

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		
Organ System	Functions	Organs
	<ul style="list-style-type: none"> • Barrier to invading organisms and chemicals 	<ul style="list-style-type: none"> • Skin • Hair

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

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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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