Chapter 01: Introduction to Pathophysiology
Banasik: Pathophysiology, 6th Edition

MULTIPLE CHOICE

1. C.Q. was recently exposed to group A hemolytic *Streptococcus* and subsequently developed a pharyngeal infection. His clinic examination reveals an oral temperature of 102.3°F, skin rash, dysphagia, and reddened throat mucosa with multiple pustules. He complains of sore throat, malaise, and joint stiffness. A throat culture is positive for *Streptococcus*, and antibiotics have been prescribed. The etiology of C.Q.'s disease is
   a. a sore throat.
   b. streptococcal infection.
   c. genetic susceptibility.
   d. pharyngitis.

   ANS: B
   Etiology refers to the proposed cause or causes of a particular disease process. A sore throat is the manifestation of the disease process. Genetic susceptibility refers to inherited tendency to develop a disease. Pharyngitis refers to inflammation of the throat and is also a clinical manifestation of the disease process.

2. A 17-year-old college-bound student receives a vaccine against an organism that causes meningitis. This is an example of
   a. primary prevention.
   b. secondary prevention.
   c. tertiary prevention.
   d. disease treatment.

   ANS: A
   Primary prevention is prevention of disease by altering susceptibility or reducing exposure for susceptible individuals by providing vaccination. Secondary prevention is the early detection, screening, and management of the disease. Tertiary prevention includes rehabilitative and supportive care and attempts to alleviate disability and restore effective functioning. Disease treatment involves management of the disease once it has developed.

3. An obese but otherwise healthy teen is given a prescription for a low-calorie diet and exercise program. This is an example of
   a. primary prevention.
   b. secondary prevention.
   c. tertiary prevention.
   d. disease treatment.

   ANS: B
   Secondary prevention is the early detection, screening, and management of the disease such as prescribing diet and exercise for an individual who has already developed obesity. Primary prevention is prevention of disease by altering susceptibility or reducing exposure for susceptible individuals. Tertiary prevention includes rehabilitative and supportive care and attempts to alleviate disability and restore effective functioning. Disease treatment involves management of the disease once it has developed.

4. A patient with high blood pressure who is otherwise healthy is counseled to restrict sodium intake. This is an example of
   a. primary prevention.
   b. secondary prevention.
   c. tertiary prevention.
   d. disease treatment.

   ANS: B
   Secondary prevention is the early detection, screening, and management of the disease, such as by prescribing sodium restriction for high blood pressure. Primary prevention is prevention of disease by altering susceptibility or reducing exposure for susceptible individuals. Tertiary prevention includes rehabilitative and supportive care and attempts to alleviate disability and restore effective functioning. Disease treatment involves management of the disease once it has developed.

5. After suffering a heart attack, a middle-aged man is counseled to take a cholesterol-lowering medication. This is an example of
   a. primary prevention.
   b. secondary prevention.
   c. tertiary prevention.
   d. disease treatment.

   ANS: C
   Tertiary prevention includes rehabilitative and supportive care and attempts to alleviate disability and restore effective functioning such as prescribing a cholesterol-lowering medication following a heart attack. Primary prevention is prevention of disease by altering susceptibility or reducing exposure for susceptible individuals. Secondary prevention is the early detection, screening, and management of the disease. Disease treatment involves management of the disease once it has developed.

6. A patient has been exposed to meningococcal meningitis, but is not yet demonstrating signs of this disease. This stage of illness is called the_____stage.
   a. prodromal
   b. latent
   c. sequela
   d. convalescence

   ANS: B
   Incubation refers to the interval between exposure of a tissue to an injurious agent and the first appearance of signs and symptoms. In infectious diseases, this period is often called the incubation (latent) period. Prodromal refers to the appearance of the first signs and symptoms indicating the onset of a disease. These are often nonspecific, such as headache, malaise, anorexia, and nausea, which are associated with a number of different diseases. Sequela refers to subsequent pathologic condition resulting from a disease. Convalescence is the stage of recovery after a disease, injury, or surgical operation.

7. A disease that is native to a particular region is called
   a. epidemic.
   b. endemic.

c. pandemic.
d. ethnographic.

