

## W. Brian Simison

Undergrad – UC San Diego  
Animal Physiology

Graduate – UC Berkeley  
Molecular Evolution

## Midterm Info

- Midterm 1 is Wednesday Feb. 22
- 100 point exam
- 79 points will come from Quail lectures
- 21 points will come from Simison lectures

## Evolution

What is your definition?

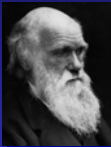


## Natural Selection

What is your definition?

## Goals

1. Understand Natural Selection and Evolution.



2. Appreciate Beauty & Wonder of Nature.



## Today's Outline

1. Scientific Method.
2. Unity of Life.
3. Levels of Organization in Nature.
4. Interdependencies Among Organisms.
5. Diversity & Nomenclature.

## Scientific Method

- Make observations
- Ask questions
- Generate hypotheses
- Experiments are conducted
- Examine the results
- Confirm or contradict the hypotheses

The best hypotheses are presented in a way that can be **falsifiable**.

## Evolution

What is your definition?

The observation that life on earth has changed through time.

**A fact, not a theory**

## Natural Selection

What is your definition?

**A theory explaining the observed fact that life on earth changes through time.**

## Unity of Life

### Common Themes in All Organisms

1. Organisms are made of cells.
2. Organisms have same biological molecules - lipids, proteins, carbohydrates, nucleic acids. DNA is a nucleic acid that codes for proteins.
3. Organisms reproduce by passing along DNA. DNA guides development.

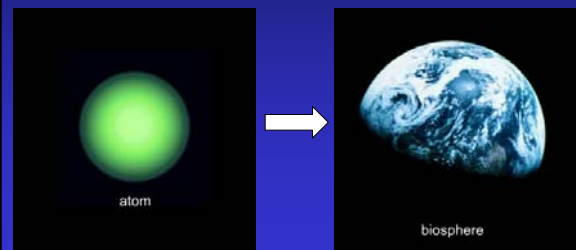
## Unity of Life

4. Organisms obtain and convert energy from their surroundings. This is part of a cell's metabolism. Cells use energy for repair, growth, and reproduction.
5. Organisms sense changes in their surroundings. They respond in controlled ways that compensate. This involves homeostasis – staying within tolerable limits.
6. Organisms evolve. Their genes change from generation to generation.

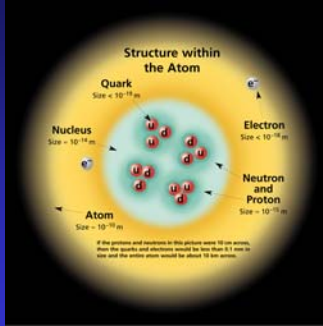
## Levels of Organization in Nature - a Hierarchy

(From Fig 1.1)

From very small to very large

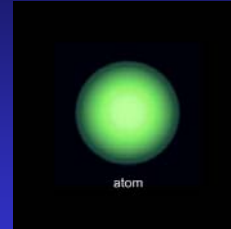


## Levels of Organization in Nature -



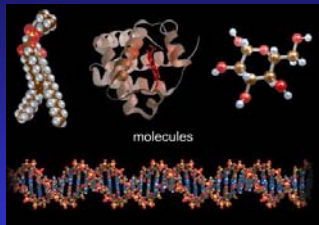
Subatomic level – fundamental units of matter.

## Levels of Organization in Nature - a Hierarchy



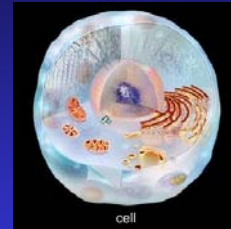
Composed of protons, Neutron and electrons.

## Levels of Organization in Nature - a Hierarchy



Two or more atoms of the same or different elements join to form molecules.

## Levels of Organization in Nature - a Hierarchy



The smallest unit that can live and reproduce on its own or as part of a multicelled organism.

## Levels of Organization in Nature - a Hierarchy



A tissue, such as bone, consists of certain types and proportions of cells interacting in some task.

