

## Chapter 1- Cellular Biology

### 1. It is true that a eukaryotic cell:

- A Is smaller than a prokaryotic cell.
- B Contains structures called organelles.
- C Lacks a well-defined nucleus.
- D Does not contain histones.

Eukaryotic cells contain organelles and histones, they have a well-defined nucleus, and are larger than prokaryotic cells.

### 2. The function of a histone found in a eukaryote cell focuses on cellular:

- A Division
- B Movement
- C Activities
- D Deoxyribonucleic acid (DNA) folding

The histones are binding proteins that cause the supercoiling of DNA into chromosomes and do not affect cellular division, movement, or activities.

### 3. An organelle that is responsible for the metabolism of cellular energy is referred to as a/an:

- A Golgi complex
- B Mitochondrion
- C Endoplasmic reticulum
- D Nucleolus

Mitochondria play a role in cellular metabolism, cellular respiration, and energy production. The Golgi complex is responsible for processing and packaging proteins from the endoplasmic reticulum, where they are synthesized. The nucleolus is a small, dense structure that contains the ribonucleic acid (RNA), DNA, and DNA-binding proteins.

### 4. Which statement best describes a desmosome?

- A A desmosome is a barrier to diffusion.
- B Desmosomes hold cells together by continuous bands.
- C A desmosome is a communicating tunnel.
- D Desmosomes function as a zona occludens.

The desmosome is a type of cell junction. The other two types include tight junctions and gap junctions. Desmosomes hold cells together by forming a continuous band of epithelial tissue or belt (or button like) points of contact. They are also a source of structural stability. Tight junctions serve as barriers to diffusion and prevent the movement of substances through transport proteins. Gap junctions are clusters of communicating tunnels.

**5. Which statement describes the function of a second messenger?**

- A Extracellular ligand that binds with membrane-bound receptors
- B Intracellular enzyme that once will trigger a cascade of intracellular events
- C Chemical messenger that opens specific channels in the cell membrane
- D Chemical messenger that blocks a membrane-bound receptor signal

The binding of a ligand to a cell surface receptor triggers the activation of intracellular second messengers. Second messengers activate signal transduction pathways in the cell that can initiate different intracellular events. Cyclic adenosine monophosphate (cAMP) and calcium ( $\text{Ca}^{++}$ ) are the two major second-messenger pathways. First messengers are the extracellular ligands that bind to cell surface receptors. Binding of first messengers can result in the opening or closing of specific cell membrane channels or the activation of second messengers.

**6. Which statement is correct regarding cellular energy?**

- A Glycolysis is the building of sugar molecules.
- B Oxidative cellular metabolism is a single reaction making adenosine triphosphate (ATP).
- C Oxidative phosphorylation occurs in the mitochondria.
- D Anaerobic glycolysis occurs in the presence of oxygen.

Oxidative phosphorylation occurs in the mitochondria. This is the mechanism by which the energy produced from carbohydrates, fats, and proteins is transferred to ATP. Glycolysis is a process that breaks down glucose molecules; it produces a net of two ATP molecules. Oxidation is a process during which a pair of electrons are removed and transferred. Oxidative cellular metabolism involves 10 biochemical reactions. Anaerobic glycolysis occurs in the absence of oxygen. Aerobic means in the presence of oxygen.  
Awarded 0.0 points out of 1.0 possible points.

**7. Movement of a solute molecule from an area of high concentration to an area of low concentration is called:**

- A Diffusion
- B Filtration
- C Osmosis
- D Hydrostatic pressure

Diffusion is the movement of a solute from an area of high concentration to an area of low concentration. Osmosis is the movement of water down a concentration gradient from an area of higher water concentration to an area of lower water concentration. Filtration is the movement of water and solute through a membrane because of a greater pushing pressure on one side of the membrane than the other. Hydrostatic pressure is the mechanical force of water pushing against a cell membrane.

**8. Which of the following is an example of an energy-releasing process?**

- A Anabolism
- B Catabolism
- C Substrate-induced reaction
- D Second messenger system

Catabolism is an energy-releasing process. The energy-using process is anabolism. A substrate is a specific substance that is converted to a product in the reaction. A second messenger is a “pass-it-on signal.” This occurs when a first messenger activates a receptor that then triggers a pass-it-on signal.

**9. Which of the following describes the term chemotaxis?**

- A Uses the second messenger system
- B Cellular signal affecting the cell of origin
- C Movement of cells along a chemical gradient
- D Ligands bind with receptors, triggering a second reaction

Chemotaxis is cellular movement along a chemical gradient caused by chemical attraction. Autostimulation is when a cell releases a signal that actually affects the cell of origin. A pass-it-on signal is a description for a second messenger system. A second messenger system is a means by which a ligand binds with receptors of a membrane system and then triggers a second system or reaction.

**10. Which of the following describes an amphipathic molecule?**

- A Hydrophobic and not Hydrophilic
- B Hydrophilic and not Hydrophobic
- C Hydrophobic and Hydrophilic**
- D Nonpolar

The amphipathic molecule is both hydrophobic and hydrophilic. A hydrophilic molecule is a charged, water-loving molecule. A hydrophobic molecule is an uncharged or water-hating molecule. A polar molecule is another name for an amphipathic molecule.

**11. Which of the following are functions of a protein? (Select all that apply.)**

- A Pores or transport channels**
- B Enzymes that drive pumps**
- C Cell surface markers**
- D Synapses for cells

Proteins may act as transport channels, pores, cell surface markers, enzymes that drive pumps, catalysts, and cell adhesion molecules (CAMs), or they may act as the key components of ATP synthesis. Synapses are the connections between two nerve cells.

**12. A \_\_\_\_\_ solution has a higher concentration (less dilute) than body solution.**

**Hypertonic**

A hypotonic solution has a lower concentration than a body solution.

## **Chapter 2-Altered Cellular and Tissue Biology**

**13. Which of the following is the most common cause of cellular injury?**

- A Free radical-induced injury
- B Chemical injury
- C Hypoxia**
- D Mechanical factors

Hypoxia is the most common cause of cellular injury and can be initiated by decreased oxygen in the environment, decreased hemoglobin, decreased red blood cells, or cardiovascular collapse. A free radical-induced injury, chemical injury, and mechanical factors are other types

of cell injury but are not the most common.

**14. Which chemical interferes with the excretion of urate while affecting the nervous and hematopoietic systems?**

- A Carbon monoxide
- B Carbon tetrachloride
- C Lead**
- D Mercury

Lead can interfere with the excretion of urate and thus increase an individual's predisposition to gout; it affects the hematopoietic and nervous systems. Carbon monoxide is a gas that is an asphyxiate and interrupts respiration. Carbon tetrachloride was formerly used in dry cleaning. It damages the liver as it is converted into a highly toxic free radical. Mercury is a heavy metal and can worsen chronic conditions such as Alzheimer disease and multiple sclerosis.

**15. A collection of blood that is located between the skull and the dura is called a/an:**

- A Epidural hematoma**
- B Contusion
- C Subdural hematoma
- D Subarachnoid hemorrhage

Epidural hematomas are a collection of blood between the inner surface of the skull and the dura. A contusion is a bruise or bleeding into the skin and underlying tissue. A subdural hematoma is a collection of blood between the inner surface of the dura and the surface of the brain. Subarachnoid hemorrhage is a condition in which a cerebral arterial aneurysm ruptures.

**16. The possible diagnosis of shaken baby syndrome is supported when an infant brought to the emergency department is found to have which type of cerebral hematoma?**

- A Epidural
- B Subdural**
- C Subarachnoid
- D Avulsion

A subdural hematoma is associated with blows, falls, or sudden acceleration or deceleration of the head, such as the sudden movements that occur with shaken baby syndrome. Epidural hematomas are the result of a torn artery, often associated with a skull fracture. Subarachnoid hemorrhage is a condition in which a cerebral arterial aneurysm has ruptured. An avulsion is a tear or rip in the skin, resulting when tensile strength of skin or tissue is exceeded.

**17. Which term describes a tear or rip of the skin with a jagged and irregular edge?**

- A Abrasion
- B Incision
- C Laceration**
- D Incised wound

Lacerations occur when the tensile strength of the skin is exceeded, resulting in ragged and irregular abraded edges; an extreme example is avulsion, in which a wide area of tissue is pulled away. An abrasion results from the removal of the superficial layers of the skin caused by friction between the skin and the injuring object. An incision is a precise cut with an instrument that leaves regular clean edges. An incised wound is longer than it is deep and has distinct edges without abrasion.

