

1 2  **Terms**

- Evolution: the change that occurs in organisms' characteristics over time
- Ecology: describes how organisms live in their environment

◎ Evolution is the *consequence* of ecology over time

3 **2.1 Darwin's Voyage on HMS *Beagle***

◎ Charles Darwin  
(1809 -1882)

◎ British

◎ Naturalist

◎ 1st suggested an explanation for why evolution occurred

◎ Published in 1859, *On the Origin of Species by Means of Natural Selection*

4 **2.1 Darwin's Voyage on HMS *Beagle***

◎ Darwin's work on evolution challenged established worldviews

- Darwin: mechanism for evolutionary change called natural selection

- eventually became accepted as theory

5 **2.1 Darwin's Voyage on HMS *Beagle***

◎ Darwin voyaged from 1831 - 1836 on the HMS *Beagle*, a ship mapping the world's coastlines

◎ observed different plants/animals

◎ These observations played an important role in the development of his thoughts about the nature of life on earth

6 **Figure 2.3 The five-year voyage of HMS *Beagle***7 **2.2 Darwin's Evidence**

◎ ??species evolve rather than remain fixed??

1)fossils of extinct organisms resembled those of living organisms

2)geographical patterns that suggested that organismal lineages change gradually as individuals move into new habitats

3)islands have diverse animals and plants that are related to yet dramatically different from their mainland sources

8  **Figure 2.5 Four Galápagos finches and what they eat.**

9  **2.3 The Theory of Natural Selection**

◎Thomas Malthus' *Essay on the Principle of Population* (1798) provided Darwin with a key insight

- human populations tend to increase geometrically,
- the capacity for humans to feed this population only grows arithmetically

10  **Figure 2.6 Geometric and arithmetic progressions**

11  **2.3 The Theory of Natural Selection**

◎Darwin expanded Malthus' view to include every organism

- all organisms have the capacity to over-reproduce
- only a limited # of offspring survive and produce next generation

◎survivors have certain physical, behavioral, or other attributes that help them to live in their environment

- survivors pass on favorable characteristics on to offspring

12  **2.3 The Theory of Natural Selection**

◎the frequency of favorable characteristics increases in a pop.

through a process called NATURAL SELECTION

- favorable characteristics are specific to an environment; they may be favored in one but not in another
- organisms whose characteristics are best suited to their particular environment survive more often and leave more offspring

13  **2.3 The Theory of Natural Selection**

⊙often referred to as “survival of the fittest”

- Darwinian fitness does not refer always to the biggest or the strongest
- fitness, in evolutionary theory, refers to organisms who, due to their characteristics, survive more often and leave more offspring

14  **2.3 The Theory of Natural Selection**

⊙Domesticated animals evolved through selective breeding for certain traits that breeders preferred

- the resulting differences between breeds of domesticated species are more extreme than what exists in nature
- artificial selection: breeders determined which traits were successful, rather than nature

15  **2.3 The Theory of Natural Selection**

⊙Darwin’s 1859 publication ignited controversy

⊙But the scientific community soon accepted Darwin’s arguments

16  **2.4 The Beaks of Darwin’s Finches**

⊙Darwin’s finches are a closely related group of distinct species

- all the birds are similar to each other except for the shape of

their bills

- genetic differences account for the physical differences in the beaks
  - birds with larger beaks make more of a protein called BMP4

17  **Figure 2.9 A diversity of finches from a single island**

18  **2.4 The Beaks of Darwin's Finches**

- ◎Darwin supposed that the birds evolved from a single ancestor to become individual species who specialized in particular foods

- ◎But David Lack's (1938) study found that different species of finches fed on the same kind of seeds
  - does this contradict Darwin?

19  **2.4 The Beaks of Darwin's Finches**

- ◎Peter and Rosemary Grant studied the medium ground finch on the island of Daphne Major in the Galápagos

- measured beak shape over many years and recorded feeding preferences
  - finches preferred to feed on small, tender seeds
  - finches switched to larger, harder-to-crack seeds when the small seeds become hard to find

20

**drought: larger seeds / bigger beaks**

**wet: small seeds/ smaller beaks**

21  **2.4 The Beaks of Darwin's Finches**

- ave beak depth ↑d after a drought
  - only large-beaked birds were able to crush the bigger seeds and survive to make the next generation

- when wet periods returned, smaller beaks prevailed at handling the then more plentiful small seeds

22  **Darwin's finches on the Galápagos are an example of ADAPTIVE RADIATION**

- .....
- cluster of species changes to occupy a series of different habitats within a region
  - each habitat offers different niches to occupy
    - Niche: how a species interacts (biologically and physically) with its environment in order to survive
  - each species evolves to become adapted to that niche

23  **2.6 What Is Ecology?**

◎Ecology: the study of how organisms interact with each other and with their environment

◎Ecology can be studied at progressively more encompassing levels of organization

24  **2.6 What Is Ecology?**

◎Levels of ecological organization

- 1. POPULATIONS: individuals of the same species that live together are members of a population
- 2. COMMUNITIES: populations of different species that live together in the same place
- 3. ECOSYSTEMS: a community and the nonliving factors which it interacts

25  **2.6 What is ecology?**

◎Levels of ecological organization

- 4. BIOMES
  - major terrestrial assemblages of plants, animals, and microorganisms that occur over wide geographic areas and have distinctive physical characteristics
- 5. BIOSPHERE
  - all the world's biomes, along with its marine and

freshwater assemblages, together constitute an interactive system called the biosphere

26  **2.7 A Closer Look at Ecosystems**

⊙ Ecosystems are the fundamental units of ecology


⊙ Ecosystems are complex to study

- they are dynamic
- they have limiting factors that affect diversity
  - energy is consumed
  - nutrients are cycled
- environmental factors also limit diversity
  - rainfall
  - temperature

27  **2.8 Communities**

⊙ A community is the component of an ecosystem that is living

- communities named by their most dominant species (usually a plant)

28  **2.9 Niche and Competition**

⊙ The niche concept

- Niche: an organism's biological role
  - a *pattern of living*
    - the sum of all ways an organism uses the resources of its environment, (space, food, etc)

29  **2.9 The Niche and Competition**

⊙ Sometimes organisms cannot occupy fully their potential niche (ie: some other organism is using it)

⊙ Competition: when 2 organisms attempt to use the same resource

- interspecific – competition betw members of different species

- intraspecific – competition betw members of same species

30  **2.10 How species evolve to occupy different niches within**

## an ecosystem

### ◎PRINCIPLE OF COMPETITIVE EXCLUSION

- ecologists say no 2 species with the same niche can coexist
- when 2 species compete for same resource, the superior competitor will drive its rival away

### ◎RESOURCE PARTITIONING

- natural selection favors changes among competitors to reduce the competition between them
- each species can avoid competition by using different resources than competitors
- this reduces niche overlap

31  **Figure 2.20 Resource partitioning among lizards**

32  **2.11 Predation**

◎One potential and important interaction in a community involves one organism eating another—called predation

◎Both predators (i.e., the eaters) and prey (i.e., the eaten) may undergo reciprocal evolutionary adjustments

- this process is called coevolution

33  **2.12 Symbiosis**

◎Symbiosis is an interaction in which two or more kinds of organisms interact in a close relationship

- the relationship types vary by whether or not each participant is unaffected (0), helped (+), or harmed (-)

34  **Types of Symbiosis**

35  **End of Week # 1**

◎read chapters 1 & 2

◎Try the end of chapter questions to test yourself.

◎Check out Publishers Website.

◎Go to instructor's website & print out greensheet/ lab # 2

◎Check out EC opportunities.