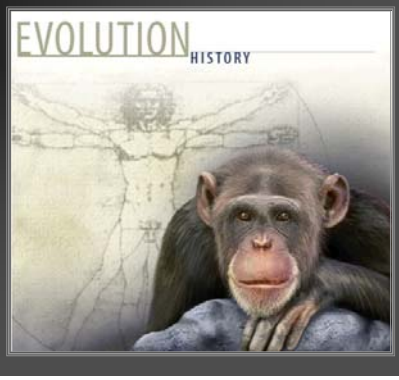
Charles Darwin



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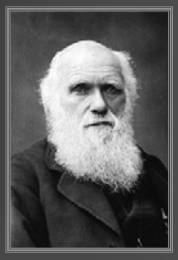
Charles Darwin

- 1809 - 1882
- Most influential contributor to thoughts about evolution
- The Origin of Species
  - 1859
- Presented evidence for changes in species through Natural Selection



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Contrast of Views

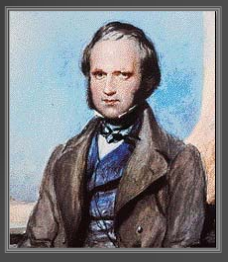
Contrast of Worldviews

Pre-Darwinian View	Post-Darwinian View
1. Earth is relatively young; age is measured in thousands of years.	1. Earth is relatively old;age is measured in billions of years.
2. Each species is specially created; species don't change, and the number of species remains the same.	2. Species are related by descent-it is possible to piece together a history of life on earth.
3. Adaptation to the environment is the work of the creator, who decided the structure and function of each type of organism. Any variations are imperfections.	3. Adaptation to the environment is the result of the interplay of random variation and natural selection.
4. Observations are supposed to substantiate the prevailing worldview.	4. Observation and experimentation are used to test hypotheses, including hypotheses about evolution.

3

Darwin's Voyage

- 1831 - at age 22
- 5 year round-the-world voyage
- H.M.S. Beagle
  - Ship's naturalist
  - At beginning of trip
    - Believed species were immutable
- As ship's naturalist, he collected and examined the species that inhabited the regions the ship visited
- Many collections
  - Fossils,coral,plants, animals



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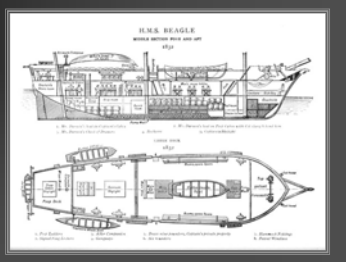
HMS Beagle



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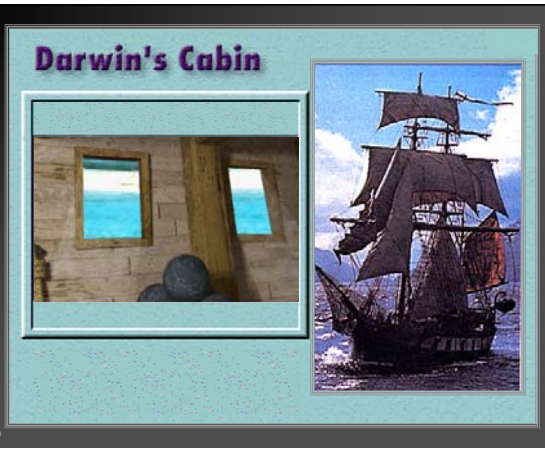

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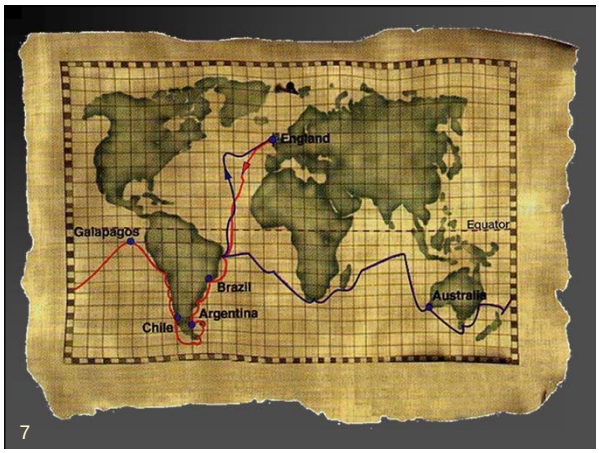

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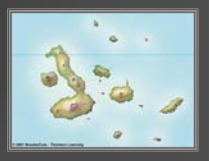
Galapagos Islands