**18. Which term describes oxygen failing to reach the blood?**

- A Suffocation**
- B Strangulation
- C Drowning
- D Petechiae

Suffocation occurs when oxygen fails to reach the blood. It is a subgroup of asphyxial injuries. Strangulation is caused by compression and closure of the blood vessels and air passages by external pressure on the neck. Drowning occurs when water or fluid alters the delivery of oxygen. Petechiae are found on the neck of a victim who has been strangled. It is the result of compression of soft tissue and the breakage of blood vessels.

**19. Heat exhaustion is defined as:**

- A Chilling or freezing of the cells
- B Cramping of voluntary muscles
- C Hemoconcentration from salt and water loss**
- D Significantly decreased blood volume

Heat exhaustion is defined by a sufficient salt and water loss that results in hemoconcentration.

Hypotension occurs secondary to fluid loss and may cause a collapse. The individual may feel weak and nauseated. Chills or freezing cells are associated with hypothermic injury. Heat cramps are cramping of voluntary muscles, usually the result of vigorous exercise. Heat stroke is a life-threatening condition associated with high environmental temperatures and humidity. Generalized peripheral vasodilation and decreased circulating blood volume are significant.

**20. Which statement regarding altitude and illness is true?**

- A Caisson disease occurs when descending too quickly while diving.
- B Pulmonary edema as the result of hypoxia and increased pulmonary hypertension.**
- C Gas emboli are caused by oxygen bubbles.
- D Altitude sickness occurs from blast injuries.

High altitude causes hypoxic injury. This hypoxia causes shunting of blood from the periphery to vital organs including the lungs and results in pulmonary hypertension. Caisson disease is often called the bends and occurs when divers ascend too quickly, resulting in a gas embolism. Gas emboli are formed when carbon dioxide and nitrogen, which are normally dissolved in blood, bubble out of solution. Blast injuries cause significant injury through the collapse of the thorax, the rupture of internal organs, and widespread hemorrhage.

**21. Which form of necrosis is associated with tuberculous infections?**

- A Coagulative
- B Liquefactive
- C Fat
- D Caseous**

Caseous necrosis is normally found in the lung from tuberculosis. Tissues appear soft and granular and resemble clumped cheese (hence the name caseous) and are surrounded by a granulomatous inflammatory wall; this pulmonary infection is caused by *Mycobacterium tuberculosis*. It is a combination of liquefactive and coagulation necrosis. Coagulative necrosis occurs primarily in the kidneys, heart, and adrenal glands and is caused by protein degradation. Liquefactive necrosis commonly occurs in the neurons and glial cells. Fat necrosis occurs in the breast, pancreas, and other abdominal structures. It is cellular dissolution caused by powerful enzymes called lipases.

**22. Which statements are true regarding apoptosis? (Select all that apply.)**

- A An active process of cellular self-destruction
- B A process that deletes cells during embryonic development
- C Local cell death after severe and sudden injury
- D Nuclear and cytoplasmic shrinkage of a cell

Apoptosis is programmed cell death. It is an active process of cellular self-destruction that is implicated in normal embryonic development, as well as in rapidly proliferating cancer cells. Apoptosis affects single cells by causing nuclear and cytoplasmic shrinkage, followed by the fragmentation of the cell membrane. Necrosis is accidental cell death that occurs to local cells after a severe and sudden injury.

**23. \_\_\_\_\_ is the term for the reversible replacement of one mature cell by a less mature cell type.**

**Metaplasia**

The term metaplasia refers to a mature cell type being replaced by another sometimes less mature cell type.

**24. A deficiency of lipids in the blood stream is known as \_\_\_\_\_.**

**Hypolipidemia**

### **Chapter 3-The Cellular Environment: Fluids and Elcetrolytes, Acids and Bases**

**25. When considering water balance, which statement is the correct balance?**

- A Isotonic fluids cause increased cellular swelling.
- B Hypertonic fluid causes increased cellular swelling.
- C Hypotonic fluid causes cellular swelling.
- D Hypernatremia causes cellular swelling.

Hypotonic extracellular fluid (ECF) causes intracellular water gain and swelling. When the ECF is hypotonic, water moves from the intravascular space to the interstitial space, across the cell membrane, and into the cell. This action causes the cell to swell. An isotonic solution is equal to the plasma in concentration of solute molecules. Therefore no net water will move because equilibrium exists. The cell size is unchanged. A hypertonic fluid has excessive solute; therefore water will leave the cell and move into the vascular space to help balance this excess. Water leaving the cell results in cell shrinkage. Hypernatremia can occur with an acute gain in sodium or a loss of water, but generally it does not cause cellular swelling.



**26. It is true that hyperchloremia:**

- A Occurs with a deficit of sodium.
- B Occurs with an excess of bicarbonate.
- C Has specific symptoms such as thirst.
- D Requires treatment of the underlying disorder.**

Hyperchloremia (too much chloride) is usually related to an underlying disorder, and therefore treatment is centered on the underlying disorder. Because chloride usually follows sodium, this condition usually occurs with an increase in sodium and a deficit of bicarbonate. Normally, neither specific symptoms are observed nor treatments are available for chloride excess.

**27. It is true that hyponatremia:**

- A Is commonly caused by inadequate sodium intake.
- B Can occur with a decrease in total body water (TBW).
- C Never occurs with burns, vomiting, or diarrhea.
- D Occurs when sodium drops below 135 mEq/L.**

Hyponatremia occurs when the serum sodium drops below 135 mEq/L. It is the most common electrolyte disorder in individuals who are hospitalized. Although inadequate sodium intake can cause hyponatremia, it is uncommon. It can also occur with an increase in TBW or as a result of burns, vomiting, diarrhea, or gastrointestinal suctioning.

**28. Which statement is true regarding potassium balance?**

- A Potassium is the major extracellular electrolyte.
- B During acidosis, potassium shifts into the cell.
- C Aldosterone is secreted when potassium is decreased.
- D Insulin causes the movement of potassium into the cell.**

Insulin causes movement of potassium into the cell and is one of the treatments for hyperkalemia. Potassium balance is especially significant in the treatment of conditions requiring insulin administration, such as insulin-dependent diabetes mellitus (type 1). Potassium is the major intracellular electrolyte and maintains the osmotic balance of the intracellular fluid (ICF) space. During acidosis, potassium is shifted out of the cell in exchange for hydrogen ions. Aldosterone is secreted when potassium is elevated, resulting in the excretion of potassium by the kidneys.

**29. Which statement is true regarding hypokalemia?**

- A Hypokalemia occurs when the serum level is below 135 mEq/L.
- B One cause of hypokalemia is diabetic ketoacidosis.**
- C Dietary causes of hypokalemia are common.
- D Diuretics do not cause hypokalemia.

Hypokalemia is low potassium. Therefore hypokalemia is defined as a serum level less than 3.5 mEq/L. It is often caused by diuretics. Diabetic ketoacidosis does cause hypokalemia. Potassium is shifted out of the cell in exchange for hydrogen and then excreted. The serum level may remain within a normal range, but then when insulin is administered, potassium is shifted back into the cells and a deficit occurs. Potassium balance is especially significant in the treatment of conditions requiring insulin administration, such as insulin-dependent diabetes mellitus (type 1). Dietary causes are uncommon.

**30. Hypernatremia is defined as levels above:**

- A 147 mEq/L**
- B 5.5 mEq/L
- C 105 mEq/L
- D 8.5 mg/dl

Hypernatremia is defined as serum levels above 147 mEq/L. Hyperkalemia is defined as serum levels above 5.5 mEq/L, and hyperchloremia is defined as serum levels above 105 mEq/L. Hypocalcemia occurs when serum calcium concentrations are less than 8.5 mg/dl.

**31. Which statement is true regarding magnesium?**

- A Hypomagnesemia occurs with a concentration less than 2.5 mEq/L.
- B Magnesium is a major extracellular cation.
- C Thirty percent is stored in the muscle and bone.
- D Symptoms of hypomagnesemia include weakness and depression.**

Symptoms of low magnesium include weakness, tetany, increased reflexes, depression, ataxia, convulsions, and irritability. Magnesium level is normal when between 1.8 and 2.4 mEq/L and is a major intracellular cation. Thirty percent is stored in the cells, with 40% to 60% stored in the bones and muscle.

**32. Which statement describes acidemia?**

- A State in which the pH of arterial blood is greater than 7.45
- B State in which the pH of arterial blood is less than 7.35**
- C Systemic decrease in hydrogen ion concentration
- D Systemic excess of base

Acidemia is a state in which the pH of arterial blood is less than 7.35. Alkalemia is a state in which the pH of arterial blood is greater than 7.45. A systemic increase in hydrogen ion concentration or loss of base is termed acidosis. A systemic decrease in hydrogen ion concentration or an excess of base is termed alkalosis.

Awarded 0.0 points out of 1.0 possible points.

