

Selectionist: explanations of evolutionary phenomena that emphasize the effects of the advantageous and balancing modes of selection as the main driving force in the evolutionary process.

1. gene substitution occurs as a consequence of selection for advantageous mutations;
2. polymorphism is maintained by balancing selection;
3. positive adaptive process whereby a new allele takes over future generations of the population if and only if it improves the fitness of the organism;
4. most polymorphism is stable: maintained at constant frequencies for long periods of time

Neutralist: explanations of evolutionary phenomena that stresses the effects of mutation, random genetic drift, and purifying selection (motoo kimura, 1968)

1. the majority of evolutionary changes and much of the variability within species are caused by random genetic drift of mutants alleles that are selectively neutral or nearly neutral;
2. there may not be strict equality in all alleles w/ respect to fitness; selection may operate but its intensity is too weak to offset the influences of chance effects: the absolute value of the selective advantage or disadvantage must be smaller than $1/2N_e$ (effective pop size): $|s| < 1/2N_e$;
3. the frequency of alleles is largely stochastic – current frequencies is a transient state representing an ongoing dynamic process; polymorphic loci are on their way to fixation or extinction;
4. most genetic polymorphism in populations is unstable and transient: allele freq's fluctuate with time and alleles are replaced continuously;
5. changes in ecological circumstances may cause many of the accumulated polymorphic loci to become deleterious and subject to purifying selection (and removal) and precipitating adaptive evolutionary without positive selection;

Both theories: agree that most new mutations are deleterious and are quickly removed from the population so that they contribute neither to the rate of substitution nor the amount of polymorphism within the population.

Key difference: the relative proportion of neutral mutations among nondeleterious mutations. Selections claim that very are selectively neutral; neutralists claim that the majority are effectively neutral.

Impact on molecular evolution:

1. general recognition that the effect of random genetic drift cannot be neglected in evolutionary dynamics of molecular change;
2. created a synthesis between molecular biology and population genetics b/c molecular evolution and genetic polymorphism are but two aspects of the same phenomena

Predictions of neutral theory:

1. inverse correlation b/n rate of subst and degree of functional constraint acting on a gene (functionally constrained genes, or parts of genes, or codon positions, evolve at the lowest rates)
2. patterns of base composition and codon usage reflect mutational rather than selective processes
3. there is a constant rate or molecular clock of sequence evolution
4. the level of within species genetic variation is the product of only population size & mutation rate and is correlated to the level of sequence divergence b/n species