Chapter 1: Introduction to The Diversity of Life

- Properties of Life
- Organization of Life
- Biological Themes and Unifying Theories
- Scientific Method

Biology: study of living things
Living things can be divided into 6 kingdoms

Properties of Life

But what does it mean to be alive? Living organisms and many non-living things share three properties

- Complexity
- Movement
- Response to stimulation

All living organisms share 5 basic properties

1. Cellular Organization: All are composed of at least one cell
2. Metabolism: All use energy
3. Homeostasis: All maintain stable internal conditions
4. Growth and reproduction
5. Heredity: All have a genetic system that is based on DNA (Deoxyribonucleic acid)

The Organization of Life

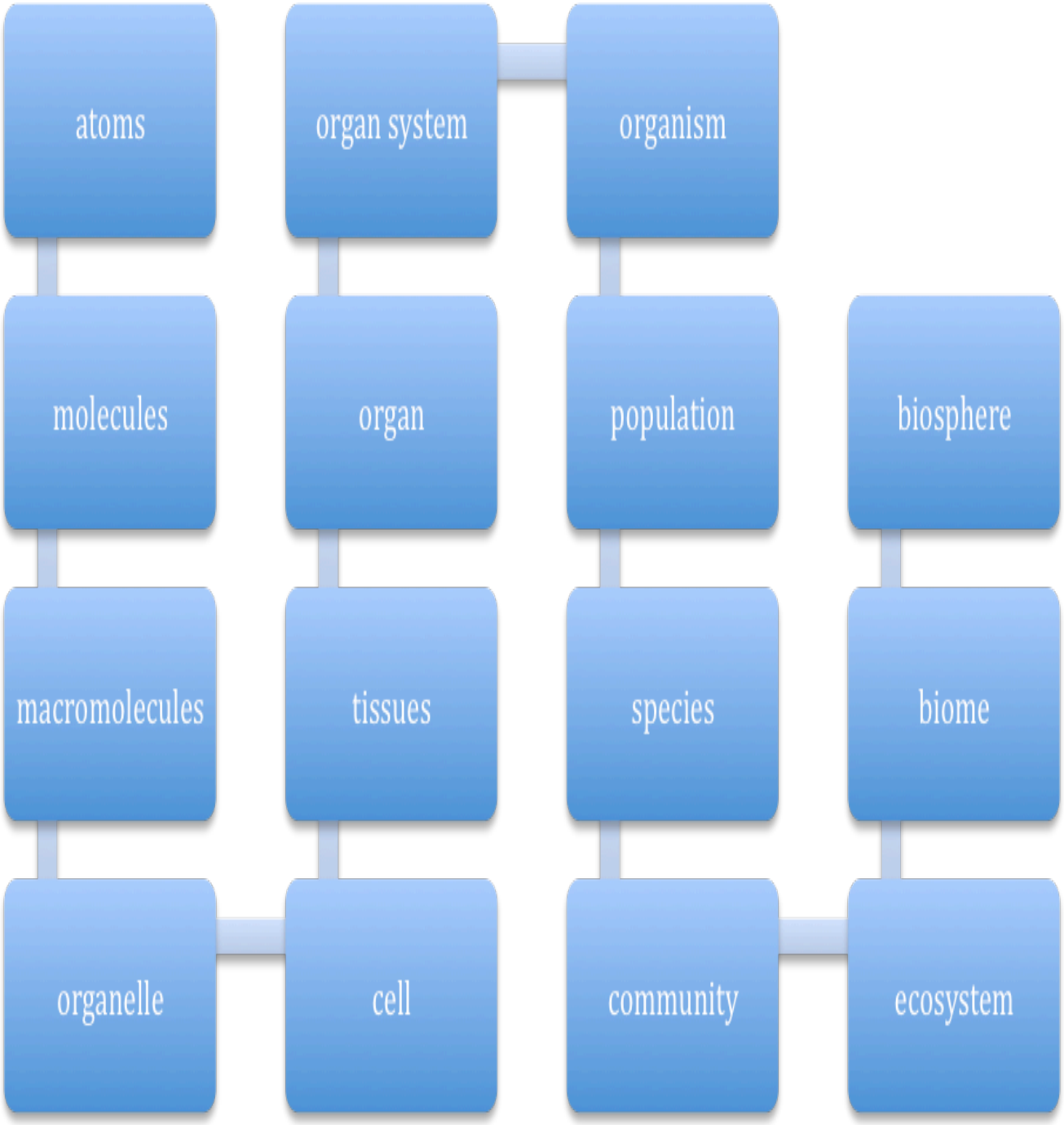
Living organisms function and interact with each other at many levels. These levels are organized in a hierarchy of increasing complexity

- Cellular Level
- Organismal Level
- Populational Level

Each higher level contains novel properties not present at the simpler level of organization

- These properties are termed emergent properties

The Organization of Life



5 general themes unify and explain biology as a science

1. Evolution
2. Energy flow
3. Structure determines function
4. Cooperation
5. homeostasis

1. **Evolution:** The genetic change in a species over time
   It is a result of a process termed natural selection
   Variation may also be caused by artificial selection

2. **The Flow of Energy:** All living organisms require energy
   The sun is the source of energy for ecosystems.
   Plants capture energy via photosynthesis.
   They then act as an energy source for other organisms

3. **Cooperation:** Cooperation between organisms is critical for evolution. Symbiosis occurs when two organisms of different species live in direct contact.

4. **Structure Determines Function:** Biological structures are well suited to their function. This is true at every level of organization.

5. **Homeostasis:** All living organisms act to maintain a relatively stable internal environment. Maintaining homeostasis requires a lot of signaling back-and-forth between cells.

Stages of Scientific Investigation

- Facts, Hypotheses and Theories.
- Observable, verifiable truths are facts.
- Testable explanations for them are hypotheses.
- Well, supported hypotheses are theories.

Theory and Certainty

Theory: a set of hypotheses that have been tested many times and not rejected

It indicates a higher degree of certainty

However, there is no absolute truth in science

So the acceptance of a theory is provisional

To scientists, a theory represents that of which they are most certain.

To the general public, a theory represents lack of knowledge or a guess

The scientific "method": A series of logical "either/or" predictions tested by experiments to reject alternative hypotheses

Four Theories Unify Biology

1. The Cell Theory
2. The Gene Theory
3. The Theory of Heredity
4. The Theory of Evolution

The Cell Theory: Organization of Life	Robert Hooke, 1665: Discovered cells Anton van Leeuwenhoek, 1670s. Discovered single-celled life Matthias Schleiden & Theodor Schwann, 1839 All living organisms are composed of cells Cells are the basic units of life Rudolf Virchow, 1866. All cells come from other cells
The Gene Theory: Molecular Basis of Inheritance	The information that determines what an organism is like is encoded in its genes Genes are located along DNA molecules The entire set of DNA instructions that specifies a cell is termed its genome
The Theory of Heredity: Unity of Life	1st advanced by Gregor Mendel in 1865 genes are inherited as discrete units Later, others proposed the chromosomal theory of inheritance . Genes are physically located on chromosomes
The Theory of Evolution: Diversity of Life	1st advanced by Charles Darwin in 1859 diversity of living world due to natural selection "descent by modification" All living organisms are related to one another in a common tree of life

Biologists divide all living organisms into domains