**33. Common causes of edema formation (increased filtration of fluid from capillaries and lymph into surrounding tissues) include which of the following? (Select all that apply.)**

- A Decreased hydrostatic pressure
- B Decreased plasma oncotic pressure**
- C Increased capillary membrane permeability**
- D Lymphatic obstruction**
- E Sodium retention**

The five common causes of increased edema are: (1) increased hydrostatic pressure, (2) decreased plasma oncotic pressure, (3) increased capillary membrane permeability, (4) lymphatic obstruction, and (5) sodium retention.

**34. Which of the following are clinical manifestations of hypokalemia? (Select all that apply.)**

- A Carbohydrate metabolism is affected as a result of decreased insulin secretion.**
- B Renal function is impaired.**
- C Neuromuscular excitability is decreased.**
- D Skeletal muscle is affected with increased contractility.

Carbohydrate metabolism is affected by depressing insulin secretion and alters hepatic and skeletal muscle glycogen synthesis. Renal function may be impaired with a decreased ability to concentrate urine, and renal tubular atrophy and fibrosis may occur. Neuromuscular excitability is decreased causing skeletal muscle weakness, smooth muscle atony, and cardiac dysrhythmias. Hypokalemia causes the skeletal muscle to be weak.

**35. Which treatments are appropriate for hyperkalemia? (Select all that apply.)**

- A Calcium gluconate
- B Treating the contributing cause
- C Administering glucagon
- D Sodium bicarbonate

Calcium gluconate, treating the contributing cause, and sodium bicarbonate are all appropriate treatments. Calcium gluconate can be administered to restore normal neuromuscular irritability when serum potassium levels are dangerously high. Glucose, which readily stimulates insulin secretion, or the administration of glucose and insulin for those with diabetes, facilitates cellular entry of potassium. Sodium bicarbonate corrects metabolic acidosis and lowers serum potassium. Glucagon is administered to treat beta-blocker overdose or hypoglycemia.

**36. One third of the body's fluid is \_\_\_\_\_.**

Extracellular

Two thirds of the body's water is intracellular; one third is extracellular. Two components of the extracellular compartment are interstitial and intravascular. TBW is approximately 60% of body weight.

**37. Which term describes the deoxyribonucleic acid (DNA) subunit of one deoxyribose molecule, one phosphate group, and one base?**

- A Polypeptide
- B Double helix
- C Nucleotide
- D Codon

A nucleotide consists of one deoxyribose molecule, one phosphate group, and one base. A polypeptide is a chain of proteins. The double helix is the twisted staircase presentation of DNA that was proposed by Watson-Crick. A codon is a triplet of amino acids.

#### **Chapter 4-Genes and Genetic Diseases**

**38. Which statement is true regarding termination codons?**

- A Eighty codons are possible.

- B Three codons signal the end of a gene.
- C Seventy codons specify amino acids.
- D Each amino acid has one codon.

Three codons signal the end of a gene, and they are called termination or nonsense codons.

**39. Which statement describes the function of DNA polymerase?**

- A Synthesizes ribonucleic acid (RNA) from the DNA template.
- B Synthesizes a polypeptide.
- C Performs base pairing in replication.
- D Splits DNA molecules.

The function of DNA polymerase is to assist with base pairing when replicating DNA. This enzyme travels along the single DNA strand, adding the correct nucleotides to the free end of the new strand. It also proofreads. Transcription is the synthesis of RNA from DNA. Translation is the formation of a polypeptide from RNA.

**40. Which statement is true regarding protein synthesis?**

- A Protein synthesis takes place in the cytoplasm.
- B DNA is replicated in the cytoplasm.
- C RNA is double stranded.
- D RNA contains the same bases as DNA.

Protein synthesis takes place in the cytoplasm, whereas DNA replication takes place in the nucleus. RNA is single stranded and has uracil, which is structurally similar to thymine. Therefore the bases are slightly different for RNA.

**41. Which statement is true regarding base pairs?**

- A Adenine pairs with guanine
- B Guanine pairs with thymine
- C Cytosine pairs with adenine
- D Uracil pairs with adenine

Uracil is structurally similar to thymine. Therefore the correct base pairs are adenine with thymine, guanine with cytosine, and uracil with adenine.

**42. Which term describes the sequence for the beginning of a gene?**

- A Intron
- B Exon

- C Promoter site
- D Anticodon

Transcription of a gene begins when an enzyme called RNA polymerase binds to a promoter site on the DNA. A promoter site is a sequence of DNA that specifies the beginning of a gene. Many of the RNA sequences are removed, and the remaining sequences are spliced together to form the functional messenger RNA (mRNA) that will migrate to the cytoplasm. The excised sequences are called introns, and the sequences that are left to code for proteins are called exons. The anticodon is the sequence of three nucleotides that undergo complementary base pairing in translation.

**43. Which statement is true regarding chromosomes?**

- A There are three cell types.
- B The somatic cells contain 46 chromosomes.
- C Gametes are diploid cells.
- D Diploid cells are formed through meiosis.

There are two cell types: somatic and gametes. Somatic cells are those that are not gametes (sperm and eggs). They have 46 chromosomes in the nucleus. These are also considered diploid cells. The gametes are haploid cells and have only 23 chromosomes. They are formed from diploid cells through meiosis.

**44. Which term describes a cell that does not contain a multiple of 23 chromosomes?**

- A Aneuploid
- B Monosomy
- C Trisomy
- D Tetraploidy

The term aneuploid means that the cell does not contain a multiple of 23 chromosomes. Monosomy is the presence of only one copy of a given chromosome in a cell. Trisomy is the presence of three copies of a chromosome. Tetraploidy is a cell that contains 92 chromosomes. Awarded 0.0 points out of 1.0 possible points.

**45. Which term describes an allele with an observable effect?**

- A Homozygous
- B Heterozygous

- C Dominant
- D Recessive

Dominant alleles have effects that are observable. Homozygous is when two alleles at a locus are identical. Heterozygous is when the two alleles at a locus are different. Recessive alleles may be hidden.

**46. Which statement is true regarding autosomal dominant gene transmission?**

- A The affected parent transmits the gene to one-half of his or her children.
- B The affected gene is found in males only.
- C Generations are skipped for transmission.
- D Females will transmit the disease more often than males.

The affected parent will transmit the trait to (approximately) one-half of his or her children; in each match, a 50% chance exists that either a normal gene or an affected gene will be transmitted to the child. The affected gene is found equally in males and females, both sexes transmit the trait equally, and no skipping of generations occurs.

**47. Which statement is true regarding autosomal recessive inheritance?**

- A Parents will always display the trait.
- B Approximately 50% of children will display the trait.
- C Males and females are equally affected.
- D An individual must be heterozygous to display a recessive trait.

Males and females are equally affected by autosomal recessive traits. Generally, parents will not display the trait; that is, they are heterozygous themselves, but each will pass the recessive trait to 25% of their children. The child must be homozygous for the trait to express the recessive trait.

**48. Match the following syndromes with the appropriate characteristics.**

Down Syndrome	Distinctive facial appearance
Turner Syndrome	Always female
Klinefelter Syndrome	Male appearance but sterile
Cri du Chat Syndrome	Child has very characteristic cry

## Chapter 5-Genes, Environment-Lifestyle, and Common Diseases

### 49. What is the definition of incidence rate?

- A Number of new cases of a disease reported during a specific period, divided by the number of individuals in the population
- B Proportion of the population affected by a disease at a specific point in time
- C Effect of a specific risk factor
- D Variation caused by the multiple effects of genes

The number of new cases of a disease reported during a specific period of time (typically 1 year), divided by the number of individuals in the population, is the incidence rate. The proportion of the population affected by a disease at a specific point in time is the prevalence rate. The effect of a specific risk factor is the relative risk. Polygenic genes cause variation.

### 50. Which statement is true regarding the risks of developing a disease?

- A Empiric risks are based on assumptions.
- B Recurrence risk is higher if more than one family member is affected.
- C An individual below the threshold of liability for a disease will have the disease.
- D The recurrence risk for disease usually increases rapidly in more remotely related relatives.

Recurrence risk is higher if more than one family member is affected and usually decreases rapidly in more remotely related relatives. Empiric risks are based on observation. For diseases that have a threshold of liability, an individual usually does not have the disease below the threshold of liability.

### 51. Which statement describes a monozygotic twin?

- A Twins who share very few traits
- B Twins who share all traits
- C Twins who form from double ovulation
- D Twins whose rates vary among populations

Monozygotic twins divide from one embryo and actually share traits. They are natural clones. Twins from double ovulation are dizygotic and may not share traits. Monozygotic twins have the same rate across populations. Dizygotic or fraternal rates vary among populations.



