

The plant of the day



Welwitschia mirabilis

Questions

- What is evolution?
- How does evolution occur?

MECHANISMS OF EVOLUTION (a review)

Biological Evolution: the change over time in the genotypic composition of populations

Microevolution: changes that occur over a small number of generations

Macroevolution: changes that happen over many generations

Population: a group of organisms of the same species occupying a particular geographic region.

Genotype: the genetic make-up of an organism.

Phenotype: the physical expression of an individual's genotype. (selection acts on phenotype not genotype)

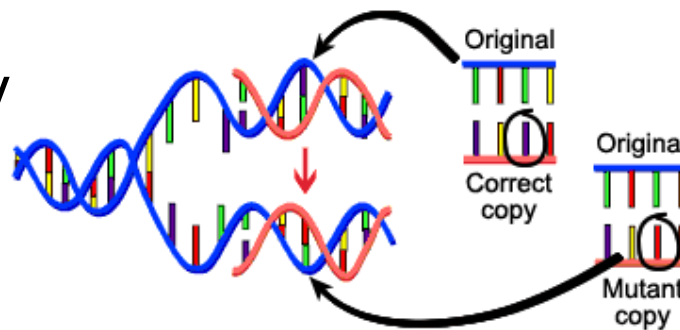
CHANGING THE GENOTYPIC COMPOSITION OF POPULATIONS

Evolutionary agents: forces that change allele and genotypic frequencies in populations: mutation, gene flow, genetic drift, and natural selection.

Mutation: random changes in genetic material. Mutation is ultimate source of all genetic variation. Mutation rates are low (one 1 in 10^8 nucleotide substitutions per generation).

DNA fails to copy accurately

Exposure to chemicals or radiation



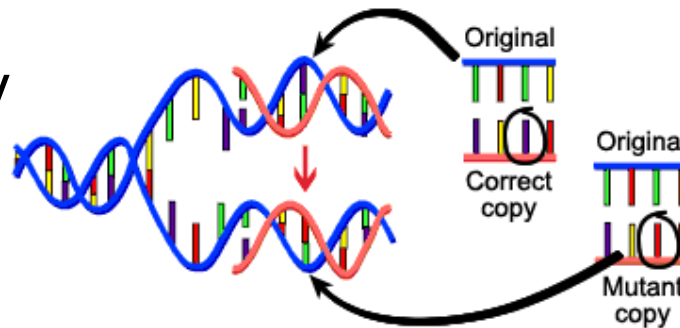
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Evolutionary agents: forces that change allele and genotypic frequencies in populations: mutation, gene flow, genetic drift, and natural selection.

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DNA fails to copy accurately