- Volcanic islands - 3.5 mya
- Isolated, west of Ecuador
- All inhabitants are descended from species that arrived on islands from elsewhere



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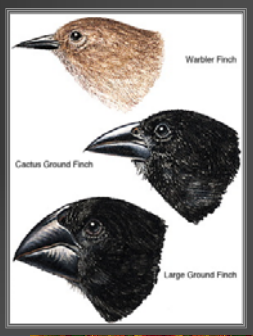
Darwin's Finches

- 13 species of finches
- Share many morphological features
- Differ in several ways
  - Beak size
  - Beak shape
  - Food eaten
- Evolved from a single species
- He attempted to correlate variations in their traits with environmental challenges



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Galapagos Tortoises

10

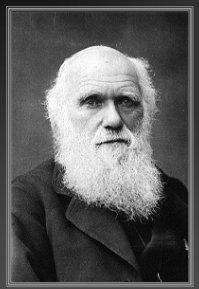
Galapagos Iguanas

Land Iguana
Terrestrial vegetation

Marine Iguana
Algae eater

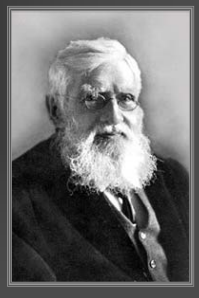
11

Theory of Natural Selection



Charles Darwin

Alfred Russel Wallace



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Darwin's Theory

- A population can change over time when individuals differ in one or more heritable traits that are responsible for differences in the ability to survive and reproduce.

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Alfred Russel Wallace

- 1823-1913
- Naturalist who arrived at the same conclusions Darwin did
- Wrote to Darwin describing his views
- Prompted Darwin to finally present his ideas in a formal paper
- Both presented papers
  - Linnean Society of London
  - July 1, 1858

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"On the Origin of Species"

- Basic draft finished in 1842
- Kept in drawer for 16 years
- Other research
  - Coral reefs
  - Barnacles
- Joint presentation of ideas at Linnean Society
- Final draft published - 1859
  - Immediate sensation

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Darwin & Wallace Proposed Two Theories

- **1. The living organisms we see today are all related by descent (common ancestry)**
- **2. The means by which evolution occurs is a process of 'natural selection.'**
  - **organisms differ from one another**
    - **i.e., there is variation**
  - **these differences are heritable,**
    - **i.e. passed from generation to generation many**
  - **more organisms are born than survive and reproduce (mortality)**
  - **therefore, any variation that makes one offspring more successful than another will have a greater chance of being passed to the next generation**
    - **("survival of the fittest")**

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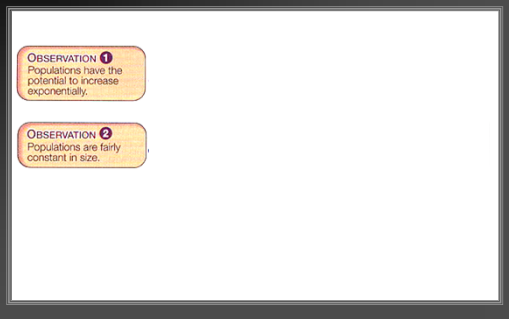
DARWIN'S OBSERVATIONS and DEDUCTIONS

17

DARWIN'S OBSERVATIONS and DEDUCTIONS



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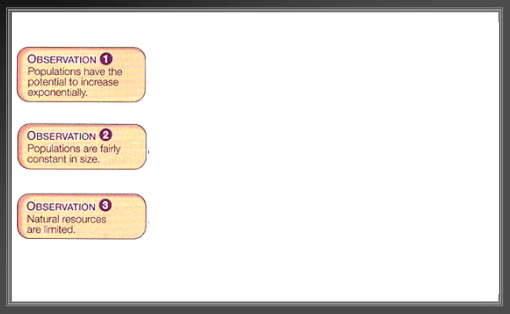
DARWIN'S OBSERVATIONS and DEDUCTIONS



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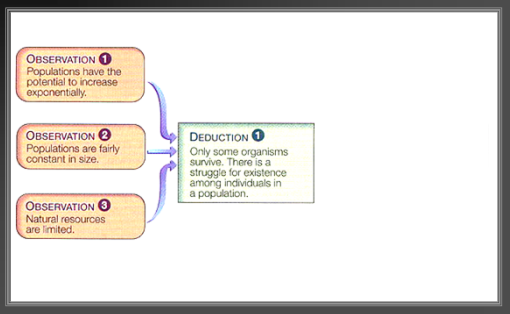
DARWIN'S OBSERVATIONS and DEDUCTIONS