**52. Which statement regarding coronary heart disease is true?**

- A It is the leading killer of Americans.
- B Atherosclerosis causes widening of the blood vessels.
- C It is more common in women.
- D Relative risk does not increase with relatives affected.

Coronary heart disease is the leading killer of Americans. Narrowing of blood vessels occurs as a result of atherosclerosis. Men are more commonly affected. Relative risk increases when two or more relatives are affected before the age 55 years.

**53. Which statement regarding hypertension is true?**

- A Systemic hypertension is observed in less than 5% of populations.
- B Environmental factors do not cause hypertension.
- C One of the most important factors affecting blood pressure is sodium intake.
- D A 100% correlation exists among family members and blood pressure.

Sodium intake, obesity, decreased physical activity, and psychosocial stress are important environmental risk factors for obesity. Systemic hypertension affects approximately 25% to 30% of the population. Only a 20% to 40% correlation exists among family members.

**54. Which gene is linked with breast cancer?**

- A BRCA1
- B APC
- C HLA II
- D IDDM

BRCA1 is located on chromosome 17, and BRCA2 is located on chromosome 13. If women inherit these genes, then their lifetime risk of getting breast cancer increases by 50% to 80%. The APC gene is associated with colon cancer. Human leukocyte antigen (HLA) II is associated with diabetes. IDDM stands for insulin-dependent diabetes mellitus.

**55. Which statement is true regarding type II diabetes?**

- A Type II diabetes accounts for fewer than 10% of all cases of diabetes.
- B Pancreatic insulin is not produced.
- C These individuals experience insulin resistance.
- D Type II diabetes is less common among obese persons.

Type II diabetes is responsible for 90% of all cases of diabetes. Usually people who develop type II diabetes are older than 40 years of age and are obese. They produce insulin and have insulin resistance.

**56. Which statement is true regarding Alzheimer disease?**

- A Alzheimer disease affects 40% of the population older than 65 years of age.
- B Alzheimer disease is characterized by progressive dementia and memory loss.**
- C It has one gene locus.
- D Antidiuretic hormone is a key factor.

Alzheimer disease affects approximately 5% to 10% of the population, age 65 years and older. It is characterized by progressive dementia and memory loss. There are multiple gene loci with three being identified. ADH is aldehyde dehydrogenase, which is responsible for alcohol metabolism.

**57. Which of the following are congenital diseases? (Select all that apply.)**

- A Cleft lip**
- B Clubfoot**
- C Hydrocephaly**
- D Obesity

Although people are born with factors that may cause obesity, infants are not born with this condition present. All of the other choices are traits that are present at birth.

**58. Match the following disorders with the possible causative gene.**

Type II Diabetes	TCF7L2
Colorectal Cancer	APC
Early Onset Alzheimers	PS1
Prevention of Alcoholism	ALDH2

**Chapter 6-Epigenetics and Disease**

**59. Which gene is often seen in retinoblastoma?**

- A MLH1
- B RB1**
- C BRCA1
- D BRCA2

Hypermethylation of the promoter region on the RB1 gene is often seen in retinoblastoma. An inherited form of colon cancer is related to methylation of the promoter region of the MLH1 gene. The BRCA1 and BRCA2 genes are observed in some cases of inherited breast cancer. Renal cell carcinoma in some cases is related to the VHL gene.

**60. 5-azacytidine has been used as a therapeutic drug in the treatment of which disease process?**

- A Leukemia
- B Brain cancer
- C Benign neoplasm
- D Type II diabetes

5-azacytidine, a demethylating agent, has been used as a therapeutic drug in the treatment of leukemia and myelodysplastic syndrome.

**61. Which characteristic supports the diagnosis of Angelman syndrome?**

- A Short stature, hypotonia, obesity
- B Tall stature, hypertonia, creases on the tongue
- C Hypertonia, large hands, webbed toes
- D Severe mental retardation, seizures, ataxia

Angelman syndrome is characterized by severe mental retardation, seizures, and ataxia.

**62. Children with Beckwith-Wiedemann syndrome are at risk for the development of:**

- A Wilms tumor
- B Rectal cancer
- C Diabetes
- D Pulmonary fibrosis

Children with Beckwith-Wiedemann syndrome are at an increased risk for the development of Wilms tumor or hepatoblastoma.

**63. Noncoding RNAs have been shown to regulate gene expression by which mechanisms? (Select all that apply.)**

- A RNA interference
- B Gene co-suppression
- C Imprinting

- D Gene splicing
- E Gene silencing

Noncoding RNAs have been shown to regulate gene expression by novel mechanisms such as RNA interference, gene co-suppression, gene silencing, imprinting, and DNA demethylation.

**64. Which features are associated with Prader-Willi syndrome? (Select all that apply.)**

- A Short stature
- B Small hands and feet
- C Hypertonia
- D Hypogonadism
- E Mild mental retardation

The following are features of a person with Prader-Willi syndrome: short stature, hypotonia, small hands and feet, obesity, hypogonadism, and mild-to-moderate retardation.

#### **Chapter 7-Innate Immunity: Inflammation**

**65. Which of the following is an example of a physical barrier?**

- A Antibacterial fatty acids
- B Lysozymes in tears
- C Epithelial cells
- D Earwax

Epithelial cells form tight junctions that are a physical barrier to entry for organisms.

**66. Which statement is true regarding the inflammatory response?**

- A Inflammatory response is the third line of defense.
- B Inflammatory response relies on cellular components only.
- C Inflammatory response generates a nonspecific response.
- D Inflammatory response occurs at healthy tissue.

The inflammatory response is the second line of defense. It occurs at the site of tissue injury and generates a nonspecific response that involves cellular and chemical components.

**67. Which complement factor is considered an anaphylatoxin?**

- A C3a
- B C1
- C C7
- D C9

C3a, C5a, and C4a are anaphylatoxins. They can induce the rapid degranulation of mast cells and the release of histamine.

**68. Which receptor is expressed on macrophages and facilitates recognition and phagocytosis of bacterial pathogens?**

- A Complement receptors
- B Scavenger receptors**
- C Toll-like receptors
- D Pattern recognition receptors

The scavenger receptors are primarily expressed on macrophages and facilitate recognition and phagocytosis of bacterial pathogens. Complement receptors recognize a variety of fragments produced through activation of the complement system. Toll-like receptors are expressed on the surface of cells, including epithelial, mast, neutrophils, macrophages, dendritic cells, and lymphocytes. They recognize pathogen-associated molecular patterns or stressed host cells. Pattern recognition receptors recognize patterns of infectious molecules. These receptors are found on cells involved in innate resistance.

**69. Which statement regarding mast cells is true?**

- A Histamine causes vasoconstriction.
- B Mast cells are found only in blood vessels.
- C Snake bites, bee venoms, and toxins may cause activation.**
- D Mast cells are not involved in allergic reactions.

A number of things cause the activation of mast cells, including physical injury, chemical agents (including toxins, bee venom, and snake bites), immunologic means, and activation of an inflammatory response. Histamine is released from mast cells and causes vasodilation. Mast cells are found in loose connective tissue close to blood vessels. Mast cells are involved in initiating many allergic reactions.

**70. Which term describes an acidic sulfur-containing lipid that produces effects similar to histamine?**

- A Leukotriene**
- B Prostaglandin
- C Adhesion molecule
- D Phagocyte

Leukotrienes act similar to histamine and cause smooth muscle contraction, increased vascular permeability, and chemotaxis. Prostaglandins cause increased vascular permeability, chemotaxis, and pain. Adhesion molecules increase the stickiness between cells. Phagocyte cells ingest and dispose of foreign material.

Awarded 0.0 points out of 1.0 possible points.

**71. Which statement is true regarding neutrophils?**

- A Neutrophils are agranular.
- B Neutrophils are the predominant phagocytes of early inflammation.**
- C Neutrophils are the largest blood cells.
- D Neutrophils enter the site of injury after lymphocytes and macrophages.

Neutrophils are the predominant phagocytes of early inflammation. They arrive before lymphocytes and macrophages. Monocytes are the largest blood cells and are granular.

**72. What biochemical messenger is produced by macrophages and lymphocytes in response to a bacterial pathogen?**

- A Interleukins**
- B Interferons
- C Chemokines
- D Tumor necrosis factor

Interleukins are biochemical messengers produced by macrophages and lymphocytes in response to a bacterial pathogen. Interferons primarily protect against viral infections. Chemokines induce leukocyte chemotaxis. Tumor necrosis factor, produced by macrophages and lymphocytes, induces a multitude of proinflammatory effects including the enhancement of endothelial cell adhesion.

