

## LECTURE GOALS:

- Appreciate what Darwin knew and what Darwin didn't know.
- Understand that Natural Selection acts on the phenotype of the individual.
- Understand Inclusive Fitness and Kin Selection as a concept.
- Next week we learn to calculate the coefficient of relatedness.

## LECTURE OUTLINE:

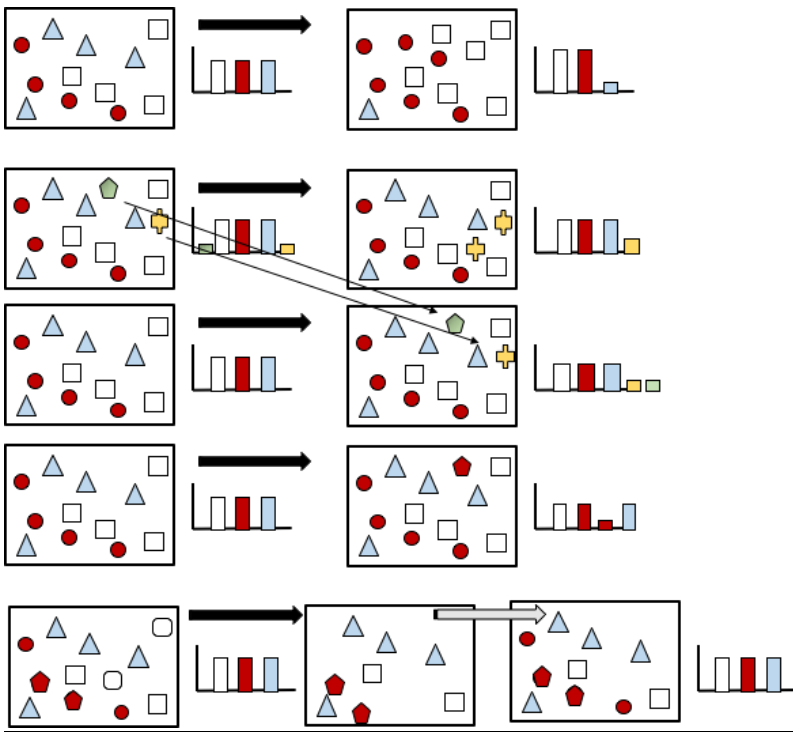
1. A Darwinian puzzle is a trait/phenotype that appears to reduce the fitness of individuals that possess it.
2. Myrmecophily presented Darwin with a puzzle that we are still piecing together today.
3. Natural selection promotes **adaptive** traits.
4. Adaptations are phenotypic traits that enhance an individual's Lifetime Reproductive Fitness (**LRF**) ("fittest" is different than "good").
5. **Selection**: A process that favors traits which enhance an individual's ability to survive and reproduce.
6. **Fitness**: The number of offspring an individual contributes to the next generation relative to other members of the population.
7. **Evolution**: A change of allele frequencies between generation. (modern definition)
8. Evolution by natural selection requires 3 things
  - a. Variation
  - b. Heritability
  - c. Differential fitness
9. Evolution without selection is possible through drift and selection can happen without causing evolution when the phenotypic trait is not heritable (i.e. is environmental).
10. Wynn Edwards championed group level selection and was countered by George C Williams. ONLY MADE IT TO HERE IN 2018
11. Cooperation, and particularly Altruism presented a puzzle to Darwin.
12. Cooperation is the process of individual organisms acting together to result in common/mutual benefit though it can also be shown to be "selfish".
13. Altruism is the process of an individual organism behaving in a manner that lower's its own reproductive success while increasing the reproductive success of the recipient.
14. Some claim that Wynne-Edwards did us a favor by formalizing the theory of "group selection" because it spurred evolutionary biologist to refute it theoretically and empirically for most instances.
15. Kin Selection is one "selfish" model based on a "gene-centric" view to explain altruism.
16. Inclusive fitness is the increased reproduce success an individual gains through the fitness of those with which it shares alleles (i.e. has common genetic material).
17. Natural selection will increase a genetically based trait that is costly if that trait influences behavior that provides increased reproductive success to a sufficient number of individuals who share a sufficient amount of genetic material (on average).
18. Next week we will calculate a "coefficient of relatedness" for two individuals that share genetic material through common relative.
19. There are a few simple rules to calculate relatedness:

HELPFUL FIGURES & NOTES:

(All PowerPoint files will be available on the course website after lecture. The subset of figures and notes here are meant to assist your note taking or studying.)



Myrmecophily



Inclusive Fitness

$$\Sigma r_b B > C$$

		Social Interactions	
		Benefit	Cost
Donor	Benefit		
	Cost		

VOCABULARY:

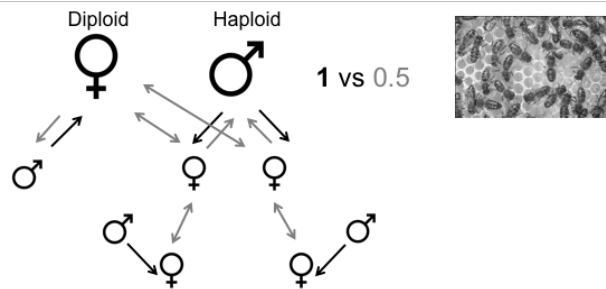
(Practice writing interesting, informative sentences that include, and capture the meaning of, 4-5 words from this list. To simply memorize a definition, is not sufficient.)

- |                  |                  |                    |
|------------------|------------------|--------------------|
| Darwinian puzzle | LRF              | Indirect Selection |
| Phenotype        | Adaptation       | Group Selection    |
| Trait            | Adaptationist    | Kin selection      |
| Character        | Cooperation      | Indirect Fitness   |
| Gene             | Altruism         | Inclusive Fitness  |
| Allele           | Direct Selection |                    |

PRACTICE EXAM QUESTIONS:

1. Explain the difference between Life Time Reproductive Fitness and simply the number of offspring and individual has.
2. How has the definition of “evolution” changed since Darwin’s time?
3. Why do some people say that Wynne-Edwards did us a favor by putting forward a formal theory that Altruism evolved to benefit the group or species as a whole?
4. How are “for the good of the species” arguments different than “group selection”.
5. Is Natural Selection necessary for Evolution to happen? (explain)

While working on the relatedness assignment, if you find that easy, try haplodiploidy



Shared gene proportions in haplo-diploid sex-determination system relationships

Sex	Daughter	Son	Mother	Father	Full Sister	Full Brother
Female	1/2	1/2	1/2	1/2	3/4	1/4
Male	1	N/A	1	N/A	1/2	1/2

READING FOR TODAY:

Readings will include information that goes beyond, but supports, the lecture material.

**Darwin Origin of Species Chapter VIII**

READING FOR NEXT CLASS:

**Ryan & Wilczynski pg. 17-25 & 197-212**

**Beginner’s Guide Chapter 9** (I’ve posted an older version on the course website in the textbook section)

Examples for lecture if you want further reading

Duval EH (2007) Cooperative display and lekking behavior of the lance-tailed manakin (*Chiroxiphia lanceolata*). *The Auk* 124:1168-1185.

Queller et al (2003) Single-gene green beard effects in the social amoeba *Dictyostelium discoideum*. *Science* 299:105-106. (understand what the gene is and how this “simple” system can tell us something about animal behavior)

Sinervo et al (2006) Self-recognition, color signals, and cycles of greenbeard mutualism and altruism. *PNAS* 103:7372–7377.

