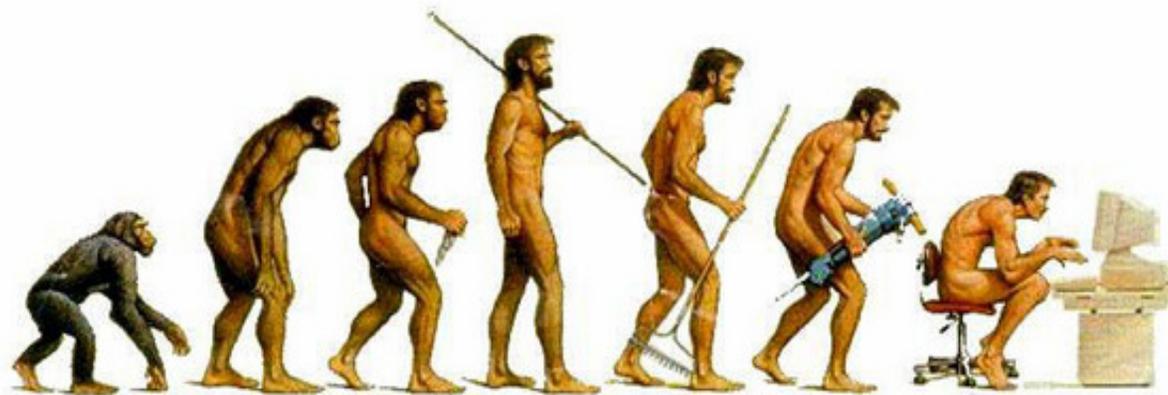


EMBRYONIC DEVELOPMENT

may show similarities
that suggest a common
ancestry even though
the adult organisms may
be very different from
each other.

All of these similarities in
the FOSSIL RECORD
ANATOMY
EMBRYOLOGY
and BIOCHEMISTRY

show RELATIONSHIPS BETWEEN ORGANISMS
and provide evidence that organisms have developed
through EVOLUTION over millions of years.



Darwin's theory of EVOLUTION by NATURAL SELECTION has six important components.

1. Overpopulation
2. Variation
3. Competition
4. Natural selection
5. Reproduction
6. Speciation

1. OVERPOPULATION

Within a population, there are more offspring produced in each generation than can possibly survive.

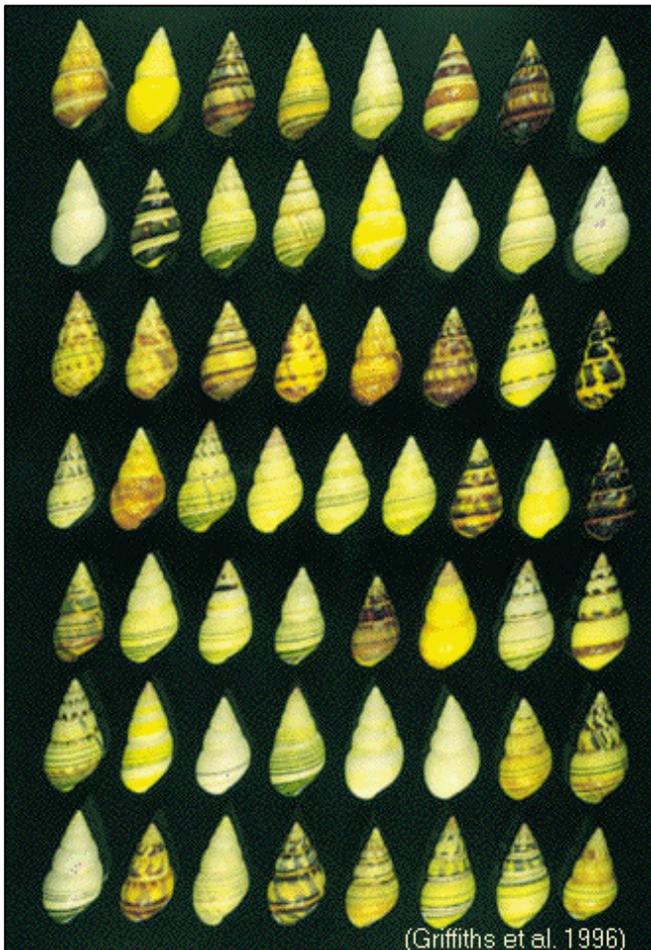


What factors limit the survival of a population?



2. VARIATIONS EXIST

Within a population, the individual organisms are different from one another.



3. COMPETITION

Natural resources are limited.

There is competition between the members of the populations for these resources.



What natural resources are limited?

In what ways do organisms compete for these resources?

4. NATURAL SELECTION

Some members of a population are better adapted to the environment than others.

The environment acts as the **SELECTING AGENT**. It determines which adaptations or variations are helpful and which are harmful.



For example, in an environment that is unusually cold, animals born with fur that is thicker than normal will survive more easily than animals with less fur.

In this case, the variation (thicker fur) helps the organism handle the environmental pressure.

5. REPRODUCTION

Individuals with helpful variations tend to reproduce more than those with less helpful variations.

They transmit the helpful variations to their offspring.



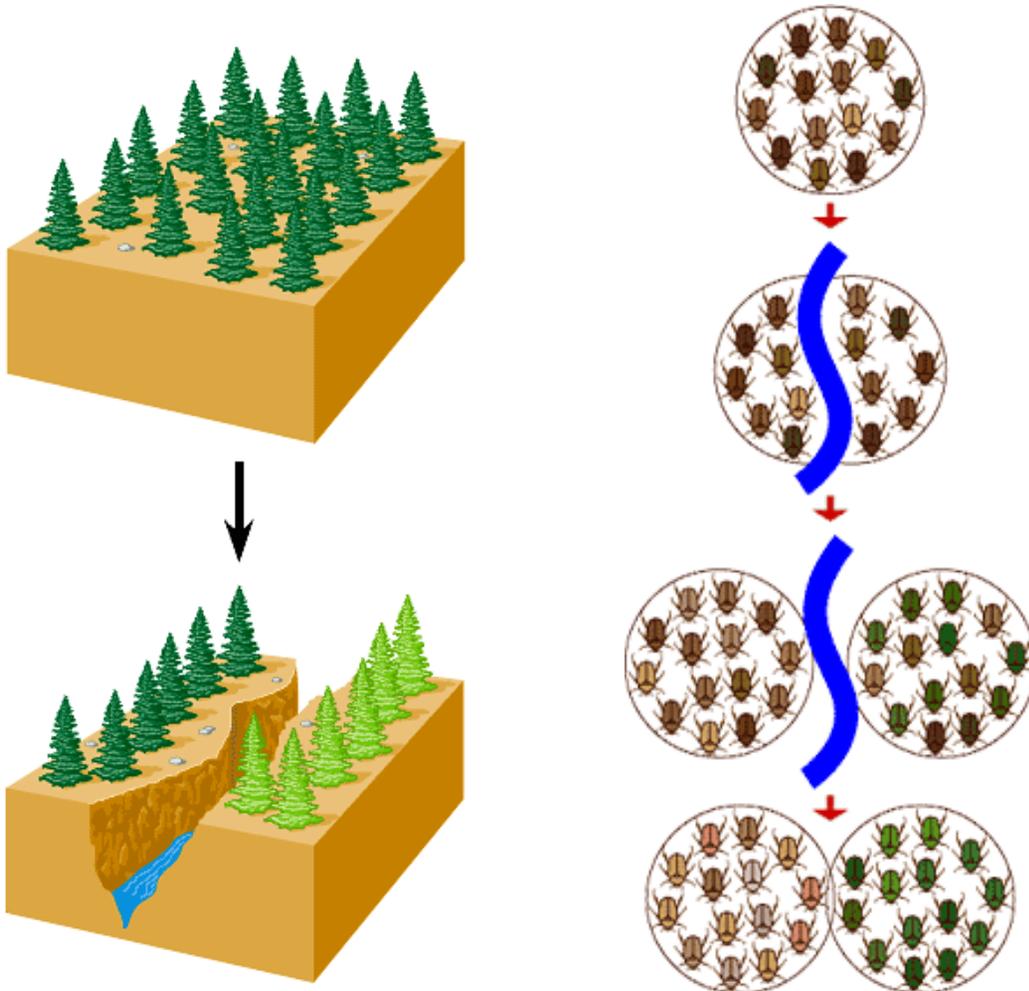
6. SPECIATION

The development of new species occurs as variations or adaptations accumulate in a population over many generations.



