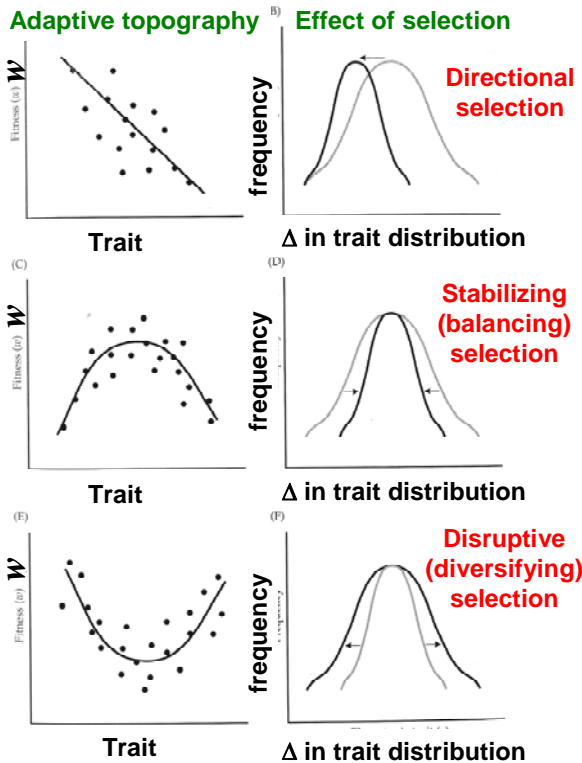


Evolution Biol 4801
Lecture 19
Chapter 12

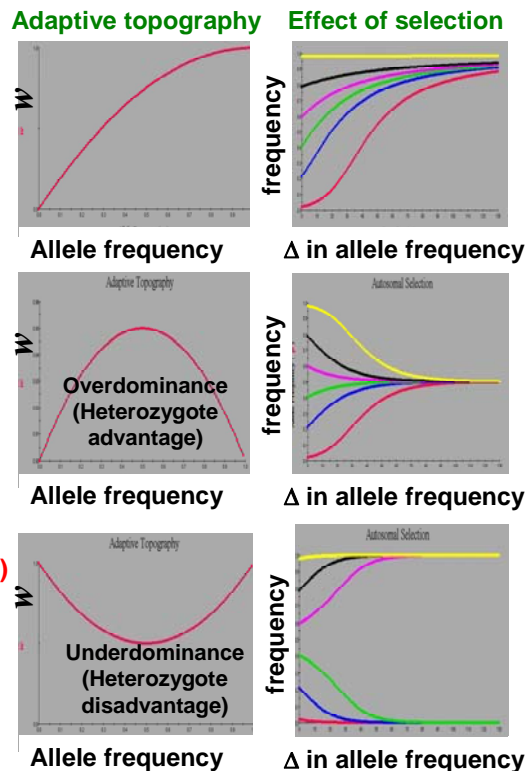
Topics for today

1. Forms of selection
2. Gene flow and selection
3. Frequency-dependent selection

Quantitative trait



Polymorphic locus



Forms of selection

1. Directional selection
 - Moves the mean
 - Reduces the variance
2. Stabilizing selection, balancing selection, heterozygote advantage
 - Doesn't move the mean (unless asymmetrical)
 - Reduces the variance
3. Disruptive selection, diversifying selection, heterozygote disadvantage, underdominance
 - Doesn't move the mean (unless asymmetrical)
 - Increases the variance

Real life examples

1. Directional selection

- Drug-resistant TB
 - Antibiotic resistance
 - Evolution of resistance happens fast
 - Insecticide resistance
- Fig. 12.9**
- Intense natural selection caused by invasive species
 - Flat periwinkle
 - Native to New England rocky coastline
 - European green crab arrived in early 19th century
 - Feeds on flat periwinkle
 - Causing natural selection on shell thickness?

EvoBeaker: Snails

2. Stabilizing selection

- Goldenrod galls size
 - *Solidago altissima* Tall goldenrod
 - Fly attacks plant in early spring
 - Plant develops gall
 - Both plant and fly genes are involved in gall formation
 - Selection from biotic community shapes gall size and shape
 - Parasitoids oviposit on small galls and kill larvae
 - Selection against small galls
 - Birds peck out and consume larvae
 1. Selection against large galls
 2. Selection for intermediate gall size

3. Disruptive selection

- Beak dimensions in black-bellied seed cracker
- Bill size and survivorship measure on > 200 juvenile birds
- Birds with large and small bills specialize on different seeds
- Intermediate sizes die

~Fig. 12.4

Gene flow can counter the effects of selection

Fig. 12.10

- Osmotic balance different in salt and fresh water
- Aminopeptidase I enzyme cleaves terminal amino acids from proteins increasing free amino acid concentration
- *ap94* allele more active
- Mussels with *ap94* in Long Island Sound have greater mortality
- Influx of genes as larvae each year

Fig. 12-11

Gene flow can cause maladaptation

- Larvae preyed on by fish
- In ponds with fish
 - Paler coloration
 - Fish odor reduces feeding activity
- The less gene flow from fishless populations, the more adaptive trait change

Fig. 12.12

4. Frequency dependent selection – two kinds (Inverse and Positive)

1. Inverse frequency dependent selection

- Rare genotype is favored
- Increases in frequency until it is not rare anymore
- Fitness declines

Example 1: Self incompatibility loci in plants

Example 2: Scale-eating cichlid

- Attacks other fish from behind
- Feeds on scales
- Right- and left-mouthed morphs

2. Positive frequency dependent selection

- Common genotype is favored
- Whichever allele is initially more fit will rapidly be fixed

Example 1: two butterfly species

- Two species of unpalatable butterfly
- Parallel geographic races
- Müllerian mimicry
- Birds avoid butterflies with similar warning coloration

Fig. 12.19

Mallet and Barton 1989 (link on web)

- Positive frequency dependent selection maintains separation of morphs
- If postman invades rayed territory, birds don't recognize it as poisonous and prey upon it