

## **Chapter 1**

### **Lecture 1**

## **What is Life?**

## Characteristics of Life

- A high degree of organization
- Containing materials found only in living organisms
- Acquiring and using energy
- Maintaining homeostasis (a constant internal environment)
- Sensing the environment
- Responding to external stimuli
- Adapting to the environment
- Altering the environment
- Reproducing

# Characteristics of life Table 1.1

Respond to external stimuli

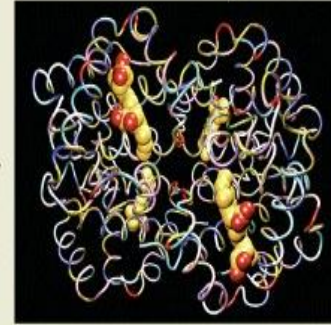


Adapt to the environment



Masterfile

Contain materials found only in living organisms



Tim Evans/Photo Researchers, Inc.

Interact with the environment



Use energy



Skip Brown/NG Image Collection

Maintain a constant internal environment (homeostasis)



Stacy Gold/NG Image Collection

Interact with the environment



Reproduce



Richard Lord/The Image Works

Have a high degree of organization

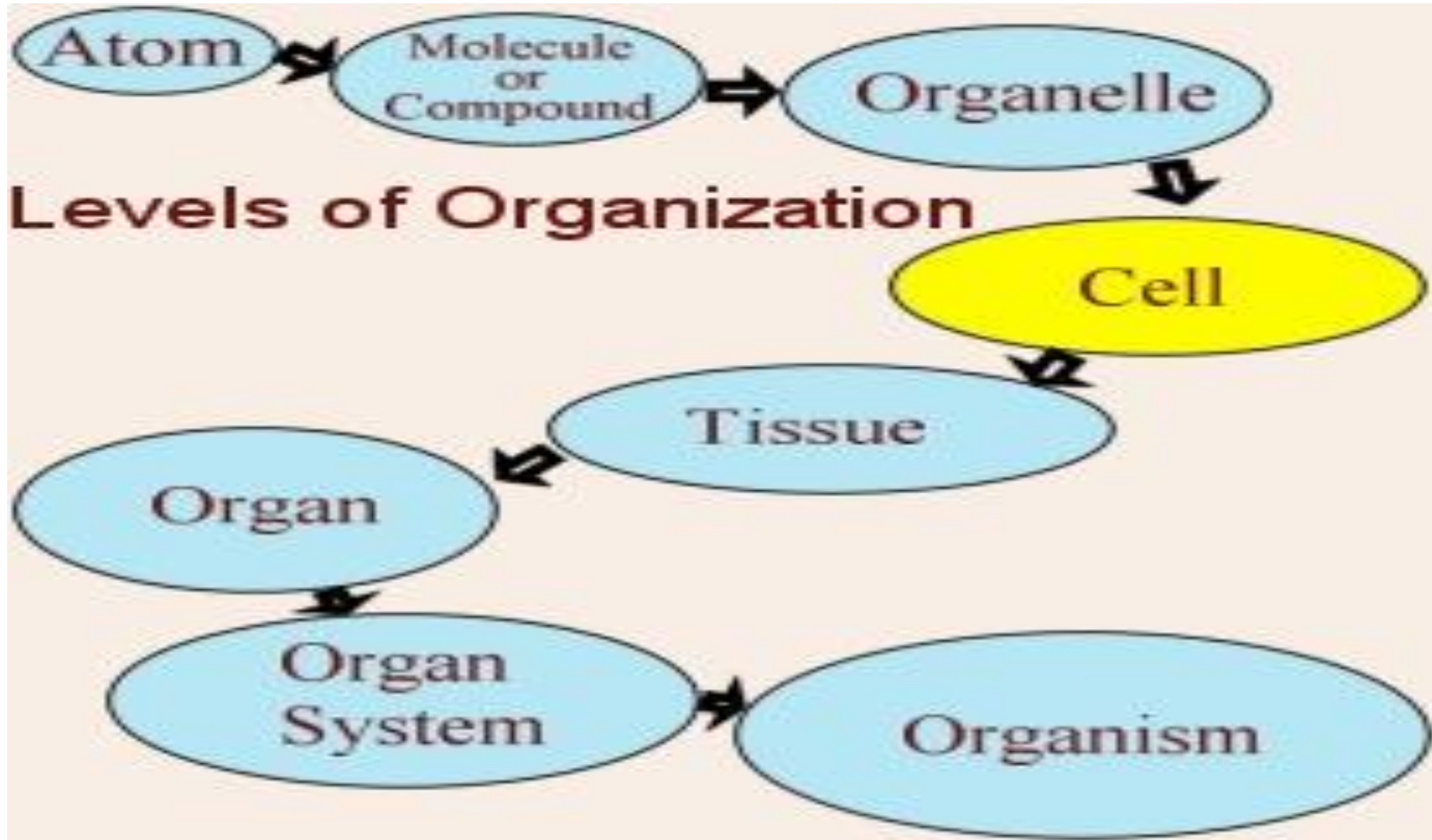


Rubberball Productions/Getty Images

## Living Organisms Have a High Degree of Organization

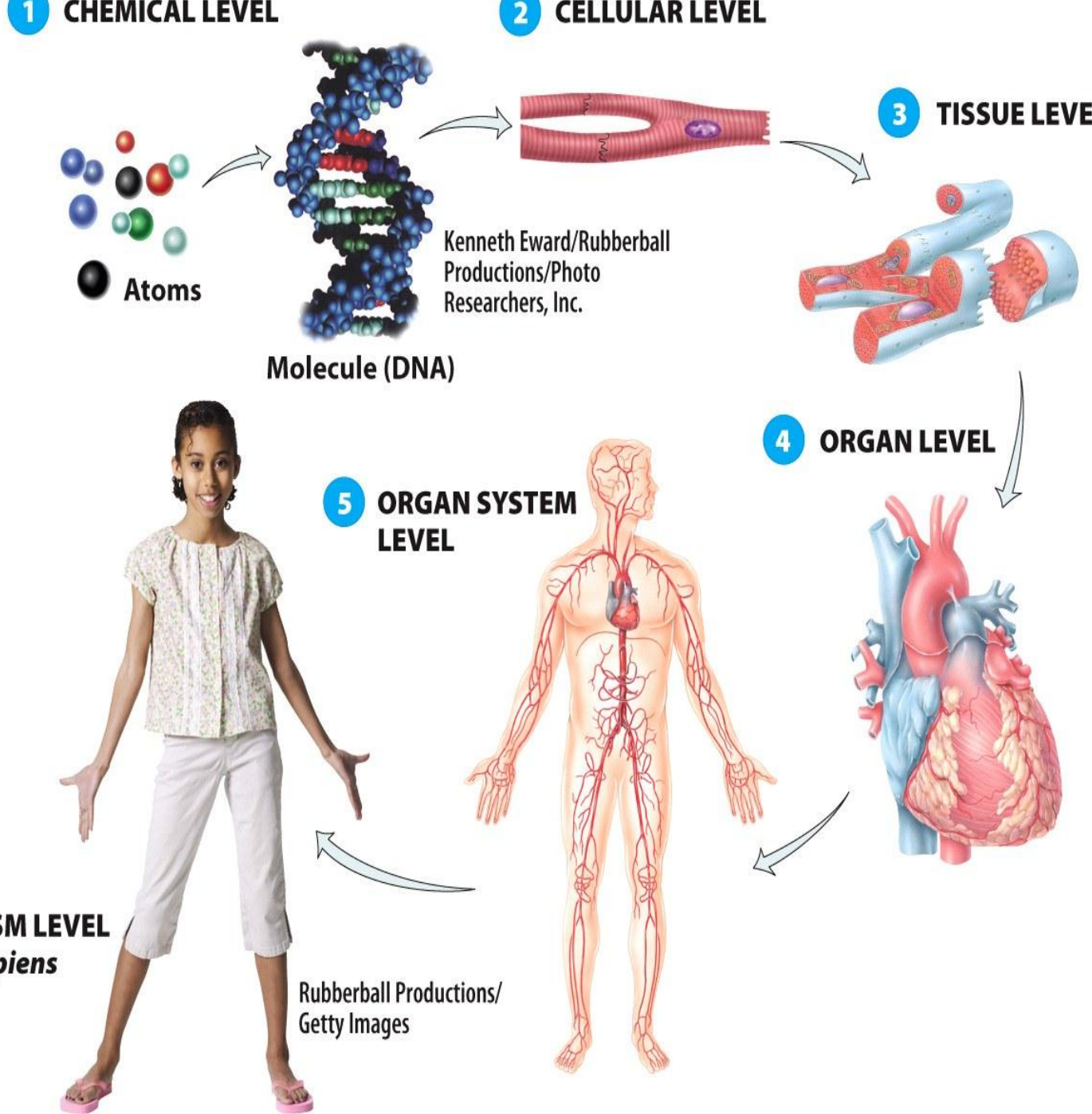
- **Cells** – **smallest unit of life** – contained within a plasma membrane
  - For example, a muscle cell
- **Tissue** – **a cohesive group of similar cells performing a specific function**
  - For example, muscle tissue
- **Organ** – **structure composed of more than one tissue**
  - For example, the heart
- **Organ systems** – **a group of organs that perform a broad biological function**
  - For example, the cardiovascular system
- **Organism** – **one living individual composed of a group of organ systems**
  - The organ systems function cooperatively toward maintaining the life and existence of that individual
  - For example, a human

