

Microevolution

- Change within a species, organisms adapt to survive in their environment
 - Micro - evolution is "driven" by natural selection
 - Natural selection theory suggests a method by which species can adapt to their environment

NATURAL SELECTION

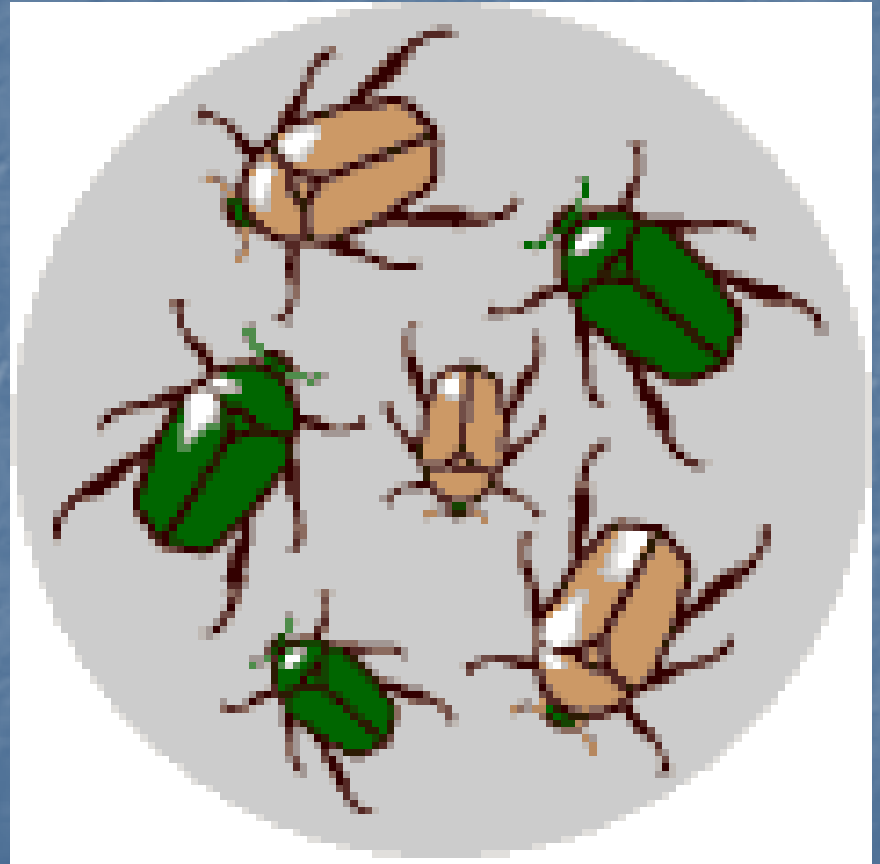
The Great Biological Paradigm

Components of Natural Selection

- Variation
- High rate of population growth
 - Competition
- Survival of the Fittest
- Differential Reproduction and Inheritance

Variation in Traits

- Ex/ Some beetles are green, some are brown
 - Let's assume it is random



Variation

- Some of these variations are inherited by the offspring
- The mechanism of the inheritance of genes is **sexual reproduction**
 - Variation produces new combinations
 - 'Good' traits can increase
 - 'Bad' traits are also present

Population Growth

Populations tend to produce more offspring than the environment can support

Ex/ 1 pair of cockroaches could produce 164 000 million in 7 months



Thomas Malthus

- *Essay on the Principle of Population* (1798)
- Populations in nature cannot continually increase
 - Sooner or later food supply is insufficient and famine stops further growth

Basically...

There's only so much to go
around (food, space, mates, etc.)