**73. Chronic inflammation is characterized by a(an):**

- A Lack of giant cells
- B Absence of exudate
- C Dense infiltrate of lymphocytes and macrophages**
- D Inflammation that lasts less than 2 weeks

Chronic inflammation is characterized by a dense infiltrate of lymphocytes and macrophages. Giant cells are multinucleated cells that are formed by fused macrophages during granuloma formation. Chronic inflammation often results in pus formation, purulent discharge, and incomplete wound healing. Chronic inflammation of any cause lasts longer than 2 weeks.

**74. Which of the following are not natural barriers?**

- A Physical
- B Resistance**
- C Biochemical
- D Mechanical

Resistance is a means by which the body may avoid being infected, but it is not a natural barrier. The natural barriers include physical, biochemical, and mechanical, as well as inflammation at the body's surfaces.

**75. Which characteristics are observable of vascular injury and inflammation? (Select all that apply.)**

- A Redness**
- B Coolness to the touch
- C Warmth to the touch**
- D Increased swelling**
- E Pain**

The four characteristics that are observable for inflammation in vascular tissue are redness, heat, swelling, and pain.

**76. Which pathways activate the complement system? (Select all that apply.)**

- A Antigen-antibody
- B Classical**
- C Lectin**
- D Alternative**

The complement system may be activated by the classical, lectin, and alternative pathways.

**77. Which functions of the clotting system are exhibited at the site of injury or inflammation? (Select all that apply.)**

- A Prevents the spread of infection to adjacent tissues.**
- B Traps microorganisms at the site of greatest inflammatory cell activity.**
- C Prevents clot formation at the site of injury.
- D Provides a framework for future repair and healing.**

The clotting system exhibits the following functions: (1) prevents the spread of infection to adjacent tissues; (2) traps microorganisms and foreign bodies at the site of inflammation for removal by infiltrating cells such as neutrophils and macrophages; (3) forms a clot that stops bleeding; and (4) provides a framework for future repair and healing.

**78. Which of the following are systemic effects of inflammation? (Select all that apply.)**

- A Abscess formation
- B Fever
- C Leukocytosis
- D Increased levels of plasma proteins
- E Decreased levels of plasma proteins

The three primary systemic changes associated with an acute inflammatory response are fever, leukocytosis, and increased levels in circulating plasma proteins. Abscesses are a local manifestation of inflammation and are walled-off lesions filled with purulent exudates.

**79. \_\_\_\_\_ factors are biochemical substances that attract leukocytes to the site of inflammation.**

Chemotactic

## **Chapter 8-Adaptive Immunity**

**80. Which is a foreign or nonself substance?**

- A Immunoglobulins
- B Lymphocytes
- C Antibodies
- D Antigens

Antigens are recognized as foreign and initiate the immune response. Immunoglobulins and antibodies are part of the adaptive immune response; they attack the antigen. Lymphocytes are a type of blood cell that is part of the adaptive response.

**81. Which statement is true regarding the immune response in humans?**

- A Before birth, lymphocytes are not produced. Incorrect
- B B lymphocytes come from the thymus.
- C The thymus releases mature lymphocytes.
- D Generation of clonal diversity occurs in primary lymphoid organs

Generation of clonal diversity occurs in the primary lymphoid organs, which includes the thymus (T lymphocytes) and bone marrow (B lymphocytes). Before birth, T and B lymphocytes that recognize almost any foreign antigen predominate. The thymus releases immature T cells that have the ability to recognize foreign antigens.

**82. Which statement best describes the cells and their functions in the humoral arm of**



**the immune system?**

- A Cells undergo differentiation and develop into subpopulations.
- B Cells attack cancerous cells.
- C Antibodies are primarily responsible for protection.**
- D Cells in the humoral arm are also called cellular immunity.

Antibodies are primarily responsible for protection against viruses and bacteria and are part of the humoral arm of the immune system. The antibody can directly invade a microorganism or activate the immune response. T cells undergo differentiation, attack cancerous cells, and are part of cellular immunity.

**83. Which term describes the type of immunity that occurs when preformed antibodies are transferred from a donor to a recipient?**

- A Passive**
- B Active
- C Memory
- D Cellular

The two types of adaptive immunity are active and passive. Passive immunity occurs when preformed antibodies are transferred from a donor to a recipient. An example of passive immunity is the passage of maternal antibodies across the placenta to the fetus. Active immunity is produced by an individual after either a natural exposure or an immunization. Memory cells are formed through cellular and humoral immunity; they remember the antigen.

**84. What is the precise portion of the antigen that is configured for recognition and binding of an antibody?**

- A Paratope
- B Epitope**
- C Self-antigen
- D Immunogen

The antigenic determinant or epitope is the precise portion of the antigen that is configured for recognition and binding of an antibody. A paratope is the matching portion on the antibody or lymphocyte receptor. A self-antigen is one that is not foreign to the host. An immunogen is an antigen that induces an immune response.

**85. Which antigen is too small to initiate an immune response?**

- A Carrier
- B Allergen
- C Hapten**
- D Self-antigen

A hapten is a molecule that is foreign but too small to induce an immune response alone. However, when it binds to a larger carrier molecule, it is able to induce an immune response. An allergen is an antigen that can induce an allergic response. A self-antigen is not foreign but has the three other criteria to be an immunogen.

**86. Which statement is true regarding immunoglobulin A (IgA) antibodies?**

- A IgA-2 is predominantly found in blood.
- B IgA-1 is predominantly found in the body's secretions.
- C The J chain anchors together the IgA molecules.
- D The gamma heavy chain is predominant.

The J chain anchors together the IgA molecules to form dimers and helps them resist degradation from enzymes. IgA-1 is found in the blood, and IgA-2 is found in the secretions of the body.

**87. It is true that immunoglobulin E (IgE) is:**

- A Designed to protect the host from large viruses
- B The primary cause of common allergies
- C The only inflammatory cell that can damage a virus
- D Specifically designed to prevent the invasion and attachment of pathogens through mucous membranes.

IgE is an antibody that is designed to protect the host from parasites and is the only inflammatory cell that can damage a parasite.

**88. Which statement is true regarding aging and the immune system function?**

- A Older adults have decreased circulating antibodies.
- B T-cell function is increased.
- C Antibody production to specific antigens is inferior.
- D Response to infection is rapid.

T-cell function is decreased, and immune responses are delayed. B-cell production is inferior; however, the cells have increased circulating antibody levels.

**89. Which criteria influence the degree of immunogenicity? (Select all that apply.)**

- A Foreignness to the host
- B Appropriate size
- C Appropriate quantity
- D Chemical simplicity
- E Chemical complexity

The four criteria that influence the degree of immunogenicity are foreignness to the host, appropriate size, appropriate quantity, and adequate complexity.

**90. Which of the following are molecular classes of immunoglobulins? (Select all that apply.)**

- A IgC
- B IgD Correct
- C IgE Correct
- D IgM Correct
- E IgN

The five classes of immunoglobulin are IgG, IgA, IgM, IgD, and IgE.

**91. Antigens that can induce an allergic response are called \_\_\_\_\_.**

Allergens

Antigens that induce an allergic response are called allergens. Molecules too small to induce an immune response are called haptens.

**92. \_\_\_\_\_ describes the inactivation or blocking of the binding of the antigen to a receptor?**

Neutralization

Neutralization is the inactivation or blocking of the binding of an antigen to a receptor.

Agglutination is the clumping of insoluble particles that are in suspension.

Precipitation is making a soluble antigen into an insoluble particle. Attenuation describes a weakened virus, often in describing a vaccination.

## **Chapter 9-Alterations in Immunity and Inflammation**

**93. Which definition is true?**

- A Allergy means the deleterious effects of hypersensitivity.
- B Immunity means an altered immunologic response.
- C Hypersensitivity means the protective response to an antigen.
- D Autoimmunity means the normal response to foreign antigens.

Allergy means the deleterious effects of a hypersensitivity reaction.

**94. Which statement is true regarding hypersensitivity reactions?**

- A They require sensitization against a particular antigen.
- B They occur after the primary immune response.
- C Reactions are always delayed.

- D The most delayed reaction is anaphylaxis.

A hypersensitivity reaction requires sensitivity to an antigen and occurs after an adequate secondary immune response. These reactions may then be immediate or delayed. The most immediate reaction is anaphylaxis.

**95. Which statement best describes a type I reaction?**

- A Most type I reactions are mediated by IgA.
- B Most type I reactions are allergic.**
- C Most occur against medications.
- D Seldom does this type contribute to autoimmune diseases.

Most type I reactions are allergic. They are mediated by IgE. Most occur against environmental antigens and can contribute to some autoimmune diseases.

**96. What antibody binds to a mast cell?**

- A Cytotropic**
- B Allergen
- C Antigen
- D Fc

A cytotropic antibody (also called a skin-sensitizing antibody or reagin) is the antibody that binds to the mast cell. An allergen is an environmental antigen that induces an allergic response. An antigen stimulates the immune response and antibody to bind to the mast cell. The Fc is the portion of the mast cell where IgE binds.

