CHAPTER 2
An Introduction to Body Systems and Psychological Influences on Health

Multiple Choice Questions

1. Charles Darwin proposed that _____ are a product of evolution that increased the chance of survival.
   a) genes
   b) chromosomes
   c) emotional reactions
   d) immune responses

   Ans: c
   Page: 21

2. Simultaneous contraction of the right and left ventricles of the heart sends blood out to the lungs (right ventricle) and the rest of the body (left ventricle) via the _____.
   a) veins
   b) atria
   c) capillaries
   d) aorta

   Ans: d
   Page: 22

3. Myocardial infarctions are the result of the process of _____.
   a) oxygenation
   b) angina
   c) fibrillation
   d) atherosclerosis

   Ans: d
   Page: 22

4. Angina refers to pain or tightness in the _____.
   a) abdomen
   b) lungs
   c) chest or stomach
   d) chest or shoulder

   Ans: d
   Page: 23

5. Digestion begins in _____.

a) the mouth
b) the esophagus
c) the stomach
d) the small intestine

Ans: a
Page: 23

6. The digestive process is controlled both locally and by _____.
a) the liver
b) the brain
c) the stomach
d) the small intestine

Ans: b
Page: 24

7. In the respiratory system, exchanges of oxygen and carbon dioxide between external air and blood take place in the _____.
a) alveoli
b) bronchi
c) bronchioli
d) trachea

Ans: a
Page: 24

8. The brain can speed or slow respiration by controlling the stimulation of the _____.
a) larynx
b) lungs
c) trachea
d) diaphragm

Ans: d
Page: 25

9. The renal system does *not* _____.
a) regulate blood pressure
b) regulate the immune system
c) remove waste products
d) control the retention and excretion of electrolytes

Ans: b
Page: 25

10. The primary components of the immune system are _____.

a) hormones
b) enzymes
c) individual cells
d) neurotransmitters

Ans: c
Page: 25

11. _____ is a classic sign of infection.
a) Bleeding
b) High blood pressure
c) Inflammation
d) Fainting

Ans: c
Page: 25

12. Inflammation is promoted by _____, which is/are secreted by certain cells of the immune system.
a) acetylcholine
b) norepinephrine
c) cytokines and histamine
d) leukocytes

Ans: c
Page: 25

13. Natural immunity protects against _____ threats only.
a) novel
b) common
c) mild
d) extreme

Ans: b
Page: 26

14. B-lymphocytes produce and secrete _____.
a) antibodies
b) toxins
c) cytokines
d) viruses

Ans: a
Page: 27

15. The baroreflex _____.

a) raises blood pressure when less blood is flowing to the brain
b) monitors the presence of glucose in the blood supplying the brain
c) controls renal function to eliminate toxic substances that may affect the brain
d) raises blood pressure when more blood is flowing to the brain

Ans: a
Page: 27

16. The autonomic nervous system is subdivided into the _____.
a) sympathetic and parasympathetic nervous systems
b) afferent and efferent nervous systems
c) central and peripheral nervous systems
d) sensory and motor systems

Ans: a
Page: 29

17. The endocrine system does *not* _____.
a) release hormones
b) complement and extend peripheral nervous system activity
c) remove waste products from the blood
d) influence body function

Ans: c
Pages: 30-31

18. Release of hormones from the central portion of the adrenal gland is controlled by the _____.
a) sympathetic nervous system
b) pituitary gland
c) kidney
d) parasympathetic nervous system

Ans: a
Page: 30

19. Physiologist Walter Cannon identified the broad pattern of response to threat that he called _____ response pattern.
a) the up-and-down
b) the take-no-prisoners
c) the fight-or-flight
d) the head-and-heart

Ans: c
Page: 31

20. Sympathetic nervous system activity _____.
    a) stimulates smooth muscle contraction in the gastrointestinal system
    b) stimulates the bronchioles of the lungs
    c) increases heart rate
    d) constricts blood vessels supplying large muscles in the arms and legs

    Ans: c
    Pages: 31-32

21. Gastrointestinal ulcers have *not* been linked to _____.
    a) bacterial infections
    b) viral infections
    c) chronic stress
    d) depression

    Ans: b
    Pages: 34-35

22. Vasovagal reactions are thought to occur as a consequence of _____.
    a) actual blood loss
    b) anticipated blood loss
    c) cultural influences
    d) non-diagnosed illness

    Ans: b
    Pages: 36-37

23. Compared to a vasovagal reaction, hypertension is _____.
    a) defined by high blood pressure
    b) acute
    c) characterized by a "dip" in pressure during sleep
    d) related to uncontrollable stress

    Ans: a
    Page: 37

24. Using rats, Selye (1956) observed that removal of the _____ prevented stress-induced ulcers.
    a) adrenal glands
    b) spleen
    c) thyroid gland
    d) parathyroid glands

    Ans: a
    Page: 39

25. Anderson and colleagues found that women with breast cancer who participated in _____ after surgery were significantly less likely to experience a recurrence.
    a) hypnosis
    b) experimental drug studies
    c) stress reduction groups
    d) experimental surgical treatment

    Ans: c
    Page: 40

Short Answer Questions

1. Briefly explain how the expression of emotion can generally increase the chance of survival but also, in certain cases, produce the opposite result.

