General Outcome 1

Students will describe a community as a composite of populations in which individuals contribute to a gene pool that can change over time.

Specific Outcomes for Knowledge

Students will:

30-D1.1k describe the Hardy-Weinberg principle and explain its significance in population gene-pool stability and non-equilibrium values

30-D1.2k describe the factors that cause the diversity in the gene pool to change; i.e., natural selection, genetic drift, gene flow, non-random mating, bottleneck effect, founder effect, migration, mutation

30-D1.3k apply, quantitatively, the Hardy-Weinberg principle to observed and published data to determine allele and genotype frequencies, using the equations $p + q = 1$ and $p^2 + 2pq + q^2 = 1$

30-D1.4k describe the molecular basis of gene-pool change and the significance of these changes over time; i.e., mutations and natural selection *(e.g., drug-resistant bacteria, herbicide resistant plants).*

Topic 1 – Hardy-Weinberg Equilibrium
Pre-Class Reading Assignment

1. Read pgs 716-721

2. Define the following terms
a. Gene pool

b. Allele frequency

c. Fixed frequency

3. For each of the following, predict whether Hardy–Weinberg equilibrium would be maintained generation after generation. If not, explain what condition of Hardy–Weinberg equilibrium the population is not meeting
(a) a population of African violets maintained by a plant breeder

(b) the population of mosquitoes in northern Alberta

(c) an elk population living in Banff

(d) a newly discovered bird population on a remote island off the coast of British Columbia

Topic 1 – Hardy-Weinberg Equilibrium
Notes
Population Equilibrium

- Population: A group of individuals of the same species living in a specific area at a specific time

- Allele frequency
  - The proportion of gene copies in a population of a given allele

- Scientists use frequencies to study changes in populations.

Hardy-Weinberg Equilibrium
- If all factors remain constant, the gene pool of a population will have the same composition generation after generation. ("genetic equilibrium")

- If a population is in genetic equilibrium, gene frequencies will remain unchanged and the population is not evolving. allele

- Uses of the Hardy / Weinberg equilibrium:
  1. Determine genotype frequencies in a population.
  2. Determine if evolution is occurring.

Conditions of Hardy-Weinberg Equilibrium
- Allele (gene) frequencies within a population will not change if the following condition are met:

- Populations are large
  - To ensure that gene frequencies don't change as a result of chance

- Mating between individuals is random

- No mutations

- No migration
  - No new genes enter or leave population

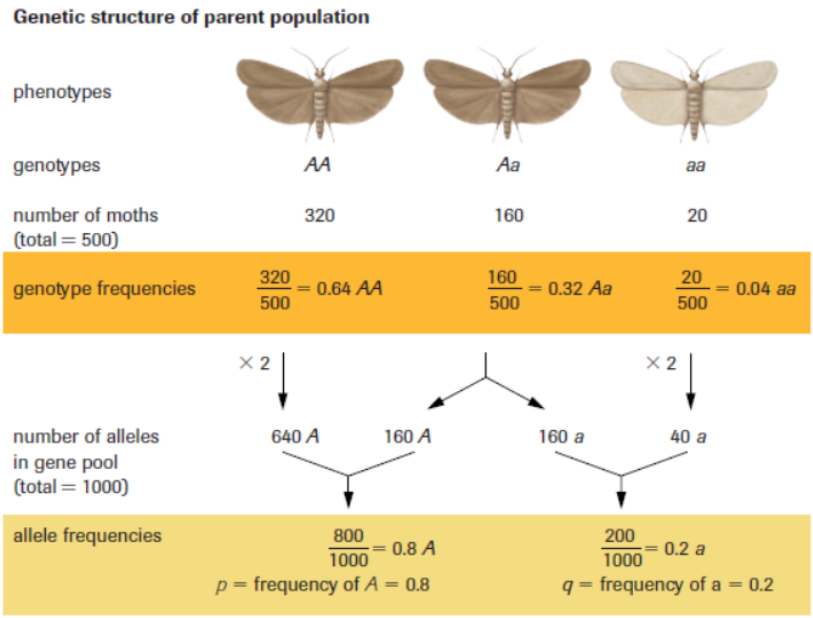
Hardy / Weinberg Mathematics:

- The following applies to any gene with only two possible alleles

$p + q = 1.0$ allele frequencies

p = frequency of dominant allele **A** in the population

q = frequency of recessive allele **a** in the population



Hardy / Weinberg Mathematics:

Hardy-Weinberg equation

$p^2 + 2pq + q^2 = 1.0$ genotype frequencies

p^2 = homozygous dominant genotype (AA)
pq = heterozygous genotype (Aa)
q^2 = homozygous recessive genotype (aa)