CORNELL NOTES
Directions: You must create a minimum of 5 questions in this column per page (average). Use these to study your notes and prepare for tests and quizzes. Notes will be stamped after each assigned sections (if completed) and turned in to your teacher at the end of the Unit for scoring.

UNIT 4: EVOLUTION
Chapter 11: The Evolution of Populations

I. Genetic Variation Within Populations (11.1)

A. Genetic variation in a population _____ the chance that some individuals will _____

1. Genetic variation in populations lead to differences in _____

2. _____ **selection** acts on **phenotype**

3. The greater the range in phenotypes, the more likely some individuals can **survive** _____ environment

a. _____- genetic variation stored in population

b. Each allele exists at a certain _____ - **gene frequency**

B. Genetic variation comes from several _____

1. **Mutation**- random change in organisms _____

a. can form new _____

b. Mutations in _____ cells can be passed on

c. Increases _____ variation in gene pool

2. **Recombination**- new allele combination form in _____

a. _____-new combinations of parents alleles

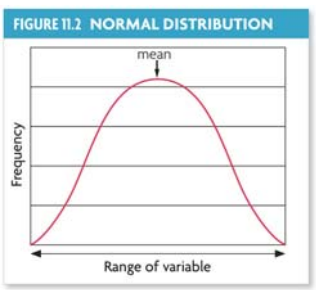
b. **Crossing over** increases _____

II. Natural Selection in Populations (11.2)

A. Natural selection acts on _____ of traits

1. Normal distribution- gives classic "_____-shaped" curve

2. Environmental conditions can change and a certain phenotype may become an _____



B. Natural Selection can change the distribution of a trait in one of three ways

1. **Microevolution**-observable change in _____ frequency of a _____ over time

a. Occurs on _____ scale within single population

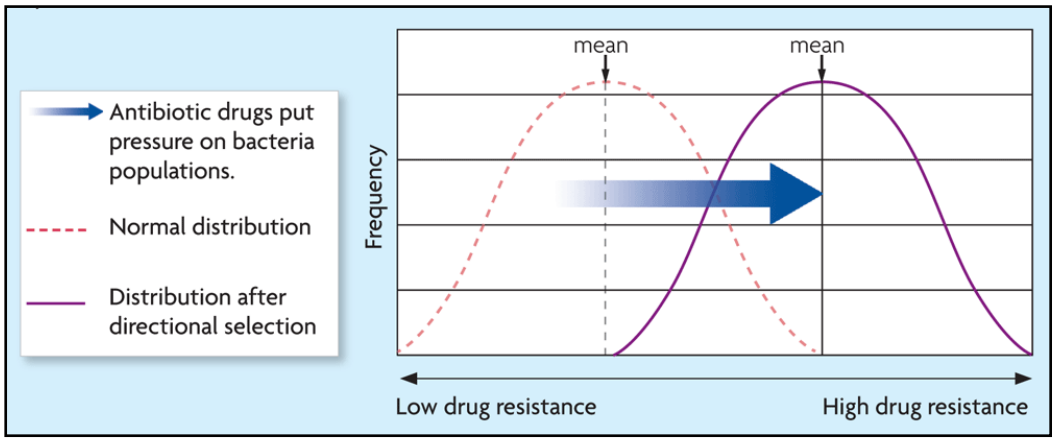
b. Natural selection can change distribution of a trait along ___ paths (directional, stabilizing, or disruptive selection

2. **Directional Selection**- causes _____ in a populations _____ distribution

a. An extreme phenotype that was once _____ is now more _____

b. Mean value of a trait shifts in direction of the more _____ phenotype

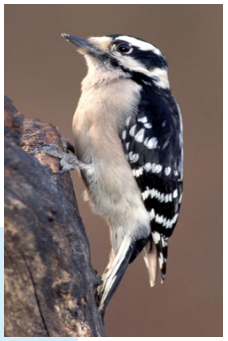
c. Lead to rise in _____**-resistant bacteria**

