A DARWINIAN VIEW OF LIFE

Objectives

1. State how Cuvier, Lyell, Malthus and Wallace contributed to evolutionary thought.
2. Contrast Lamarckian and Darwinian concepts of evolution.
3. State the basic principles of evolution by natural selection.
4. Discuss the evidence for evolution.
5. Contrast homologous v. analogous structures.
6. Contrast convergent v. divergent evolution.

Outline

A. Development of Theory
    1. Anaximander
    2. Aristotle
    3. Georges Cuvier
    4. Charles Lyell
    5. Thomas Malthus
    6. Jean Baptiste de Lamarck
    7. Alfred Russel Wallace
    8. Charles Darwin

B. Mechanism of Evolution

C. Evidence for Evolution

A. History of Evolutionary Theory

1. Anaximander

- Life arose in water

- Simpler forms preceded more complex ones

2. Aristotle

- Species are fixed and unchanging

3. Georges Cuvier

- Stratification of soil layers

    - Catastrophism

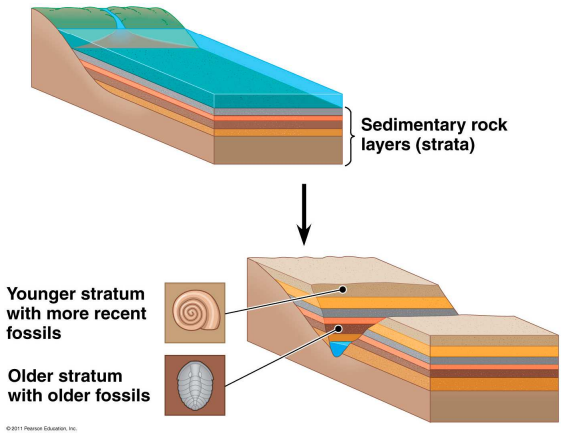
        - Variation in fossils between layers

        - Greater change with greater distance

4. Charles Lyell

- Uniformitarianism

    - Changes between layers are gradual



5. Thomas Malthus

- Populations will outgrow food supply

    - Food supplies grow arithmetically

    - Populations grow exponentially

6. Jean Baptiste de Lamarck

- Diversity due to change over time
- Higher species arise from lower ones
    - Humans the pinnacle of evolution
- Inheritance of acquired traits
    - New traits arise from need and use

7. Alfred Russel Wallace

- Studied birds-of-paradise in Indonesia
    - Only one species on mainland
        - Many different species on islands
- Birds adapted to new islands
    - Adaptive radiation

8. Charles Darwin

- Studied life of Galapagos Islands
    - Few types of animals
        - Differed from mainland species
        - Differed among islands

- Finches
    - One species on mainland
    - Thirteen species on islands
        - Differed in size, beak shape, food

(a) Cactus-eater

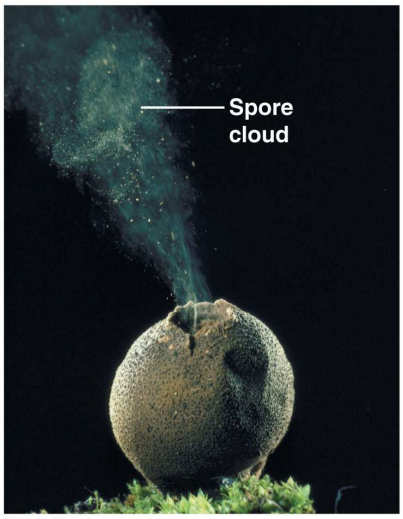
(b) Insect-eater

(c) Seed-eater

- Arrived from mainland
    - Diversified to best adapt to new home
    - Small differences in size, feeding habits amplified over time
    - Eventually became new species

