

## Introduction

Darwin - What did he do?

- Alfred Russel Wallace
- publication of *Origin of Species* by Darwin in 1859
- Natural selection based on four observations
  - Reasoning
  - Error - source of the inherited variation
- Herbert Spencer - philosopher
- Thomas Malthus - clergyman

Mendel

- was a contemporary of Darwin and although work was published, it wasn't noted until 1900 when his findings were rediscovered by deVries, Correns, and Von Tschermak (and supported by Bateson).
- Principles:
  1. Paired factors
  2. Dominance - demonstrated in all (7) of his garden pea traits
  3. Segregation
    - Independent assortment (not formally proposed by Mendel but implicit in his publications)

1900-1940

Split between the "geneticists"(aka "essentialists") or "mendelians" and the "naturalists"

Mayr referred to the split between the functional biologist (concerned with the "proximate" cause) who was interested in the interaction between the translation of the genetic program within the environment of the respective individual and looked principally at discontinuous variation, and the evolutionist (concerned with the "ultimate" cause) who was interested in origin of the genotype in the historical reasons of adaptation and speciation responsible for the particular genetic program that now exists and was interested in continuous variation. There was a group of geneticists who saw the naturalists view in their writings including Wright.

Sewall Wright

- some genetic variation in populations over time could be attributed in part to genetic drift (random fluctuations in allele frequencies in a population) rather than selection.

R.A. Fisher

- all alleles must have different adaptive properties under at least some environmental conditions and therefore all variation is adaptive.

Fisher	Wright
Selectionist	Neutralist
Famous book: <i>Genetical Theory of Natural Selection</i>	Famous book: <i>Evolution in Mendelian Populations</i>
Natural selection acts on all variation ultimately resulting in the disappearance of variation from populations	Genetic drift causes gene frequencies of many different genes to change. Since the interaction between genes is important in determining fitness, selective forces on individual genes is not constant.
Continuous variation important. Developed mathematical theories explaining that phenotypic variation is partitioned into a genetic component and an environmental component.	Discontinuous variation important. Developed mathematical theories to explain the role of genetic drift and selection on genotypes.

- essence of Neutralists vs. Selectionists  
 neutralists - most mutations are neutral; these accumulate; and result in high levels of populational variation  
 selectionists - selection, mainly in the form of "balancing selection" (e.g., industrial melanism in *Biston betularia*) acting on mutations keeps variability high.
- discrete variation results from qualitative traits; continuous variation results from quantitative traits.

R. C. Lewontin and J. L. Hubby, 1966

- protein electrophoresis in animal populations (Drosophila).

What is Population genetics?

- Field of study which involves the determination of the level of genetic variation existing within and among natural populations and the explanation of this variation in terms of its origin, maintenance, and evolutionary importance.

Introduction to genetic variation - pages 1-7 in text review many of the fundamentals and concepts learned in general genetics.

In order to save time, I expect you to be familiar with pp 1-7 in the book on "Genetic and Molecular Essentials" and "DNA Cleavage, Manipulation and Amplification." Know the following terms: **gene, genotype, phenotype, proteins, polypeptides, alleles, nucleotide bases (A,T,G,C and U in RNA), mechanism of gene expression (a.k.a. information flow or the Central Dogma), RNA splicing (introns and exons), codon, genetic code, genome, chromosomes, locus, homozygous, heterozygous, restriction enzymes, restriction sites, 5'-3' orientation, gel electrophoresis, PCR, Southern blot**