

Biological evolution: A change in the genetic make-up of a population over time.

Evolutionary evidence:

1. Fossil record
2. Homologies
3. Empirical data

Natural Selection – Charles Darwin

Darwin's Observations and Inferences:

observation 1 = organisms have potential to reproduce in large numbers

observation 2 = natural populations remain pretty much constant in size

observation 3 = natural resources are limited, there isn't enough for everyone

***inference 1** = there exists a continuous **struggle for existence** among members of a population*

observation 4 = organisms are not all the same, they vary in their features

observation 5 = some of this variation is heritable, passed from parent to offspring

***inference 2** = there are differences in survival and reproduction among the varying organisms in the population*

***inference 3** = over generations, this differential survival and reproduction leads to changes in the appearance of the population & leads to appearance of new adaptations*

Charles Darwin, *On the Origin of Species*, 1859

Natural Selection:

The theory that evolution occurs by natural selection asserts that, of the range of different individuals which make up the population of a given species, those individuals having certain characteristics contribute more offspring to the succeeding generation than those having other characteristics; and if such characteristics have an inherited basis, the composition of the population is thereby changed in the next generation.

Conditions for Natural Selection

1. Variation

- Individuals must vary

2. Inherited basis

- Variation must have a genetic basis
- ONLY genes are passed from one generation to another

3. Differential survival and reproduction

- Some individuals survive better and reproduce more than others

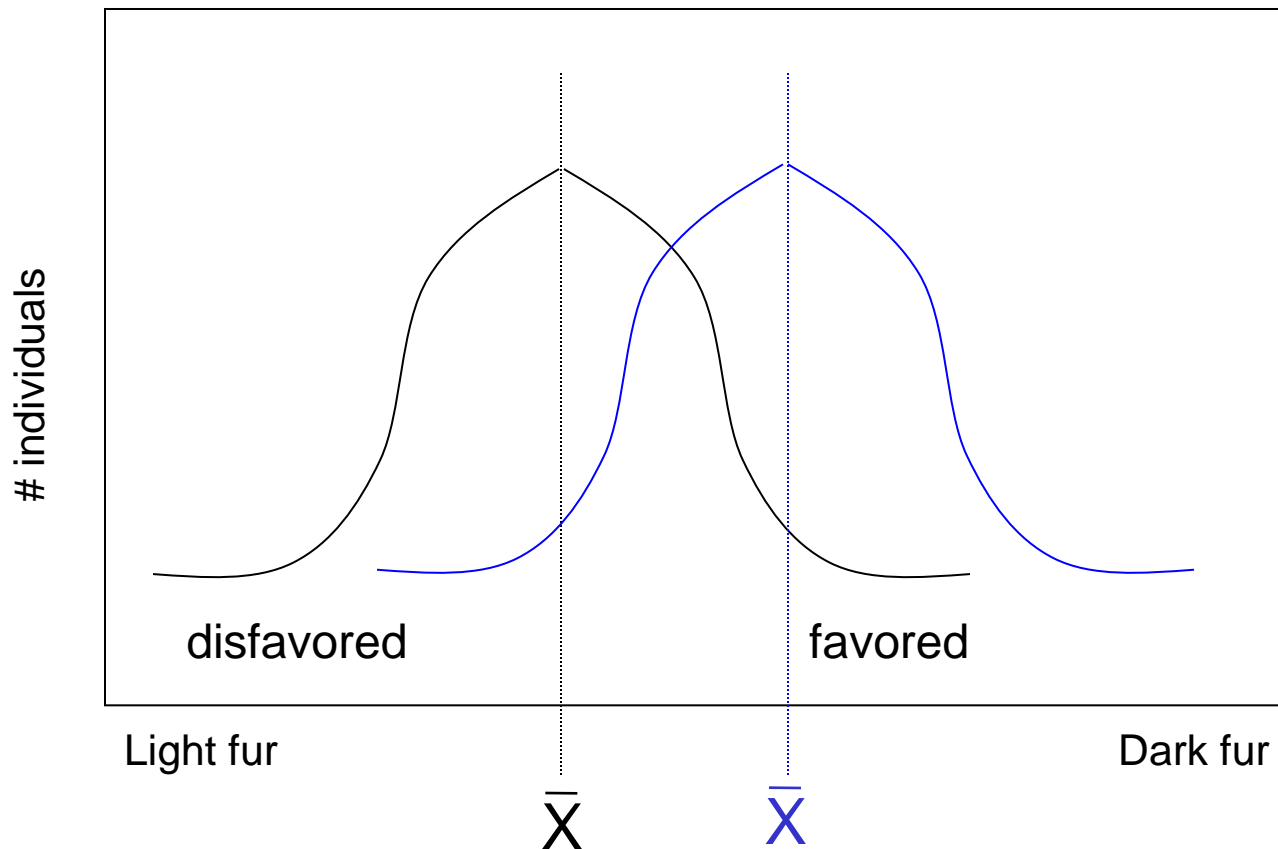
***Implied struggle for survival:** More offspring produced than environment can support so individuals compete for access to those resources*

