Lecture Outline

• Defining life by properties of being alive (7)

• Order of structural hierarchy levels of the living world
  – Ascending/up & descending/down
  – emergent properties

• Unifying themes
  – Form and function
  – Cell Theory & types of cells
  – Genetic material- DNA
  – Scientific Method and approaches
Properties of Living Organisms

1. Order
2. Reproduction
3. Growth and development
4. Energy processing
5. Interact with the environment
6. Regulation
7. Evolutionary adaptation
Properties of Living Organisms

- Order
- Reproduction
- Growth and development
- Energy processing or transformation
- Interaction with environment
- Regulation of internal conditions – Homeostasis
- Evolutionary adaptation

Ordered organization of the living world
  - Levels of structural hierarchy
  - Ascending vs. descending-
  - Emergent properties
Levels of Order in the Living World

- Organized into structural hierarchical levels
- Ascending vs. Descending
- Each level builds on the level below it
- Interaction between components of each level of the structural hierarchy leads to the emergence of new properties
**Figure 1.2_1**

- **Biosphere**: Madagascar
- **Ecosystem**: Forest in Madagascar
- **Community**: All organisms in the forest
- **Population**: Group of ring-tailed lemurs
- **Organism**: Ring-tailed lemur
Organism: Ring-tailed lemur

Organ system: Nervous system

Organ: Brain

Tissue: Nervous tissue

Cell: Nerve cell

Organelle: Nucleus

Atom

Molecule: DNA

Figure 1.2_2
Emergent Properties

Biological systems are much more than the sum of their parts
Regulation of internal conditions-
Homeostasis

Biological processes are self-regulating by feedback mechanisms

1. Negative feedback
2. Positive feedback
Living organisms interact with their environment transforming energy.
Living organisms interact with their environment transforming energy.

Ecosystem

- **Sunlight**
  - Producers (such as plants)
  - Chemical energy (food)
  - **O₂**
  - **CO₂**
  - Water and minerals taken up by tree roots
  - Cycling of chemical nutrients

- **O₂**
- **CO₂**
- Heat
- **O₂**

- Consumers (such as animals)
  - Chemical energy (food)
  - **CO₂**

- Decomposers (in soil)
Figure 1.4

Ecosystem

- **Sunlight**
- **CO₂**
- **Heat**
- **Chemical energy** (food)
- **Producers** (such as plants)
- **Consumers** (such as animals)
- **Water and minerals** taken up by tree roots
- **Cycling of chemical nutrients**
- **Decomposers** (in soil)

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Growth & Development

Sperm cell

Nuclei containing DNA

Egg cell

Fertilized egg with DNA from both parents

Embryo's cells with copies of inherited DNA

Unspecialized cells

Different specialized cells

Offspring with traits inherited from both parents
Evolutionary Adaptation of populations

Populations: groups of organisms belonging to the same species

Populations
  • Genetic diversity
  • Under influence of external factors
  • Differential reproductive success
    (Natural Selection)

Populations adapt to their surrounding and evolve
Evolutionary Adaptation
- Charles Darwin

How evolution really works

Biological Themes

- Form/structure and Function
- The Cell Theory & Types of cells
- Genetic Material- DNA
Structure or form fits function at all levels of the biological organization
Biological Themes/ The cell Theory

- A cell is the basic unit of biological structure and function
- All cells arise from preexisting cells
Two Types of cells on earth differ in size and complexity

- **Prokaryotic cells**: DNA is not surrounded by a membrane
- **Eukaryotic cells**: membrane-enclosed organelles, including a DNA-containing nucleus
- DNA directs all cell’s activities

- Genetic information must be duplicated before any cell divides
Electronic information recognized by Player

Music is produced

Genetic information recognized by Cell machinery

Protein is produced
Wrap-up

• Defining life by properties of being alive (7)

• Order of structural hierarchy levels of the living world
  – Ascending/up & descending/down
  – emergent properties

• Unifying themes
  – Form and function
  – Cell Theory & types of cells
  – Genetic material- DNA
  – Scientific Method and approaches (Lab)