HARDY WEINBERG LAW

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HARDY WEINBERG'S EQUILIBRIUM

What is Population genetics?

- *Definition: study of distributions and changes of allele frequency and interaction of alleles in a population*
- A population is prone to the four main **evolutionary forces**:

1. **Natural selection**
2. **Genetic drift**
3. **Mutation**
4. **Gene flow (migration)**

- Study of population genetics is essential for understanding:
  - **Species adaptation** and **Evolution**

HARDY-WEINBERG LAW

- The **Hardy–Weinberg principle**, also known as the **Hardy–Weinberg equilibrium, model, theorem**, or **law**, states that allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences.
- These influences include
- *mate choice*,
- *mutation*, *selection*,
- *genetic drift*,
- *gene flow*

The seven assumptions underlying Hardy–Weinberg equilibrium are as follows

- organisms are diploid
- only sexual reproduction occurs
- generations are nonoverlapping
- mating is random
- population size is infinitely large
- allele frequencies are equal in the sexes
- there is no migration, mutation or selection

Violations of the Hardy–Weinberg assumptions can cause deviations from expectation.

- Random mating. The HWP states the population will have the given genotypic frequencies (called Hardy–Weinberg proportions) after a single generation of random mating within the population.
- When the random mating assumption is violated, the population will not have Hardy–Weinberg proportions. A common cause of non-random mating is inbreeding, which causes an increase in homozygosity for all genes.

If a population violates one of the following four assumptions, the population may continue to have Hardy–Weinberg proportions each generation, but the allele frequencies will change over time.

- Selection, in general, causes allele frequencies to change, often quite rapidly.

- While directional selection eventually leads to the loss of all alleles except the favored one (unless one allele is dominant, in which case recessive alleles can survive at low frequencies), some forms of selection, such as balancing selection, lead to equilibrium without loss of alleles.

- Mutation will have a very subtle effect on allele frequencies.
- Mutation rates are of the order 10^{-4} to 10^{-8}, and the change in allele frequency will be, at most, the same order.
- Recurrent mutation will maintain alleles in the population, even if there is strong selection against them.

- Small population size can cause a random change in allele frequencies.
- This is due to a sampling effect, and is called genetic drift.
- Sampling effects are most important when the allele is present in a small number of copies.

•Migration genetically links two or more populations together.

• In general, allele frequencies will become more homogeneous among the populations.

• Some models for migration inherently include nonrandom mating (Wahlund effect, for example). For those models, the Hardy–Weinberg proportions will normally not be valid.

THANKYOU