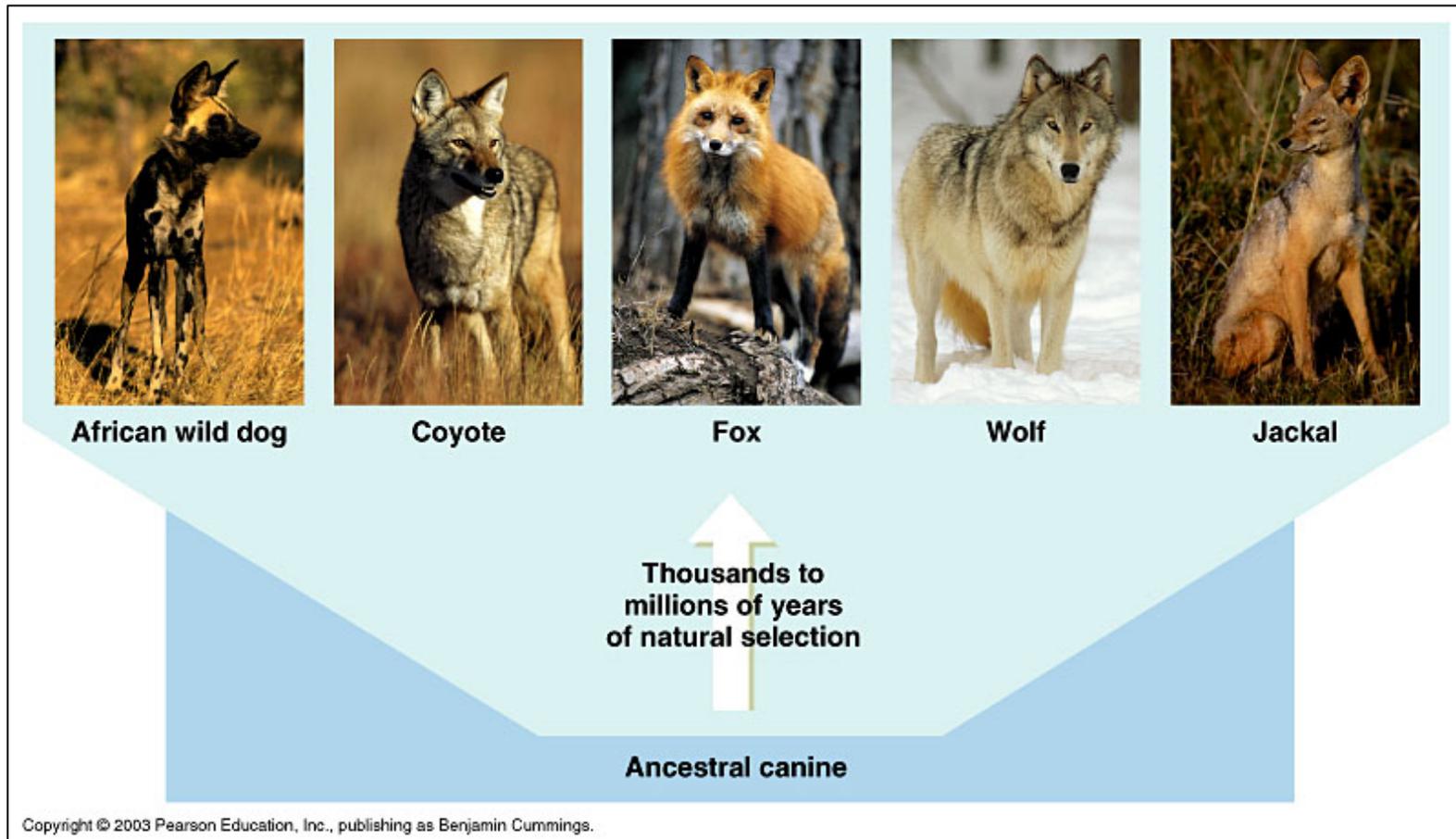
A biological SPECIES is a group of interbreeding populations that are REPRODUCTIVELY ISOLATED from other species in natural environments.

Speciation is often the result of **GEOGRAPHIC ISOLATION** - when a population is divided into two groups that are prevented from mating with each other.