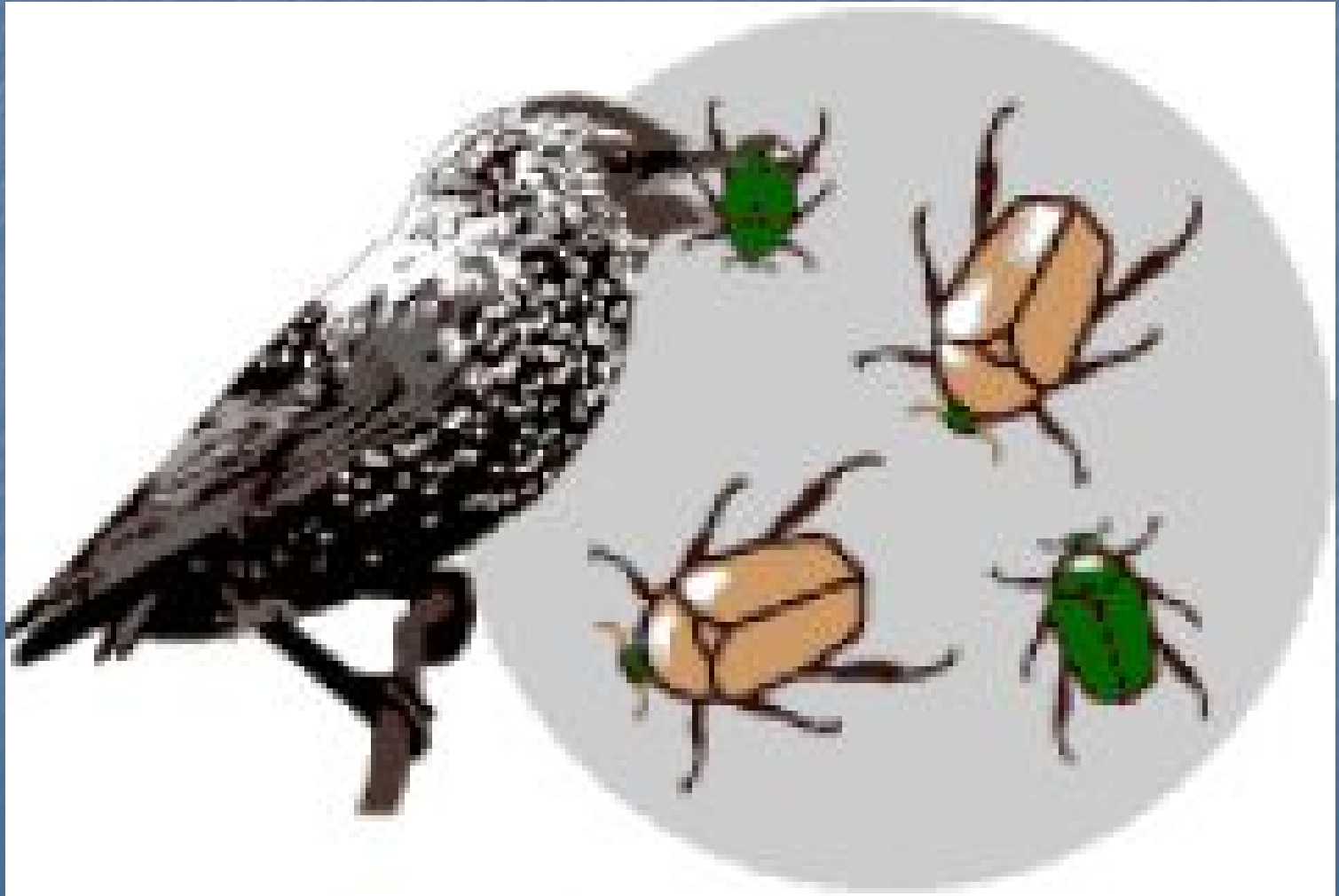
Competition

There must be a struggle for survival

Some of the offspring produced in a generation do not survive

Competition is a major factor limiting population sizes

Competition for Survival



Competition for Mates



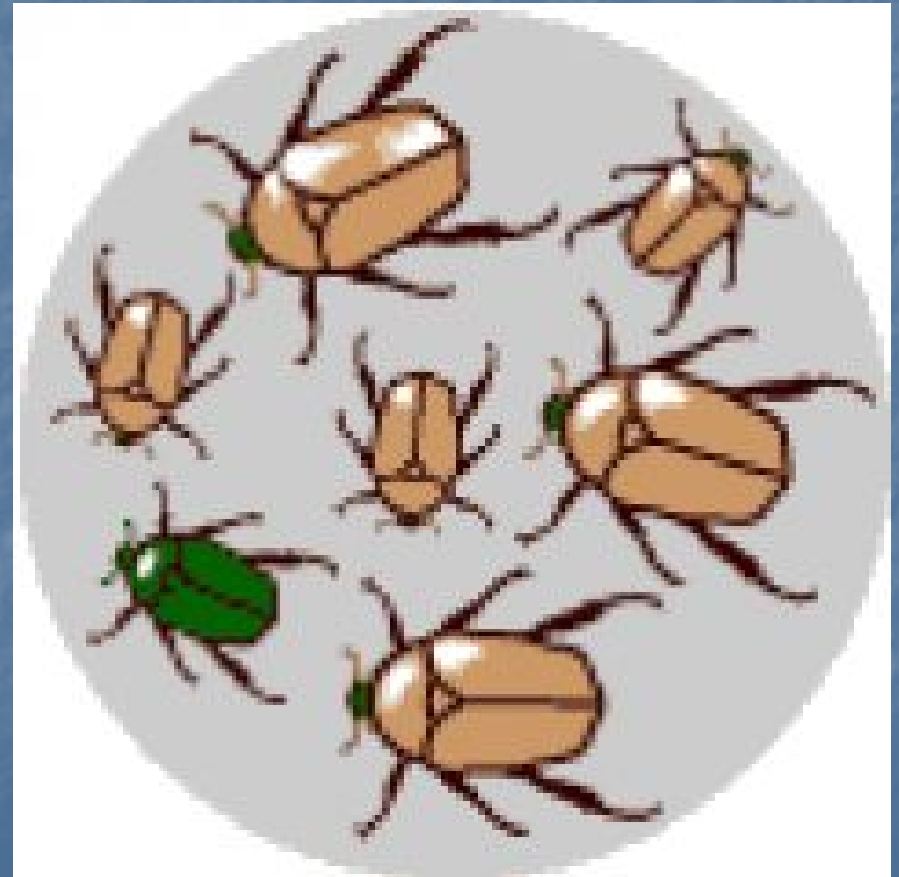
Female topi antelopes fighting for mates. On mating arenas (leks), female topi compete to mate with preferred males by fighting and actively disrupting the mating of others