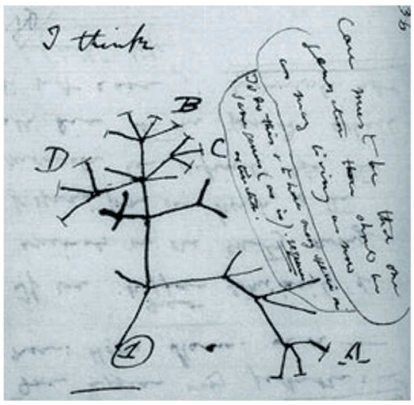
B. Mechanism of Evolution

- Natural Selection



- Adaptation

- Descent with modification



  - Adaptive Radiation

C. Evidence for Evolution

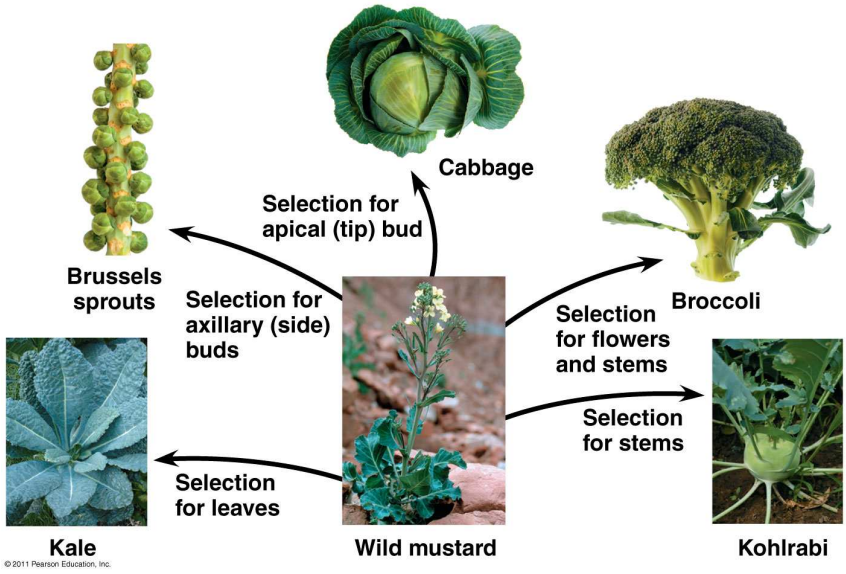
- Direct Observations of Selection

  - e.g., antibiotic resistance

  - e.g., pesticide/herbicide resistance

- Artificial Selection

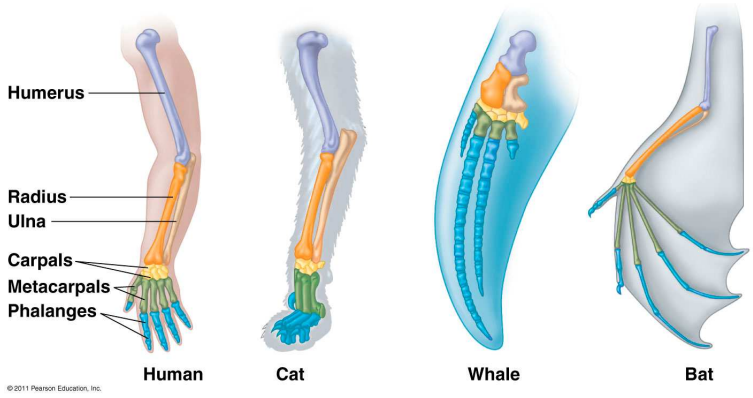
  - Demonstrates directional selection



- Comparative Anatomy

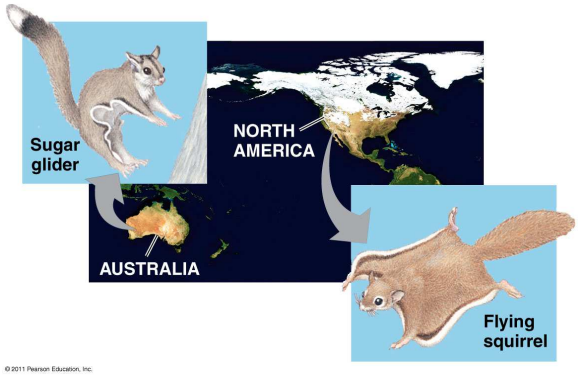
  - Homologous

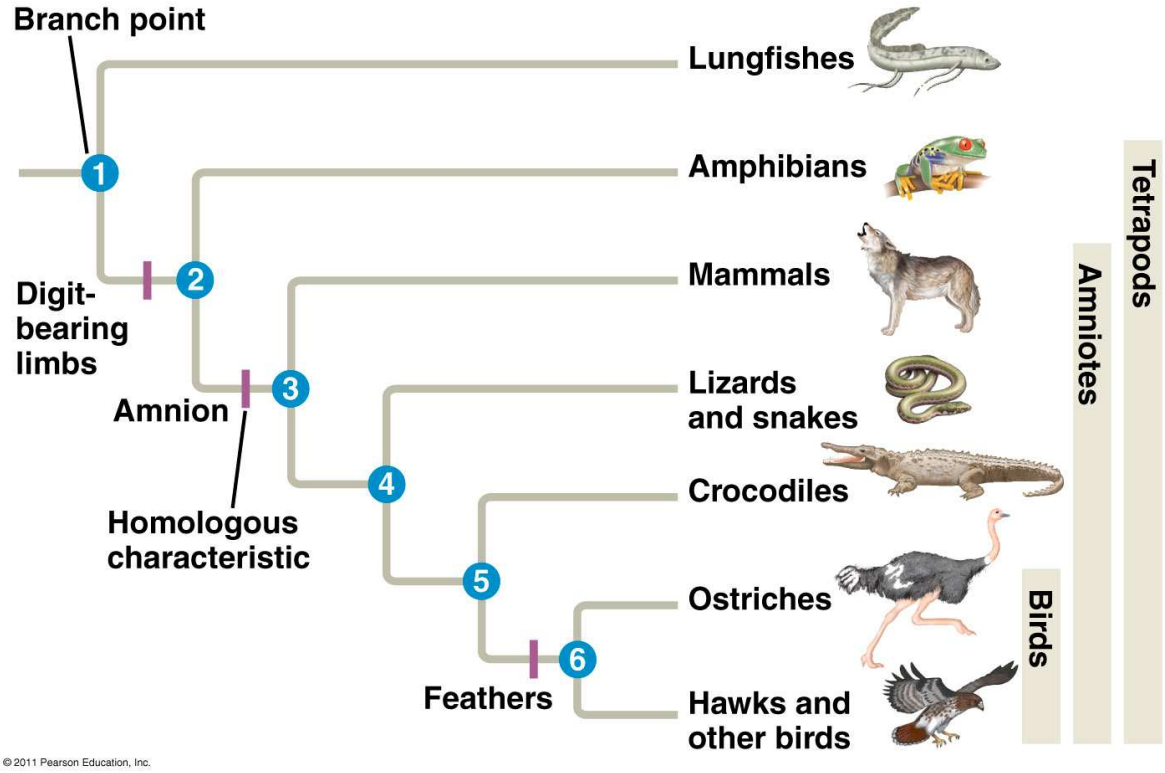
    - Divergent Evolution



  - Analogous

    - Convergent Evolution





- Molecular Biology

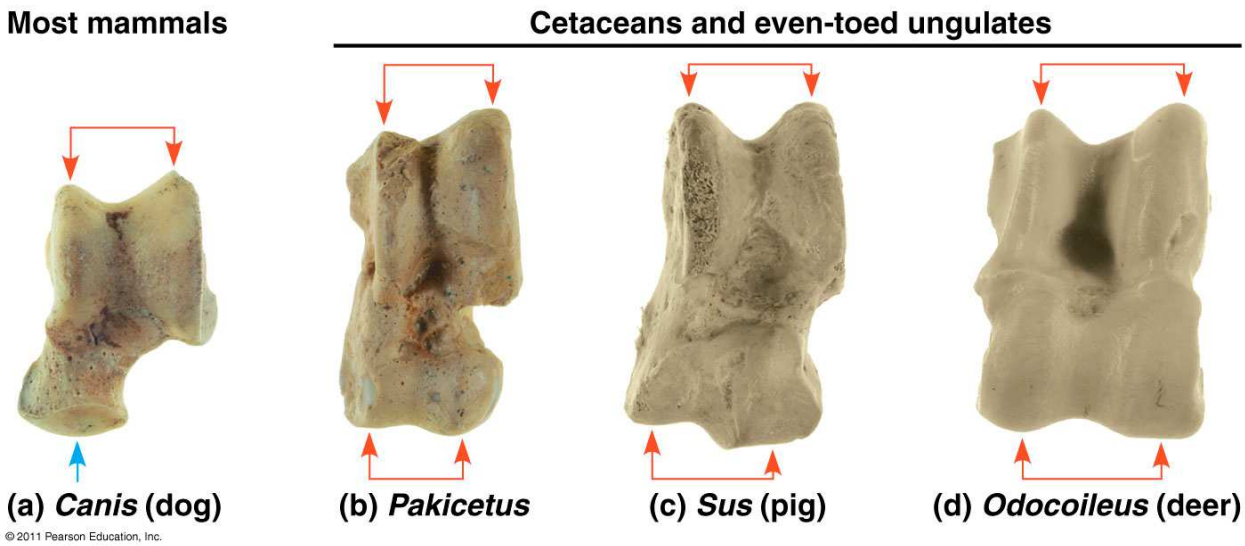
  - Uses differences in sequence

    - Differences least among closest relatives

```
A5ASC3.1   14 SIKLWPPSQTTRLLLVERMANNLST..PSIFTRK..YGSLSKEEAERENAKQIEEVACSTANQ.....HYEKEPDGDGGSAVQLYAKECSKLILEVLK 101
