Theory of evolution

Where did it all start?
Theory of evolution

• *Evolution* video
Alfred Russel Wallace

1850’s in Indonesia
Selective breeding

- Lots of other breeds for show
  AND all from one original species
Artificial selection

European agriculturalists chose as parents for subsequent generations individual wild mustard plants that varied from the population’s average by producing unusually large leaves, stems, buds, or flowers.
Species are capable of exponential growth

Thomas Malthus, 1798
• While species may be capable of exponential growth, resources are not!
• Population growth is limited—death rates are high
So...

If there are not enough resources for all that are born,

THEN

Not all individuals can survive to reproduce
Who gets to survive?

• What factors determine which individuals can survive and reproduce?

• What must be true?
Some variation is heritable

• All populations exhibit variation
• Selective breeding
Deduction 1

Since there is variation in a population
AND
Since not all that are born can survive to reproduce
THEN
Those individuals that are best suited to the environment will survive to reproduce
Natural Selection

• In other words:
  • “Non-random differential survival or reproduction of classes of phenotypically different entities”
    – (Futuyma, 1986)

• Popular, but misguided statement
  – “only the strong survive”
  – Not accurate
Deduction 2

Since some variation is heritable
AND
Only those that survive to reproduce will pass their traits on to the future
THEN
Population characteristics will change over time
Evolution

1. Any change in the characteristics of organisms in a population over many generations

2. Any change in the trait frequencies of a population over time
Natural Selection is one of the mechanisms that drives the process of evolution
How to study evolution

• Back to the Galapagos
  – Peter and Rosemary Grant
  – Studied these two species of finch on several islands since 1970
  – Captured birds and measured them
Research in evolution

• Measured beak sizes over 30 years
• Weather changes and the El Niño
• Beak size changed over time
• Could be traced to changes in seed availability
• Seed availability was related to weather
Adaptation

Process: the changes caused by natural selection leading to a greater fit between the **population** and its environment across generations

Trait: a trait that confers higher **fitness** on individuals that have it than any other alternative trait