



جامعة الأميرة نورة بنت عبدالرحمن  
Princess Nourah bint Abdulrahman University

# Introduction: Themes in the Study of Life

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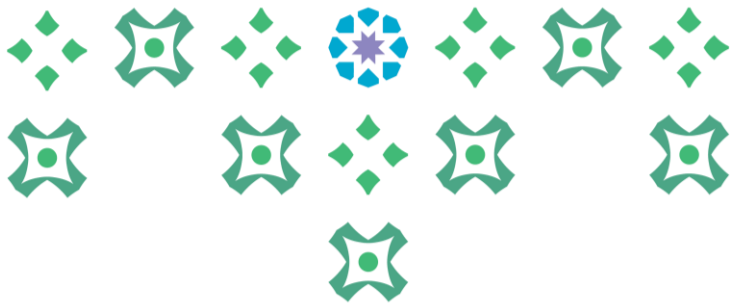
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## Definition:

### Biology:

Is the scientific study of life.

### Biologist:

Scientist who conduct research in Biology.

### Life:

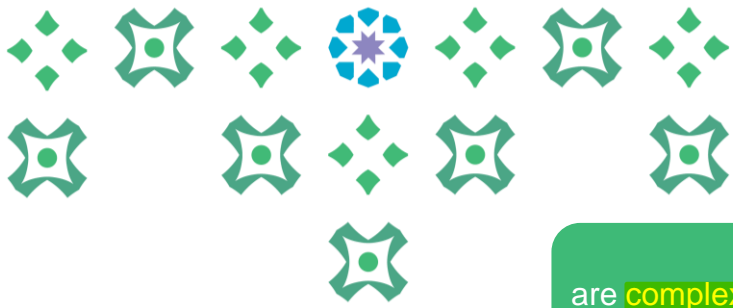
What living things do.



