

FOUR FORCES
Natural Selection
Mutation
Genetic Drift
Gene Flow

NATURAL SELECTION

Driving Force - DIRECTIONAL

Acts on variation in population

Therefore, must be VARIATION to begin with

Where does variation come from?

Ultimate source?

MUTATION

We think of mutation as deleterious,

but NO - must have or no evolution

Some mutations are advantageous

Natural Selection operates on both kinds of MUTATION

Also affecting variation is:

GENETIC DRIFT

Definition: RANDOM FLUCTUATIONS IN THE FREQUENCY OF AN ALLELE FROM GENERATION TO GENERATION

IF the variation is neutral -

then just RANDOM CHANCE if the allele is passed on

-sometimes is passed on, sometimes not- 50/50 odds

IF *few* people have the allele, just by *CHANCE* could disappear

The smaller the population,

the greater the chance the allele will disappear

For example: Population with 10% Blue Eyes

-earthquake- just by chance 10 people with blue eyes die
if population is 1 million, 100,000 people have blue eyes
no effect

BUT if population is 100 and 10 die, blue allele decreased A LOT

NOTE: eye color is a NEUTRAL VARIATION-

not affect likelihood of dying in an earthquake

GENETIC DRIFT affects NEUTRAL ALLELES

General tendency is to reduce variation

INTERESTING KIND of GENETIC DRIFT: FOUNDER'S EFFECT

Subset of a large population leaves and starts its own population

BIG GROUP leaves: chances that allele frequencies will be the same

SMALL GROUP leaves:

increase chances allele frequencies will be different (sampling)

Mutiny on the Bounty, Pitcairn Island

M&Ms

GENE FLOW

(Also called admixture)

result of: MIGRATION and INTERBREEDING

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Smaller populations are MORE AFFECTED by gene flow
-like with Genetic Drift

10 people with blue eyes migrate to a population of:

1 million people - no effect

100 people - big effect

GENE FLOW: introduce variation

THE FOUR FORCES:

not only cause small changes from generation to generation,
but cause NEW SPECIES to evolve

SPECIATION

Species: potentially mate and produce viable offspring

-must be fertile offspring

pretty straightforward for living species

fossils a problem

fossils evolve

Australopithecines

Homo erectus

Homo sapiens

One replaces another

result of accumulation of genetic changes over time: *chronospecies*

MODEL 1: straight line = anagenesis

MODEL 2 divergent evolution,

branching bush = cladogenesis

Convergent evolution results in superficial resemblance

DARWIN ENVISIONED

evolution occurring slowly and gradually, but . . .