

The Logic of Selection

- Heritable variation
 - Different genotypes lead to different phenotypes
 - Parents pass on their genes to their children
- Differential reproduction
 - Because of limited resources
 - Correlated with genetic variation

Levels of Selection

- Proximate - How?
- Ultimate - Why?

Heritability

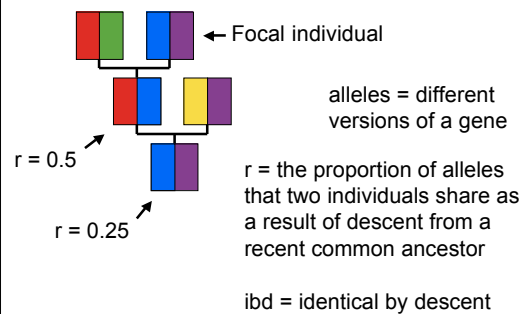
- The proportion of the total phenotypic variance in a population that is caused by genotypic variance.
- Heritable ≠ Genetic (Inherited)
- High heritability means that a relatively large proportion of total variance in the trait is caused by variance in genes, not caused by genes
- Low heritability means that trait variance caused by variance in the environment is relatively greater than that caused by variance in genes

$$\frac{V_{\text{genetic}}}{V_{\text{genetic}} + V_{\text{environmental}}}$$

Why is there heritable variation left?

- Variability represents functionless noise
- Spatial or temporal heterogeneity of selection
- Frequency-dependent selection
- Heterozygote advantage

Coefficient of Relatedness (r)



Hamilton's Rule

- r = relatedness
- c = cost to the actor
- b = benefit to the recipient
- If a trait causes an actor to direct altruistic behaviour towards a recipient with relatedness r, and $r > \frac{c}{b}$, then the genes influencing that trait will be favoured by natural selection.
- Relatedness is only important because it is a statistical indicator of whether an individual shares the gene influencing the trait.

$$r > \frac{c}{b}$$

Survival of the Fittest?

Natural selection favours traits that help organisms to increase their genetic representation in future generations. Traits increasing reproduction will be favoured over traits increasing survival if the two are in conflict. Survival is only useful to an organism inasmuch as it is correlated with increased reproduction.



Sexual selection is often seen as separate from natural selection because it commonly results in adaptations that reduce survival.

Mating

- Why sex?
- Parental investment theory
- Sex differences
 - What do men want?
 - What do women want?
- Sperm competition
- MHC and mate choice

Multiple Mating Strategies

- Short-term
 - Women - indirect benefits
 - Men - quantity of mates/offspring
- Long-term
 - Women - direct benefits
 - Men - quality of mates/offspring
- Conditional
 - Different behavioural tactics are consciously or unconsciously "chosen" by individuals.
 - Choices are made in response to environmental cues, often relative mate value.
 - Individuals are genetically monomorphic and can utilize the same set of possible tactics.
 - A chosen tactic yields higher fitness given a current environment in situations like the EEA.

Families

- Why mate? To have offspring.
- What cues do parents use to allocate PI?
- Parent-offspring conflict
 - Maternal-fetal conflict
- Trivers-Willard hypothesis
- Differential PI at the extreme is seen in genetic versus step-parent homicides.

Birth Order

- Firstborns, middleborns and lastborns have different *niches* in a family.
- Firstborns and lastborns are more family-oriented than middleborns. Firstborns are more conservative.

Evolutionarily Stable Strategies

- An ESS is a strategy which, if nearly universal in a population, can not be beaten by any other strategy.
- An ESS could be worse than another strategy when rare.
- In an anonymous one-shot Prisoner's Dilemma, the ESS is to always defect.
- How could cooperate ever be an ESS?

	cooperate	defect
cooperate	3 3	0 5
defect	5 0	1 1

Altruism

- Kin Selection
- Reciprocal Altruism
 - Direct
 - Indirect
 - Reputation
- Public Goods
 - Tragedy of the commons
 - Cheater detection/punishment
- Costly Signaling
- Group/Deme Selection?

