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Chapter 02: Altered Cellular and Tissue Biology: Environmental Agents
Rogers: McCance & Huether's Pathophysiology, 9th Edition

MULTIPLE CHOICE

1. Which type of cell adaptation occurs when normal columnar ciliated epithelial cells of the bronchial lining have been replaced by stratified squamous epithelial cells?
   a. Hyperplasia
   b. Metaplasia
   c. Dysplasia
   d. Anaplasia

   ANS: B
   Metaplasia is the reversible replacement of one mature cell by another, sometimes a less-differentiated cell type. The best example of metaplasia is the replacement of normal columnar-ciliated epithelial cells of the bronchial (airway) lining by stratified squamous epithelial cells. The other options do not accurately describe the event in the question.

   DIF: Cognitive Level: Remembering

2. What does the loss of the adenosine triphosphate (ATP) during ischemia cause cells to do?
   a. Shrink because of the influx of calcium (Ca)
   b. Shrink because of the influx of potassium chloride (KCl)
   c. Swell because of the influx of sodium chloride (NaCl)
   d. Swell because of the influx of nitric oxide (NO)

   ANS: C
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   A reduction in ATP levels causes the plasma membrane's sodium–potassium (Na+–K+) pump and sodium–calcium exchange to fail, which leads to an intracellular accumulation of sodium and calcium and diffusion of potassium out of the cell. (The Na+–K+ pump is discussed in Chapter 1.) Sodium and water can then freely enter the cell, and cellular swelling results. The other options do not accurately describe the result of ATP at the cellular level.

   DIF: Cognitive Level: Remembering

3. The mammary glands enlarge during pregnancy primarily as a consequence of what hormonal process?
   a. Atrophy
   b. Hyperplasia
   c. Anaplasia
   d. Dysplasia

   ANS: B
   Hormonal hyperplasia occurs chiefly in estrogen-dependent organs, such as the uterus and breast. Atrophy is a decrease or shrinkage in cellular size. Anaplasia is a condition of poor cellular differentiation, a characteristic of cancer cells. Dysplasia is a change in the size, shape, and organization of mature cells.

   DIF: Cognitive Level: Remembering

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4. Free radicals play a major role in the initiation and progression of which diseases?
   a. Cardiovascular diseases such as hypertension and ischemic heart disease
   b. Renal diseases such as acute tubular necrosis and glomerulonephritis
   c. Gastrointestinal diseases such as peptic ulcer disease and Crohn disease
   d. Muscular disease such as muscular dystrophy and fibromyalgia

   ANS: A
   Emerging data indicate that reactive oxygen species play major roles in the initiation and progression of cardiovascular alterations associated with hyperlipidemia, diabetes mellitus, hypertension, ischemic heart disease, and chronic heart failure. Free radical damage is not a contributing mechanism for the renal, gastrointestinal, or muscular diseases listed unless in conjunction with ionizing radiation

   DIF: Cognitive Level: Remembering

5. How do free radicals cause cell damage?
   a. Stealing the cell's oxygen to stabilize the electron, thus causing hypoxia
   b. Stimulating the release of lysosomal enzymes that digest the cell membranes
   c. Transferring one of its charged, stabilized atoms to the cell membrane, which causes lysis
   d. Giving up an electron, which causes injury to the chemical bonds of the cell membrane

   ANS: D
   A free radical is an electrically uncharged atom or group of atoms having an unpaired electron. Having one unpaired electron makes the molecule unstable; thus to stabilize, the molecule gives up an electron to another molecule or steals one. Therefore it is capable of forming injurious chemical bonds with proteins, lipids, or carbohydrates—key molecules in membranes and nucleic acids. Free radical damage is not caused by hypoxia, lysosomal enzymes, or transferring atoms.

   DIF: Cognitive Level: Remembering

6. What is a consequence of plasma membrane damage to the mitochondria?
   a. Enzymatic digestion halts DNA synthesis.
   b. Influx of calcium ions halts ATP production.
   c. Edema from an influx in sodium causes a reduction in ATP production.
   d. Potassium shifts out of the mitochondria, which destroys the infrastructure.