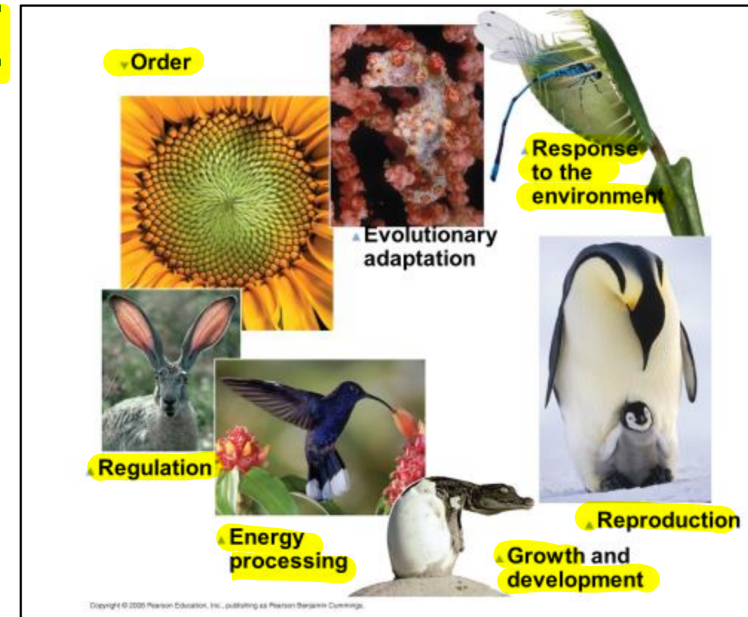
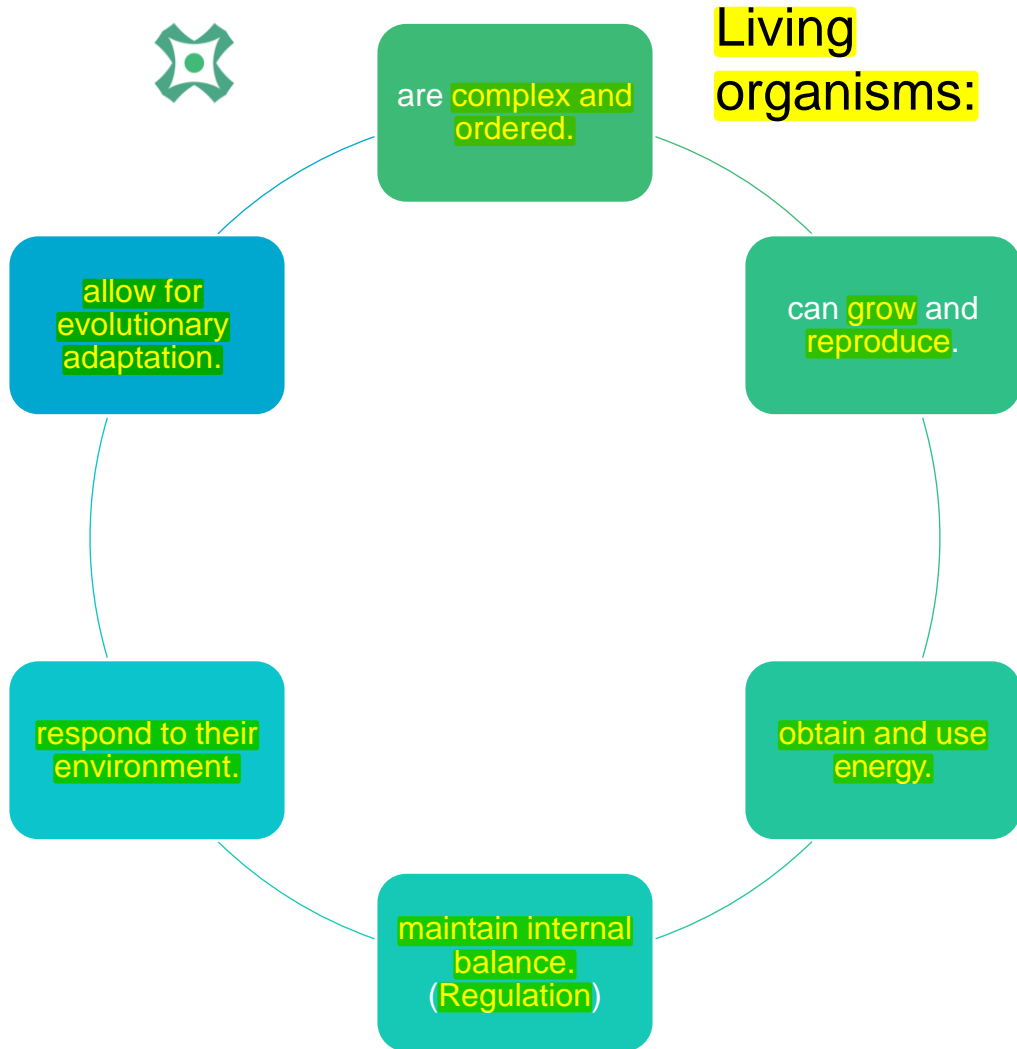
#### Lecture 1: Themes in the Study of Life

**Biology** is the scientific study of life. Biologists' questions can be ambitious. They may ask how a single tiny cell becomes a tree or, how the human mind works, or how the different forms of life in a forest interact. At the most fundamental level, we may ask: **What is life?** Even a child realizes that a dog or a plant is alive, while a rock or a car is not. Yet the phenomenon we call life defies a simple, one-sentence definition. We recognize life by what living things do.





# The Properties of LIFE



## THE PROPERTIES OF LIFE:

1-**Order**: This close-up of a sunflower illustrates the highly **ordered** structure that characterizes life.

2-**Regulation**: The regulation of blood flow through the blood vessels of this jackrabbit's ears helps maintain a **constant body temperature** by adjusting **heat exchange** with the surrounding air.

3-**Reproduction**: Organisms (living things) reproduce their own kind.

