# AP Bio FRQ Fridays

## 2008B #3
## Hardy-Weinberg Equilibrium

# FRQ Friday #20

# 2008B #3

Evolution is one of the unifying themes of biology. Evolution involves change in the frequencies of alleles in a population. For a particular genetic locus in a population, the frequency of the recessive allele (*a*) is 0.4 and the frequency of the dominant allele (*A*) is 0.6.

(a) What is the frequency of each genotype (*AA*, *Aa*, *aa*) in this population? What is the frequency of the dominant phenotype?

$$AA = p^2 \qquad Aa = 2pq \qquad aa = q^2$$

$$p^2 = 0.6^2 = 0.36 \qquad 2pq = 2(0.6)(0.4) = 0.48 \qquad q^2 = 0.4^2 = 0.16$$

$$dominant\ phenotype = AA + Aa \qquad AA + Aa = 0.36 + 0.48 = 0.84$$

Calculations **(4 points maximum)**

- Frequency *AA* = .36
- Frequency *Aa* = .48
- Frequency *aa* = .16
- Frequency dominant phenotype = .84

(Correct equation needed for credit if one of calculated numbers is wrong.)

# FRQ Friday #20

# 2008B #3

(a) What is the frequency of each genotype (*AA*, *Aa*, *aa*) in this population? What is the frequency of the dominant phenotype?

Calculations **(4 points maximum)**

- Frequency *AA* = .36
- Frequency *Aa* = .48
- Frequency *aa* = .16
- Frequency dominant phenotype = .84

(Correct equation needed for credit if one of calculated numbers is wrong.)

(a) The frequency of the genotype AA, or the homozygous dominant genotype, is expressed as $p^2$ in the Hardy-Weinberg equation. The frequency of AA is 36%. The frequency of genotype Aa, or heterozygous, is expressed as 2pq, and is 48%. The frequency of genotype aa, or homozygous recessive, is expressed as $q^2$, and is 16%. The frequency of the dominant phenotype is found by adding $p^2$ (homozygous dominant) with 2pq (heterozygous). The frequency of this phenotype is 84%.

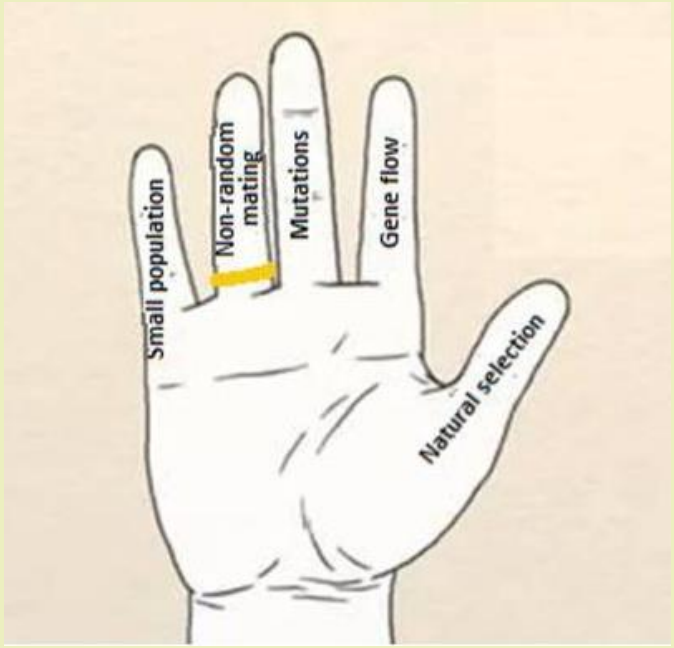
# FRQ Friday #20

# 2008B #3

(b) How can the Hardy-Weinberg principle of genetic equilibrium be used to determine whether this population is evolving?

Evolving population **(2 points maximum)**

- Allelic frequency changes or five conditions that do not change if population is not evolving
- Means of measurement/detection




# FRQ Friday #20

# 2008B #3

(b) How can the Hardy-Weinberg principle of genetic equilibrium be used to determine whether this population is evolving?

Evolving population **(2 points maximum)**

- Allelic frequency changes or five conditions that do not change if population is not evolving
- Means of measurement/detection

(b) The frequency results found above of both genotypic and phenotypic frequencies are of a certain population under given conditions. This same population can be tested with the Hardy-Weinberg equilibrium equation at a different time or under different conditions. Then, the results (both genotypic and phenotypic frequencies) can be compared and observed to see if there is a change, or indication, that the ~~species is evolving~~ population is evolving.

# FRQ Friday #20

# 2008B #3

(c) Identify a particular environmental change and describe how it might alter allelic frequencies in this population. Explain which condition of the Hardy-Weinberg principle would not be met.

Explain which condition of the Hardy-Weinberg principle would not be met. **(4 points maximum)**

- Environmental change identified **(1 point)** (first one scored)
- Explanation of how allelic frequency changed **(1–2 points)**
- Which Hardy-Weinberg condition not met **(1 point)**

(c) If the land where a population of cows lived was experiencing a severe drought, a good portion of the population might migrate to find more fertile land, and therefore food. This migration could result in the loss of a specific allele, alterating the allelic frequencies in the remaining population. The Hardy-Weinberg principle of 'no migration' would not be met in this example.

more

or sudden decrease