B4F917.1   13 SIKLWPPSESTRIMLVDRMTNNLST..ESIFSRK..YRLLGKQEAHENAKTIEELCFALADE.....HFREEPDGDGSSAVQLYAKETSKMMLEVLK 100
A9S1V2.1   23 VFKLWPPSQGTREAVRQKMALKLSS..ACFESQS..FARIELADAQEHARAIEEVAFGAAQE.....ADSGGDKTGSAVVMVYAKHASKLMLETLR 109
B9GSN7.1   13 SVKLWPPGQSTRLMLVERMTKNFIT..PSFISRK..YGLLSKEEAEEDAKKIEEVAFAAANQ.....HYEKQPDGDGSSAVQIYAKESSRLMLEVLK 100
Q8H056.1   30 SFSIWPPTQRTRDAVVRRLVDTLGG..DTILCKR..YGAVPAADAEPAARGIEAEAFDAAAA..SGEAAATASVEEGIKALQLYSKEVSRRLLDFVK 120
Q0D4Z3.2   44 SLSIWPPSQRTRDAVVRRLVQTLVA..PSILSQR..YGAVPEAEAGRAAAAVEAEAYAAVTES.SSAAAAPASVEDGIEVLQAYSKEVSRRLLELAK 135
B9MVW8.1   56 SFSIWPPTQRTRDAIISRLIETLST..TSVLSKR..YGTIPKEEASEASRRIEEEAFSGAST.......VASSEKDGLEVLQLYSKEISKRMLETVK 141
Q0IYC5.1   29 SFAVWPPTRRTRDAVVRRLVAVLSGDTTTALRKRYRYGAVPAADAERAARAVEAQAFDAASA....SSSSSSSVEDGIETLQLYSREVSNRLLAFVR 121
A9NW46.1   13 SIKLWPPSESTRLMLVERMTDNLSS..VSFFSRK..YGLLSKEEAAENAKRIEETAFLAAND.....HEAKEPNLDDSSVVQFYAREASKLMLEALK 100
