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## BIOLOGY – UNIT 3 – CHAPTERS 16 & 17 NOTES

### EVOLUTION

#### Jean Baptiste de Lamarck

- first major theory of evolution
- based on 3 principles:
  - a desire to change = if an animal wants or needs to change its body, then it does
  - use and disuse = if a part of an animal isn't used, then it shrinks and disappears; if it is used a lot, then it grows bigger, stronger, or more numerous
  - acquired traits = traits that an animal receives during its lifetime will be passed to its offspring
- WHAT IS WRONG WITH LAMARCK'S THEORY? (EVERYTHING!)

#### Charles Darwin

- a naturalist from England
- first voyage at 22 years old
- sailed to the Galapagos Islands off the coast of Ecuador (South America)
- most famous book was "On the Origin of Species by Means of Natural Selection" (1859)

#### Darwin's Research

- He collected several species of birds (finches)
- Each bird had a specialized way of catching food in its beak
- All the birds on the islands resembled one particular bird on South America
- HOW COME SOME OF THE BIRDS HAVE DIFFERENT TRAITS?
- WHY DID THE ISLAND FINCHES RESEMBLE THOSE ON SOUTH AMERICA?
- The finches must have changed throughout time in order to survive.
- They evolved different traits in response to the different environments on the islands.
- In the case of their beaks, the environmental factor was food availability.

#### Darwin's Theory of Evolution

- definition of evolution = change in species over time
- natural selection = organisms with traits well suited to an environment are more likely to survive and produce more offspring
- FITNESS = the ability to successfully reproduce and produce fertile offspring
- Reproduction is the most important thing in life according to Darwin

5 Steps of Natural Selection

1. GENETIC VARIATION  
Every species contains differences in DNA  
EX: Some giraffes have longer necks and some have shorter necks.
2. OVERPRODUCTION OF OFFSPRING  
Organisms often produce more offspring than can survive.  
EX: The giraffes produce a lot of offspring.
3. FITNESS  
Only some individuals survive and reproduce.  
EX: Tall giraffes could reach the food. They survived and reproduced.  
Short giraffes could not reach the food. They died and did not reproduce.
4. GENETIC CHANGE  
Natural selection changes the % of genes in the population.  
EX: The “tall” gene becomes more common. The “short” gene becomes less common.
5. ADAPTATION  
Species adapt to the environment. Some genes are more favored than others.  
EX: Most of the giraffes in the population are taller. The shorter ones were unable to survive.

Examples of Natural Selection (Classwork)

- EX: Darwin’s Finches (only food sources are nuts, fruits, and seeds)
1. There are birds with short, fat beaks and long, thin beaks.
  2. \_\_\_\_\_
  3. \_\_\_\_\_
  4. \_\_\_\_\_
  5. \_\_\_\_\_
- EX: Drug-Resistant Bacteria
1. Some bacteria are killed by antibiotics and some are not.
  2. \_\_\_\_\_
  3. \_\_\_\_\_
  4. \_\_\_\_\_
  5. \_\_\_\_\_
- EX: Pesticide-Resistant Insects
1. Some insects are killed by pesticides and some are not.
  2. \_\_\_\_\_
  3. \_\_\_\_\_
  4. \_\_\_\_\_
  5. \_\_\_\_\_
- EX: The Peppered Moths (the trees have been covered with soot)
1. There are light and dark peppered moths.
  2. \_\_\_\_\_
  3. \_\_\_\_\_
  4. \_\_\_\_\_
  5. \_\_\_\_\_

## Proof of Evolution

1. Homologous Structures = similar bone structures found in closely related animals  
EX: human arm, bird wing, whale flipper
2. Vestigial Organ = an organ that is no longer used by an animal  
EX: human appendix, coccyx (tail bone), wisdom teeth
3. Molecular Data = comparing similar DNA or proteins sequences of different animals  
EX: humans and chimpanzees have 98.4% DNA similarities
4. Comparative Embryology = animals that are closely related have similar features during development (before they are born)  
EX: human embryos have gill-like slits (humans evolved from fish)  
EX: human embryos have a “tail” (humans evolved from primates)
5. Fossils = remnants of animals from the past  
EX: Archaeopteryx = fossil that proves that birds evolved from dinosaurs

## Evolution Without Natural Selection

1. Founder Effect = when a small group is separated from a large population, the small group will have a different % of genes than the original (larger) group  
EX: Carolina and Dimetri are swept away by a storm to a deserted island.  
All the offspring will be tall.
2. Bottleneck Effect = when a storm or natural disaster randomly destroys most of a population, the survivors that are left to reproduce may not have the same genetic qualities as the original (larger) group  
EX: A storm destroys everyone except Carlos, Kristia, Danilo, Charbel, and Carolina.  
All the offspring will be Spanish.
3. Artificial Selection = when humans determine which organisms are going to mate.  
EX: farmers planting the seeds from the best crops  
EX: dog/horse breeders

## Species Concept

- Organisms of the same species are able to mate and produce fertile offspring.
- If they can't mate together, then they are different species!
- EX: horse + donkey → mule (not a species because it is sterile)

## 5 Pre-Zygotic Reproductive Barriers

1. Habitat Isolation = species are separated based on where they live
2. Temporal Isolation = species are separated based on when they mate (time of day or mating seasons)
3. Behavioral Isolation = species are separated based on differences in mating rituals
4. Mechanical Isolation = species are separated based on incompatible reproductive organs
5. Gametic Isolation = species are separated based on incompatible gametes (eggs + sperm)

## 3 Post-Zygotic Reproductive Barriers

1. Reduced Hybrid Viability = hybrid fails to develop or reach “puberty”
2. Reduced Hybrid Fertility = hybrid reaches “puberty” but can't make functional gametes
3. Hybrid Breakdown = hybrid produces offspring, but the offspring are weak or infertile

### 3 Modes of Natural Selection

1. **Directional Selection:** one extreme trait is favored  
EX: - Trait: speed of wolves  
- Evolution favors faster wolves  
- Graph is shifted to the left or right
  
2. **Stabilizing Selection:** the middle form of the trait is favored  
EX: - Trait: human birth weight  
- Evolution favors medium birth weight  
- Graph produces a thinner bell curve
  
3. **Diversifying Selection:** both extreme traits are equally favorable, but not the middle trait  
EX: - Trait: type of beak (Darwin's finches)  
- Evolution favors short/fat beaks (for eating nuts and fruit) as well as long/thin beaks (for eating worms and insects), but not medium-sized beaks  
- Graph produces an upside-down bell curve