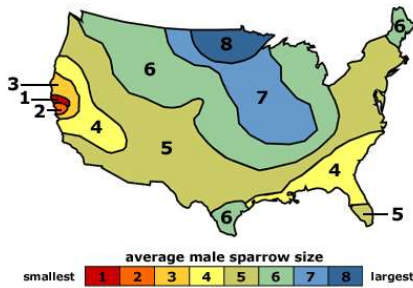


AIM: What causes organisms to change over time?

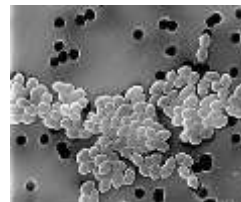
**THEORY OF EVOLUTION**  
all species have descended from earlier ancestral species

**1. microevolution**

changes in the genetic makeup of a population of a species in successive generations



**house sparrows**  
because of the colder climate northern sparrows developed to be larger in size and darker than those in southern regions

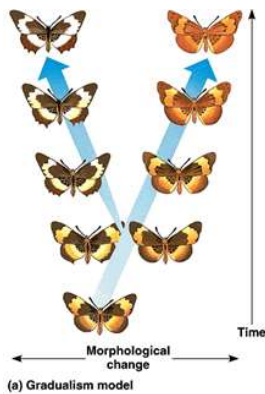


**bacteria develop a resistance to antibiotics**  
similarly: plants develop resistance to herbicides and different animals/insects develop a resistance to

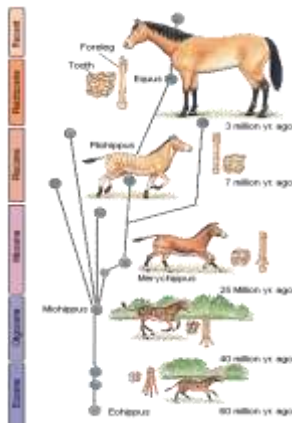
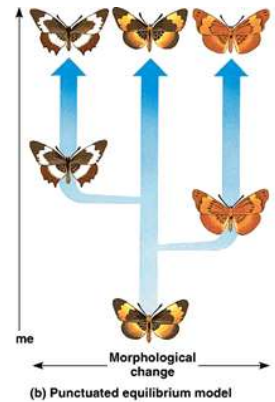
**2. macroevolution - long-term, large-scale changes that can lead to the formation of a new species**

macroevolutionary Models

a. Gradualism  
a model of evolution in which gradual change over a long period of time leads to biological diversity



b. Punctuated Equilibrium  
soon after species appear in the fossil record they will become stable, showing little evolutionary change for most of their geological history and then, because of some event (a major mutation / catastrophic environmental change) a sudden rapid change in a species occurs.



The phylogenetic tree illustrating the evolution of eohippus to the modern day horse is an example of macroevolution.

## How does microevolution work?

**Allele:** different forms of a specific gene

**Changes in allele frequencies occur because of:**

### 1. MUTATIONS

- a. exposure to external factors: radioactivity, X-rays, chemicals
- b. "mistakes " in genetic coding (copies of DNA) in reproductive cells

### 2. NATURAL SELECTION (*Charles Darwin: On the Origin of Species 1859*)

- a. there must be a natural variability for a trait in a population
- b. the trait must be heritable (have a genetic basis that is passed on)
- c. **differential reproduction** - more offspring are produced with the traits that better enable survival in their environment

**Adaptations or Adaptive Traits:** any genetically controlled trait that helps an organism survive in their niche (can be physical or behavioral)

Examples: chimp and opposable thumb for grasping,  
large ears of fennec fox for hearing and to regulate body temperature  
snowshoe hare fur changes color with seasons

### Kettlewell's Experiment – England (1953-1956)

meets all 3 criteria for evolution by natural selection

speckled light-gray  
peppered moth



Pre-Industrial Revolution  
95% speckled light-gray  
5% dark-gray



dark-gray  
peppered moth



Industrial Revolution  
95% dark-gray  
5% speckled light-gray