**97. Which statement is true regarding atopic individuals?**

- A If one parent has allergies, then a 4% chance exists that the offspring will have similar allergies.
- B If two parents have allergies, then a 50% chance exists that their offspring will have similar allergies.
- C Atopic individuals tend to produce higher quantities of IgE.**
- D No genes are associated with an atopic state.

Higher quantities of IgE are present in atopic individuals. If one parent has an allergy, then the individual has a 40% of having allergies; with two parents, the individual has an 80% of having allergies. Multiple genes have been associated with the atopic state

**98. Which statement is true of serum sickness?**

- A The formation of immune complexes in the blood cause serum sickness.
- B It is the deposition of complexes in the blood vessels.
- C It occurs through cytotoxic T cells.
- D It binds antigen to the cell surface.

Serum sickness reactions are caused by the formation of immune complexes in the blood and their deposition in target tissues. An Arthus reaction deposits complexes into the walls of blood vessels. Type IV mechanisms occur through either cytotoxic T lymphocytes or lymphokine-producing T-helper (Th) 1 cells. Antigen is bound to the cell surface in type II reactions.

**99. The Arthus reaction is an example of which type of sensitivity reaction?**

- A I
- B II
- C III
- D IV

The Arthus reaction is a type III hypersensitivity reaction.

**100. Which statement is true regarding a type IV allergic reaction?**

- A Is immediate in its action.
- B Is infiltrated with B cells.
- C Has a red, soft center.
- D Can be transferred by cells.

Type IV hypersensitivity reactions can be transferred by cells but not by serum. Their actions are delayed because their onset takes from 24 to 72 hours. The site is infiltrated with T lymphocytes and macrophages. A clear hard center surrounds the erythema (redness).

**101. Which is an example of an alloimmune disease?**

- A Tuberculin reaction
- B Graves disease
- C Contact dermatitis
- D Penicillin allergy

Graves disease, myasthenia gravis, immune thrombocytopenic purpura, alloimmune neutropenia, and systemic lupus erythematosus are all examples of alloimmune diseases during which the child can be affected because the mother has the disease. Tuberculin reaction is a type IV reaction. Contact dermatitis is a type I reaction. Penicillin is an allergen that induces type I hypersensitivity.

**102. Which statement is true regarding unmatched packed red blood cell (RBC) transfusions?**

- A Only three different RBC antigens have been identified.
- B Approximately 80 major carbohydrate antigens exist.
- C People with O type blood have neither A or B antigens.**
- D A person with type A blood contains anti-O antibodies.

Type O blood does not contain type A or B antigens. However, 80 major different RBC antigens are present. A person with type A blood carries anti-B antibodies and a person with type B blood carries anti-A antibodies. Those with type O blood have anti-A and anti-B antibodies.

**103. Histamine release leads to which of the following? (Select all that apply.)**

- A Bronchial smooth muscle contraction**
- B Bronchoconstriction Correct
- C Decreased vascular permeability
- D Vasoconstriction
- E Edema Correct

Histamine contracts bronchial smooth muscle, which causes bronchoconstriction. Vascular permeability, edema, and vasodilation also increase.

**104. Antibody-related damage to cells through phagocytosis is an example of a mechanism of \_\_\_\_\_ type \_\_\_\_\_ hypersensitivity.**

**type 2**

There are five mechanisms by which type II hypersensitivity reactions can affect cells: (1) The cell is destroyed by antibody and complement; (2) antibodies may cause damage through phagocytosis; (3) neutrophil granules, as well as several toxic oxygen products, will damage tissue; (4) antibody-dependent cell-mediated cytotoxicity is the fourth mechanism; and (5) a fifth mechanism causes cell malfunction, not death.

## Chapter 10- Infection

### 105. Which term describes an agent's ability to produce disease?

- A Virulence
- B Pathogenicity
- C Infectivity
- D Immunogenicity

Pathogenicity is the ability of an agent to produce disease and depends on the speed of reproduction, the extent of tissue damage, and the production of toxins. Virulence is the capacity of a pathogen to cause severe disease. Infectivity is the ability of the pathogen to invade and multiply in the host. Immunogenicity is the ability of pathogens to induce an immune response.

### 106. Which statement is true regarding bacteremia?

- A It occurs with a normal defense system of the body.
- B Gram-positive bacteria typically cause bacteremia.
- C Endotoxins often cause symptoms such as vasodilation.
- D Symptoms include increased blood pressure.

Endotoxins are often produced by bacteria that grow in the blood. Common symptoms include vasodilation, hypotension (reduced blood pressure), and decreased oxygen delivery and can produce cardiovascular shock. Bacteremia is often caused by gram-negative bacteria and usually occurs with a failure of the body's defense mechanisms.

### 107. Which statement regarding viruses is true?

- A Viruses are less common than bacterial infections.
- B Viruses actively produce exotoxins.
- C Viruses bypass many defense mechanisms by developing intracellularly.
- D Viruses contain all their genetic information in ribonucleic acid (RNA).

Viruses enter the cell and may bypass many defense mechanisms. Viruses are the most common form of infection. They contain deoxyribonucleic acid (DNA) and RNA for their genetic information. They do not produce exotoxins or endotoxins.

### 108. Which statement regarding fever is true?

- A Fever is a failure of the body to regulate temperature.
- B An endogenous pyrogen may produce fever.
- C The body's central thermostat is the pituitary gland.

- D Fever is a failure of the body's defense system.

A pyrogen is a substance that causes fever. Exogenous and endogenous pyrogens exist and affect the regulatory set point in the hypothalamus, which is the body's thermostat. Fever is not a failure of the body's defense system but may actually be beneficial. The body does not fail to regulate temperature; rather, the temperature is regulated at a higher level than normal with a fever.

**109. What contributes to antibiotic-resistant pathogens?**

- A Inadequate sanitation
- B Genetic mutation**
- C Loss of multidrug transporters
- D Limited use of antibiotics

Antibiotic resistance usually results from genetic mutations in the microorganism that can be directly transmitted to neighboring microorganisms. Sanitation and clean drinking water can help control infection. Multidrug transporters on the microorganism's membrane affect the rate of intracellular accumulation of antibiotics by preventing entrance or increasing the efflux of the antibiotic into the cell. Overuse of antibiotics can lead to the destruction of the normal flora and selective overgrowth of antibiotic-resistant strains.

**110. The stages of pathologic infection include which of the following? (Select all that apply.)**

- A Invasion**
- B Death
- C Colonization**
- D Metastasis
- E Multiplication**

The stages of pathologic infection include colonization, invasion, spread, and multiplication. Death and metastasis are not stages of pathologic infection.

**111. Which of the following are mechanisms of antigenic variation? (Select all that apply.)**

- A Siderophoric switching
- B Mutation**
- C Recombination**
- D Gene switching**



Mutation, recombination, and gene switching all are forms of antigenic variation. Siderophores are iron receptors on bacteria that assist in replication, and they have nothing to do with antigenic variation.

**112. Which mechanisms are used by viruses to evade the immune response? (Select all that apply.)**

- A Rapid division
- B Antigenic specificity
- C Self-protein coat
- D Immune suppression
- E Lipopolysaccharide

Viruses have developed a number of ways to evade the immune system, including rapid division, the ability to survive inside a host cell, coating the viral capsid with self-antigens from the host cell, antigenic variation, neutralization of immune complexes, complement evasion, immune suppression, and tissue damage.

## **Chapter 11-Stress and Disease**

**113. What is the definition of the reactive response?**

- A Mounting a response in anticipation of a stressor
- B Mounting a response in reaction to a stressor
- C Mounting a response to a learned stressor
- D Mounting a response to a physical stressor

A reactive response is a psychologic response to a stressor. An anticipatory response is a psychologic response to an anticipated response. A conditioned response is an anticipated psychologic (learned) response to stimuli that have been associated with danger.

**114. A stress response is initiated in what part of the nervous system?**

- A Peripheral nervous system
- B Exocrine system
- C Parasympathetic nervous system
- D Central nervous system

The stress response is initiated in the central nervous and endocrine systems.

**115. A stress response results in the stimulation of which sympathetic nervous system receptors?**

- A  $\alpha$ -Adrenergic receptors
- B  $\beta$ -Receptors
- C Adrenocorticotrophic hormone (ACTH)
- D Growth hormone (GH)

The alpha receptors of the sympathetic nervous system are stimulated during the stress response.

**116. Which statement is true regarding the effects of circulating epinephrine in the body?**

- A The heart rate will slow down.
- B The heart's contractility will decrease.
- C Blood vessels to skeletal muscle will constrict.
- D Transient hyperglycemia will result.

