

# Chapter 1 Lecture Notes—an introduction to Biology

## Chapter 1 Lecture Notes—an introduction to Biology

Biol 100 – K. Marr

### Topics Discussed in these notes

1. Biological Organization
2. The Characteristics of Life
3. The Cell Theory
4. Cell Types: Prokaryotes vs. Eukaryotes
5. DNA– the universal genetic language of life
6. The 3 domains of life
7. Evolution of life via Natural Selection
8. Self-test/Review Questions

#### Biological Organization— from organism to atom

**1. Organ System:** A group of body parts that carries out a particular function in an organism



**2. Organ:** A structure consisting of two or more tissues that performs specialized functions within an organism



**3. Tissue:** A group of similar cells that carries out a particular function in an organism



## The Characteristics of Life

1. **Order**—
2. **Metabolism**—organized synthesis and break down of molecules; can produce energy to power life processes.
3. **Motility**—organisms can move themselves or their parts.
4. **Responsiveness**—perceive and react to their environment
5. **Development**—develop from simple to more complex organism
6. **Heredity**—genes are passed from parent to offspring; genes control an organism's phenotype.
7. **Evolution**—populations change over time as they
8. **Adaptations**—the environment selects organisms with traits/ that are best suited for an organisms environment

#### Biological Organization— from organism to atom (cont.)



**4. Cell:** The simplest entity that has all the properties of life

**5. Organelle:** A structure within a cell that performs a specific function



**6. Molecule:** A cluster of atoms held together by chemical bonds



## The Cell Theory

### Cell Theory

a.)

b.)

### There are two major types of cells

a.)

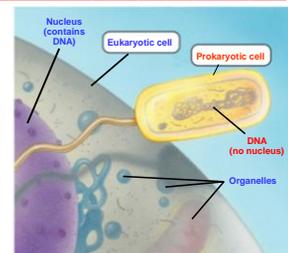
b.)

## Prokaryotic vs. Eukaryotic Cells

### Prokaryotic cells

#### Eukaryotic cells

- more complex
- contain organelles
- The \_\_\_\_\_ is the largest organelle in most eukaryotic cells
- Evolved after prokaryotes



*DNA—the genetic language of life*

1. All cells use DNA as the chemical material of genes

Genes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

2. The language of DNA contains just four letters (nitrogen bases): **A, G, C, T**

a. \_\_\_\_\_

3. **Mutation**—a change in a gene’s sequence

a. \_\_\_\_\_

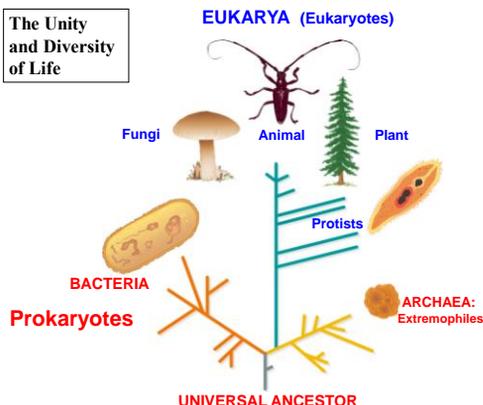
b. \_\_\_\_\_



**Life in Its Diverse Forms**

- Diversity is the hallmark of life
- The diversity of known life includes 1.7 million species
- Estimates of the total diversity range from 5 million to over 30 million species

The Unity and Diversity of Life

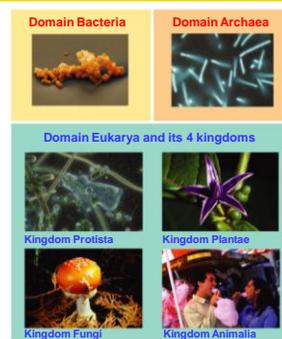


*The Three Domains of Life*

1. **Bacteria**  
 a.) \_\_\_\_\_  
 b.) \_\_\_\_\_

2. **Archaea**  
 a.) \_\_\_\_\_  
 b.) \_\_\_\_\_

3. **Eukarya**  
 a.) \_\_\_\_\_  
 b.) \_\_\_\_\_



*The Four Kingdoms of Eukarya*

1. **Protista**  
 • \_\_\_\_\_  
 • Examples: \_\_\_\_\_

**Multicellular Eukaryotes:**

2. **Plantae**  
 • \_\_\_\_\_  
 • Examples: \_\_\_\_\_

3. **Animalia**  
 • \_\_\_\_\_  
 • Examples: \_\_\_\_\_

4. **Fungi**  
 • \_\_\_\_\_  
 • Examples: \_\_\_\_\_

*Unity in the Diversity of Life*

- Underlying the diversity of life is a striking unity, especially at the lower levels of structure
  - Example: the universal genetic language of DNA
- Evolution accounts for this combination of unity and diversity

**EVOLUTION: BIOLOGY'S UNIFYING THEME**

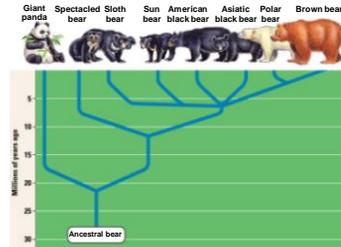
- The history of life is a saga of a restless Earth billions of years old
- **Fossils document this history**