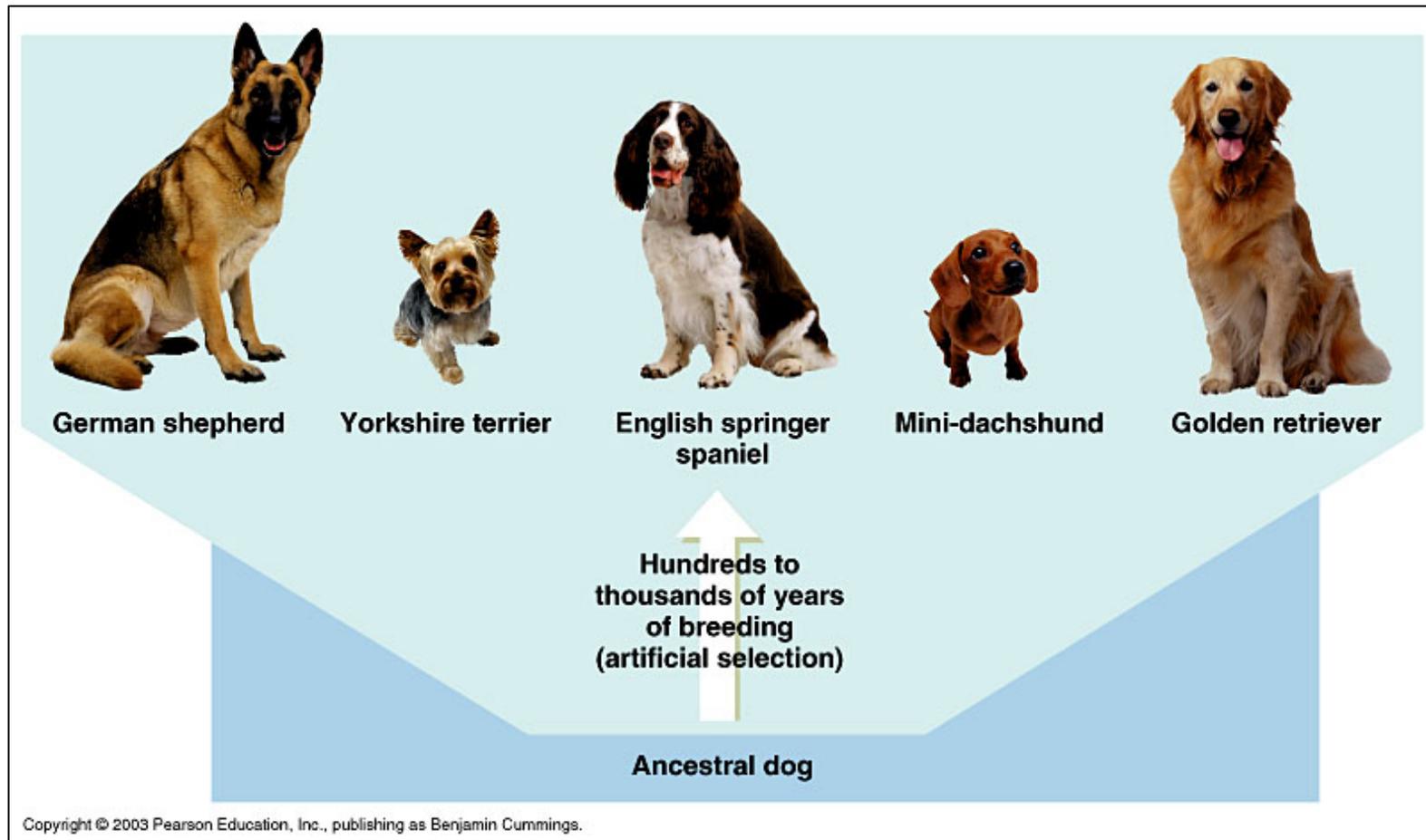


Differences between the two groups accumulate until they are so different that they can no longer interbreed even if they get back together.

Natural selection throughout billions of years of the Earth's history has resulted in the formation of millions of different species.



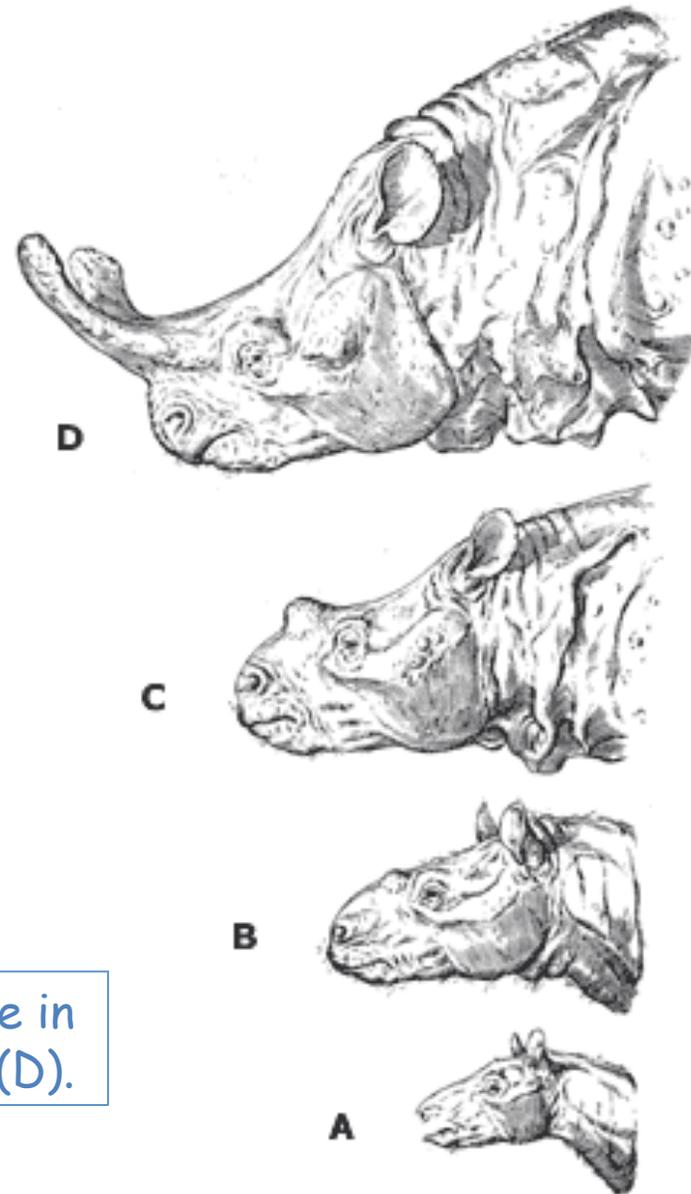
People have used their knowledge of patterns of inheritance to influence the development of organisms in the same way through **ARTIFICIAL SELECTION** aka **SELECTIVE BREEDING**.



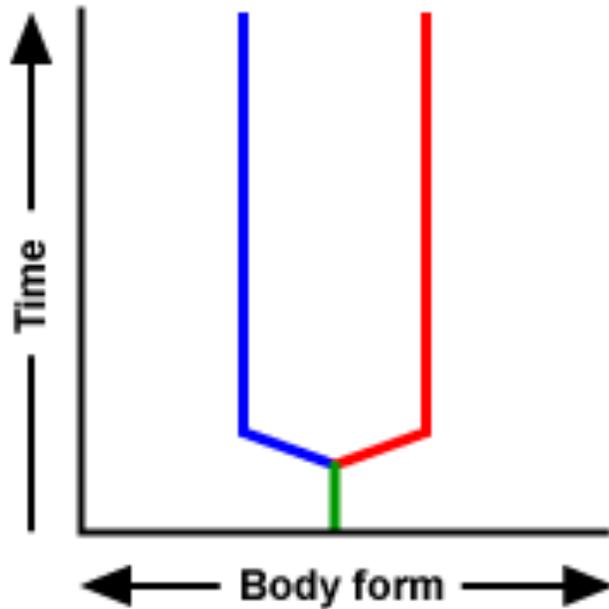
GRADUALISM is the theory that evolutionary change occurs slowly, gradually, and continuously.

The gradual accumulation of small variations eventually causes reproductive isolation and a new species arises.