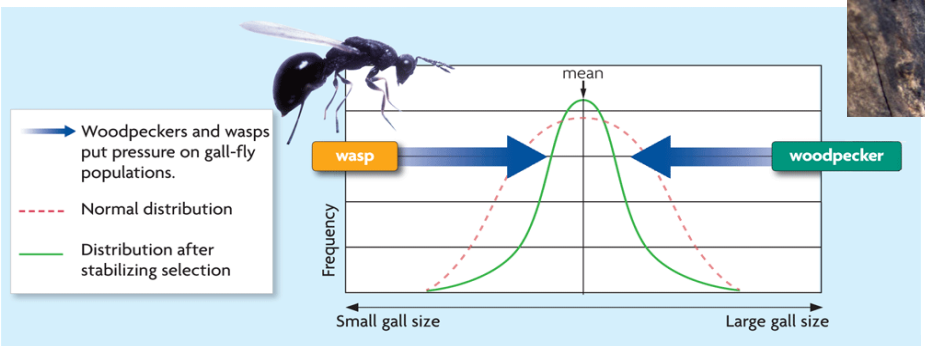


3. **Stabilizing Selection**- the intermediate phenotype is _____ and becomes **more common.**

a. _____ genetic diversity

b. Extreme phenotypes may be _____

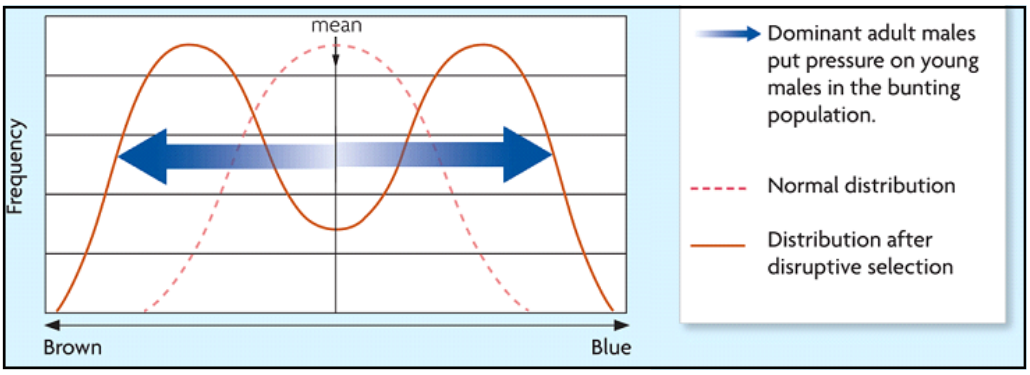




4. **Disruptive Selection**- occurs when both extremes are favored and _____ are selected against

a. Intermediate forms selected _____

b. Can lead to formation of new _____



III. Other Mechanisms of Evolution (11.3)

A. Gene flow is the movement of alleles between populations

1. **Gene flow**- movement of _____ from one _____ to another

a. **Increases** genetic variation of _____ population

b. **Gene flow** between populations keeps gene pools _____

c. **Less** gene flow can create **genetically** _____ populations

d. **Lack of gene flow** increases chance that two populations will _____ **into different species**

B. Genetic drift is a change in allele frequencies due to chance

1. **Small populations** are _____ _____ to be affected by _____

2. **Genetic Drift**- changes in allele frequencies due to _____ (Two ways this occurs)

a. _____ **Effect**- genetic drift that occurs after an _____ (e.g. overhunting)

b. _____ **Effect**- genetic drift that occurs after a small number of individuals _____ a new area

3. Effects of Genetic Drift

a. **Lose of** _____ **variation**- ability of group to _____ to changing environment is _____.

b. _____ **alleles** may become **more common** in gene pool due to _____ alone

C. **Sexual selection** occurs when certain traits increase mating success

1._____ can have important effect on evolution of population

a. _____ make many sperm continuously (value of each relatively _____)

b. _____ more limited in number of offspring can produce (each investment more valuable, and they want a good return)

