

# Biology 30 IB Populations

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## Unfinished!

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- Most species have thousands of genes
- More genes = more genetic diversity
- More alleles in said genes = more genetic variation
- Genetic diversity increases from sexual reproduction

## Human Populations

### Problems with Human Genes

- Few offspring
- Observations take time
- Many traits affected by environment as well as genes

### Population Sampling

- Technique used to study human populations
- **Representative group** = group within population is selected, not entire population
- **Trends or Frequencies** = how often genes occur in the representative group
- **Gene pool**, aka. **genome** = all genes in a population
- **Fixed frequency** = only 1 allele for a gene, all organisms in population have gene

### Frequency

- **Genotype frequency** = proportion of a population with a particular genotype (expressed as a decimal)
- **Phenotype frequency** = proportion of a population with a particular phenotype (expressed as a decimal or %)
- **Allele frequency** = rate of occurrence of a particular allele in a population with respect to a particular gene (expressed as a decimal)

## Hardy Weinberg Principle

- Populations have either a...
  - tendency to remain stable
  - tendency toward variability
- **Genetic equilibrium** = if all other factors remain constant, the gene pool will have the same composition generation after generation
- Population **evolve** when **equilibrium is upset**

## No Change Conditions

Conditions under which no change will occur in a gene pool are...

- Large populations = ensures that changes in gene frequencies are not the result of random chance alone
- Random mating
- No mutations
- No migration = no immigration, no emmigration, no new genes enter or leave the population
- Equal viability (no disease), fertility, and mating ability of all genotypes (no selection advantage)

## Hardy Weinberg Equilibrium

1.

$$p + q = 1$$

- Allele frequency
- $p$  = frequency of dominant allele (e.g. A)
- $q$  = frequency of recessive allele (e.g. a)

2.

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

- Genotypic frequency
- Above formula, but for all heterozygote father and heterozygote mother crosses

### Tips

- $A = p$ ,  $a = q$
- $AA = p^2$ ,  $Aa$  &  $Aa = 2pq$ ,  $aa = q^2$
- Work with homozygous recessive individuals first  
(only one possible genotype — homozygous recessive)