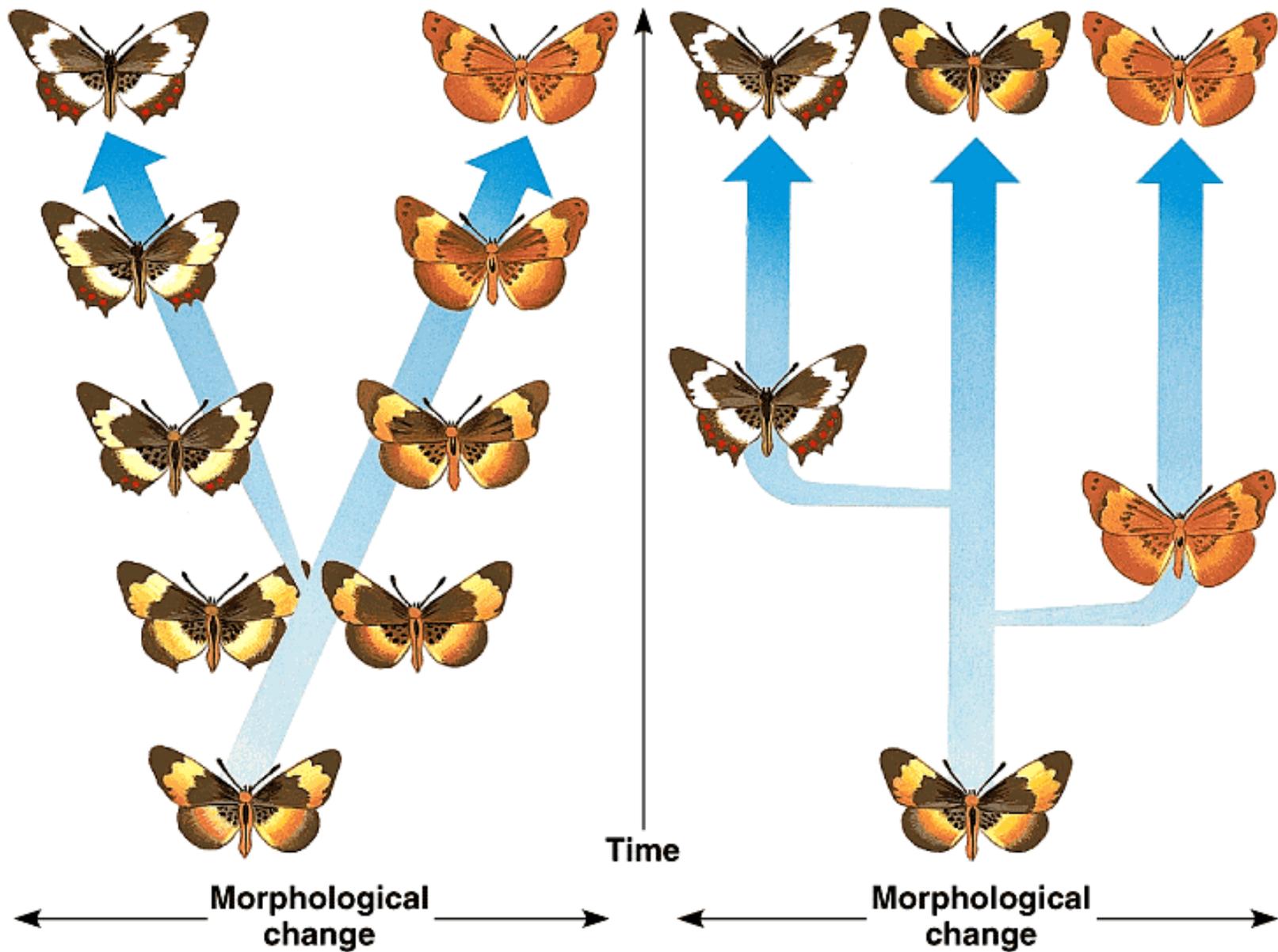
The TITANOTHERES shown here range in time from about 55 mya (A) to 35 mya (D).



The theory of PUNCTUATED EQUILIBRIUM proposes that species have long periods of stability interrupted by brief periods of major change.



The coelacanth exhibits about 80 million years' worth of morphological stability.



(a) Gradualism model

(b) Punctuated equilibrium model

Ecology

ECOLOGY studies the interdependence between living organisms and their living and non-living environments.



Organisms may relate to one another in many different ways.

predator/prey



producer/consumer

decomposer



SYMBIOSIS: an interspecies relationship involving frequent close contact.



host



parasite

The effect of symbiosis may be positive, neutral, or negative.

Whatever their relationships, the components of living systems, from a single cell to an ecosystem, interact to maintain balance.



ATOMS
MOLECULES
ORGANELLES
CELLS
TISSUES
ORGANS
SYSTEMS
ORGANISMS
POPULATIONS
COMMUNITIES
ECOSYSTEMS
BIOMES
BIOSPHERE

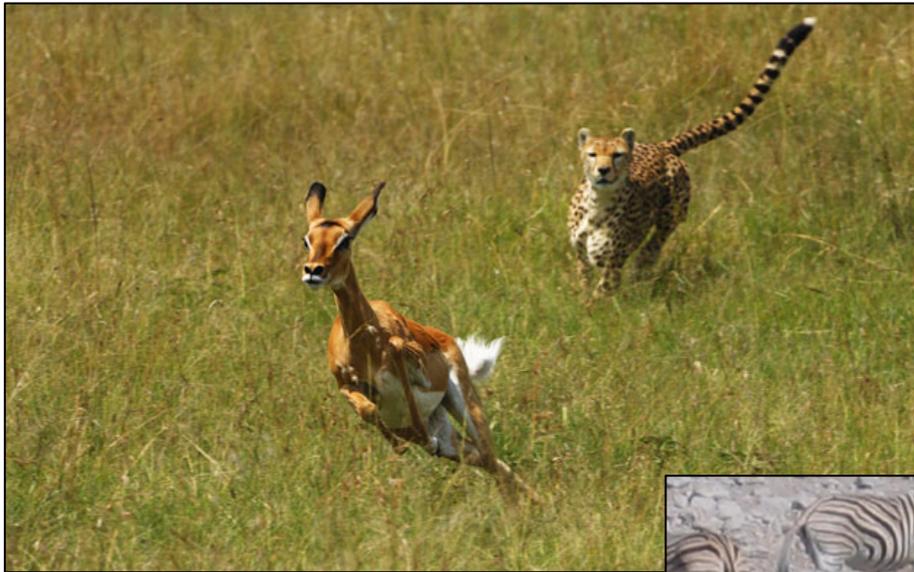


An **ORGANISM** is an individual living thing.

A **POPULATION** consists of all the interacting members of a species in a local area.



How do the members of a population interact with one another?



A **COMMUNITY** includes all of the different populations that live and interact in the same area.



How do the members of a community interact with one another?

An ECOSYSTEM consists of the non-living environment and all its interacting species.



A diverse ecosystem is more stable than an ecosystem that lacks diversity.



Diversity increases the chances that some organisms will be able to withstand disruptions to the environment.

ENERGY FLOWS THROUGH ECOSYSTEMS.



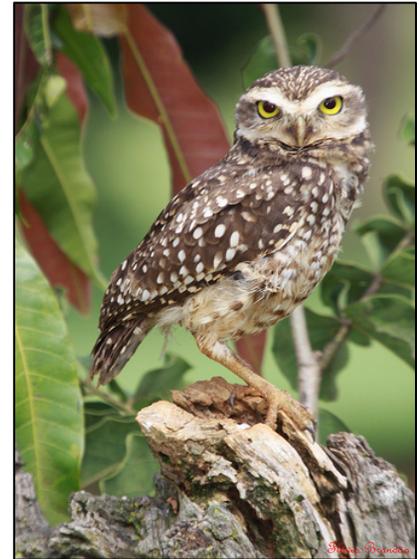
The SUN is the primary energy source for most ecosystems.

REMEMBER THIS??

AUTOTROPHS use the sun's energy to make food by the process of photosynthesis.



The sun's energy flows through producers to herbivores to carnivores in a FOOD CHAIN.