Epinephrine dilates blood vessels of the muscles and causes transient hyperglycemia. The epinephrine will increase heart rate and contractility. The venous return to the heart will increase, thus increasing cardiac output and blood pressure.

**117. Which statement is true regarding how cortisol reacts when activated by ACTH?**

- A Cortisol is plasma bound to corticotropin.
- B Gluconeogenesis is halted.
- C Cortisol increases blood glucose.
- D Cortisol decreases protein synthesis.

Cortisol has many actions. It is bound to a protein called transcortin. It stimulates gluconeogenesis, increases glucose production, and increases protein synthesis. Awarded 0.0 points out of 1.0 possible points.

**118. Which statement is true regarding the immune system in response to stress?**

- A T-helper 1 (Th1) cells increase.
- B A shift in Th1 cells occurs.
- C The immune system is not affected.
- D Cortisol is released.

Stress can activate an excessive immune response through cortisol. It can cause the suppression of Th1 cells and a shift in Th2 cells.

Awarded 0.0 points out of 1.0 possible points.

**119. Which of the following is a function of norepinephrine?**

- A Increases contraction of the heart
- B Constricts smooth muscle in all blood vessels**
- C Secretes steroid hormones
- D Stimulates adrenal medulla

Norepinephrine is released from the adrenal medulla and regulates blood pressure by constricting smooth muscle in all blood vessels. Epinephrine increases myocardial contractility and heart rate. The steroid hormones are stimulated by the hypothalamus, which sets off a chain of events during which steroid hormones are secreted from the adrenal cortex. Cortisol is one of the primary steroid hormones.

**120. Which statement regarding corticotropin-releasing hormone (CRH) and its influence on the immune system is true?**

- A CRH is also released from peripheral inflammatory sites.**
- B CRH causes vasoconstriction.
- C CRH causes decreased vascular permeability.
- D Red blood cells are the peripheral targets.

CRH is released from the hypothalamus and from peripheral inflammatory sites. Because this hormone is proinflammatory, it causes vasodilation and increased vascular permeability. The primary target of peripheral CRH is the mast cell.

**121. Which statement is true regarding stress and the immune system?**

- A Seasonal allergies are related to stress.
- B Cardiovascular disease is one condition that is related to stress.**
- C The level of proinflammatory cytokines is decreased.
- D Negative emotions cause few alterations in cytokine production.

Cardiovascular disease, aging, cancer, osteoporosis, arthritis, type II diabetes mellitus, and chronic obstructive pulmonary disease (COPD) are associated with the prolonged presence of proinflammatory cytokines. These proinflammatory cytokines increase during stress. Negative emotions are directly associated with the increased level of these proinflammatory cytokines.

**122. Which of the following are stages in the development of the general adaptation syndrome? (Select all that apply.)**

- A Alarm**
- B Exposure

- C Resistance
- D Exhaustion

The three successive stages in the development of the general adaptation syndrome are alarm, resistance, and exhaustion.

## Chapter 12-Cancer Biology

Which statement regarding tumors is *true*?

- A. ☐ All neoplasms are cancerous.
- B. ☒ *Cancer refers to a malignant tumor.* Correct**
- C. ☐ Benign growths are cancerous.
- D. ☐ Malignant tumors have slow growth.

The term *cancer* refers to a malignant tumor with rapid growth, a loss of differentiation, and the absence of normal tissue organization. Neoplasm generally refers to new growth and may be benign or cancerous. Benign growths, which are not referred to as cancers, may retain some normal tissue structure and do not invade the capsules surrounding them or spread to regional lymph nodes or distant locations.

2. 2. Which of the following is a characteristic of a malignant tumor?

- A. ☐ It is encapsulated.
- B. ☐ It does not invade local tissues.
- C. ☐ It is well differentiated.
- D. ☒ *It is able to spread far from the tissue of origin.* Correct**

Malignant tumors have no capsule, which allows them to spread readily. They have rapid growth rates and specific microscopic alterations. They are poorly differentiated and spread to distant tissues.

3. What is the term for cancers originating in connective tissue?

- E. ☒ *Sarcoma* Correct**
- F. ☐ Leukemia
- G. ☐ Lymphoma
- H. ☐ Carcinoma

Cancers arising from connective tissue usually have the suffix sarcoma. Cancers of lymphatic tissue are called lymphomas, whereas cancers of blood-forming cells are called leukemias. Carcinoma is a cancer of epithelial tissue.

4. Which marker is used to evaluate a tumor of the adrenal gland?

- I. ☐ Prostate-specific antigen (PSA)

- J. ☐ Alpha-fetoprotein (AFP)
- K. ☒ **Catecholamines** **Correct**
- L. ☐ Adrenocorticotrophic hormone (ACTH)

Catecholamines are secreted by the adrenal medulla and are found in excess if a tumor exists. PSA levels are used to detect prostate cancer. AFP is used to detect liver and germ cell cancers. ACTH is the marker used to detect pituitary adenomas.

**5. When in its normal state, which gene negatively regulates proliferation?**

- M. ☐ Oncogenes
- N. ☒ **Tumor-suppressor genes** **Correct**
- O. ☐ Proto-oncogenes
- P. ☐ Telomeres

Tumor-suppressor genes encode proteins that, when in their normal state, negatively regulate proliferation. Oncogenes are mutant genes that, when in their normal nonmutant state, direct the synthesis of protein that positively accelerate proliferation. A proto-oncogene is an oncogene in its nonmutant state. Telomeres are protective ends or caps on each chromosome.

**6. Which statement is *true* regarding the staging of cancer?**

- Q. ☐ Localized cancer is considered a high stage.
- R. ☐ Benign tumors are stage 4.
- S. ☒ **Cancers that have spread regionally are stage 3.** **Correct**
- T. ☐ Stage 1 has the poorest prognosis.

Cancer confined to the organ of origin is stage 1; cancer that is locally invasive is stage 2; cancer that has spread to regional structures, such as lymph nodes, is stage 3; and cancer that has spread to distant sites, such as a liver cancer spreading to the lung or prostate cancer spreading to bone, is stage 4. The prognosis generally worsens with increasing tumor size, lymph node involvement, and metastasis. Benign tumors do not spread to distant regions.

**7. Which statement is *true* regarding metastasis?**

- U. ☐ Metastasis is a highly efficient process.
- V. ☒ **Metastasis occurs through the vascular and lymphatic systems.** **Correct**
- W. ☐ Metastatic cancer cells suppress proteases.
- X. ☐ Most cancer cells are able to metastasize to new areas.

Two distinct mechanisms give rise to patterns of distant spread. First, cancer cells spread through vascular and lymphatic pathways, as well as natural tissue planes. Metastatic cells are very heterogeneous, and some of these cells have new abilities that can facilitate metastasis. Metastasis is highly inefficient; to metastasize, a cancer cell must surmount multiple physical and physiologic barriers. Many metastatic cells secrete proteases and protease activators to

digest the extracellular matrix and basement membrane, enabling cells to move. Only rare cells in a cancer are able to metastasize.

**8. Which statement characterizes radiation therapy?**

- Y. ☐ **Radiation is used to kill cancer cells while minimizing damage to normal structures. Correct**
- Z. ☐ Effective killing of cancer cells using radiation requires poor local delivery of oxygen.
- AA. ☐ Radiation blocks the normal growth pathways in cells.
- AB. ☐ Radiation can cause reversible changes in normal tissues.

Radiation is used to kill cancer cells while minimizing damage to normal structures. Effective cell killing using radiation also requires good local delivery of oxygen. Radiation produces slow changes in most cancers and irreversible changes in normal tissues as well. Antimetabolite chemotherapy blocks normal growth pathways in cells.

**9. Which virus(es) is(are) linked to the development of cancer? (Select all that apply.)**

- AC. ☐ Hepatitis A
- AD. ☐ **Hepatitis B Correct**
- AE. ☐ **Hepatitis C Correct**
- AF. ☐ **Epstein-Barr virus Correct**
- AG. ☐ **Human papillomavirus Correct**

Hepatitis B and C have been linked to the development of liver cancer, which is usually caused by chronic inflammation. Epstein-Barr virus can lead to B-cell lymphomas in those individuals who are immunosuppressed. Human papillomavirus has been linked to cervical, anogenital, and penile cancers. Hepatitis A has not been linked to the development of cancer.

**10. Which statement(s) is (are) true regarding caretaker genes? (Select all that apply.)**

- AH. ☐ **Caretaker genes encode proteins that repair damaged deoxyribonucleic acid (DNA). Correct**
- AI. ☐ **Loss of function results in increased mutation rates. Correct**
- AJ. ☐ **Loss of function can cause increase rates of specific cancers. Correct**
- AK. ☐ Mutations that disrupt caretaker genes are not inherited.
- AL. ☐ Loss of function causes chromosome instability.