Q9C500.1   57 SLRIWPPTQKTRDAVLNRLIETLST..ESILSKR..YGTLKSDDATTVAKLIEEEAYGVASN.......AVSSDDDGIKILELYSKEISKRMLESVK 142
Q2HRI7.1   25 NYSIWPPKQRTRDAVKNRLIETLST..PSVLTKR..YGTMSADEASAAAIQIEDEAFSVANA.......SSSTSNDNVTILEVYSKEISKRMIETVK 110
Q9M7N3.1   28 SFKIWPPTQRTREAVVRRLVETLTS..QSVLSKR..YGVIPEEDATSAARIIEEEAFSVASV.ASAASTGGRPEDEWIEVLHIYSQEIXQRVVESAK 119
Q9M7N6.1   25 SFSIWPPTQRTRDAVINRLIESLST..PSILSKR..YGTLPQDEASETARLIEEEAFAAAGS.......TASDADDGIEILQVYSKEISKRMIDTVK 110
Q9LE82.1   14 SVKMWPPSKSTRLMLVERMTKNITT..PSIFSRK..YGLLSVEEAEQDAKRIEDLAFATANK.....HFQNEPDGDGTSAVHVYAKESSKLMLDVIK 101
Q9M651.2   13 SIKLWPPSLPTRKALIERITNNFSS..KTIFTEK..YGSLTKDQATENAKRIEDIAFSTANQ.....QFEREPDGDGGSAVQLYAKECSKLILEVLK 100
B9R748.1   48 SLSIWPPTQRTRDAVITRLIETLSS..PSVLSKR..YGTISHDEAESAARRIEDEAFGVANT.......ATSAEDDGLEILQLYSKEISRRMLDTVK 133
```

- Fossil Record

    - Record of descent with modification



    - Best documented for animals

- Biogeography

    - Related organisms live nearby