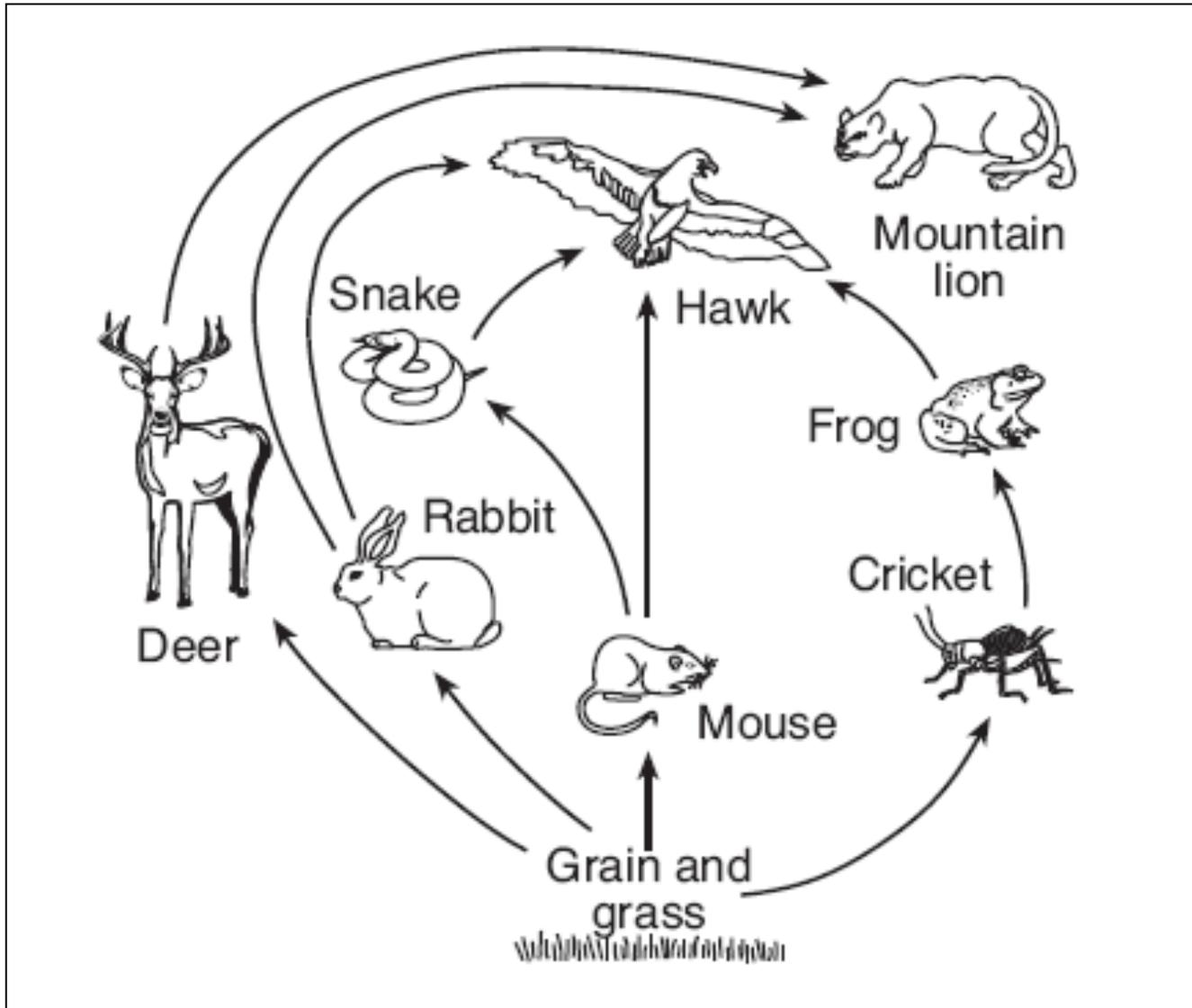


Grass → Cricket → Frog → Owl

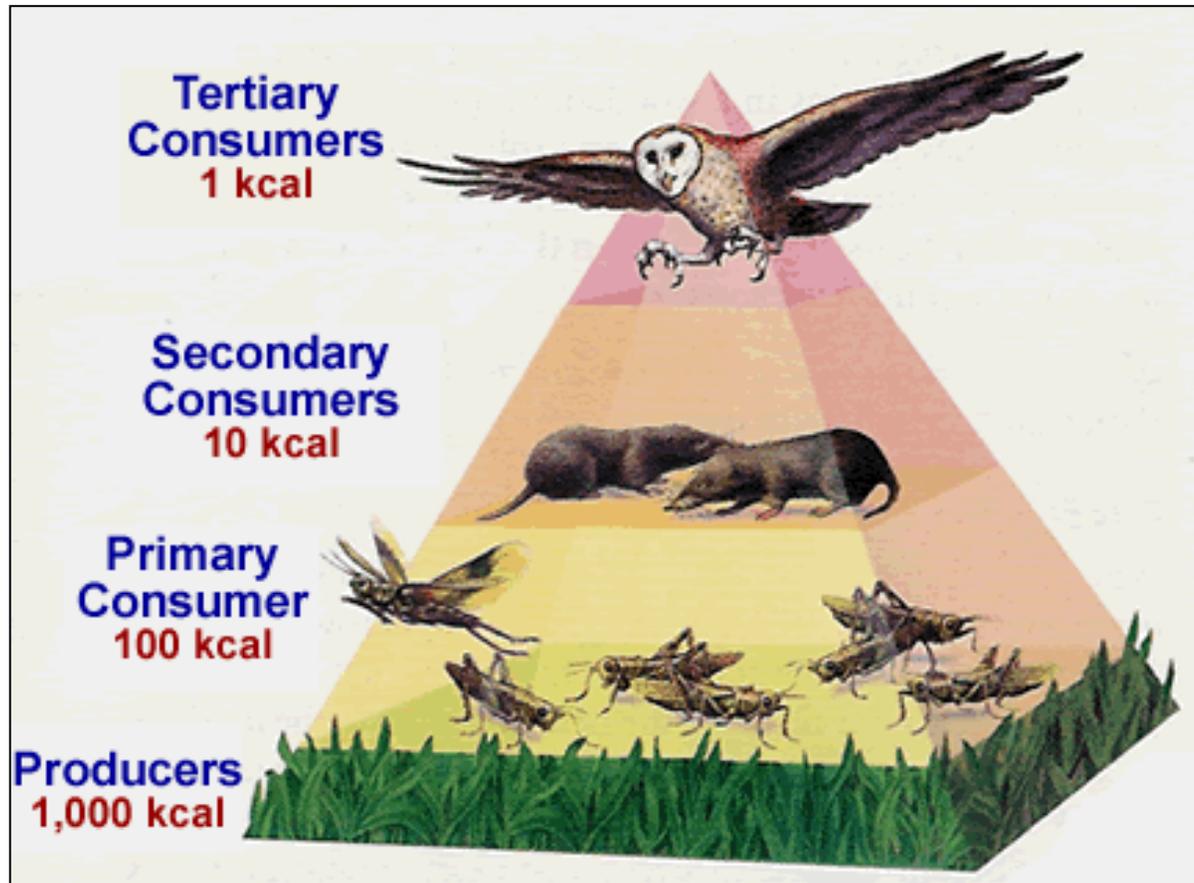
BACTERIA and FUNGI decompose the remains of organisms and their wastes at every level of the food chain.



FOOD WEBS identify the complex relationships among many producers, consumers, and decomposers in an ecosystem.



At each link in a food web, some energy is stored, but most of an organisms energy is USED for its own processes.



