Course Learning Outcomes for Unit IV

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

1. Discriminate common examples of toxins that affect the following systems or target organs in the human body: immune, respiratory, liver, kidney, skin, eye, nervous system, reproductive, and cardiovascular.

Reading Assignment

Chapter 11: Toxicology of the Immune System

Chapter 12: Respiratory System Inhalation Toxicology

Chapter 13: Toxicology of the Liver

Unit Lesson

This unit covers the topics of toxicology of the immune system, the respiratory system, and the liver.

The immune system is the body's defense mechanism against foreign organisms, foreign cells, and other foreign substances (Kacew & Lee, 2013). The immune system is composed of several types of organs (i.e., bone marrow, thymus, spleen, and lymph nodes,) cells, and non-cellular components (Kacew & Lee, 2013). A variety of substances have been found to affect the immune system. A well-known virus that has received intense media coverage, research funding, and attention over the past 20-30 years is the human immunodeficiency virus, or HIV. The final stages of HIV is known as AIDS, acquired immune deficiency syndrome. The first cases of the then unknown illness were reported in the United States in June of 1981. More than 619,000 people with AIDS have died in the U.S. since the epidemic began (AIDS.gov, 2012). HIV is believed to have originated in West Africa and was spread to humans by the consumption of chimpanzees that carried the virus. Once in the human body, the virus attacks T-cells or CD4 cells and uses them to make copies of themselves. The virus has progressed to AIDS when the virus has destroyed too many of the body's T-cells and the immune system is weakened and susceptible to opportunistic infections (AIDS.gov, 2012). HIV is one example of a toxicant that impacts the immune system. It is important to understand the major immunotoxicants as discussed in your textbook.

The primary function of the respiratory system is to supply blood with the oxygen to be delivered throughout the body. The respiratory system is made up of the organs and tissues that help you breathe (NIH, 2012). Oxygen enters the body through the nose and mouth, travels through the larynx (voice box) and trachea (windpipe), and into the bronchial tubes that enter the lungs. Within the lungs, the oxygen travels from the bronchial tubes to smaller tubes (bronchioles) that end in air sacs (alveoli). Each of these air sacs are covered in blood vessels (capillaries), which travel throughout the body using a network of arteries and veins to distribute blood rich oxygen and remove carbon dioxide (NIH, 2012). The respiratory system of humans is increasingly exposed to airborne toxicants (Kacew & Lee, 2013). 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 (Kacew & Lee, 2013). The toxicants are delivered to the blood stream by the respiratory system, just as oxygen is, and are circulated by the blood to various parts of the body where their effects are exerted, such as general anesthesia. The textbook discusses the effects of these toxicants on human health.
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 (Kacew & Lee, 2013). Most toxicants enter the body via the gastrointestinal tract, and after absorption, they are carried by the hepatic portal vein to the liver. 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 (Kacew & Lee, 2013). Toxicants can induce a variety of toxic effects on different organelles in the cells in the liver, exhibiting different types of liver injuries. Liver necrosis involves the death of hepatocytes. The color and appearance of the liver can often indicate the nature of toxicity, such as fatty liver, or cirrhosis (Kacew & Lee, 2013).

References


Suggested Reading

- “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. Locate this article by searching the Academic OneFile database in the CSU Online Library.

- Respiratory protection is the focus of the article “Don’t Be Left Breathless,” by Chris Vanhoven. What airborne hazards are you exposed to? Locate this article by searching the Business Source Complete database in the CSU Online Library.

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—xicology of the immune system, respiratory system, and liver.

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.
Reading Quiz

Take some time to look up the answers that you do not recall from the assigned reading.

1. The biochemical changes are complex, and various hepatotoxicants apparently act through:
   a. distal axonopathy.
   b. different mechanisms.
   c. nervous systems.
   d. perinuclear changes.

2. Which toxicant causes cholestasis?
   a. Methotrexate
   b. Urethane
   c. Chlorpromazine
   d. Calcium sulfate

3. Chronic bronchitis may be caused by:
   a. nitrogen gas.
   b. nickel.
   c. aluminum dust.
   d. cotton dust.

4. Which toxic gases can cause cellular damage?
   a. Hydrogen and oxygen
   b. Ozone and oxides of nitrogen
   c. PCB and TCDD
   d. Fluoride and arsenic

5. A macrophage is derived from a:
   a. monocyte.
   b. mast cell.
   c. plasma cell.
   d. polymorphonuclear cell.

6. The immune system consists of a network of organs including:
   a. dermis, epidermis, horny layer, and hair follicle.
   b. neurons, axons, myelin sheath, and glutamate.
   c. bone marrow, thymus, spleen, and lymph nodes.
   d. ovum, ootid, leydig cells, and testis.

7. Which Ig is present on B-cell surface and functions as an antigen receptor?
   a. IgA
   b. IgD
   c. IgE
   d. IgG

8. Amphotericin-B induces renal toxicity in a majority of the patients, affecting various:
   a. organogenesis.
   b. renal structures.
   c. cytosine molecules.
   d. escherichia coli.

Non-graded Learning Activities are provided to aid students in their course of study. You do not have to submit them. If you have questions, contact your instructor for further guidance and information.
Key Terms

1. Autoimmunity
2. Bursal equivalent
3. Cholestasis
4. Cirrhosis
5. Hepatotoxicants
6. Humoral immunity
7. Hypersensitivity reactions
8. Immunocompetence
9. Immunodeficiency
10. Immunoglobins
11. Immunosuppression
12. Liver necrosis
13. Macrophages