EVOLUTION

What is Evolution?

- Evolution is the process by which species (not individuals) change over time.
- The theory of evolution unites all living things and reminds us that humans are part of nature.



Evidence for Evolution

Charles Darwin along with several other scientists saw evidence of gradual change.

Their experiences provided us with evidence of evolution at work.







Processes Of Evolution

- The processes by which inherited traits change over time:
 - 1. Natural Selection
 - 2. Sexual Selection
 - 3. Migration
 - 4. Mutation
 - 5. Genetic Drift

1. Natural Selection

Individuals that are better adapted to their environment survive and reproduce more successfully than less well adapted individuals do.

How it acts:

-All populations have genetic variation

-Individuals tend to produce more offspring than the environment can support

-All populations depend upon the reproduction of individuals.

1. Natural Selection Continued

- Natural Selection acts only to change the relative frequency of alleles that exist in a population
- It acts on <u>genotypes</u> by removing unsuccessful <u>phenotypes</u> from a population.







Patterns of Natural Selection Directional Selection: selection acts to eliminate one extreme from a range of phenotypes. Often seen in the evolution of single-gene traits like pesticide resistance

in insects. range not resistant

sumenhat completer resistant resistant



<u>Stabilizing Selection</u>: eliminates individuals that have alleles for any extreme type. The intermediate phenotype increases. This is very

ex white pink re

common in nature.

white PINK red

Disruptive selection: eliminates the average/intermediate

phenotypes and increases the

ex white gran

extremes.

black white gray







- 2 Stabilizing Selection
- 3 Disruptive Selection
- 1 Directional Selection



Sexual Selection

Individuals select mates based on certain characteristics to ensure that their offspring get the best genes.

- Increases genetic variability
- Only able to pass on 50% of genes

Intrasexual selection

When members of the same sex compete for a mate.



Intersexual Selection

Also known as mate choice, when individuals of one sex (usually females) are choosy in selecting their mates.

Females often select males based size, color, ability to gather food, build a nest, sing, etc. in order to ensure that her children get the best genes.





Artificial Selection

 Selective breeding of plants and animals to promote the occurrence of desirable traits in offspring.



Mutation

Mutations can happen in all cell types, some are beneficial, some are harmful. A mutation is only beneficial if it makes the individual better suited for the environment.



Migration

The movement of individuals into, out of, or between populations. Migration can change the numbers and types of alleles in a population by increasing the genetic variation.



Genetic Drift

Chance events can cause rare alleles to be lost from one generation to the next, especially in small populations. These random events affect the frequency of alleles and cause the gene pool to drift towards a certain phenotype.



Speciation

Species: group of organisms that can interbreed and produce fertile offspring in nature. There is a *gene pool* for each species.



Ways a new species can form:

Reproductive Isolations:

<u>Geographic Isolation</u>: physical separation of populations prevents interbreeding and mixing of gene pools.

<u>Behavioral Isolation:</u> two populations develop differences in courtship rituals or other behaviors that prevent them from breeding.

<u>Temporal Isolation:</u> Two or more species reproduce at different times.

Patterns of Evolution

Gradualism:

- Darwin along with Charles Lyell, thought that evolution was <u>slow and steady</u>.
- The fossil record shows that many organisms have changed gradually over time.



Catastrophism

 Theory that geological formations and changes in species occurred because of catastrophic events, like the biblical flood, which occurred in the past on a scale never observed today.



Punctuated Equilibrium:

 Long stable periods are interrupted by brief periods of more rapid Time change (a hundred years versus a million.)

Phyletic Gradualism **Punctuated Equilibrium** Morphology

Convergent Evolution

- Sometimes organisms in different places evolve in similar environments.
- Natural selection forms similar structures and characteristics in organisms that are not closely related.