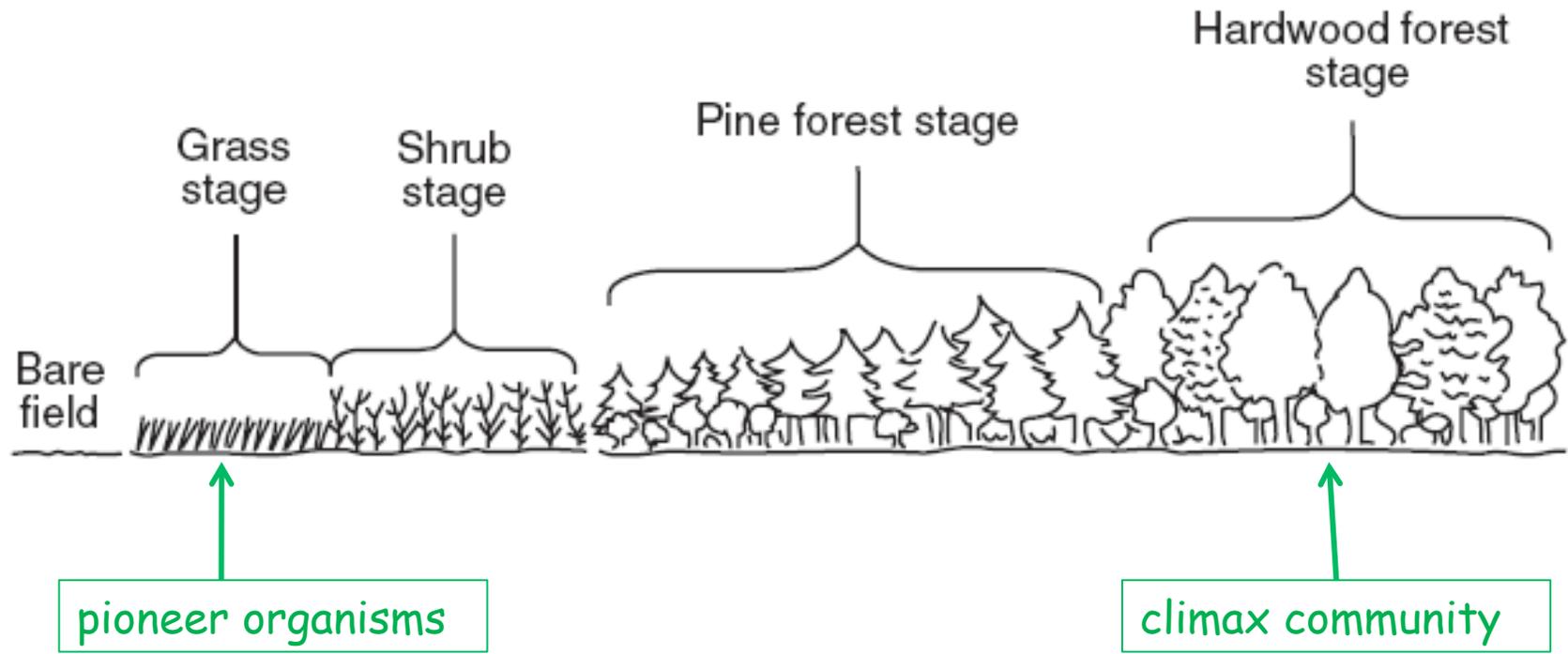
The world contains a wide diversity of physical conditions, which creates a variety of habitats for wildlife.



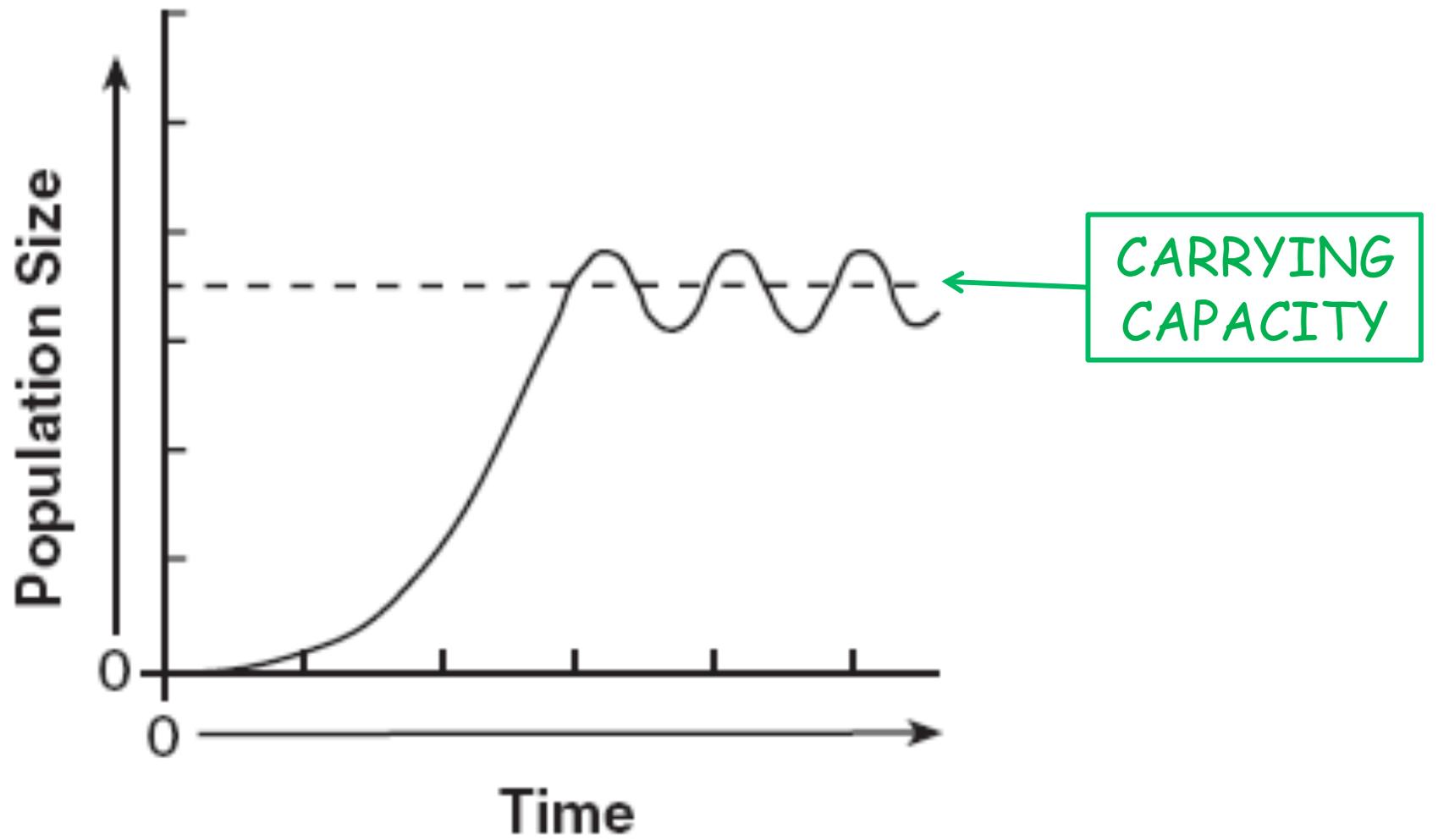
Competition can occur between members of different species for an ecological role or NICHE.