## Levels of Organization in Nature - a Hierarchy



An organ consists of two or more tissues interacting in some task.

## Levels of Organization in Nature - a Hierarchy



organ system

Organs interact physically, chemically, or both. Parrotfish skin consists of several layers of tissues and glands.

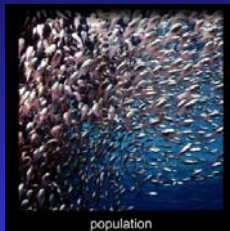
## Levels of Organization in Nature - a Hierarchy



multicelled organism

Cells of multicelled organisms are organized as tissues, organs and organ systems.

## Levels of Organization in Nature - a Hierarchy



population

A group of individuals of the same species occupying a specified area.

## Levels of Organization in Nature - a Hierarchy



community

All populations of all species in a specified area. A reef community in the Red Sea.

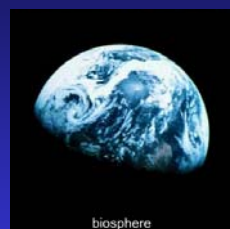
## Levels of Organization in Nature - a Hierarchy



ecosystem

A community that is interacting with its physical environment. It has inputs and outputs of energy and materials.

## Levels of Organization in Nature - a Hierarchy



biosphere

The biosphere encompasses all regions of Earth's waters, crust and atmosphere that contain organisms.

## Interdependencies Among Organisms

1. Energy flows through organisms.
2. Producers – plants or other organisms that make their own food
3. Consumers – animals eat producers
4. Decomposers – break down sugars and other molecules which can be cycled back to producers
5. All energy is eventually returned to the environment.
6. Organisms are interconnected and this affects structure, size, and composition of populations and communities.

## Producers, Consumers, Decomposers, and the Environment



## Diversity and Scientific Nomenclature

- In 1735, Carolus Linnaeus devised a classification system to organize the diversity of nature. **Binomial nomenclature** - Every organism has a two-part name
- We can use the names we give each organism to indicate a degree of evolutionary relationship between organisms. We can group the names at higher and higher levels.

## Diversity and Scientific Nomenclature

- The Linnaean classification scheme uses 7 nested levels:

Kingdom  
Phylum  
Class  
Order  
Family  
Genus  
Species

- The Linnaean classification system is hierarchical.

## Classification of Homer's Home

Location of Homer Simpson's house:

**Galaxy:** Milky Way

**Solar System:** Sun System

**Planet:** Earth

**Continent:** North America

**Country:** United States

**State:** Kentucky?

**County:** Springfield

**City:** Springfield

**Street:** Evergreen Terrace

**House Number:** 742



## Classification of Blue-dog

For the dog:

**Kingdom:** Animalia

**Phylum:** Chordata

**Class:** Mammalia

**Order:** Carnivora

**Family:** Canidae

**Genus:** *Canis*

**Species:** *familiaris*



## 6 Kingdoms

1. **Archaeobacteria** – bacteria that live in harsh environments such as hot springs, salt lakes, sewage treatment plants, guts of ruminants. They have special cell walls and cell membranes.
2. **Eubacteria** – “true bacteria” are widespread.

The Archaeobacteria and Eubacteria are single celled **prokaryotes** (no nucleus or sac that surrounds the DNA).

## 6 Kingdoms

3. **Protista** – most are bigger, more complex than bacteria. Includes producers, consumers, and decomposers. Includes “protozoans” and even includes giant, multicellular “seaweeds” or algae (kelps too).
4. **Fungi** – common grocery store mushroom. Most are multicellular decomposers and consumers that feed by secreting enzymes to digest food outside their bodies.

## 6 Kingdoms

5. **Plantae** – most are photosynthetic producers with cellular pipelines to move water and solutes through roots, stems, and leaves.
6. **Animalia** – usually motile, consumers (herbivores, carnivores, parasites, scavengers).

Last four Kingdoms (Protista, Fungi, Plantae, Animalia) are **eukaryotes** (have a nucleus).