   ANS: B
   Calcium alterations are an important mechanism of cell injury and death. Cell membrane injury leads to calcium influx into the cell. An influx of calcium ions from the extracellular compartment activates multiple enzyme systems, resulting in cytoskeleton disruption, membrane damage, activation of inflammation, and eventually DNA degradation. Calcium ion accumulation in the mitochondria causes the mitochondria to swell, which is an occurrence that is associated with irreversible cellular injury. The injured mitochondria can no longer generate ATP, but they do continue to accumulate calcium ions. Mitochondrial consequences of cell membrane damage do not include enzymatic digestion, reduced ATP production due to edema, or infrastructure damage from potassium shifts.

   DIF: Cognitive Level: Remembering

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7. What is a consequence of leakage of lysosomal enzymes during chemical injury?
   a. Enzymatic digestion of the nucleus and nucleolus occurs, halting DNA synthesis.
   b. Influx of potassium ions into the mitochondria occurs, halting the ATP production.
   c. Edema of the Golgi body prevents the transport of proteins out of the cell.
   d. Shift of calcium out of the plasma membrane occurs, destroying the cytoskeleton.

   ANS: A
   Acid hydrolases from leaking lysosomes are activated in the reduced pH of the injured cell and they digest cytoplasmic and nuclear components. Influx of potassium ions into the mitochondria, edema of Golgi bodies, and calcium destruction of the cytoskeleton are not a consequence of leakage of lysosomal enzymes during chemical injury.

   DIF: Cognitive Level: Remembering

8. Lead causes damage within the cell by interfering with the action of what?
   a. Sodium and chloride
   b. Potassium
   c. Calcium
   d. ATP

   ANS: C
   Lead affects many different biologic activities at the cellular and molecular levels, many of which may be related to its ability to interfere with the functions and homeostasis of calcium. Lead does not appear to cause damage by interfering with the action of sodium, chloride, potassium, or ATP.

   DIF: Cognitive Level: Remembering TBEXAM.COM

9. A health professions student asks the professor to explain apoptosis. What response is most accurate?
   a. Programmed cell death
   b. Due to chemical injury
   c. Unpredictable patterns of cell death
   d. Results in benign malignancies

   ANS: A
   Apoptosis is an active process of cellular self-destruction, also known as programmed cell *death, which* is implicated in normal and pathologic tissue changes. Apoptosis causes cell death in many pathologic states, not just from chemical injury. A predictable, tightly regulated cellular program leads to apoptosis. Apoptosis does not cause benign malignancies.

   DIF: Cognitive Level: Understanding

10. A healthcare professional is assessing a child whose parents report poor grades in school, trouble paying attention, and “naughty” behaviors that have become so frequent the child is always in trouble. For which health condition should the professional facilitate testing?
    a. Hypoxic injury
    b. Lead poisoning
    c. Mercury exposure
    d. Cadmium injection

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ANS: B
Decreased academic achievement, IQ, and specific cognitive measures; increased incidence of attention-related behaviors and problem behaviors are related to lead exposure. Hypoxic injury is usually caused by ischemia, which is not apparent in this child. Exposure to mercury poisoning in utero can lead to deafness, blindness, intellectual disability, cerebral palsy, and central nervous system (CNS) defects. The main effects of cadmium poisoning are renal tubular disease and obstructive lung disease.

DIF: Cognitive Level: Understanding

11. A student asks why carbon monoxide causes tissue damage. What response by the professor is best?
    a. Competes with carbon dioxide so that it cannot be excreted
    b. Binds to hemoglobin so that it cannot carry oxygen
    c. Destroys the chemical bonds of hemoglobin so it cannot carry oxygen
    d. Removes iron from hemoglobin so it cannot carry oxygen

    ANS: B
    Because carbon monoxide's affinity for hemoglobin is 200 times greater than that of oxygen, it quickly binds with the hemoglobin, preventing oxygen molecules from doing so. Carbon monoxide does not cause tissue damage by competing with carbon dioxide, destroying chemical bonds, or removing iron from hemoglobin.

    DIF: Cognitive Level: Understanding

12. A healthcare professional is working with a person who drinks several 6-packs of beer a week. What testing does the professional encourage the person to get?
    a. Hepatic function
    b. Gastrointestinal function
    c. Renal function
    d. Central nervous system function

    ANS: A
    Chronic alcohol use/abuse affects the hepatic system primarily. The gastrointestinal and renal systems are not as significantly impacted. Central nervous system problems are often seen in acute alcohol intoxication, and may be seen in advanced alcoholic liver disease.

