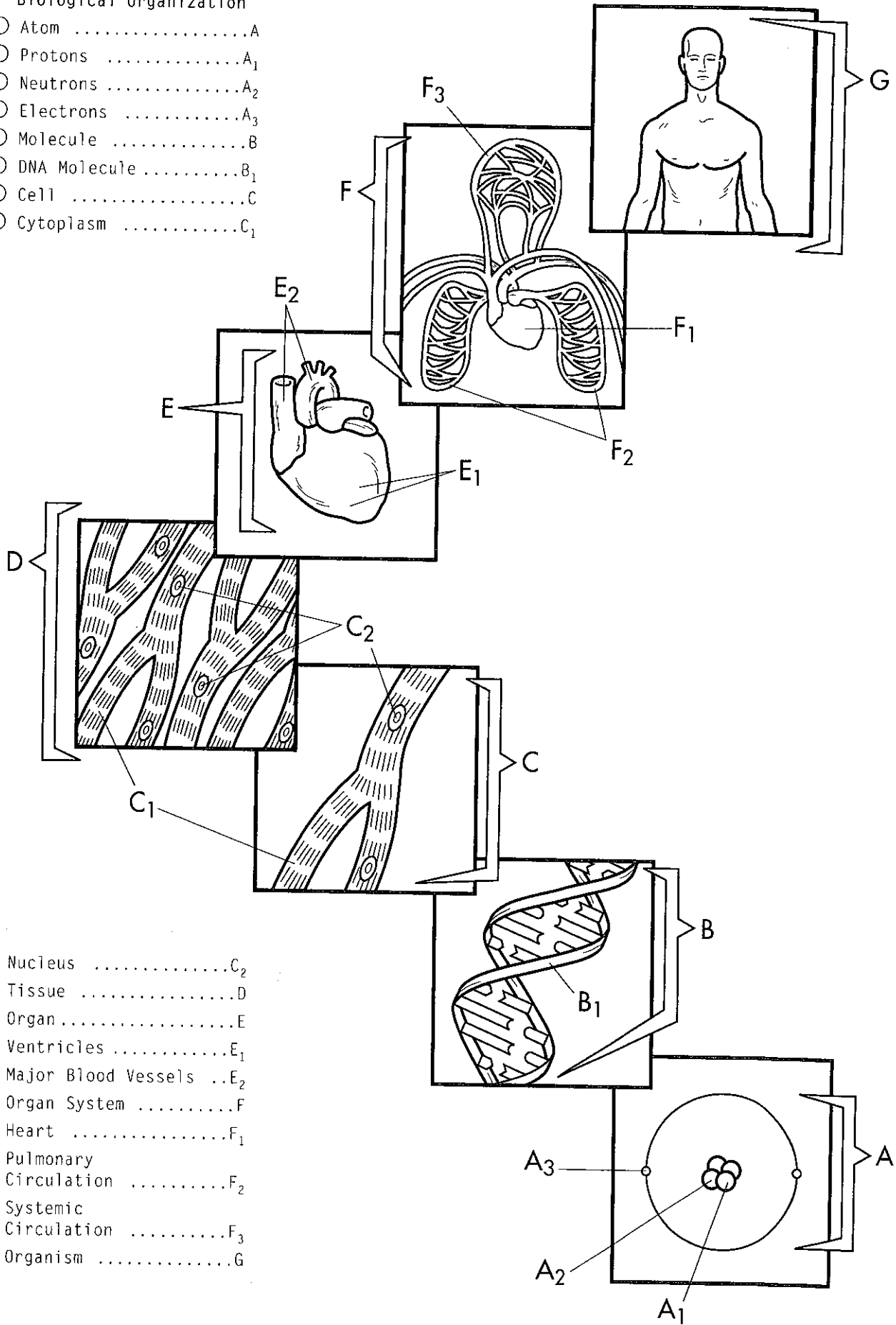


Biological Organization

Biological Organization

- AtomA
- ProtonsA₁
- NeutronsA₂
- ElectronsA₃
- MoleculeB
- DNA MoleculeB₁
- CellC
- CytoplasmC₁



- NucleusC₂
- TissueD
- Organ.....E
- VentriclesE₁
- Major Blood Vessels ..E₂
- Organ SystemF
- HeartF₁
- Pulmonary CirculationF₂
- Systemic CirculationF₃
- OrganismG

Chapter 1-2: Biological Organization

Organization in living things exists in a hierarchical structure. Organization exists within organisms, as we will discuss in this plate, and also within environments; this will be covered in the ecology chapter.