ANS: B
A disease that is native to a particular region is called endemic. An epidemic is a disease that spreads to many individuals at the same time. Pandemics are epidemics that affect large geographic regions, perhaps spreading worldwide.

8. In general, with aging, organ size and function
a. increase.
b. decrease.
c. remain the same.
d. are unknown.

ANS: B
In general, with aging, organ size and function decrease.

9. The stage during which the patient functions normally, although the disease processes are well established, is referred to as
a. latent.
b. subclinical.
c. prodromal.
d. convalescence.

ANS: B
The stage during which the patient functions normally, although the disease processes are well established, is called the subclinical stage. The interval between exposure of a tissue to an injurious agent and the first appearance of signs and symptoms may be called a latent period or, in the case of infectious diseases, an incubation period. The prodromal period, or prodrome, refers to the appearance of the first signs and symptoms indicating the onset of a disease. Convalescence is the stage of recovery after a disease, injury, or surgical operation.

MULTIPLE RESPONSE

1. Your patient's red blood cell is slightly elevated today. This might be explained by (*Select all that apply.*)
a. gender difference.
b. situational factors.
c. normal variation.
d. cultural variation.
e. illness.

ANS: A, B, C, E
Gender, situations (e.g., altitude), normal variations, and illness may all determine red blood cell count. Culture affects how manifestations are *perceived* (normal versus abnormal).

2. Socioeconomic factors influence disease development because of (*Select all that apply.*)
a. genetics.
b. environmental toxins.
c. overcrowding.

d. nutrition.
e. hygiene.

ANS: B, C, D, E
Socioeconomic factors influence disease development via exposure to environmental toxins (occupational) and overcrowding, nutrition (over- or undernutrition), and hygiene (e.g., in developing countries). Genetics is not influenced by socioeconomic factors.

TRUE/FALSE

1. When the cause is unknown, a condition is said to be idiopathic

   ANS: T
   Many diseases are idiopathic in nature.

2. The nurse is swabbing a patient's throat to test for streptococcal pharyngitis. The nurse must understand that tests such as this differ in the probability that they will be positive for a condition when applied to a person with the condition; this probability is termed sensitivity.

   ANS: T
   The sensitivity of any test refers to the probability that the test will be positive when applied to a person with the condition and will not provide a false negative result. In contrast, specificity is the probability that a test will be negative when applied to a person who does not have a given condition.

MULTIPLE CHOICE

1. Indicators that an individual is experiencing high stress include all the following *except*
   a. tachycardia.
   b. diaphoresis.
   c. increased peripheral resistance.
   d. pupil constriction.

   ANS: D
   Pupils dilate during stress from the effects of catecholamines. Tachycardia, diaphoresis, and increased peripheral resistance are indicators of stress and also occur because of catecholamine release.

2. Which is *not* normally secreted in response to stress?
   a. Norepinephrine
   b. Cortisol
   c. Epinephrine
   d. Insulin

   ANS: D
   Insulin secretion is impaired during stress to promote energy from increased blood glucose. Norepinephrine is secreted during stress as a mediator of stress and adaptation. Cortisol is secreted during stress as a mediator of stress and adaptation and stimulates gluconeogenesis in the liver to supply the body with glucose. Epinephrine is secreted during stress as a mediator of stress and adaptation and increases glycogenolysis and the release of glucose from the liver.

3. Selye's three phases of the stress response include all the following *except*
   a. allostasis.
   b. resistance.
   c. alarm.
   d. exhaustion.

   ANS: A
   Allostasis is defined as the ability to successfully adapt to challenges. Allostasis may/may not occur in response to stress. Alarm, resistance, and exhaustion are the three phases of the stress response as described by Selye in the general adaptation syndrome.

4. Many of the responses to stress are attributed to activation of the sympathetic nervous system and are mediated by
   a. norepinephrine.
   b. cortisol.
   c. glucagon.
   d. ACTH.

   ANS: A

Norepinephrine is secreted in response to activation of the sympathetic nervous system during stress by the adrenal medulla. Cortisol is secreted by the adrenal cortex. Glucagon is secreted by the pancreas. ACTH is secreted by the pituitary gland.

5. The effects of excessive cortisol production include
a. immune suppression.
b. hypoglycemia.
c. anorexia.
d. inflammatory reactions.