    DIF: Cognitive Level: Understanding

13. During cell injury caused by hypoxia, why does an increase in the osmotic pressure within the cell occur?
    a. Plasma proteins enter the cell.
    b. The adenosine triphosphatase (ATPase)-driven pump is stronger during hypoxia.
    c. Sodium chloride enters the cell.
    d. An influx of glucose occurs through the injured cell membranes.

    ANS: C

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In hypoxic injury, movement of fluid and ions into the cell is associated with acute failure of metabolism and a loss of ATP production. Normally, the pump that transports sodium ions out of the cell is maintained by the presence of ATP and ATPase, the active transport enzyme. In metabolic failure caused by hypoxia, reduced ATP and ATPase levels permit sodium to accumulate in the cell, whereas potassium diffuses outward. The increase of intracellular sodium increases osmotic pressure, which draws more water into the cell. (Transport mechanisms are described in Chapter 1.) The remaining options do not accurately describe the cell injury that results in increased osmotic pressure caused by hypoxia.

DIF: Cognitive Level: Remembering

14. Which statement is *true* regarding the difference between subdural hematoma and epidural hematoma?
    a. No difference exists, and these terms may be correctly used interchangeably.
    b. A subdural hematoma occurs above the dura, an epidural hematoma occurs under the dura.
    c. A subdural hematoma is often the result of shaken baby syndrome, whereas an epidural hematoma rapidly forms as a result of a skull fracture.
    d. A subdural hematoma usually forms from bleeding within the skull, an epidural hematoma occurs from trauma outside the skull.

    ANS: C
    A subdural hematoma is a collection of blood between the inner surface of the dura mater and the surface of the brain, resulting from the shearing of small veins that bridge the subdural space. Subdural hematomas can be the result of blows, falls, or sudden acceleration-deceleration of the head, which occurs in the *shaken baby syndrome*. An epidural hematoma is a collection of blood between the inner surface of the skull and the dura and is almost always associated with a skull fracture. The other options do not accurately describe the differences between the two hematomas.

    DIF: Cognitive Level: Remembering

15. A healthcare professional is working at the health tent during a marathon. A runner is brought to the tent complaining of nausea and weakness. What is the first thing the professional should do?
    a. Call 911.
    b. Have the person lie down.
    c. Give the person salt tablets.
    d. Ask about street drug use.

    ANS: B
    Heat exhaustion is probably the most common heat-related injury. Symptoms include nausea and weakness due to hypovolemia. The person can suddenly collapse due to the loss of fluids, so the first measure the professional should take is to have the runner lie down. This is not a medical emergency so 911 does not yet need to be called. Salt replacement is the treatment for heat cramps. Street drug use could cause nausea or weakness, but since the person is running outside and sweating, a heat-related injury is far more likely.

    DIF: Cognitive Level: Applying

16. In hypoxic injury, why does sodium enter the cell and cause swelling?

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a. The cell membrane permeability increases for sodium during periods of hypoxia.
b. ATP is insufficient to maintain the pump that keeps sodium out of the cell.
c. The lactic acid produced by the hypoxia binds with sodium in the cell.
d. Sodium cannot be transported to the cell membrane during hypoxia.

ANS: B
In hypoxic injury, movement of fluid and ions into the cell is associated with acute failure of metabolism and a loss of ATP production. Normally, the presence of ATP and ATPase, the active transport enzyme, maintains the pump that transports sodium ions out of the cell. In metabolic failure caused by hypoxia, reduced ATP and ATPase levels permit sodium to accumulate in the cell, whereas potassium diffuses outward. The other options do not accurately describe the cause of the swelling caused by hypoxia.

DIF: Cognitive Level: Remembering

17. What is the most common site of lipid accumulation?
a. Coronary arteries
b. Kidneys
c. Liver
d. Subcutaneous tissue

ANS: C
Although lipids sometimes accumulate in heart and kidney cells, the most common site of intracellular lipid accumulation, or fatty change, is liver cells. Subcutaneous tissue is not a common site of lipid accumulation.

