

## 8.3: Organs and Organ Systems

# Organ Systems and Organs

Before one can understand how xenobiotics affect these different body components, it's important to understand normal body components and how they function. For this reason, this section provides a basic overview of anatomy and physiology as it relates to toxicity mechanisms.

## Basic Body Structure and Organization

We can think of the basic structure and functional organization of the human body as a pyramid or hierarchical arrangement in which the lowest level of organization (the foundation) consists of cells and chemicals. Organs and organ systems represent the highest levels of the body's organization (Figure 1).

Figure 8.3.1. Pyramid represents a hierarchical organization of human body components  
(Image Source: NLM)

Simplified definitions of the various levels of organization within the body are:

- **Organ system** — a group of organs that contribute to specific functions within the body. Examples include:
  - Gastrointestinal system
  - Nervous system
- **Organ** — a group of tissues precisely arranged so that they can work together to perform specific functions. Examples include:
  - Liver
  - Brain
- **Tissue** — a group of cells with similar structure and function. There are only four types of tissues:
  1. Epithelial
  2. Connective
  3. Muscle
  4. Nerve
- **Cell** — the smallest living units in the body. Examples include:
  - Hepatocyte
  - Neuron
- **Chemicals** — atoms or molecules that are the building blocks of all matter. Examples include:
  - Oxygen
  - Protein

## Organ Systems of the Human Body

The human body consists of eleven organ systems, each of which contains several specific organs. An organ is a unique anatomic structure consisting of groups of tissues that work in concert to perform specific functions. Table 1 includes the structures and functions of these eleven organ systems.

Organ Systems of the Human Body		
The human body consists of eleven <u>organ systems</u> , each of which contains several specific <u>organs</u> . An <u>organ</u> is a unique anatomic structure consisting of groups of <u>tissues</u> that work in concert to perform specific functions. Table 1 includes the structures and functions of these eleven <u>organ systems</u> .		
Organ System	Functions	Organs
	<ul style="list-style-type: none"> <li>• Barrier to invading organisms and <u>chemicals</u></li> </ul>	<ul style="list-style-type: none"> <li>• Skin</li> <li>• Hair</li> </ul>

<b>Integumentary</b>	<ul style="list-style-type: none"> <li>• Temperature control</li> </ul>	<ul style="list-style-type: none"> <li>• Subcutaneous tissue</li> </ul>
<b>Skeletal</b>	<ul style="list-style-type: none"> <li>• Supports and moves body</li> <li>• Protects internal organs</li> <li>• Mineral storage</li> <li>• Blood formation</li> </ul>	<ul style="list-style-type: none"> <li>• Bones</li> <li>• Cartilage</li> <li>• Ligaments</li> <li>• Bone marrow</li> </ul>
<b>Muscular</b>	<ul style="list-style-type: none"> <li>• Locomotion</li> <li>• Heat production</li> </ul>	<ul style="list-style-type: none"> <li>• Muscles</li> <li>• Tendons</li> </ul>
<b>Nervous</b>	<ul style="list-style-type: none"> <li>• Coordinates activities of other organ systems</li> <li>• Responds to sensations</li> </ul>	<ul style="list-style-type: none"> <li>• Brain</li> <li>• Spinal cord</li> <li>• Nerves</li> <li>• Eyes</li> <li>• Ears</li> </ul>
<b>Endocrine</b>	<ul style="list-style-type: none"> <li>• Regulates body functions by chemicals (<i>hormones</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• Pituitary gland</li> <li>• Parathyroid gland</li> <li>• Thyroid gland</li> <li>• Adrenal gland</li> <li>• Thymus</li> <li>• Pancreas</li> <li>• Gonads</li> </ul>
<b>Cardiovascular</b>	<ul style="list-style-type: none"> <li>• Transports oxygen and nutrients to tissues</li> <li>• Removes waste products</li> </ul>	<ul style="list-style-type: none"> <li>• Heart</li> <li>• Blood</li> <li>• Blood vessels</li> </ul>
<b>Lymphatic</b>	<ul style="list-style-type: none"> <li>• Returns tissue fluid to blood</li> <li>• Defends against foreign organisms</li> </ul>	<ul style="list-style-type: none"> <li>• Spleen</li> <li>• Lymph nodes</li> <li>• Thymus</li> <li>• Lymphatic vessels</li> </ul>
<b>Respiratory</b>	<ul style="list-style-type: none"> <li>• Oxygen/carbon dioxide exchange</li> </ul>	<ul style="list-style-type: none"> <li>• Lungs</li> <li>• Trachea</li> <li>• Larynx</li> <li>• Nasal cavities</li> <li>• Pharynx</li> </ul>
<b>Digestive</b>	<ul style="list-style-type: none"> <li>• Processes foods</li> <li>• Absorption of nutrients into body</li> </ul>	<ul style="list-style-type: none"> <li>• Stomach</li> <li>• Intestinal tract</li> <li>• Liver</li> <li>• Pancreas</li> <li>• Esophagus</li> <li>• Salivary glands</li> </ul>
<b>Urinary</b>	<ul style="list-style-type: none"> <li>• Elimination of wastes</li> <li>• Regulates pH and volume of blood</li> </ul>	<ul style="list-style-type: none"> <li>• Kidneys</li> <li>• Urinary bladder</li> <li>• Urethra</li> </ul>
<b>Reproductive</b>	<ul style="list-style-type: none"> <li>• Produces germ cells (<i>eggs and sperm</i>)</li> <li>• Environment for growth of fetus (<i>female</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• Ovaries</li> <li>• Uterus</li> <li>• Mammary glands</li> <li>• Testes</li> <li>• Prostate gland</li> <li>• External genitalia</li> </ul>

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Table 8.3.1. Organ systems of the human body

### Knowledge Check

1) Groups of cells with similar structure and function are known as:

- a) Tissues
- b) Organs
- c) Organ systems

#### Answer

Tissues - **This is the correct answer.**

Tissues are groups of cells with similar structure and function. There are only four types of tissues: epithelial tissue, connective tissue, muscle tissue, and nerve tissue.

2) The organ system that transports oxygen and nutrients to tissues and removes waste products is the:

- a) Urinary system
- b) Integumentary system
- c) Cardiovascular system

#### Answer

Cardiovascular system - **This is the correct answer.**

The cardiovascular system functions to transport oxygen and nutrients to tissues and removes waste products. The primary organs are the heart, blood, and blood vessels.

3) The organ system that regulates body functions by chemicals (hormones) is known as the:

- a) Nervous system
- b) Reproductive system
- c) Endocrine system

#### Answer

Endocrine system - **This is the correct answer.**

The endocrine system functions to regulate body functions by chemicals (hormones). It contains several organs including the pituitary gland, parathyroid gland, thyroid gland, adrenal gland, thymus, pancreas, and gonads.

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