Competition

- 'Good' traits allow for more successful competition
 - Sexual selection
 - Social dominance

Heredity

- The surviving brown beetles have brown baby beetles because this trait has a genetic basis.



The Great Debate

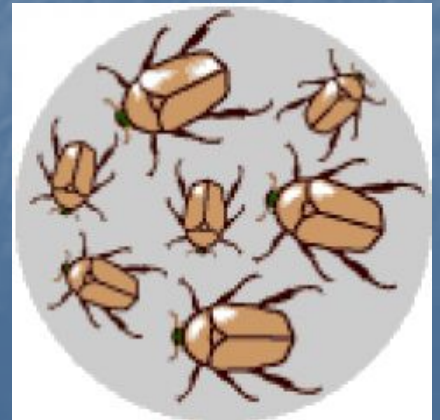
- Mendel's work was able to explain some of the patterns of inheritance through the mixing that occurs during **meiosis** and **fertilization**
- Darwin could not explain the origin of new variants
 - Where do the 'good' and 'bad' traits come from?
 - Is it engineered or random?
- This had to wait until the 1920s and 1930s when work began on **mutations** after the discovery of radiation

Survival of the Fittest

- Struggle for survival between members of a population
- Individuals with advantageous variations will breed and produce more offspring

Natural Selection – The Result

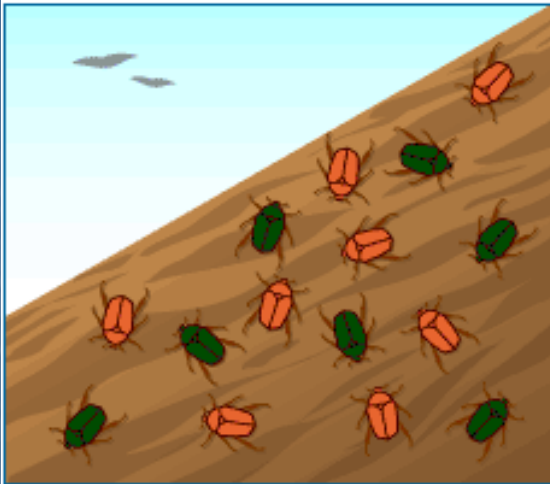
- As generations pass by, best adaptations become more prominent
- Ex/
 - Pesticide resistance in insects
 - Antibiotic resistance in bacteria
 - Industrial melanism in moths
 - Tolerance to heavy metals in plants



Natural Selection ≠ Only Mechanism

- Observing the evolution of a new species is unlikely in the lifetime of a scientist
 - Evolution is a fact
 - Evolution by natural selection remains a theory
 - Other mechanisms exist that can also lead to the evolution of species
 - We'll discuss them later...