DIF: Cognitive Level: Remembering

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18. What mechanisms occur in the liver cells as a result of lipid accumulation?
a. Accumulation of lipids that obstruct the common bile duct, preventing flow of bile from the liver to the gallbladder
b. Increased synthesis of triglycerides from fatty acids and decreased synthesis of apoproteins
c. Increased binding of lipids with apoproteins to form lipoproteins
d. Increased conversion of fatty acids to phospholipids

ANS: B
Lipid accumulation in liver cells occurs after cellular injury sets the following mechanisms in motion: increased synthesis of triglycerides from fatty acids (increases in the enzyme, b-glycerophosphatase, which can accelerate triglyceride synthesis) and decreased synthesis of apoproteins (lipid-acceptor proteins). Accumulation of lipids does not cause obstruction of bile flow, increased binding of lipids with apoproteins, or conversion of fatty acids to phospholipids.

DIF: Cognitive Level: Remembering

19. Hemoprotein accumulations are a result of the excessive storage of what?
a. Iron, which is transferred from the cells to the bloodstream
b. Hemoglobin, which is transferred from the bloodstream to the cells
c. Albumin, which is transferred from the cells to the bloodstream
d. Amino acids, which are transferred from the cells to the bloodstream

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ANS: A
Excessive storage of iron, which is transferred to the cells from the bloodstream, causes hemoprotein accumulations in cells. Hemoglobin, albumin, or amino acids will not cause hemoprotein accumulations.

DIF: Cognitive Level: Remembering

20. A patient experienced multiple traumatic injuries and received many blood transfusions within a few days of the injuries. For which medical condition should the healthcare professional monitor the patient for?
a. High blood pressure
b. HIV infection
c. Hemosiderosis
d. Kidney damage

ANS: C
Hemosiderosis is a condition that occurs only when excess iron is stored as hemosiderin in the cells of many organs and tissues. This condition is common in individuals who have received repeated blood transfusions or prolonged parenteral administration of iron. While blood transfusions can expose a person to infectious diseases, this is not as likely to be a problem since blood products are tested. Kidney damage may occur in patients with traumatic injuries, but is not directly related to the multiple blood transfusions.

DIF: Cognitive Level: Applying

21. What is the cause of free calcium in the cytosol that damages cell membranes by uncontrolled enzyme activation?
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a. Activation of endonuclease interferes with the binding of calcium to protein.
b. Activation of phospholipases, to which calcium normally binds, degrades the proteins.
c. An influx of phosphate ions competes with calcium for binding to proteins.
d. Depletion of ATP normally pumps calcium from the cell.

ANS: D
If abnormal direct damage occurs to membranes or ATP is depleted, then calcium increases in the cytosol. The other options do not accurately describe the cause of free calcium in cytosol to damage cell membranes.

DIF: Cognitive Level: Remembering

22. What two types of hearing loss are associated with noise?
a. Acoustic trauma and noise-induced
b. High frequency and low frequency
c. High frequency and acoustic trauma
d. Noise-induced and low frequency

ANS: A

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Two types of hearing loss are associated with noise: (1) acoustic trauma or instantaneous damage caused by a single sharply rising wave of sound (e.g., gunfire), and (2) noise-induced hearing loss, the more common type, which is the result of prolonged exposure to intense sound (e.g., noise associated with the workplace and leisure-time activities). The remaining options are not related to noise but rather to the amplitude of the sound.

DIF: Cognitive Level: Remembering

23. What type of necrosis results in the accumulation of leukocytes and their release of enzymes?
    a. Coagulative
    b. Liquefactive
    c. Caseous
    d. Gangrene

ANS: B
Liquefactive necrosis is characterized by digestion of the dead cells transforming tissue into a viscous liquid. It commonly results from hypoxic injury within the CNS. It is also seen in focal bacterial and sometimes in fungal infections because microbes stimulate the accumulation of leukocytes and their release of enzymes. Coagulative necrosis commonly occurs in the kidney, heart, and adrenal glands. Caseous necrosis is a combination of coagulative and liquefactive processes and is seen in tuberculosis. Gangrene refers to death of tissue and results from severe hypoxic injury, commonly occurring because of arteriosclerosis, or blockage, of major arteries, especially in the lower leg.

DIF: Cognitive Level: Remembering

24. What type of necrosis is often associated with pulmonary tuberculosis?
    a. Bacteriologic
    b. Caseous
    c. Liquefactive
    d. Gangrenous

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ANS: B
Caseous necrosis, which commonly results from tuberculous pulmonary infection, particularly *Mycobacterium tuberculosis*, is a combination of coagulative and liquefactive necrosis. The other types of necrosis are not observed in pulmonary tuberculosis.