## Levels of organization





## Hierarchy of Organization of Life



## Living Things Must Maintain Homeostasis

- *Homeo = unchanging*
- *stasis = standing*
  - Therefore – homeostasis means “staying the same”
- Because humans function properly only within narrow ranges of temperature and chemistry
  - Homeostasis can be more fully defined as the condition in which the body’s internal environment remains relatively constant and within physiological limits
- Homeostasis is controlled by both **conscious and unconscious** responses
  - *For example*, humans maintain body warmth by unconscious blood vessel constriction and by consciously selecting appropriate clothing

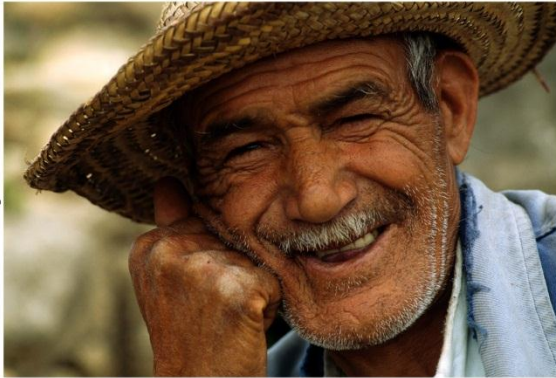
## Human Biology is Structured and Logical

- The natural world seems overwhelming and chaotic until we organize it
- Biology is organized into steps from the microscopic to macroscopic levels
- Small units make up larger units – which in turn form still larger units
- **Artificial classification (aka, Taxonomy)**
  - Uses a system of names to identify organisms and shows their relationships
  - Groups organisms based on similar characteristics
  - Kingdom, phylum, class, order, family, genus, species
- **Natural organization emerges from the structure of organisms**
  - It is a system based on increasing structural complexity
  - Each level in the hierarchy is composed of groups of similar units from the previous level
  - Atoms, molecules, cells, tissues, organs, organ systems, organism



