V) Maintenance of Polymorphism under selection

C. Recurrent deleterious mutation (recessive)

F(A) = p dominant, not deleterious

F(a) = q recessive, deleterious

μ = mutation rate = F(A => a)

1. **decrease in F(a) due to selection:**

$$\Delta q_s = -\left(\frac{pq^2 s}{\overline{W}}\right) \text{ (as before)}$$

2. **increase in F(a) due to mutation:**

$$\Delta q_m = \mu p$$

3. **Equilibrium point where they exactly balance**

$$-\left(\frac{pq^2 s}{\overline{W}}\right) = \mu p$$

Since this is basically a directional selection model we can assume the F(a) is very low and therefore $\overline{W}$ is close to 1. The above equation then simplifies to:

$$pq^2 s = \mu p$$

$$q^2 = \frac{\mu p}{sp} = \frac{\mu}{s}$$

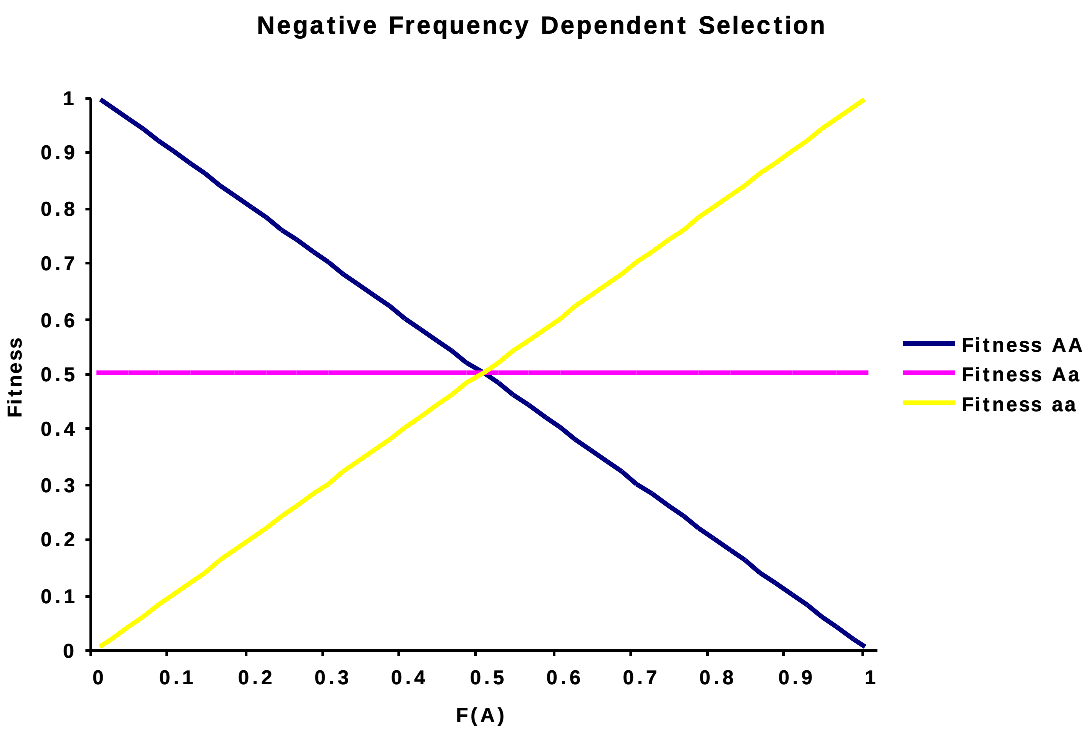
$$\hat{q} = \sqrt{\frac{\mu}{s}}$$

Fast mutation = larger $\hat{q}$ and slow mutation = smaller $\hat{q}$

D. **<u>Frequency Dependent Selection</u> – the fitness of the genotype depends on the frequency of that genotype in the environment.**

1. **Negative Frequency Dependence:**

Genotype	AA	Aa	aa
Fitness	s(1-p)	1	t(1-q)



E. Heterogenous Environment

1. Temporally Varying Selection

Genotype	AA	Aa	aa
Fitness Spring	1.0	0.8	0.6
Fitness Fall	0.7	0.9	1.0
Average Overall	0.85	0.85	0.8
Mean Relative	1.0	1.0	0.94

$\hat{p}$ – no real equilibrium unless the fitness values are symmetrical across time or the heterozygote has highest mean relative fitness (marginal overdominance). Note the heterozygote does not, however, have to be overdominant in any single time.

2. Spatially varying selection

Genotype	AA	Aa	aa
Fitness Niche 1	1.0	1.0	1 - s
Fitness Niche 2	1 - t	1 - t	1.0

$\hat{p}$ – is a function of the magnitude of the selection coefficients and the area of each niche. An equilibrium is possible if the combination of the two results in a marginal overdominance.