

Structural Organization of Living Things (Biota)

by
Ellen Deehan, M.S.

Biologists describe and study life (biota) at several levels of structural organization, which are arranged in a hierarchical fashion from large biological structures (e.g., all life on Earth) to small biological structures (e.g., cells).

Most of us relate best to the level of biological structure called an *organism*, because each of us is an individual organism. When studying life science, students sometimes have difficulty remembering what level of biological structure is being discussed in each classroom activity.

**Knowing the levels of biological organization
(in Tables I-a & I-b)
can be crucial to reducing student confusion
in life science.**

Tables I-a and I-b are best used by starting at *organism* and either working down to smaller and smaller structures that make up each organism (I-a), or working up to larger and larger structures composed of many organisms (I-b).

Table I-a. Hierarchy of internal structures of multicellular creatures. Biologists study the bodies of plants and animals at several levels of biological organization. This table is best used by starting at *organism* and working down through smaller and smaller structures that make up an organism.

Level of Biological Organization	Description	Animal Examples	Plant Examples
ORGANISM	One individual of a species	You!	California Poppy
Body Systems	Organs that work together within an animal	Circulatory system Respiratory system Digestive system Urinary system	[Not Applicable]
Organs	A part of an organism with a special function	Heart Lungs Stomach	Flower Leaf Stem Root
Tissues	Several types of cells that work together	Blood Muscle Nerve	Epidermis Xylem Phloem
Cells	Smallest independent unit of life	Red blood cell White blood cell Brain cell	Guard cell Vessel Root hair
Organelles	Small membrane-bound structures within a cell	Mitochondria	Chloroplasts Mitochondria
Molecules	Chemical compound	Water Sugar Carbohydrate Protein Fat	Water Carbon dioxide Chlorophyll Oxygen gas Sugar
Atoms	Chemical element	Carbon atom Hydrogen atom Oxygen atom	Carbon atom Hydrogen atom Oxygen atom
Subatomic	Particles that make an atom	Electron Proton Neutron	Electron Proton Neutron

Table I-b. Hierarchy of ecological structures composed of many living organisms (biota). Biologists study how plants and animals interact with each other and with their environment. This table is best used by starting at *organism* and working up through larger and larger structures composed of many organisms.

Level of Biological Organization	Description	Animal Examples	Plant Examples
Biosphere*	All living creatures on the planet (on land and in water)	All biomes on Earth	All biomes on Earth
Biome*	All communities within a regional vegetation type	Catalina Island is in a chaparral biome	San Francisco Bay Area is in an oak savanna biome
Biological Community*	All populations of all species present in a given area	All species of plants and animals living on Catalina Island	All species in a meadow near San Francisco Bay
Population	All individuals of one species in an area (area can be defined to be small to large)	All people living on Catalina Island	All California poppies in a meadow near San Francisco
ORGANISM	One individual of a species	You!	California Poppy

*Note that the levels of *community*, *biome*, and/or *biosphere* can also be described as *ecosystems* when we are referring to both the *biotic* and *abiotic*¹ components of the environment.

The following table (Table II) combines simplified versions of Tables I-a and I-b to show how organisms fit into the full hierarchical structure of biology. Table II can be a useful reminder for teachers and students.

¹ *Abiotic* means nonliving (such as: water, rock, air, light); *biotic* means living and/or once-living.

Table II. Full hierarchical structure of biology. This table is best used by starting at *organism* and working either: 1. down through smaller and smaller structures that make up an organism; or 2. up through larger and larger structures composed of many organisms.

Level of Biological Organization	Description	Animal Example	Plant Example
Biosphere*	All life on Earth	All life on Earth	All life on Earth
Biome*	Regional communities	Regional communities	Regional communities
Biological Community*	All species in an area	All species in an area	All species in an area
Population	All individuals of one species in an area	All people in an area	All California poppies in an area
ORGANISM	One individual of a species	You!	California Poppy
Body Systems	Organs that work together	Circulatory system	N/A
Organs	Structure with a special function	Heart	Stem
Tissues	Cells that work together	Blood	Xylem
Cells	Smallest independent unit of life	White blood cell	Vessel
Organelles	Structure within a cell	Mitochondria	Chloroplasts
Molecules	Chemical compound	Water	Chlorophyll
Atoms	Chemical element	Hydrogen atom	Magnesium atom
Subatomic	Particles in atom	Electron	Proton

*Note that the levels of *community*, *biome*, and/or *biosphere* can also be described as *ecosystems* if we are referring to both the *biotic* and *abiotic* components of the environment.