## Hierarchy of Life Beyond the Individual

James L. Stanfield/NG Image Collection



Raga Jose Fuste/Prisma/SuperStock



Dugald Bremner/NG Image Collection



Raymond Gehman/NG Image Collection



Todd Gipstein/NG Image Collection



## Biological Classification is Logical

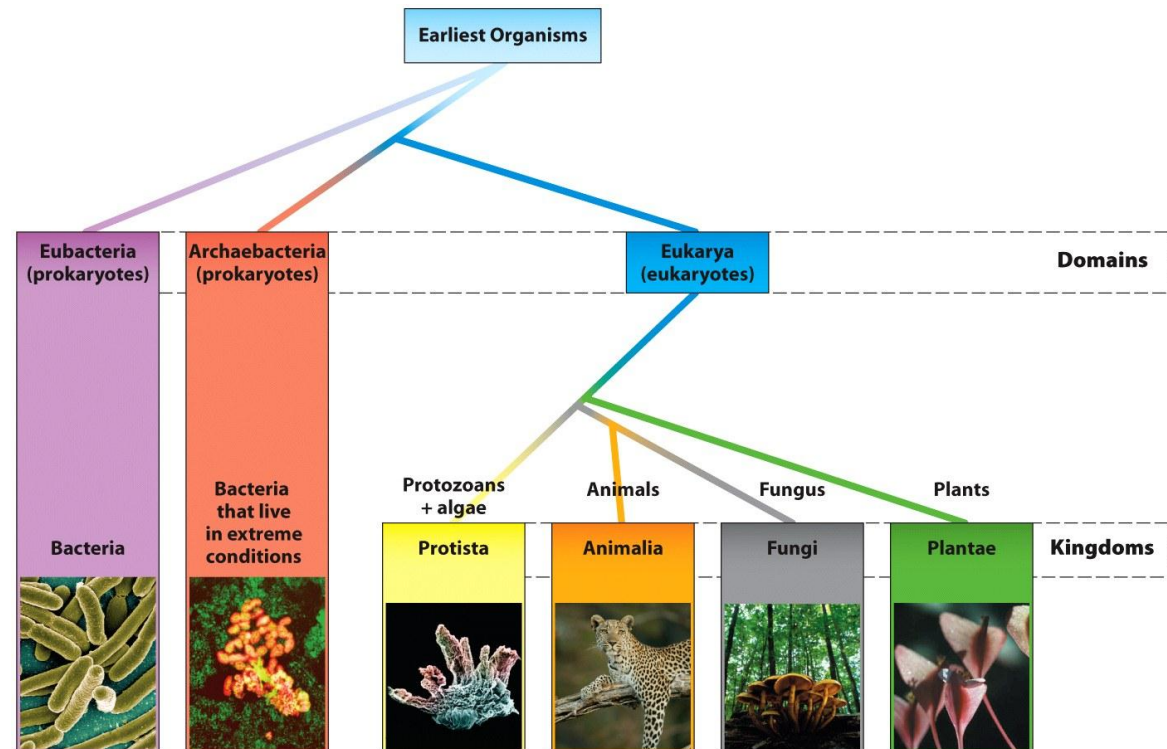
- Taxonomy is a branch of science which classifies organisms into groups with similar characteristics
- Taxonomy identifies...

### 1. THREE Domains

- Eubacteria
- Archaeobacteria
- Eukarya

### 2. SIX Kingdoms

- Archaeobacteria
- Eubacteria
- Protista
- Fungi
- Plantae
- Animalia



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## A Hierarchy of Similarity

- Each category defines organisms more tightly, thus resulting in a hierarchy of **similarity**
  - Kingdom
  - Phylum
  - Class
  - Order
  - Family
  - *Genus*
  - *species*\*
- **\*species implies reproductive isolation**
  - Members of a particular species can produce viable and fertile offspring only if they breed with each other (with very few exceptions)





## KINGDOM

**Animalia**  
(all multicellular organisms that ingest nutrients rather than synthesize them)



## PHYLUM

(all animals with a vertebral column or dorsal hollow notocord—a structure along the back of animals—that protects their central nervous system)



## CLASS

**Mammalia**  
(all vertebrates with placental development, mammary glands, hair or fur, and a tail located behind the anus)



## ORDER

**Primates**  
(mammals adapted for life in trees, with opposable thumbs)

# Human Taxonomy



## FAMILY

**Hominidae**  
(primates that move primarily with bipedal—two-footed—locomotion)



## GENUS

***Homo***  
(hominids with large brain cases, or skulls)



## SPECIES

(The only living organisms in the genus *Homo*, with a unique set of combined characteristics from our order [bipedal], order [opposable thumb], and genus [large brain case])