In this plate, we will show the hierarchy of organization that exists in a human. We will begin with the most basic level of organization at the bottom of the plate, and show the increasing complexity as we move up.

The most fundamental level of organization on Earth is the atom. All matter in the universe is composed of atoms. There are ninety-two naturally occurring elements, each of which is made up of a distinct atom. About 99% of the atoms in living things are carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorous.

At the bottom of the plate we show a typical **atom (A)**; you should color the bracket in a bold color such as dark red or green. The atom consists of positively charged particles called **protons (A₁)** and uncharged particles, or **neutrons (A₂)**. These particles are surrounded by **electrons (A₃)**, which have a negative charge. Elements vary according to the number of protons present in the nuclei of their atoms. An atom of carbon, for example, has six protons in its nucleus, while an atom of oxygen has eight protons.

Atoms join to form the **molecule (B)**. A molecule consists of various kinds of atoms bonded to one another. In the plate, we show a **DNA molecule (B₁)**, which is involved in heredity. It is composed of atoms of carbon, hydrogen, oxygen, and nitrogen and phosphorus. The atoms are linked and wound to form the familiar spiral staircase (double helix) of the DNA molecule. A light color should be used for it.

The most basic unit of life is the **cell (C)**. In the plate, we show a muscle cell, which has both **cytoplasm (C₁)** and a **nucleus (C₂)**. The cell is composed of molecules of protein, carbohydrate, lipid, and nucleic acid. It is long and slender in shape, and contracts to create movement. The human body consists of approximately 100 trillion cells.

Atoms and molecules are inert, but the cell is alive and has the properties of a living thing, which were discussed in the previous plate. We will now progress to the next level to see how cells are organized.

In some cases, cells operate independently. These are unicellular organisms, which include bacteria and protozoa. In humans, cells are generally grouped together to form tissues. In the plate, you can see one section of a typical **tissue (D)** outlined by the bracket. When muscle cells contract in unison, the entire muscle contracts. Other types of body tissues are nervous tissue, epithelial tissue, and connective tissue. They are discussed in a future plate, titled Cell Types and Tissues.

When various tissues join with one another, they can form an **organ (E)**. In this plate, we show the heart as a typical organ. The heart has two pumping chambers called **ventricles (E₁)**. Carrying blood to and from the ventricles are the **major blood vessels (E₂)**. Arteries take blood away from the heart to the body and veins bring blood back to it. The heart contains various types of tissues: muscle tissue that allows contraction, nerve tissue that controls the contraction rate, and membranous tissue that encloses it.

Various organs in combination are called an **organ system (F)**. An example of an organ system is the circulatory system. It consists of the **heart (F₁)** and numerous blood vessels. Certain of these blood vessels carry blood to and from the lungs and compose the **pulmonary circulation (F₂)**, while other vessels carry blood to and from the other sections of the body and compose the **systemic circulation (F₃)**. Another organ system is the digestive system. Organs in this system include the esophagus, stomach, pancreas, small and large intestines, and liver.

The highest level of biological organization is the **organism (G)**. It is composed of numerous organ systems, including the digestive, nervous, circulatory, respiratory, excretory, and reproductive systems. The organ systems work closely together.

Biological organization can also be studied at the level of ecology, which we will discuss later in the book. A number of organisms grouped together constitute a population, and various populations form a community.

Chapter 1 Coloring Book

1-2 Biological Organization

- a. In what type of structure does organization exist in living things:
- b. What is the most fundamental level of organization of life on Earth?
- c. How many naturally occurring elements exist?
- d. About 99% living things are composed of what five atoms?
- e. Positively charged particles are called? Uncharged particles? Negatively charged particles?
- f. Atoms join to form:
- g. The most basic unit of life:
- h. What four compounds make up a cell?
- i. How many cells does the human body contain?
- j. What kind of organism has cells that operate independently?
- k. Cells generally join to form:
- l. When various tissues join with one another, they can form a(n):
- m. Various organs in combination are called a(n):
- n. The highest level of biological organization:
- o. Organisms group together to form a _____, which can then form _____.