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Physical Anthropology

Causes of Evolution

Hardy-Weinberg: in the absence of disrupting factors (mutation, migration, sampling error, selection and linkage), the allele (gene) and genotype frequencies at any given locus in a static, random mating population will be repeated faithfully from generation to generation; should the frequencies be perturbed for any reason, they will return to the expected equilibrium values after one generation of random mating.

Main points:
1) The sole determinant of the distribution of genotypes among offspring is the relative proportion of alleles found among their parents. (i.e. can predict genotype proportions from freq. of alleles present in the parent's generation)
2) Freq. of genes of a population is inherently stable from one generation to next.
3) Equilibrium of gene freq. reached immediately in event 2 populations merge (i.e. the first hybrid population will be in a state of genetic equilibrium).

Utility of H-W principle
1) Allows one to estimate departures from equilibrium.
2) Can predict genotype freq. when gene freq. are known and random mating assumed.
3) Used to calculate number of heterozygote carriers of recessively inherited conditions.

Only one of the following populations is in a state of H-W equilibrium:

	AA	Aa	aa	
I	0.20	.80	0	
II	0.36	.48	.16	p = .6
III	0.50	.20	.30	q = .4
IV	0.60	.00	.40	

Factors which upset H-W equilibrium:
1) natural selection
2) gene flow
3) mutation
4) genetic drift (sampling error)
5) non-random mating

panmitic, equilibrium or random mating population

Mating: random/nonrandom mating
nonrandom: inbreeding, assortative (negative and positive)
consanguineous marriage (Amish, Mennonites)
incest taboo

Mutation
Causes: spontaneous irradiation, x-ray, chemicals, temperatures

deleterious

Genetic drift - change in gene freq, caused by restrictive sampling of each generation's gene pool to establish the next: fixation or loss of alleles.

	A	a
A	AA	Aa
a	Aa	aa

"bottleneck" effect

e.g. Pingelap atoll (achromatopsia)
Alpine isolates (deaf mutes, blindness)

Gene flow (migration) - hybridization and intermarriage/miscegenation
American Black-white intermarriage Rh, Fy, Gm
Fy^o - almost 100% in Am. Black
I^A and I^B across Eurasia

Natural selection - differential change in relative frequencies of genotypes due to differences in ability of their phenotypes to obtain representation in the next generation.
--eliminate individuals whose phenotypes are at disadvantage
--preserve individuals whose phenotypes are advantageous
"differential reproduction of genotypes"
1) survivance selection
2) differential fertility

phenylketonuria (failure to metabolize phenylalanine)
Rh incompatibility of mother-fetus
selection: stabilizing, balancing, directional, diversifying
genetic polymorphism = "occurrence together on the same locality of 2 or more discontinuous forms of a species (or alleles) in such proportions that the rarest of them cannot be maintained merely by recurrent mutation." (E.B. Ford, 1940).

balanced selection, balance polymorphism
sickle cell anemia (Hb^s)
falciparum malaria

Hb^SHb^S = sickle cell anemia
Hb^AHb^A - very susceptible to malaria
Hb^AHb^S - resistent to malaria (sickle cell trait)