Figure 1.10

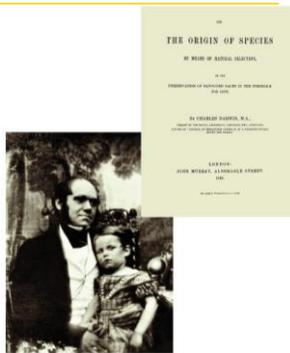
**Life evolves**

- Each species is one twig of a branching tree of life extending back in time



**The Darwinian View of Life**

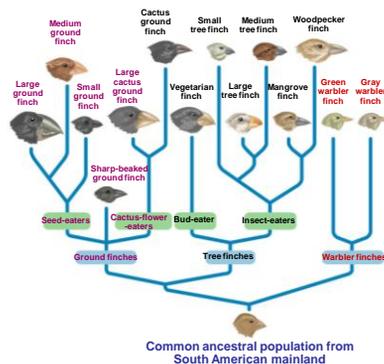
- The evolutionary view of life came into focus in 1859 when **Charles Darwin** published *The Origin of Species*
- Darwin's book developed two main points
  - Descent with modification
  - Natural selection



**Natural Selection**

- Darwin was struck by the diversity of animals on the **Galápagos Islands**
- He thought of adaptation to the environment and the origin of new species as closely related processes
  - **As populations separated by a geographic barrier adapted to local environments, they became separate species**

- **14 species of Galápagos finches have beak shapes adapted to suit their environments**
- **Natural selection is the mechanism of evolution**



**Darwin's Inescapable Conclusion**

- Darwin synthesized the concept of natural selection from **two observations** that were neither profound nor original
  - Others had the pieces of the puzzle, but Darwin could see how they fit together

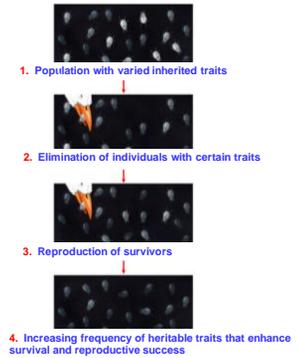
**The Theory of Natural Selection**

- **Observation 1:** \_\_\_\_\_
- **Observation 2:** \_\_\_\_\_
- **Darwin's Hypothesis:** \_\_\_\_\_
  - Some individuals are better suited to the environment than others and will therefore reproduce in larger numbers
- **It is this unequal reproductive success that Darwin called natural selection:**
  - Those organisms with *heritable* traits that are best suited for the environment will survive and pass those traits on to future generations
  - What does the selecting in natural selection? \_\_\_\_\_

**The Theory of Natural Selection**

- **Natural selection is the mechanism of evolution**
- **What are the two major causes of variation within a species?**

- 1.) \_\_\_\_\_
- 2.) \_\_\_\_\_



**Observing Natural Selection**

**Examples of natural selection in action**

1. The development of antibiotic-resistant bacteria
2. Pima Indians
3. Arctic Hare
4. Long Distance Runners from East Africa
5. Cockroaches in Florida
6. Alcohol Metabolism in Asians vs. Europeans
7. Human Skin Color



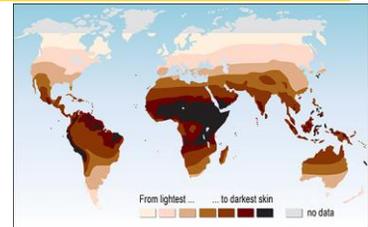
**Tuberculosis**

**Observing Natural Selection: Human Skin Color**

• **What role does Natural Selection Play in Determining Skin Color?**

**Key Concepts...**

- High doses of U.V. Light damages skin cells and DNA
- Our body needs some UV light to help us produce \_\_\_\_\_
- \_\_\_\_\_ regulates how much UV light our skin lets in.



• *"Your Family May Once Have Been A Different Color"* (NPR's Morning Edition 2-2-09): <http://www.npr.org/templates/story/story.php?storyId=100052939>

**Observing Artificial Selection**

**Artificial selection—**

- Selective breeding of domesticated plants and animal by humans



- Darwin's publication of *The Origin of Species* fueled an explosion in biological research

- **Evolution is one of biology's best demonstrated, most comprehensive, and longest lasting theories**
- **Evolution is the unifying theme of biology**



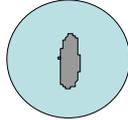
**Estimating the Size of an Object Viewed with a Microscope**

- Calculate the length and width of the following microscopic object in both millimeters and micrometers. **1 mm = 1000  $\mu$ m**
- Base your calculations on the following *hypothetical* field sizes:

**Low power (30x):** 4.0 mm = \_\_\_  $\mu$ m

**Medium power (180x):** \_\_\_ mm = \_\_\_  $\mu$ m

**High power (300x):** \_\_\_ mm = \_\_\_  $\mu$ m



Object viewed at high power (300x)

**Remember:** Field size decreases by the same factor as the magnification increases!