2. **Sexual selection**- when certain _____ increase _____ **success**

a. Certain traits can become very _____ over time through sexual selection

b. These traits for mating success not always adaptive for _____ of the individual

IV. Hardy-Weinberg Equilibrium (11.4)

A. **Hardy-Weinberg equilibrium** describes populations that are _____ evolving

1. Said genotype frequencies stay the same over time as long as certain _____ are met. (5 conditions)

a. **Very** _____ **populations** (no genetic drift can occur)

b. **No** _____ **or** _____ (no gene flow can occur)

c. **No** _____ (no new alleles can be added to the gene pool)

d. _____ **mating** (no sexual selection can occur

e. **No** _____ **selection** (all traits must equally aid in survival)

B. The Hardy-Weinberg equation is used to _____ genotype **frequencies** in a population

1. Used in simple _____-_____ systems

2. Shows values that would exist in population in _____

3. Use **equation** (if calculated frequencies match actual frequencies, then population in equilibrium)

$$p^2 + 2pq = q^2 = 1$$

VARIABLES

p = **frequency of allele *T*** (dominant allele)

q = **frequency of allele *t*** (recessive allele)

p^2 = **frequency of fish with *TT*** (dominant homozygous genotype)

$2pq$ = **frequency of fish with *Tt*** (heterozygous genotype)

q^2 = **frequency of fish with *tt*** (recessive homozygous genotype)

C. There are 5 factors that can lead to evolution (**populations not in Hardy-Weinberg equilibrium are** _____)

1. _____ **drift** (allele frequencies change due to chance)

2. **Gene flow** (movement of _____-emigration and immigration)

3 _____ (New alleles form through mutation and create genetic _____)

4. _____ **selection** (certain traits improve mating _____)

5. _____ **selection** (certain traits advantageous to survival. Alleles for these traits increase in frequency)

V. Speciation Through Isolation (11.5)

A. The isolation of populations can lead to _____

1. **Speciation**- the rise of two or more _____ from one _____ species

2. _____ **isolation-** when members of **different populations** can **no longer mate successfully** with one another)

B. Populations can become _____ in several ways

1. **Behavioral barriers**

a. **Behavioral isolation**- isolation caused by differences in _____ or _____ behavior)

b. Chemical scents, courtship dances, courtship songs, sexual signals used to attract _____

2. **Geographic barriers**

a. **Geographic isolation**- involves _____ barriers that divide _____

b. Include mountains, rivers, dried lakebeds,etc.

c. **Over time** isolated populations become _____ **different**

3. **Temporal Barriers**

a. **Temporal Isolation**- _____ prevents _____ between populations

b. **Reproductive periods** may change and can lead to _____

VI. Patterns of Evolution (11.6)

A. Evolution through natural selection is not _____

1. **Environment** controls the _____ taken by natural selection

2. The **response of species to environmental challenges** and opportunities is _____ **random**

a. _____ **Evolution**- evolution towards similar characteristics in unrelated species

b. _____ **Evolution**- related species evolve in different directions and become increasingly different

B. Species can shape each other over _____

1. _____- two or more species evolve in response to changes in each other

2. **Evolutionary arms race**- _____ can occur in _____ relationships

C. Species can become extinct

1. **extinction**- _____ of a species from Earth

2. **Background extinctions**- extinctions that occur _____ at very _____ rate

3. _____ **extinction**- more rare, but more intense

a.. Can occur on _____ level

b. Thought to occur due to _____ events (e.g. ice age, asteroid impact)

D. Speciation often occurs in patterns

1. **Punctuated equilibrium**- _____ of evolutionary activity

a. Episodes of speciation occur _____

b. Followed by periods of _____ change

2. **Adaptive radiation**- Diversification of one _____ species into many descendent species