DIF: Cognitive Level: Remembering

25. What type of necrosis is associated with wet gangrene?
    a. Coagulative
    b. Liquefactive
    c. Caseous
    d. Fibrinoid

ANS: D

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Gangrenous necrosis is particularly common with severely compromised circulation of the lower leg, either from acute or chronic disorders. With hypoxia, bacterial invasion, which enters a wound, can readily result in gangrenous necrosis. *Wet gangrene*, the more lethal form, develops secondary to necrotizing bacterial infections, particularly infection with gram-positive cocci, gram-negative rods, or anaerobic microorganisms, especially *Clostridium* spp. These microorganisms invade the site, causing a liquefactive necrosis.

DIF: Cognitive Level: Remembering

26. After ovulation, the uterine endometrial cells divide under the influence of estrogen. This process is an example of what hormonal process?
    a. Hyperplasia
    b. Dysplasia
    c. Hypertrophy
    d. Anaplasia

    ANS: A
    Hormonal hyperplasia chiefly occurs in estrogen-dependent organs, such as the uterus and breast. After ovulation, for example, estrogen stimulates the endometrium to grow and thicken for reception of the fertilized ovum. Dysplasia refers to abnormal changes in the size, shape, and organization of mature cells. Hypertrophy is an increase in the size of cells that consequently increases the size of the affected organ. Anaplasia is a condition of poor cellular differentiation, a characteristic of cancer cells. Dysplasia is a change in the size, shape, and organization of mature cells.

    DIF: Cognitive Level: Understanding

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27. What is the abnormal proliferation of cells in response to excessive hormonal stimulation?
    a. Dysplasia
    b. Pathologic dysplasia
    c. Hyperplasia
    d. Pathologic hyperplasia

    ANS: D
    Pathologic hyperplasia is the abnormal proliferation of normal cells and can occur as a response to excessive hormonal stimulation or the effects of growth factors on target cells. Dysplasia refers to abnormal changes in the size, shape, and organization of mature cells. Hyperplasia is an increase in the number of cells in an organ or tissue resulting from an increased rate of cellular division and is a response to prolonged injury.

    DIF: Cognitive Level: Remembering

28. Removal of part of the liver leads to the remaining liver cells undergoing which compensatory process?
    a. Atrophy
    b. Metaplasia
    c. Hyperplasia
    d. Dysplasia

    ANS: C

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Compensatory hyperplasia is an adaptive mechanism that enables certain organs to regenerate. For example, the removal of part of the liver leads to hyperplasia of the remaining liver cells (hepatocytes) to compensate for the loss. The other options do not accurately identify the compensatory process described in the question.

DIF: Cognitive Level: Understanding

29. What is the single most common cause of cellular injury?
    a. Hypoxic injury
    b. Chemical injury
    c. Infectious injury
    d. Genetic injury

ANS: A
Hypoxia, or lack of sufficient oxygen, is the single most common cause of cellular injury. The other options are not as commonly observed as is the correct option.

DIF: Cognitive Level: Remembering

30. In decompression sickness, emboli are formed by bubbles of what?
    a. Oxygen
    b. Nitrogen
    c. Carbon monoxide
    d. Hydrogen

ANS: B
If water pressure is too rapidly reduced, the gases dissolved in blood bubble out of the solution, forming emboli. Oxygen is quickly redissolved, but nitrogen bubbles may persist and obstruct blood vessels. Ischemia, resulting from gas emboli, causes cellular hypoxia, particularly in the muscles, joints, and tendons, which are especially susceptible to changes in oxygen supply. The remaining options are not involved in the formation of decompression sickness emboli.

DIF: Cognitive Level: Remembering

31. Which is an effect of ionizing radiation exposure?
    a. Respiratory distress
    b. Sun intolerance
    c. DNA aberrations
    d. Death

ANS: C
The effects of ionizing radiation may be acute or delayed. Acute effects of high doses, such as skin redness, skin damage, or chromosomal aberrations, occur within hours, days, or months. The delayed effects of low doses may not be evident for years. The other options are not commonly considered effects of radiation exposure.