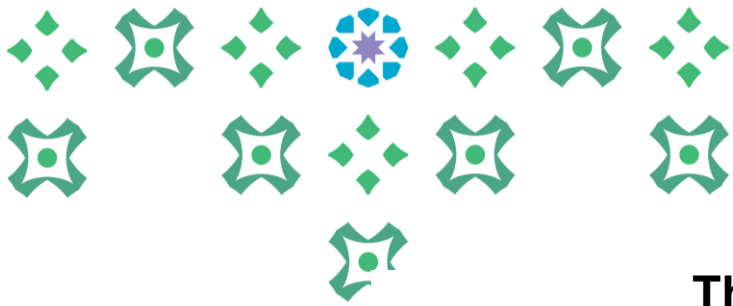
4-**Evolutionary adaptation**: The appearance of this pygmy sea horse camouflages the animal in its environment. Such adaptations evolve over many generations by the reproductive success of those individuals with heritable traits that **are best suited to their environments**.

5-**Energy processing**: This butterfly obtains **fuel** in the form of **nectar** from flowers. The butterfly will use **chemical energy** stored in its food to power flight and other works.

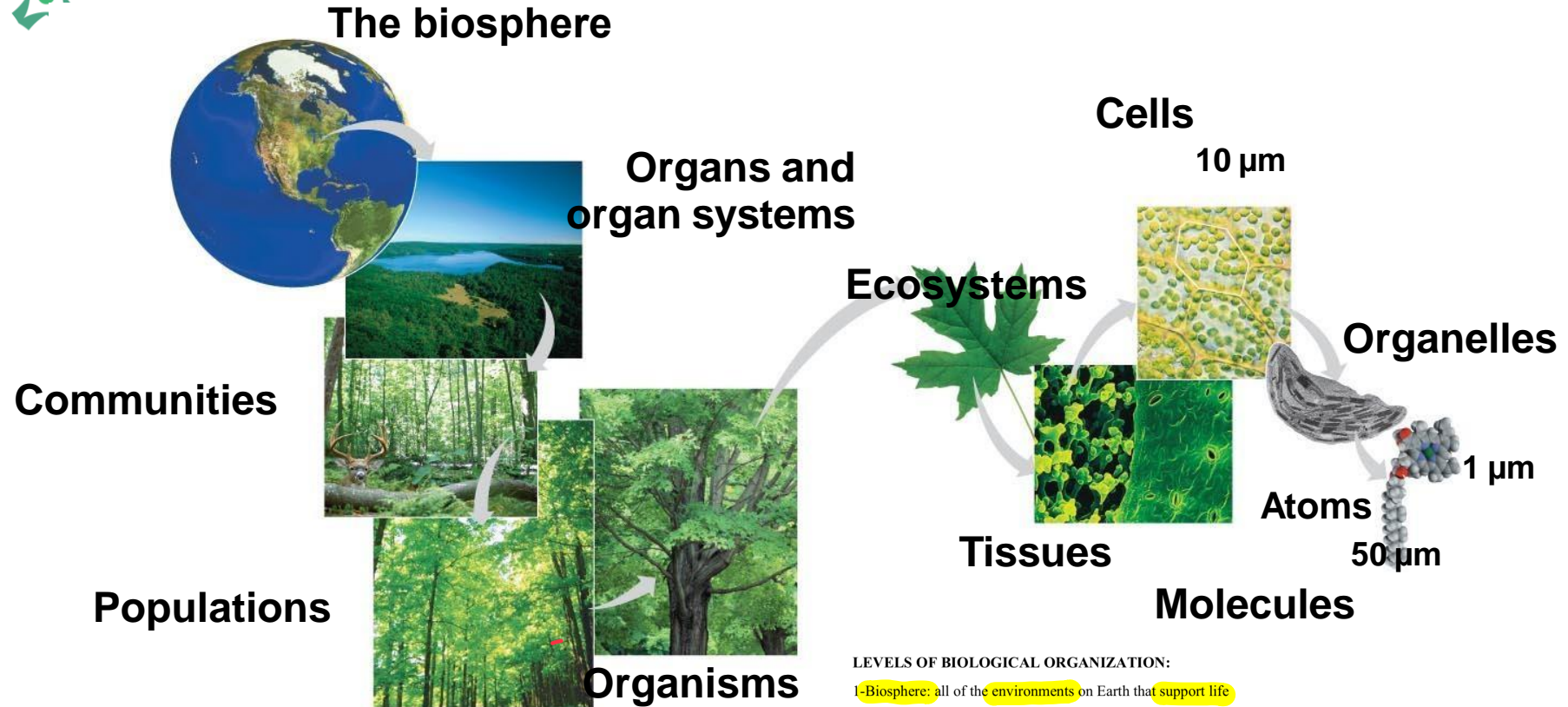
6-**Response to the environment**: This Venus flytrap closed its trap rapidly in response to the environmental stimulus of a damselfly landing on the open trap.