   Ans: Emotions recruit resources (metabolic, attentional, etc.) to prepare the individual for "fight or flight." As such, they have evolved to maximize the chances of the individual's survival and/or the propagation of his/her genes. However, it is believed that in the modern world—at least in developed countries—the challenges humans once faced in nature have changed, and the "fight or flight" response may impose a cost without a corresponding benefit.
   Pages: 31-32

2. Briefly discuss why the activation of the immune system, which is designed to protect the body, can actually lead to illness.

   Ans: The immune system must walk a very fine line: on the one hand, it must identify and quickly kill any living organism that is entering the body to prevent serious harm. On the other hand, it must avoid harming body tissues and organs. Under a variety of conditions (e.g., AIDS and auto-immune diseases) this balance is disrupted, leading to disease.
   Pages: 27, 40-41

3. Explain why the role of the hypothalamic-pituitary-adrenal axis is important in health psychology.

   Ans: The hypothalamic-pituitary-adrenal axis represents the main pathway through which the brain regulates the endocrine system. As such, it plays a major role in orchestrating all emotional responses, including those related to stress.
   Pages: 30-31

4. Describe the effect of life stress on immune function.

   Ans: Life stress can both increase and decrease immune function, depending in part on the length of the stressful situation. Brief stressors appear to produce an adaptive, sympathetically mediated increase in immune function that, if repeated, might contribute to problems such as asthma or rheumatoid arthritis. On the other hand, stressors of longer duration can lead to a cortisol-related reduction in immune activity. This may have developed

as a way of modulating the immune response to reduce inflammation that may hinder ongoing escape behaviour and perhaps reduce the risk of autoimmune disorders. However, even more recent results suggest that the pendulum may swing back to immune enhancement with very prolonged stress. Long-term release of cortisol may desensitize glucocorticoid receptors, decreasing the body's ability to control immune function. As a result, inflammation and other aspects of immune function may go up.
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5. Explain why the work of Hans Selye was popular in his time and why it is still relevant today.

   Ans: Hans Selye extended the work of Cannon and popularized the idea of stress among physicians and within the general public as a common and potentially threatening aspect of modern life in developed societies. His ideas sparked a vast field of research that continues to this day.
   Pages: 34-39

6. Explain why the emotional anticipation of an important event that may never occur can be useful for evolution but harmful in modern life.

   Ans: Similarly to "rumination," a process that extends the harmful effects of a stressful event that is already finished, the anticipation of a future stressful event may trigger damage for something that may not even occur. This response may have been useful in terms of preparing for stressful surprises, but it is most often inappropriate in modern life.
   Pages: 34, 36-37

7. Explain why it is incorrect to declare the ulcer problem "solved" despite Marshall and Warren's discovery of the Helicobacter pylori (H. pylori) bacterium.

   Ans: While the importance of H. pylori continues to be acknowledged, views have become more nuanced in recent years. For example, about 30 per cent of people with ulcers do not have H. pylori and ulcers sometimes reoccur in people treated for H. pylori despite elimination of the bacterium. Most important, most people with H. pylori do not develop ulcers. Thus, it is more accurate to view it as a strong risk factor for ulcers that can be exacerbated by other factors, including stress. The idea that stress may contribute to ulcer formation by reducing immune activity is also consistent with the growing area of psychoneuroimmunology and with the role of depression, which is known to have a particularly strong effect on cortisol release.
   Pages: 34-35

8. Briefly outline and discuss two examples that demonstrate that the central nervous system controls the digestive process.

   Ans: Two common examples are salivation when hungry and observing/smelling food and lack of appetite when confronted with a tense situation. Both examples illustrate how regulation by the nervous system steers the overall activity of the digestive system based on

general needs and goals, and that this role is superimposed over the automatic mechanisms intrinsic to the digestive system.
Pages: 24, 29, 32

9. Briefly compare and contrast the functions of the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS).

   Ans: Though slower and less precisely targeted than somatic nervous system activity, PNS activity is generally quicker and more specific than SNS activity. There is much greater opportunity for sympathetic activity to spread and linger compared to parasympathetic activity. Imagine walking down a deserted street late at night. Unexpectedly, a cat knocks over a trash can. Sympathetic activity will probably lead to a number of different responses —increased sweating, heart rate, constriction of blood vessels, etc.—that may leave you feeling "wired" for some time.
   Pages: 28-29

10. List a common cause of chronic stress in modern life and explain how this may affect the autonomic and the endocrine systems, leading to certain illnesses.