ANS: A
Cortisol suppresses immune function and inflammation and stimulates appetite. Cortisol leads to hyperglycemia by stimulating gluconeogenesis in the liver.

6. All the following stress-induced hormones increase blood glucose *except*
a. aldosterone.
b. cortisol.
c. norepinephrine.
d. epinephrine.

ANS: A
Aldosterone results in water and sodium retention and potassium loss in the urine. It does not affect blood glucose. Cortisol is a glucocorticoid secreted by the adrenal cortex. Cortisol stimulates gluconeogenesis in the liver, thus increasing blood glucose. Norepinephrine inhibits insulin secretion, thus increasing blood sugar. Epinephrine increases glucose release from the liver and inhibits insulin secretion, thus increasing blood glucose.

7. Allostasis is best defined as
a. steady-state.
b. a state of equilibrium, of balance within the organism.
c. the process by which the body heals following disease.
d. the overall process of adaptive change necessary to maintain survival and well-being.

ANS: D
Allostasis refers to the overall process of adaptive change necessary to maintain survival and well-being.

8. The primary adaptive purpose of the substances produced in the alarm stage is
a. energy and repair.
b. invoke resting state.
c. produce exhaustion.
d. set a new baseline steady-state.

ANS: A
These resources are used for energy and as building blocks, especially the amino acids, for the later growth and repair of the organism. The substances do not produce a resting state. The substances can produce exhaustion if they continue, but that is not the adaptive purpose of these. Although a new baseline steady-state may result from the stress response that is not the adaptive purpose of the substances produced during the alarm stage.

9. Persistence of the alarm stage will ultimately result in
   a. stress reduction.
   b. permanent damage and death.
   c. movement into the resistance stage.
   d. exhaustion of the sympathetic nervous system.

   ANS: B
   If the alarm stage were to persist, the body would soon suffer undue wear and tear and become subject to permanent damage and even death. Actions taken by the individual during the resistance stage lead to stress reduction. The resistance stage may or may not occur following the alarm stage, based on resource availability. The sympathetic nervous system will continue to function, resulting in continued release of stress hormones.

10. The effect of stress on the immune system
    a. is unknown.
    b. has been demonstrated to be non-existent in studies.
    c. most often involves enhancement of the immune system.
    d. may involve enhancement or impairment the immune system.

    ANS: D
    Many studies demonstrate that long-term stress impairs the immune system, but many researchers identify that short-term stress may enhance the immune system.

MULTIPLE RESPONSE

1. Aldosterone may increase during stress, leading to (*Select all that apply.*)
   a. decreased urinary output.
   b. increased blood potassium.
   c. increased sodium retention.
   d. increased blood volume.
   e. decreased blood pressure.

   ANS: A, C, D
   Aldosterone increases water and sodium reabsorption and potassium excretion by the renal distal tubules and collecting ducts, thus leading to decreased urinary output, sodium retention in the body, and increased extracellular fluid volume. Because it leads to potassium excretion, aldosterone leads to decreased blood potassium.

2. Chronic activation of stress hormones can lead to (*Select all that apply.*)
   a. cardiovascular disease.
   b. depression.
   c. impaired cognitive function.
   d. autoimmune disease.
   e. overactive immune function.

   ANS: A, B, C, D

Excessive cortisol levels promote hypertension, atherosclerosis, and the development of cardiovascular disease. Chronic overactive stress hormones may result in atrophy and death of brain cells. Elevated levels of stress hormones are found in individuals with depressive disorders. Chronic stress leads to immune function impairment, rather than overactive immune function, and has been implicated in autoimmune disorders.

3. Events which occur during the alarm stage of the stress response include secretion of (*Select all that apply.*)
   a. catecholamines.
   b. ACTH.
   c. glucocorticoids.
   d. immune cytokines.
   e. TSH.

   ANS: A, B, C, D
   During the alarm stage, catecholamines (epinephrine, norepinephrine), ACTH, glucocorticoids, and immune cytokines are secreted. TSH is not secreted during the stress response.