7-**Growth and development**: **Inherited information carried by genes** controls the pattern of **growth and development of organisms**, such as this oak seedling (Figure 1)





# Levels of Biological Organization



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## LEVELS OF BIOLOGICAL ORGANIZATION:

1-Biosphere: all of the environments on Earth that support life

2-Ecosystem: all the organisms living in a particular area and the physical components with which the organisms interact

3-Community: the entire array of organisms living in a particular ecosystem

4-Population: all the individuals of a species living in a specific area

5-Organisms: Individual living things are called organisms. Each of the maple trees and other plants in the forest is an organism.

6- Organs and Organ Systems: each a team of organs that cooperate in a larger function. Organs consist of multiple tissues. A maple leaf is an example of an organ, a body part that carries out a particular function in the body. Stems and roots are the other major organs of plants. The organs of complex animals and plants are organized into organ systems.

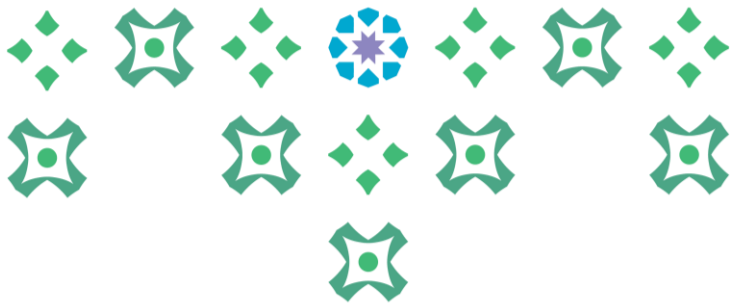
7- Tissues: Each tissue is a group of cells that work together, performing a specialized function.

8- Cells: The cell is life's fundamental unit of structure and function. Some organisms are single cells, while others are multicellular. A single cell performs all the functions of life, while a multicellular organism has a division of labor among specialized cells.

9-Organelles: a membrane-enclosed structure that performs a specific function within a cell. Chloroplasts are examples of organelles.

10 -Molecules: A molecule is a chemical structure consisting of two or more units called atoms. Chlorophyll is the pigment molecule that makes a maple leaf green, and it absorbs sunlight during photosynthesis.

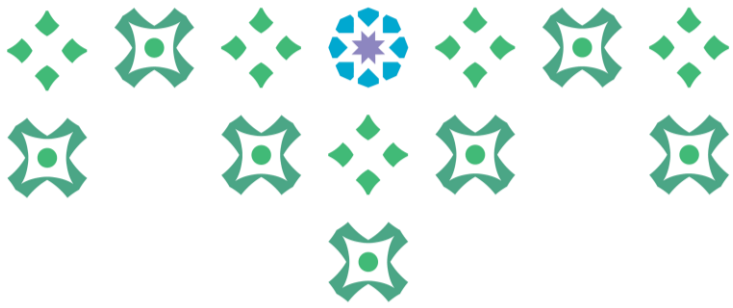




## Domains of Life

- **Domain Bacteria** and **domain Archaea** comprise the **prokaryotes**
- **Domain Eukarya** includes **all eukaryotic organisms**