Natural selection in the wild

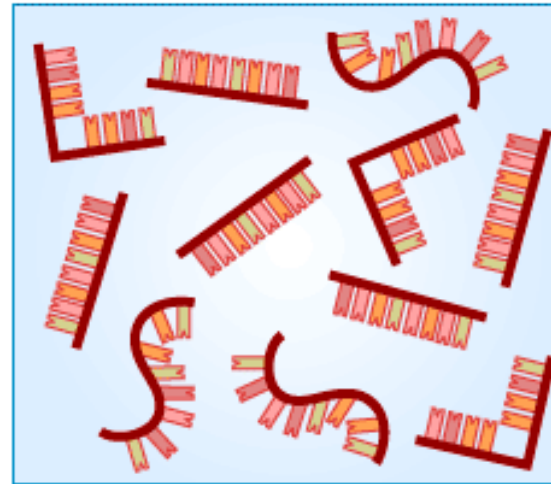


1. There is variation in a population of organisms.

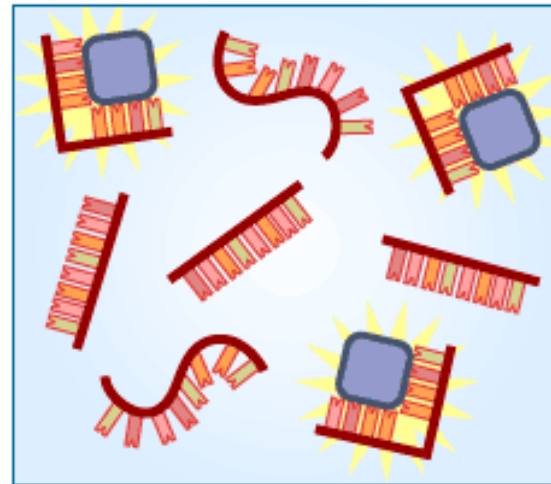


2. Some variants are more likely to survive than others.

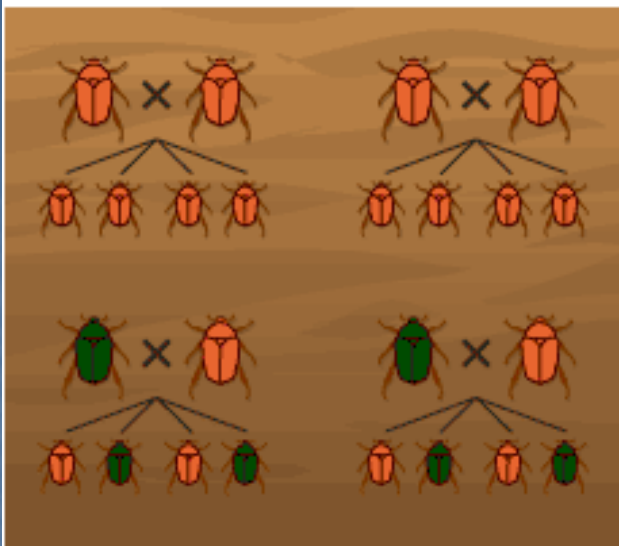
Artificial selection in the lab



1. There is variation in a population of RNA molecules.



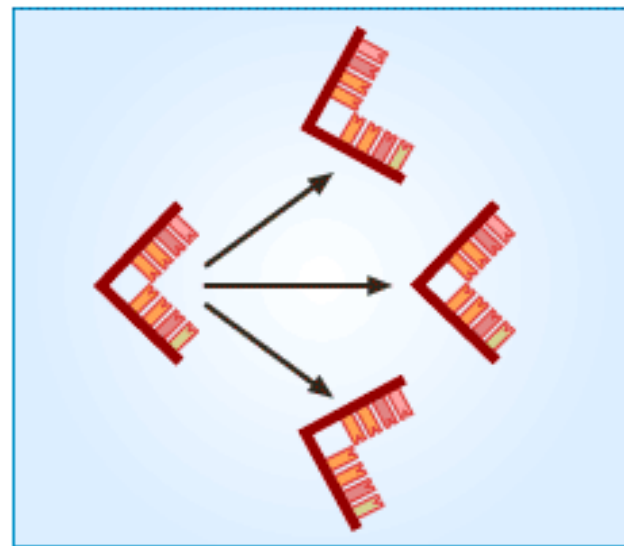
2. RNAs that perform a particular job are more likely to be selected than others. Selected RNAs are removed from the original pool.