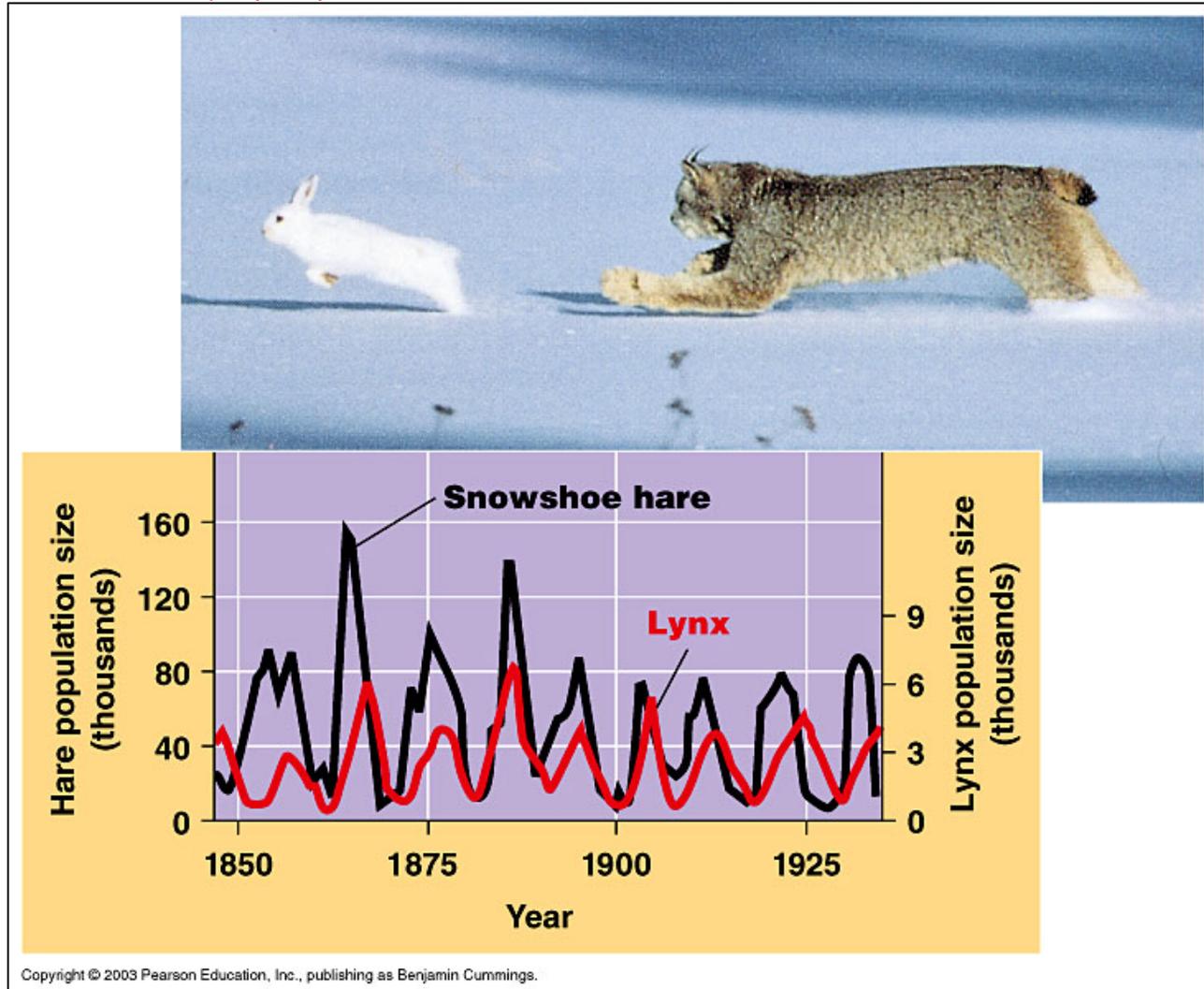
What factors define an organism's role in the environment?



New York State's
DECIDUOUS FOREST



Every population is linked with others.



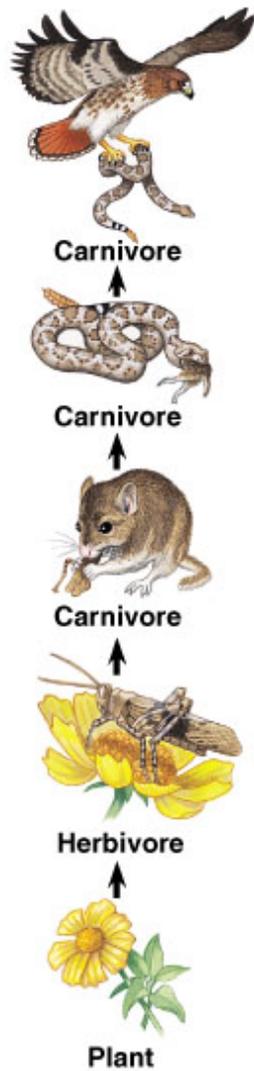
This graph is typical of the cyclic changes in population sizes of a predator and its prey.

The largest biome on earth is the **MARINE BIOME**.



The greatest amount of photosynthesis on earth takes place in microscopic autotrophs that live at the surface of the oceans.