    Ans: Highly demanding jobs with limited freedom of action, such as those of firefighters and nurses, are associated with high risk of stress-related disorders. Stress produces activation of the autonomic nervous system, leading to release of catecholamines, which in turn produce vasoconstriction, thus facilitating the establishment of hypertension. Stress also stimulates release of cortisol from the adrenal gland, which can facilitate ulcer formation.
    Pages: 31-35, 37-38

Essay Answer Questions

1. Compare and contrast the responses of the central nervous system and the immune system when defending the body against an outside threat.

   Ans: Students are expected to stress the similarities as well as the differences between the central nervous system and the immune system. Among the similarities are
   - the availability of ready-to-use automatic responses, reflexes, and natural immunity; and,
   - the built-in capability for long-term memory to effectively tailor a response to a particular threat.

   On the other hand,
   - the central nervous system is generally faster than the immune system;
   - the central nervous system operates against external, macroscopic threats, whereas the immune system operates against microscopic threats entering the body; and,
   - the central nervous system operates by orchestrating behaviours, whereas the immune system operates by delivering proteins (antibodies) and/or specialized cells (lymphocytes) against any invader.

   Pages: 25-29

2. Discuss the role of the hormone produced by the anterior pituitary gland that is most profoundly involved in stress response.

   Ans: Students are expected to research and discuss the function of ACTH at various levels:
   - the role of the hypothalamus as a "hub" controlling most autonomic, emotional, and neuro-vegetative functions;
   - how the hypothalamus controls the anterior pituitary (portal system) and its different control of the posterior pituitary;
   - the name of the peptide involved, including CRF;
   - how the anterior pituitary works, with a focus on the secretion of ACTH;
   - the adrenal cortex, the endocrine gland targeted by ACTH;
   - the main adrenal hormone controlled by ACTH, cortisol, and its centrality in the response to stress; and,
   - the chronic overproduction of cortisol being linked to several illnesses, including diabetes, hypertension, and digestive ulcers.

   Pages: 30-31

3. Discuss the evidence linking chronic stress to gastric ulcers as well as the evidence against this connection.

   Ans: Students are expected to review and discuss the early evidence obtained from experimental primates:
   - that stress leads to the formation of gastrointestinal ulcers;
   - the popularity of these observations;
   - criticism of this early work and subsequent observations in rats demonstrating that inescapable shock increases the risk of gastrointestinal ulcers;
   - the relationship of inescapable shock to animal models of depression, such as "learned helplessness," and the corroboration of this hypothesis by the effectiveness of antidepressants in suppressing ulcers in inescapable shock experiments;
   - the discovery of an infectious agent contributing to ulcer formation: H. pylori;
   - 1995 epidemiological data from post-earthquake Japan reviving the stress hypothesis for ulcer formation; and,
   - the modern multi-factorial view of the causes of ulcer formation.

   Pages: 34-35

4. Outline the likely process linking chronic stress, hypertension, endothelial damage, and vascular inflammation to coronary vascular obstruction and, eventually, cardiac ischemia.

   Ans: Students are expected to review and discuss
   - how acute stress increases blood pressure via the autonomic and endocrine mechanisms (i.e., catecholamines and steroids);
   - how repeated acute stresses and/or chronic stress can lead to sustained and eventually chronic hypertension—the mechanism of this transition is not well understood;

- the fact that hypertension in combination with inappropriate diet (fats) and smoking produces damage to the arterial wall, starting from the endothelium—both diet and smoking are directly linked to stress;
- the fact that arterial damage eventually translates into the formation of atherosclerotic plaque, which can obstruct blood flow in critical areas such as the coronary supply to the heart; and,
- how, in combination with coronary vassal constriction (linked to stress), atherosclerotic plaque can lead to a sudden blockage of blood supply to the heart, causing ischemia and death.

Pages: 37-38

5. Using specific examples compare and contrast the effects of (1) damage to the somatic nervous system and (2) disruption of the autonomic nervous system.

   Ans: This question is meant to shed light on the different roles of the somatic and autonomic nervous systems using a clinical angle. Damage to the somatic nervous system could be illustrated by describing the effects of
   - compression or a section of the peripheral motor nerves controlling the right hand;
   - damage due to stroke or head trauma, destroying a portion of the central motor cortex controlling the right hand; and,
   - in both cases, the result is a very specific and localized deficit (paralysis of the right hand) and does not affect the movement of other parts of the body (e.g., the left hand).

   In parallel, it will emerge that tumors or trauma can damage portions of the autonomic nervous system, but the resulting effects will be less obvious because
   - the autonomic nervous system has a modulatory role (for example, the heart keeps beating even in the absence of sympathetic and/or parasympathetic input). This contrasts with the skeletal muscle which is paralyzed without motor innervation.
   - compensatory mechanisms can obscure the effect of the lesion (for example, in the absence of sympathetic innervation, catecholamines from the adrenal medulla are still available and the heart will respond to them). This contrasts with the skeletal muscle, which has no compensatory mechanisms without motor innervation.

   Pages: 27-29