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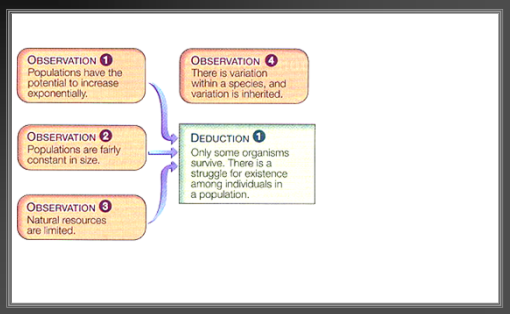

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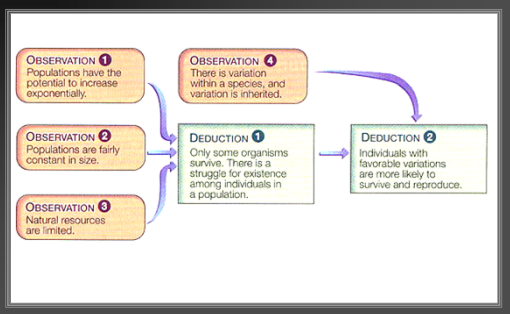
DARWIN'S OBSERVATIONS and DEDUCTIONS



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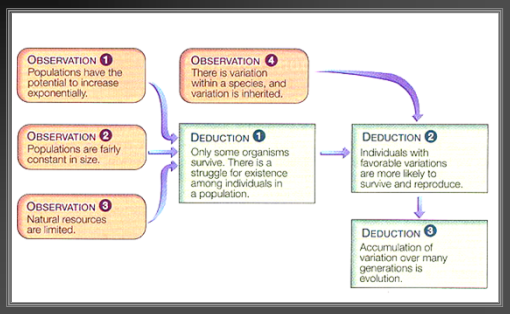
DARWIN'S OBSERVATIONS and DEDUCTIONS



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DARWIN'S MAIN IDEAS

Facts Based on Observations of Nature:

1. Organisms are varied, and some variations are inherited. Within a species, no two individuals (except identical siblings) are exactly alike.
2. More individuals are born than survive to reproduce.
3. Individuals compete with one another for the resources that enable them to survive.

Inferences from Observations:

4. Within populations, the characteristics of some individuals make them more able to survive and reproduce in the face of certain environmental conditions.
5. As a result of the environment's selection against nonadaptive traits, or "survival of the fittest," only individuals with adaptive traits live long enough to transmit traits beneficial in that environment. Over time, natural selection can change the characteristics of populations, even molding new species.

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REVIEW OF DARWIN'S POINTS 1-2

- Individuals of a species vary in form, function, and behavior
  - Much of the variation is heritable
  - Can be transmitted from parents to offspring
- Some forms of heritable traits are adaptive to the prevailing environmental conditions
  - They improve an individuals chance of surviving and reproducing

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REVIEW OF DARWIN'S POINTS 3-4

- Natural selection is the outcome of differences in the survival and reproduction of individuals that show variation in one or more traits
- Natural selection leads to a better fit with prevailing environmental conditions.
  - Adaptive forms of traits tend to become more common and other forms less so
  - The population changes its characteristics
    - **IT EVOLVES**

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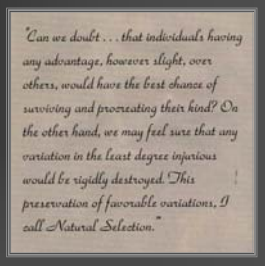
NATURAL SELECTION

- "Those individuals that possess superior physical, behavioral, or other attributes are more likely to survive than those that are not so well endowed"
- Selection
  - Artificial
  - Natural
- *Survival of the fittest*



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Natural Selection

- A difference in the survival and reproductive success of different phenotypes
- Acts directly on phenotypes and indirectly on genotypes
- Change over Time
  - Over time, the alleles that produce the most successful phenotypes will increase in the population
  - Less successful alleles will become less common
  - Change leads to increased fitness
    - Increased adaptation to environment

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Natural Selection-Put Another way

- Individuals vary in some heritable traits
- Some forms of heritable traits are more adaptive
  - A trait that gives the individual an advantage in survival or reproduction, under a given set of circumstances
- Natural selection is differences in survival and reproduction among individuals that vary in their traits
- Adaptive forms of traits become more common than other forms

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THE EVOLUTIONARY VIEW

Life's diversity is the sum total of variations in traits that have accumulated in different lines of descent generation after generation, as by natural selection or other processes of change

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