# Domain Eukarya

- The domain Eukarya includes three multicellular kingdoms:
  - **Plantae**
  - **Fungi**
  - **Animalia**
- Other eukaryotic organisms were formerly grouped into a kingdom called **Protista**, though these are now often grouped into many separate kingdoms



Protists



Kingdom Fungi



Kingdom Plantae



Kingdom Animalia

(c) DOMAIN EUKARYA

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## **THEMES IN BIOLOGY:**

### 5 unifying themes in Biology

- ✓ **Life evolves.** (e.g. **Antibiotic resistance** in bacteria evolves in response to the overuse of antibiotics.)
- ✓ Within **biological systems**, **structure** (the **shape of something**) and **function** (what it does) are **often related**.
- ✓ Life's processes involve the expression and transmission of genetic information. - **The unity of life is based on DNA and a common genetic code**
- ✓ Life requires the transfer and transformation of **energy and matter**.
- ✓ organisms **interact with their environments** - other **organisms** and **physical factors**

## Organizing The Diversity of Life:

Approximately 1.8 million species have been identified and named to date, and thousands more are identified each year.

Estimates of the total number of species that actually exist range from 10 million to over 100 million.

**Taxonomy** is the **branch of biology** that **names and classifies species** into **groups** of increasing breadth

Domains, followed by kingdoms, are the broadest units of classification

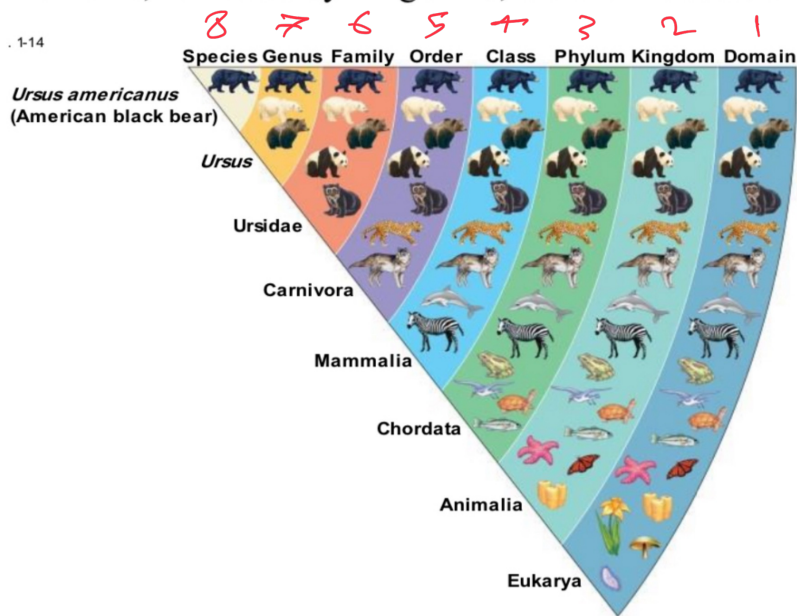


Figure 3: Classifying life

- ❖ The **three-domain system** is currently used, and replaces the old five-kingdom system
- ❖ **Domain Bacteria** and **domain Archaea** comprise the **prokaryotes**
- ❖ **Domain Eukarya** includes **all eukaryotic organisms**.



The domain Eukarya includes three multicellular kingdoms:

- ✓ Plantae
- ✓ Fungi
- ✓ Animalia

Other eukaryotic organisms were formerly grouped into a kingdom called Protista, though these are now often grouped into many separate kingdoms

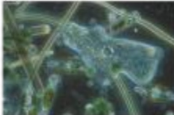
(a) DOMAIN BACTERIA



(b) DOMAIN ARCHAEA



(c) DOMAIN EUKARYA



Protists



Kingdom Fungi



Kingdom Plantae



Kingdom Animalia