- Can also be referred to as **differences in Darwinian fitness**

Types of Selection:

1. Directional selection – individuals on one extreme are favored and individuals on the other extreme are disfavored

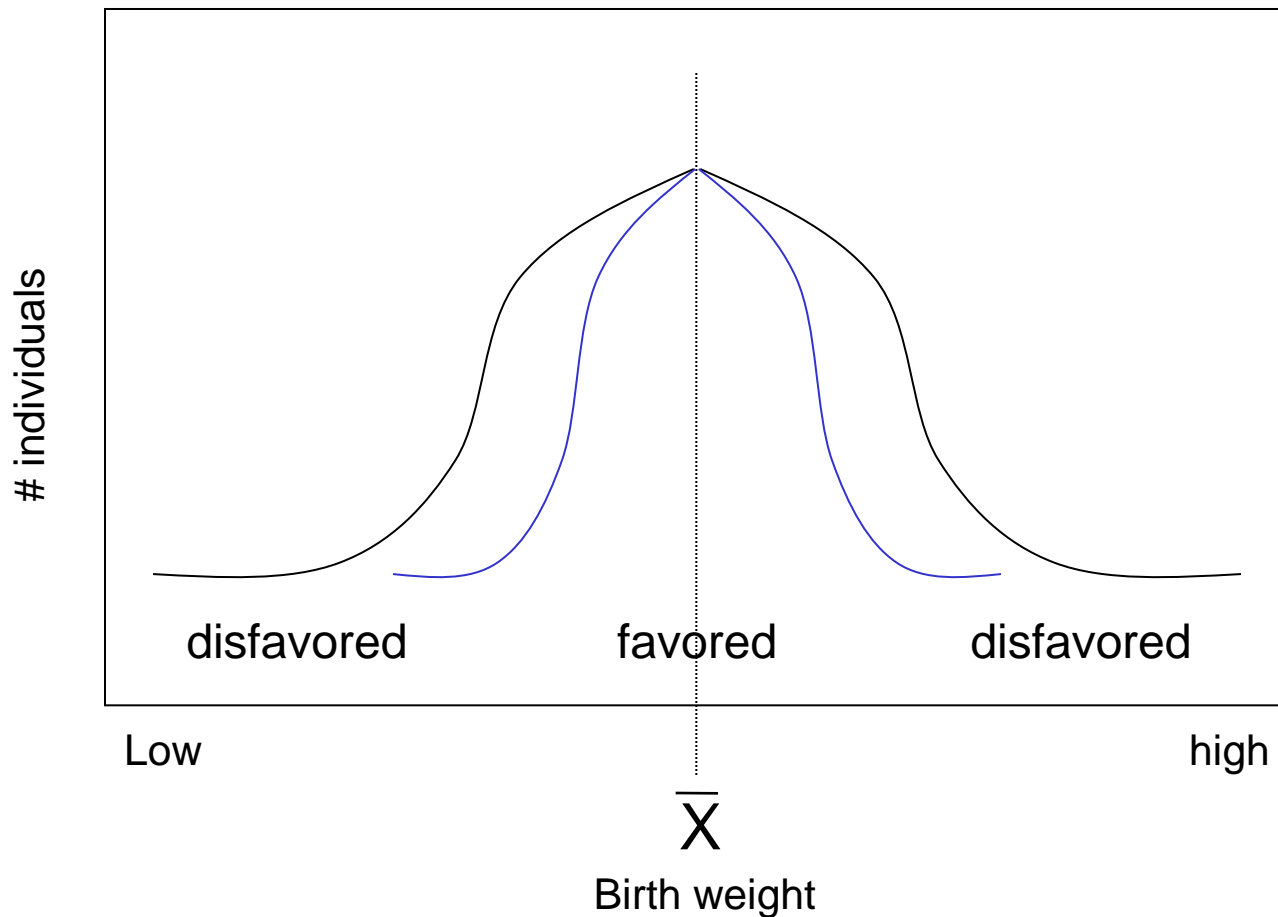
E.g. fur color in mice



Types of Selection:

2. Stabilizing selection – individuals on both extremes are disfavored and individuals in the middle are favored

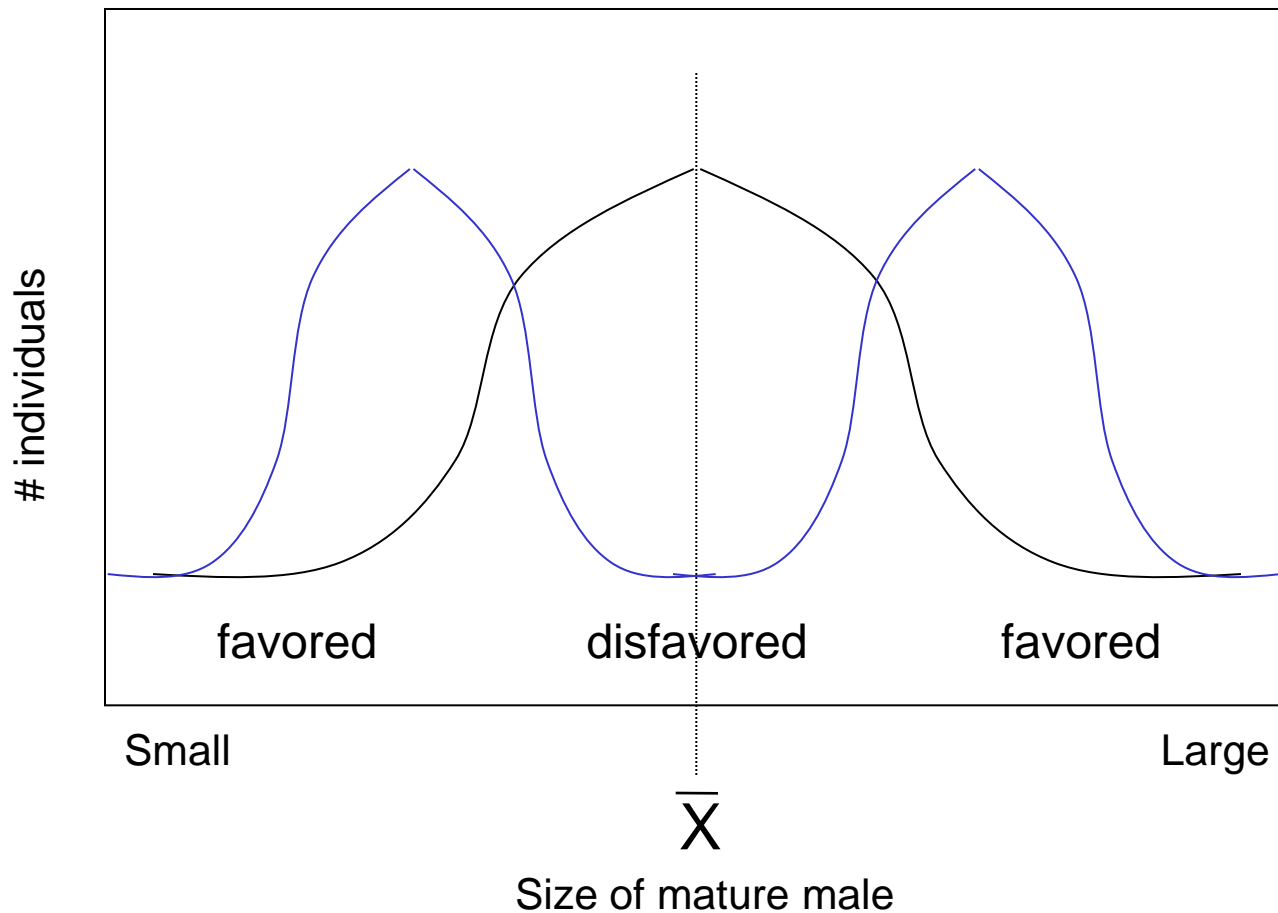
E.g. birth weight in humans



Types of Selection:

3. Disruptive selection – individuals on both extremes are favored and individuals in the middle are disfavored

E.g. reproductive success in Coho Salmon



Darwinian Fitness = measure of an individual's contribution of offspring compared to everyone else in the population

- Fitness accumulates over a lifetime

Total fitness = survivorship + reproductive success

Important points about natural selection and evolution:

1. Selection acts on individuals but individuals do NOT evolve.

Populations/species evolve

2. “Survival of the fittest”

- implies survival most important
- really about reproduction
- “fittest” often misunderstood as physical fitness
- ok as long as “fittest” = Darwinian fitness

3. “For the good of the species”

- selection acts on **individuals**
- natural selection does NOT occur for the good of the species

4. No intent in evolution



Infanticide

e.g. lions



Overspecialization

e.g. Cheetahs

Adaptation

Any feature of an organism that helps it to better survive and reproduce = Any feature that conveys fitness

- all adaptations are the result of natural selection
- adaptations are always *for* something; they serve a purpose

Important points about adaptations:

1. Adaptations are NOT always necessary for the survival of the organism
2. Not all traits are adaptations
3. Adaptations are not perfect

Peacocks

