Learning Objectives

Upon completion of this unit, students should be able to:

1. Name the components of the immune system, their functions, and toxicants that affect the immune system.
2. Discuss the effects of immunotoxicants and testing procedures on various cellular and humoral components of the immune system.
3. Describe the structure and functions of the respiratory system and the health effects of several toxicants on the respiratory system.
4. Identify different types of liver injury, different mechanisms by which injuries are induced, morphologic and biochemical changes in the liver.
5. Explain a number of testing procedures and examinations for the failure of respiratory system and liver injury.
6. Describe the structure and functions of the kidney, toxic effects on the kidney, various testing procedures, and the morphologic examinations.

Written Lecture

The function of the immune system is to protect the host against foreign organisms (virus, bacteria, fungus), “foreign cells” (neoplasm), and other foreign substances. The immune system consists of a network of organs including the bone marrow, thymus, spleen, and lymph nodes. A variety of substances have been found to affect the immune system. They may be placed in different categories such as antineoplastic drugs, heavy metals, pesticides, halogenated hydrocarbons, miscellaneous compounds, etc.

With industrialization, the respiratory system of humans is increasingly exposed to airborne toxicants. Many toxicants are known to adversely affect the respiratory system in humans and animals. Inhalable toxicants exist in the form of gases, vapors, liquid droplets, and solid particulate matters. After absorption, they are carried by the circulating blood to various parts of the body and exert their effects, such as general anesthesia. Other major cause of pulmonary fibrosis is asbestos, pollens, spores of molds, bacterial contaminants, cotton dust, and so forth. Cigarette smoking contains a number of carcinogens which initiate and promote carcinogenesis.

The liver is the largest and metabolically the most complex organ in the body. It is involved in the metabolism of nutrients as well as most drugs and toxicants. The toxicology of liver is complicated by the variety of liver injuries and by the different mechanisms through which the injuries are induced. The liver is often the target organ for a number of reasons. Most toxicants enter the body via the gastrointestinal tract, and after absorption they are carried by the hepatic portal vein to the liver. Toxicants can induce a variety of toxic effects on different organelles in the cells in liver, exhibiting different types of liver injury. Liver necrosis involves the death of hepatocytes. Bromobenzene is also bioactivated in the liver. Cirrhosis is characterized by the presence of septae of collagen distributed throughout most of the liver. The most important cause of human
cirrhosis is chronic ingestion of alcoholic beverages. The color and appearance of the liver can often indicate the nature of toxicity, such as fatty liver, or cirrhosis.

Urine is the principal route by which most toxicants are excreted. As a result, the kidney concentrates toxicants in the filtrate, transports toxicants across the tubular cells, and bioactivates certain toxicants. Additional water is removed from the filtrate in the distal and the collecting tubules as Na⁺ is actively reabsorbed. However, most toxicants preferentially affect specific parts of the kidney. Many antibiotics are also secreted by the proximal tubules and can induce alterations in the tubular functions.

### Supplemental Reading

Learn more about unit topics by exploring articles available in the CSU Online Library, such as:

- “Renal function after reduction in cadmium exposure: An 8-year follow-up of residents in cadmium-polluted areas,” by Ingvar A. Bergdahl, Alfred Bernard, Taiyi Jin, Lidian Lei, Huigi Li, and Yihuai Liang, discusses the effects of long-term exposure to cadmium on kidney function, including how a decrease in exposure can result in a reversal of some adverse effects. (Academic OneFile database)

- Respiratory protection is the focus of the article “Don’t be left breathless,” by Chris Vanhoven. What airborne hazards are you exposed to? (Business Source Complete database)

### Learning Activities (Non-Graded)

#### Create an Interview:

After you finish the unit Reading Assignments, reflect on what you read and what you would like to know more about concerning the unit topics—toxicology of the immune system, respiratory system, liver, and kidney.

For this activity, your role is that of a health magazine reporter. You have been granted a personal interview with a high-ranking official in the World Health Organization (WHO). Think of all the knowledge this official must have concerning toxicity and its effects on humans! You will have two hours during which you can discuss any topics you wish. What kinds of information would you like to find out from this individual?

Do your research so that you are prepared when you meet the WHO official. For this activity, create an interview consisting of 15-20 questions concerning health issues addressed in this unit and what you would like to know in addition to what you read in the Reading Assignment.

This is a non-graded activity, so you do not have to submit it.