DIF: Cognitive Level: Remembering

32. What is dysplasia?
    a. Abnormal increase in the number of a specific cell type
    b. True adaptive process at the cellular level

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c. Modification in the shape of a specific cell type
d. Lack of oxygen at the cellular level

ANS: C
Dysplasia refers only to abnormal changes in the size, shape, and organization of mature cells, not an increase in number. Dysplasia is not a true adaptive change and is not due to lack of oxygen at the cellular level.

DIF: Cognitive Level: Remembering

MULTIPLE RESPONSE

1. Which organs are affected by lead consumption? *(Select all that apply.)*
   a. Bones
   b. Teeth
   c. Pancreas
   d. Nerves
   e. Eyes

   ANS: A, B, D
   The organ systems that are primarily affected by lead include the nervous system, bones, kidneys, teeth, cardiovascular, and reproductive and immune systems.

   DIF: Cognitive Level: Remembering

2. A healthcare professional is screening children for fetal alcohol syndrome. Which children would the professional assess as possibly suffering from this disorder? *(Select all that apply.)*
   a. Frequent asthma attacks
   b. Cognitive impairment
   c. Short stature for age
   d. Esophageal stricture
   e. Facial anomalies

   ANS: B, C, E
   Fetal alcohol syndrome (FAS) can lead to specific facial abnormalities, growth deficits, and CNS abnormalities. The children displaying these signs should be suspected of having FAS. FAS does not cause asthma or esophageal strictures.

   DIF: Cognitive Level: Applying

3. What organs are affected by the type of necrosis that results from either severe ischemia or chemical injury? *(Select all that apply.)*
   a. Lungs
   b. Brain
   c. Kidneys
   d. Muscles
   e. Heart

   ANS: C, E

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Coagulative necrosis, which occurs primarily in the kidneys, heart, and adrenal glands, is a common result of hypoxia from severe ischemia or hypoxia caused by chemical injury, especially the ingestion of mercuric chloride. The other options do not accurately identify organs affected by necrosis resulting from ischemia or chemical injury.

DIF: Cognitive Level: Remembering

4. Which statements are true about melanin? *(Select all that apply.)*
   a. Rarely found in epithelial cells
   b. Found in cells called *keratinocytes*, which are present in the retina
   c. A factor in the prevention of certain types of cancer
   d. Most influential in managing the effects of short-term sunlight exposure
   e. Accumulates in specific cells found in the skin

   ANS: B, C, E
   Melanin accumulates in epithelial cells (keratinocytes) of the skin and retina and is an extremely important pigment because it protects the skin against long exposure to sunlight and is considered an essential factor in the prevention of skin cancer. Melanin is found in epithelial cells and is not most influential in managing the effects of short-term sunlight exposure.

   DIF: Cognitive Level: Remembering

5. What are examples of adaptive cellular responses? *(Select all that apply.)*
   a. Atrophy
   b. Dysplasia
   c. Hypertrophy
   d. Hyperplasia
   e. Metaplasia

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   ANS: A, C, D, E
   Atrophy, hypertrophy, hyperplasia, and metaplasia are considered to be adaptive cellular responses. Dysplasia is not a true adaptive response.

   DIF: Cognitive Level: Remembering

6. What are examples of blunt force injuries? *(Select all that apply.)*
   a. Bruise to the upper arm, resulting from a fall
   b. Simple tibia fracture sustained in a skiing accident
   c. Cut on the finger while slicing vegetables for a salad
   d. Spleen laceration caused by a punch during a physical fight
   e. Small caliber gunshot wound to the foot while target shooting

   ANS: A, B, D
   Blunt force injuries are the result of tearing, shearing, or crushing types of injuries, resulting in bruises, fractures, and lacerations caused by blows or impacts. Knife wounds and gunshot wounds are considered penetrating injuries.

   DIF: Cognitive Level: Remembering

7. Which statements are *true* regarding the effects of marijuana use? *(Select all that apply.)*
   a. Beneficial effects include decreases in nausea and pain.

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b. Heavy use can result in psychomotor impairments.
c. Possibly causes reproductive changes
d. Research does not support marijuana use as a factor in developing lung cancer.
e. Fetal development appears to be unharmed by marijuana use.

ANS: A, B, C
Marijuana's effects include psychomotor impairments with heavy use, possible lung cancer (dose not determined), and fetal developmental effects. Reproductive changes have been seen in animal studies and may occur in humans. Beneficial effects include a decrease in nausea and chronic pain.

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