3. Survivors reproduce.



4. The population has evolved and now contains more individuals with the selected trait.

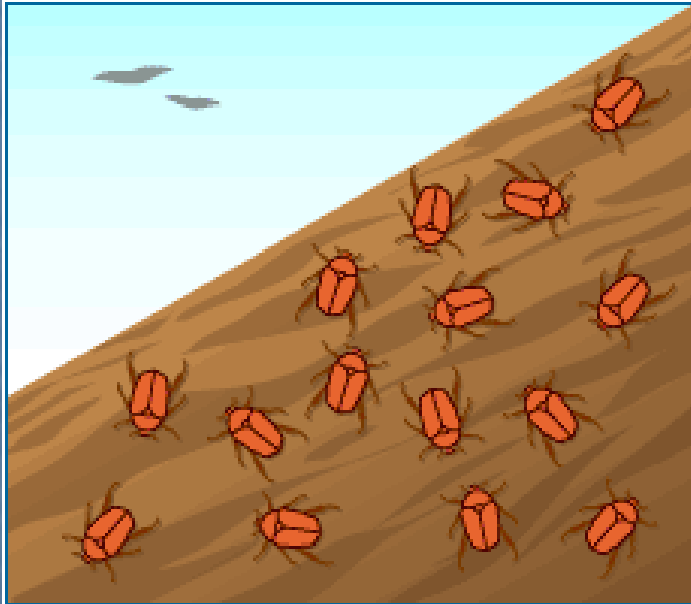


3. Selected RNAs are copied.



4. The population of RNA has evolved and now contains more useful molecules.

As time passes, selection and reproduction (steps 2-4) are repeated for each generation.



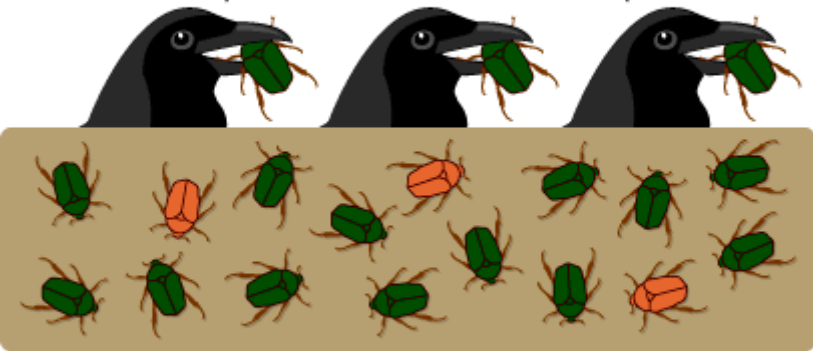
5. After many rounds of selection, the entire population has the selected trait.



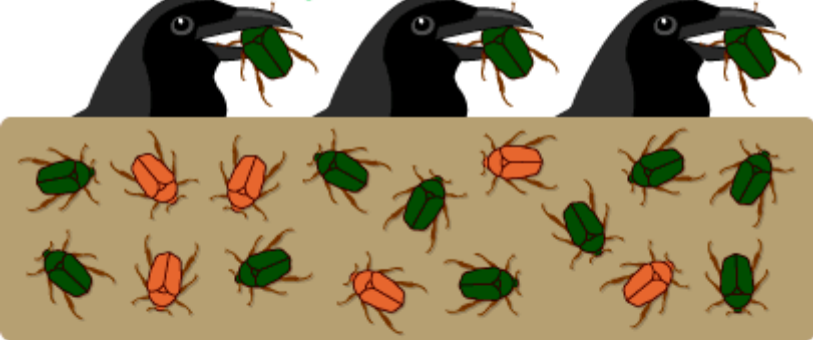
5. After many rounds of selection, the entire population consists of useful molecules.

Natural selection, in a nutshell:

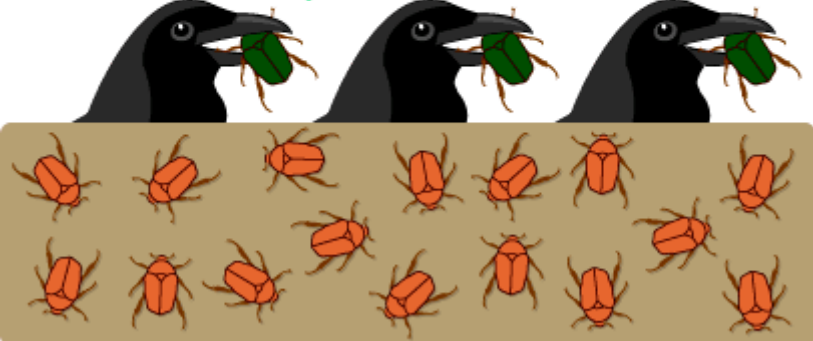
Yum! Green beetles! Our favorite!



...generations later...



...generations later...



Green beetles have been selected against, and brown beetles have flourished.

Natural Selection – Take Home Points

- Variation – differences among traits that occur in members of the same species
- Selective pressure – things that organisms have to deal with in order to survive
- Survival of the fittest – best adapted individuals have a greater chance of survival
- Differential Reproduction – survivors have a better chance of reproducing and passing on their genes (traits)

Darwin's Dangerous Idea

- <http://www.youtube.com/watch?v=910dz5sCb1I&list=PLAA7266B85052D062&feature=plcp>