MULTIPLE CHOICE

1. Glycolysis is the metabolic process of breaking down a glucose molecule to form
   a. CO_2 and H_2O.
   b. 2 ATP and 2 pyruvate.
   c. 30 ATP.
   d. oxygen.

   ANS: B
   Glycolysis produces a net gain of two ATP molecules and breaks down glucose modules to produce two pyruvate molecules. Oxidative phosphorylation produces CO_2 and H_2O. Oxidative phosphorylation produces 30 ATP molecules. Oxygen is not produced by glycolysis, but it is necessary for oxidative phosphorylation.

2. The benefit of glycolysis is that this second stage of catabolism supplies
   a. ATP to meet energy needs of the body.
   b. pyruvate to the citric acid cycle.
   c. energy for oxidative phosphorylation.
   d. lactate during anaerobic conditions.

   ANS: B
   The benefit of glycolysis is to supply pyruvate to the citric acid cycle of cellular metabolism, which then produces much ATP. Glycolysis only produces two ATP modules, which is insufficient for energy needs. Glycolysis does not supply energy for oxidative phosphorylation. Lactate produced during prolonged anaerobic conditions builds up and can lead to lactic acidosis, which is an undesirable outcome.

3. Repolarization of a neuron after a depolarizing action potential is because of
   a. activation of the Na^+-K^+ pump.
   b. influx of calcium.
   c. efflux of potassium.
   d. influx of sodium.

   ANS: C
   Repolarization is because of efflux of potassium from the cell. The Na^+-K^+ pump maintains cellular volume via osmotic pressure and helps to maintain resting membrane potential. Calcium influx prolongs the action potential. Influx of sodium initiates depolarization.

4. Excitable cells are able to conduct action potentials because they have
   a. receptors for neurotransmitters.
   b. tight junctions.
   c. ligand-gated channels.
   d. voltage-gated channels.

   ANS: D

Voltage-gated channels respond to changes in membrane potential and are responsible for conducting action potentials. Receptors for neurotransmitters allow neurotransmitters to bind to the cell membrane but are not directly responsible for action potentials in excitable cells. Tight junctions are intercellular connections that help segregate proteins on the cell membrane and are not involved in conducting action potentials. Ligand-gated channels respond to binding of a signaling molecule such as a neurotransmitter, but are not directly responsible for action potentials in excitable cells.

5. The resting membrane potential in nerve and skeletal muscle is determined primarily by
   a. extracellular sodium ion concentration.
   b. the ratio of intracellular to extracellular potassium ions.
   c. activation of voltage-gated sodium channels.
   d. activity of energy-dependent membrane pumps.

   ANS: B
   The major determinant of the resting membrane potential is the difference in potassium ion concentration across the membrane. Extracellular sodium helps maintain cell volume and resting membrane potential, but it is not the primary determinant. Activation of voltage-gated sodium channels help initiate an action potential. Channels are not linked to an energy source; ions flow passively across the cell membrane.

6. An increase in extracellular potassium ion from 4.0 to 6.0 mEq/L would
   a. hyperpolarize the resting membrane potential.
   b. make it more difficult to reach threshold and produce an action potential.
   c. hypopolarize the resting membrane potential.
   d. alter the threshold potential.

   ANS: C
   An increase in extracellular potassium hypopolarizes the cell (makes it less negative) because more K^+ ions stay inside the cell owing to the reduced concentration gradient. Hyperpolarization of the resting membrane potential (makes it more negative) is caused by a decrease in extracellular potassium. Hyperpolarization resulting from a decrease in extracellular potassium makes it more difficult to reach threshold and produce an action potential. The threshold for action potential does not change with a change in extracellular potassium.

7. GTP-binding proteins (G-proteins) function to
   a. activate receptors on the extracellular surface.
   b. degrade second-messenger molecules.
   c. activate intracellular enzyme systems.
   d. synthesize ATP.

   ANS: C
   G-proteins activate specific target enzymes within the cell and these enzymes then produce second-messenger molecules that trigger specific intracellular function. Membrane-bound G-protein channels are a component of the cell membrane; they do not activate other receptors on the extracellular surface. G-proteins do not degrade second messengers, but instead produce these. G-proteins do not synthesize ATP.

8. Phospholipids spontaneously form lipid bilayers, because they are