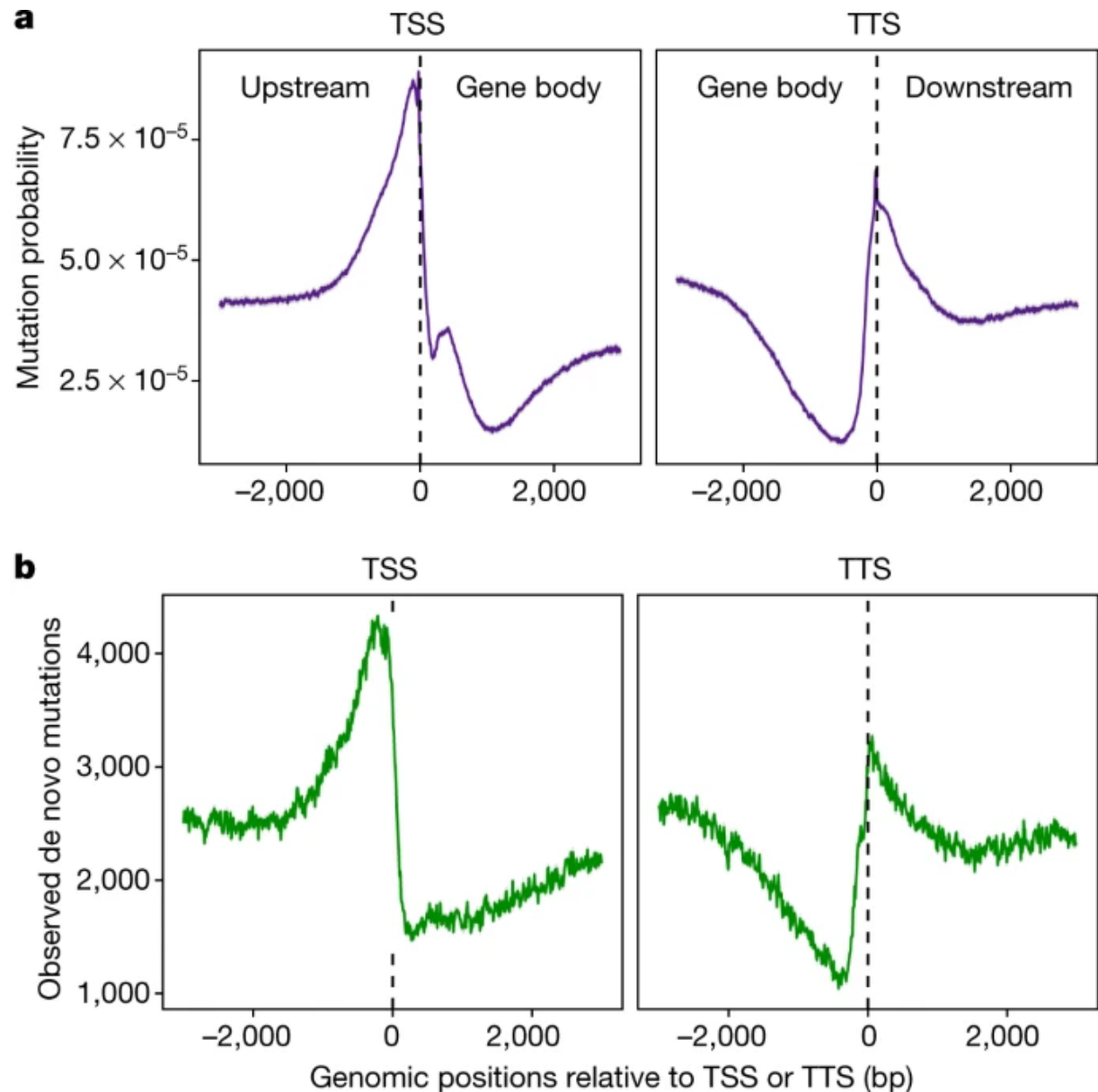
Exposure to chemicals or radiation



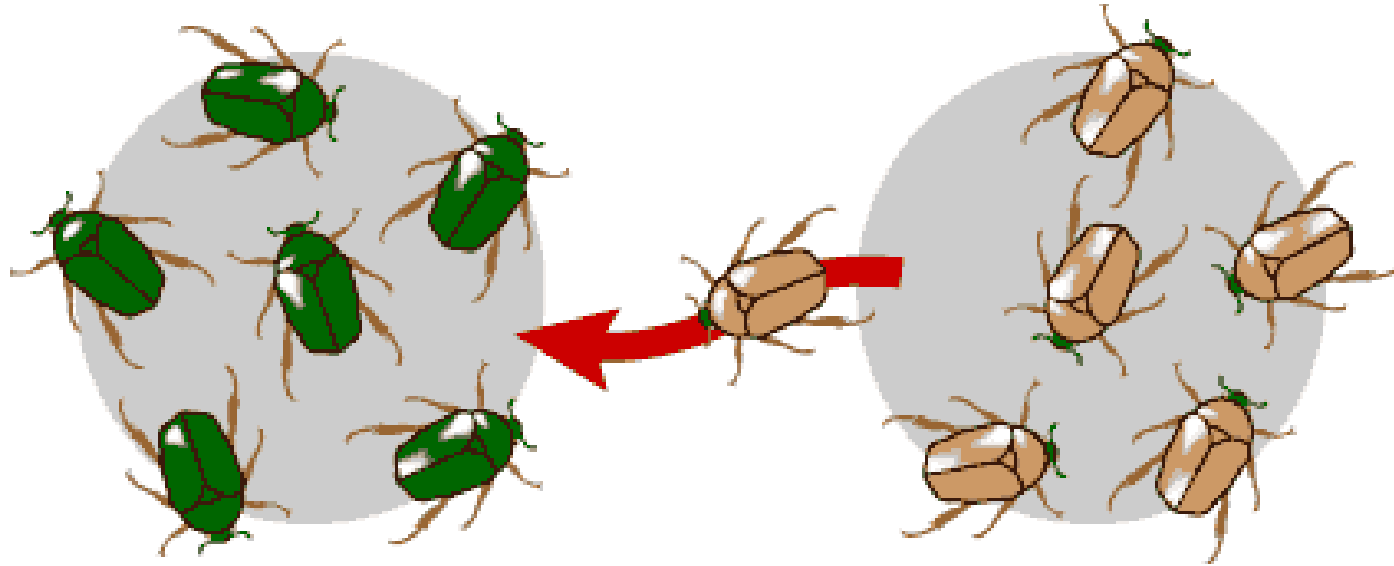
MUTATION

Lower mutation rate in gene bodies

Monroe, J.G., Srikant, T., Carbonell-Bejerano, P. et al. *Nature* 602, 101–105 (2022).



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Gene Flow: migration of individuals followed by breeding produces gene flow. Gene flow adds new alleles to populations or changes the frequency of alleles already present.

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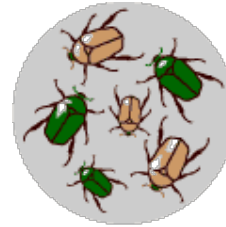


Genetic drift: In each generation, some individuals may, just by chance, leave behind a few more descendants (and genes, of course!) than other individuals.

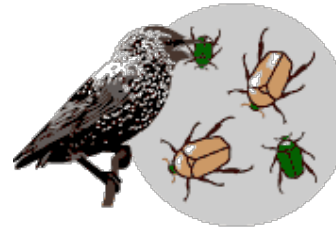
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Natural selection: Individuals vary in traits that lead to differential reproduction.

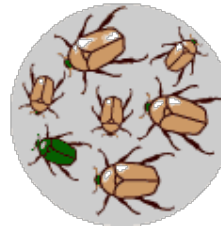
Beetles vary in color



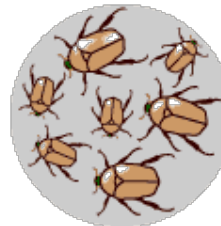
Green beetles are eaten by birds and so survive to reproduce less often



The surviving brown beetles have brown baby beetles because this trait has a genetic basis.



The more advantageous trait, brown coloration, which allows the beetle to have more offspring, becomes more common in the population.



Definitions (to aid with the reading for next period):

Effective population size: the number of breeding individuals in an idealized population

Inbreeding depression: reduced fitness as a result of breeding of related individuals.

Outbreeding depression: reduced fitness as a result of breeding of distantly related individuals.

Unanswered Questions

- What is the relative importance of the different evolutionary agents?
- Do these evolutionary agents vary in importance in different organismal groups?
- If so, what ecological and demographic factors account for this variation?