Quaternary consumers

Tertiary consumers

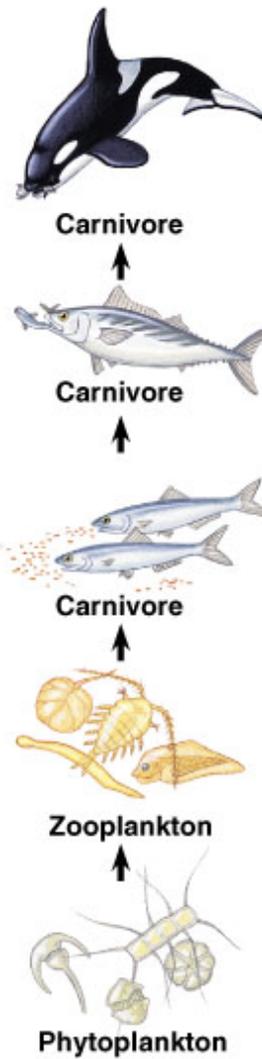
Secondary consumers

Primary consumers

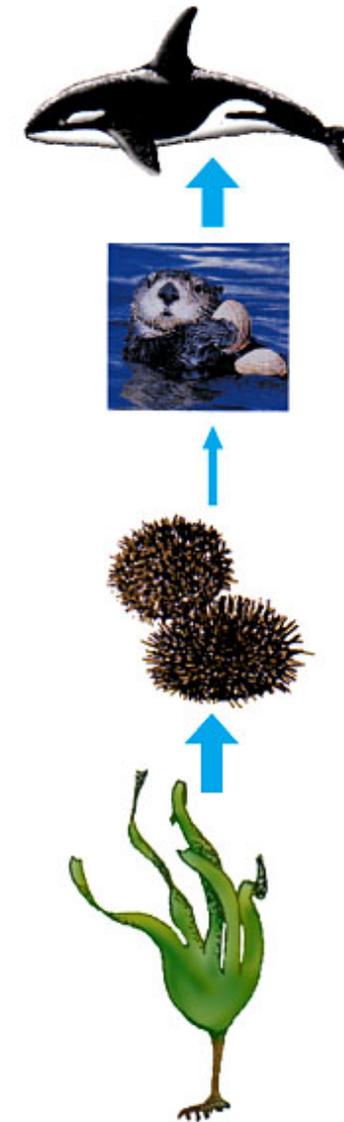
Primary producers

A terrestrial food chain

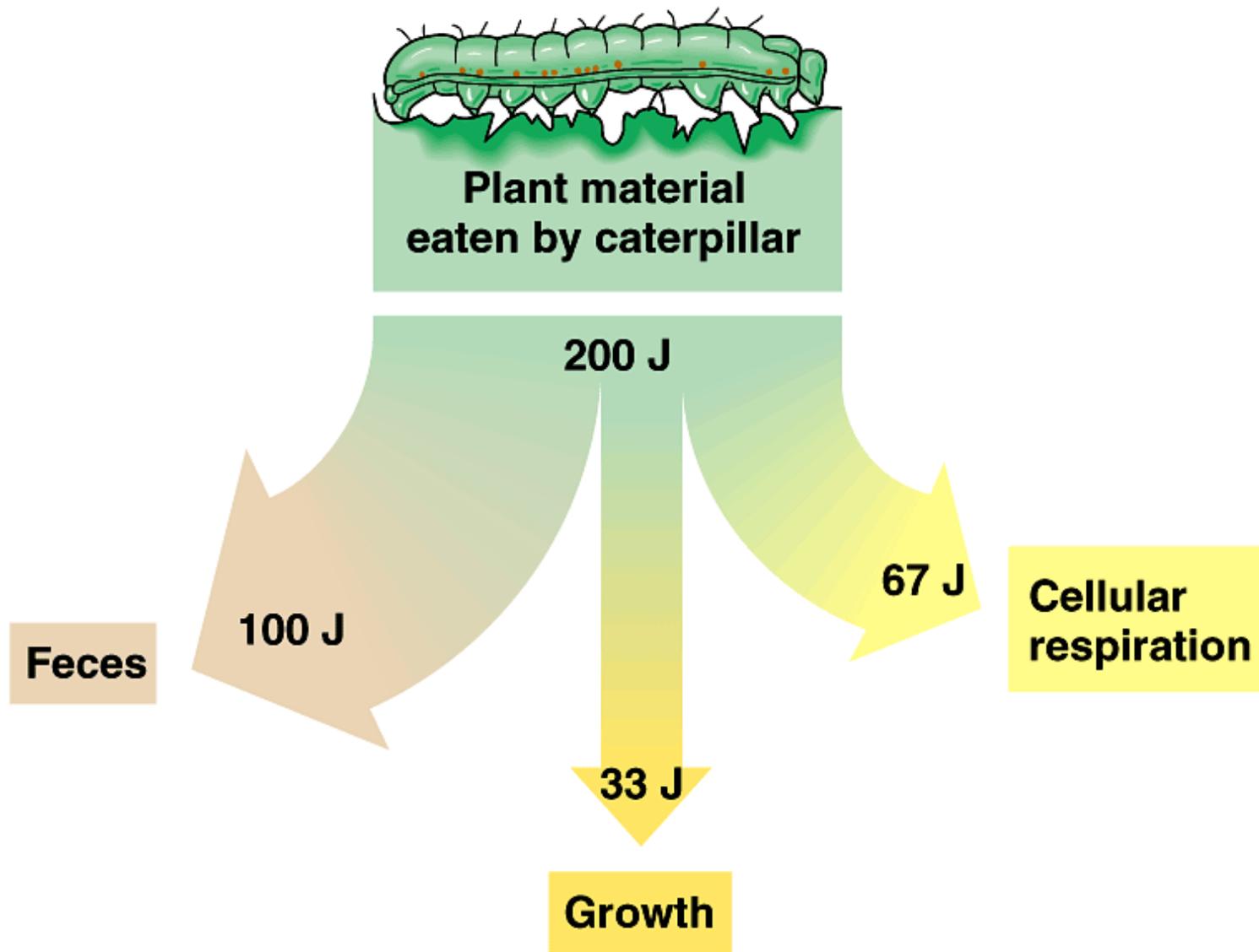
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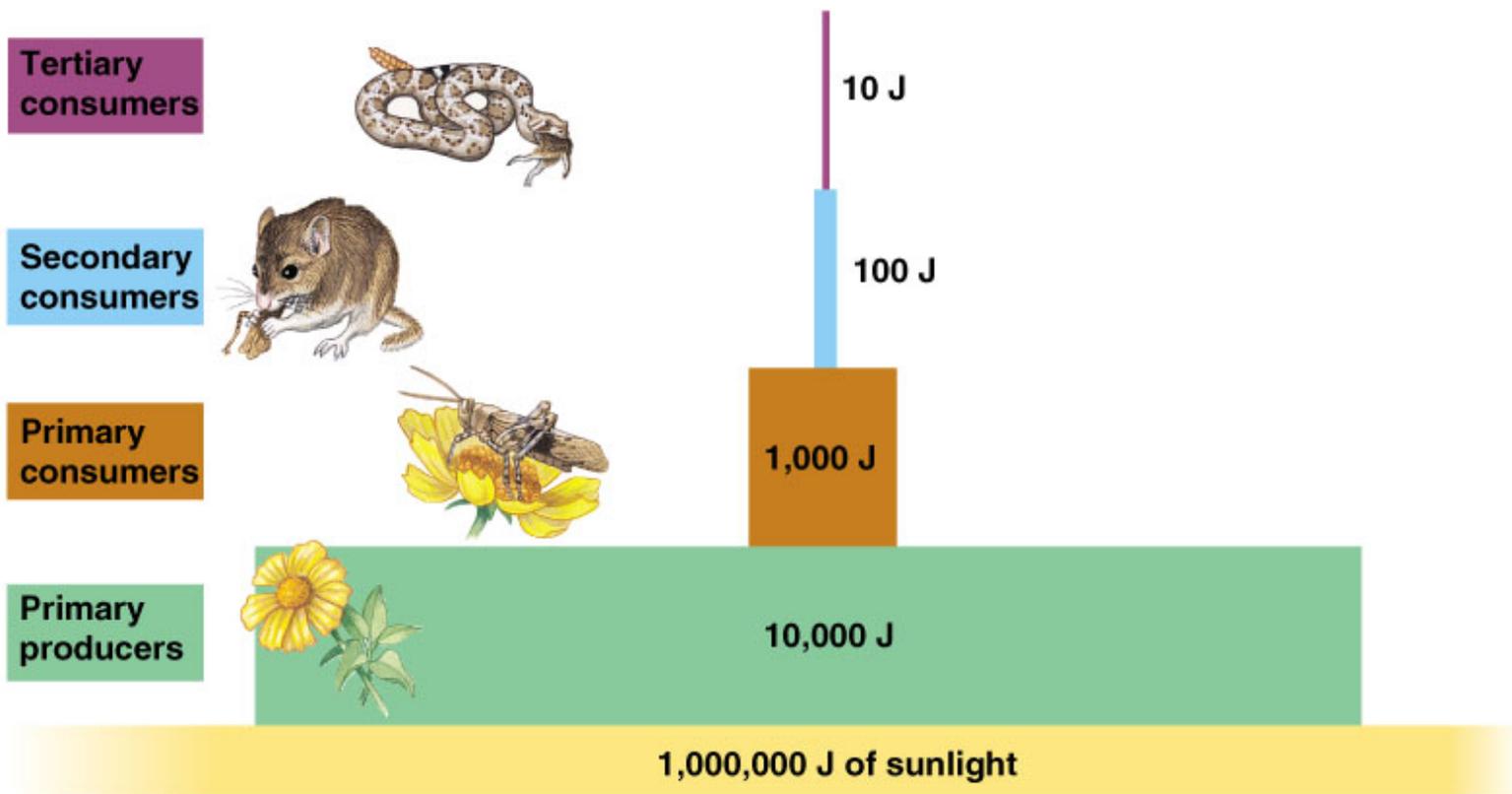


A marine food chain



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DDT concentration:
increase of
10 million times

