

1. Among 1500 New Yorkers 100 had MM genotype, 100 had MN genotype, and 1300 had NN genotype. What is the frequency of M allele in the population of New York?

a) 0.066
b) 0.1
c) 0.258
d) 0.2

Does population of New York differ from the expectations of Hardy-Weinberg theorem?
a) yes b) no

2. In Angola, 64 out of 400 newborns suffer from sickle-cell anemia (have ss genotype). Notice that you cannot find the frequency of s allele directly, because you do not know how many newborns are heterozygous (have an Hs genotype). Use the Hardy-Weinberg theorem to estimate the frequency of s allele.

fr(s) =

a) 0.16 b) 0.08 c) 0.84 d) 0.4

Hardy-Weinberg theorem

Why is Hardy-Weinberg population said to be at equilibrium?

fr(A) = 0.2, fr(a) = 0.8

Genotype fr. change

fr(AA) = 0.04, fr(Aa) = 0.32, fr(aa) = 0.64

Forces of evolution – any factors that change **ALLELE** frequency in a population

1. Natural Selection
2. Genetic drift
3. Gene flow (~ migration)
4. Mutations

Microevolution = allele frequency change in a population

Natural Selection

Fitness is the proportion of the individual's genes in the gene pool of the next generation.

Relative fitness (w): $1 \geq w \geq 0$

Selection coefficient (s) $w + s = 1; w = 1 - s$

	AA	Aa	aa
fitness:	$1 - s_1$	1	$1 - s_2$

equilibrium: allele frequencies no longer change

↑
q

Modes of Natural Selection

1. Directional selection for the dominant phenotype
AA Aa ~~aa~~
2. Directional selection for the recessive phenotype
~~AA~~ ~~Aa~~ aa
3. Balancing selection
~~AA~~ Aa ~~aa~~
4. Selection against heterozygotes, disruptive
AA ~~Aa~~ aa
5. Frequency dependant selection

1. Directional selection for the dominant phenotype

AA Aa ~~aa~~

Examples: Tay-Sachs disease (tt); Cystic fibrosis (cc); Thalassaemia (tt)

fr(A) = 0.2, fr(a) = 0.8

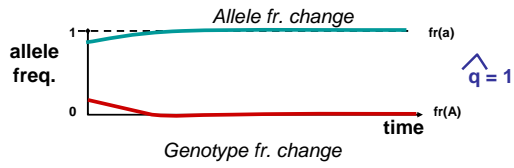
Genotype fr. change

fr(AA) → 1 fr(Aa) → 0
fr(aa) → 0

Recessive allele "hides" in heterozygous individuals

2. Directional selection for the recessive phenotype

~~AA~~ ~~Aa~~ aa



Genotype fr. change
 $fr(AA) \rightarrow 0$ $fr(Aa) \rightarrow 0$
 $fr(aa) \rightarrow 1$

Dominant alleles are rapidly eliminated

Directional selection for the recessive phenotype

Examples:

achondroplastic Dwarfism (D)
von Willebrand disease (coagulation disorder)
Porphyria

Albinism among Hopi of
Arizona and Zuni of New
Mexico
selection for OCA2 albinos