Caretaker genes are repair mechanisms responsible for maintenance of the genetic code. Loss of function of caretaker genes leads to increased overall mutation rates and is responsible for the increase in rates for specific cancers. Inherited mutations can disrupt the caretaker genes that protect the integrity of the genome. The underlying mechanism of chromosome instability is not clear but may be caused by malfunctions in the cellular machinery that regulates chromosome segregation at mitosis.

**11. Which of the following are characteristics of cachexia? (Select all that apply.)**

- AM. ☐ Increased appetite
- AN. ☐ Weight gain
- AO. ☐ **Early satiety** **Correct**
- AP. ☐ **Altered metabolism** **Correct**
- AQ. ☐ **Considered a sign of cancer** **Correct**

Cachexia includes anorexia, early satiety, weight loss, anemia, asthenia, taste alterations, and altered metabolism. Clinical manifestations of cancer include cachexia.

### Chapter 13-Cancer Epidemiology

It is *true* that tobacco smoking:

- A. ☐ Is responsible for 10% of all cancer deaths.
- B. ☐ **Has been declining among U.S. adults since 1997.** **Correct**
- C. ☐ Is dangerous only to lung tissue.
- D. ☐ Accounts for 4000 to 5000 deaths a year worldwide.

The prevalence of current smoking among U.S. adults has declined from 24.7% in 1997 to 18.9% in 2011. For every person who dies from tobacco use, another 20 people suffer with at least one serious tobacco-related illness. Smoking also causes damage to blood vessels and contributes to a number of other diseases. Tobacco use accounts for one out of every five deaths each year in the United States—many more than 4000 to 5000 in the United States alone.

### 2. Which statement is *true* concerning the association of adiposity with cancer?

- E. ☐ No difference has been found in breast cancer mortality between obese and nonobese women.
- F. ☐ Hyperinsulinemia can be protective for breast cancer.
- G. ☐ The relationship of obesity and cancer progression is clearly understood.
- H. ☐ **An association between body mass index (BMI) and breast cancer mortality risk exists.** **Correct**

A meta-analysis of over 40 studies of women diagnosed with breast cancer shows a modest but significant increase in all-cause and breast cancer–specific mortality in obese versus nonobese women. Hyperinsulinemia is associated with a risk of cancers of the colon, endometrium, and possibly the kidney and pancreas, and chronic hyperinsulinemia increases the risk of cancer as well. Overall, the putative mechanisms whereby obesity drives the progression of cancer are not completely known, and the process is complex. For most obese women (BMI >40), the risk of dying of breast cancer is doubled.

### 3. A man has worked with asbestos in his career for longer than 40 years. Which cancer is he most likely to develop?

- I. ☐ Bladder
- J. ☐ Leukemia

- K. ☐ Stomach
- L. ☐ **Lung** **Correct**

Asbestos may cause mesothelioma or lung cancer. Benzol inhalation is linked to leukemia in shoemakers and in workers in the rubber cement, explosives, and dye industries. According to the International Agency for Research on Cancer (IARC), strong evidence indicates an increased risk of bladder, skin, and lung cancers after consumption of water with high levels of arsenic. Bacterial infection from *Helicobacter pylori* has been associated with stomach cancer.

4. Which statement is *not* true regarding the body's defense mechanisms against cell damage?

- M. ☐ The phase I activation enzyme is represented by cytochrome P-450.
- N. ☐ The enzymes that protect against damage are predominantly found in the liver.
- O. ☐ **The two systems are xenobiotic and antioxidant.** **Correct**
- P. ☐ Most xenobiotics are transported in the blood by lipoproteins.

Xenobiotics are a variety of compounds that can cause cellular damage and are transported by lipoproteins in the blood. The body has two primary defense systems to protect against xenobiotics that cause cell damage: (1) detoxification enzymes, and (2) the antioxidant system. The enzymes are primarily found in the liver, and the phase I activation enzymes are represented by the P-450 system.

5. Which statement is *true* regarding ultraviolet (UV) light?

- Q. ☐ **UV light causes basal cell carcinoma and squamous cell carcinoma.** **Correct**
- R. ☐ The degree of damage is not affected by wavelength.
- S. ☐ UV light can cause the formation of sarcomas.
- T. ☐ The principal source of ultraviolet radiation (UVR) is tanning beds.

Skin exposure to UVR and to ionizing radiation (IR) produces reactive oxygen species (ROS) in large quantities, which can lead to oxidative stress, tissue injury, and direct deoxyribonucleic acid (DNA) damage. The duration, intensity, and wavelength content affect exposure. UV light can cause the formation of basal cell and squamous cell carcinomas. The principal source of UVR is sunlight.

6. Which statement is *true* regarding basal cell carcinoma (BCC)?

- U. ☐ BCC is most commonly found on the trunk of the body.
- V. ☐ BCC is commonly found on those with a dark complexion.
- W. ☐ Individuals with these tumors usually have a history of tanning, not burning.
- X. ☐ **BCC is most commonly found on sun-exposed areas of the body.** **Correct**

BCC commonly occurs on the head and neck. Individuals with these tumors generally have light complexions, light eyes, and fair hair. They tend to sunburn rather than tan and live in areas of



high sunlight exposure. Usually these cancers arise on areas of the body that receive the greatest sun exposure, although they are not necessarily restricted to these skin sites.

7. A person drinks alcohol in excessive quantities. Which areas are likely to develop cancer related to alcohol consumption? (*Select all that apply.*)

- Y. ☐ Oral cavity **Correct**
- Z. ☐ Larynx **Correct**
- AA. ☐ Pharynx **Correct**
- AB. ☐ Spleen
- AC. ☐ Liver **Correct**

Cancers of the gastrointestinal system are linked to alcohol: cancer of the oral cavity, larynx, pharynx, hypopharynx, esophagus, and liver.

8. Obesity results in a higher risk of death from which cancers? (*Select all that apply.*)

- AD. ☐ Esophageal **Correct**
- AE. ☐ Kidney **Correct**
- AF. ☐ Colorectal **Correct**
- AG. ☐ Brain

Consensus now exists that obesity is a risk factor for cancers of the endometrium, colorectum, kidney, esophagus, breast (postmenopausal), and pancreas. Evidence is evolving that suggests the existence of an association of obesity with cancers of the thyroid, gallbladder, liver, ovary, aggressive types of prostate cancer, and non-Hodgkin lymphoma.

9. Which statements are *true* regarding melanoma? (*Select all that apply.*)

- AH. ☐ Melanoma may suddenly appear without warning. **Correct**
- AI. ☐ Individuals with fair skin and hair color are at risk for melanoma. **Correct**
- AJ. ☐ Individuals with a history of three or more sunburns are at risk for melanoma. **Correct**
- AK. ☐ Even in the early stages, melanoma is not curable.

Correct Feedback:

Melanomas can appear suddenly without warning or can arise from or near a mole (melanocytic nevus) and melanomas most commonly affect whites. Established risk factors for melanoma are genetic and phenotypic traits, increasing age, fair skin and hair color, greater than 20 nevi, freckling, three or more atypical nevi, and an increased likelihood of burning with sun exposure. Environmental exposures important in melanoma include a history of three or more episodes of sunburn; periodic excessive sunlight exposure (vacations with intense exposure); and UV exposure at tanning salons. When detected in the early stages, melanoma is highly curable. Approximately 20% of melanomas, however, are diagnosed at nonlocalized and advanced stages.

Incorrect Feedback:

Melanomas can appear suddenly without warning or can arise from or near a mole (melanocytic nevus) and melanomas most commonly affect whites. Established risk factors for melanoma are genetic and phenotypic traits, increasing age, fair skin and hair color, greater than 20 nevi, freckling, three or more atypical nevi, and an increased likelihood of burning with sun exposure. Environmental exposures important in melanoma include a history of three or more episodes of sunburn; periodic excessive sunlight exposure (vacations with intense exposure); and UV exposure at tanning salons. When detected in the early stages, melanoma is highly curable. Approximately 20% of melanomas, however, are diagnosed at nonlocalized and advanced stages.

**10. Air pollution is associated with cancer. Which statements pertaining to this association are *true*? (Select all that apply.)**

- AL. ☐ *Ground level ozone is the major component of smog.* **Correct**
- AM. ☐ *Radon exposure can occur in underground mines and in homes.* **Correct**
- AN. ☐ *Evidence suggests that air pollution is associated with cancers other than lung and childhood cancers.*
- AO. ☐ *Indoor air pollution is considered worse than outdoor air pollution.* **Correct**

Ozone is the main ingredient in smog air pollution. Radon is a natural radioactive substance ubiquitous in rock and soil that can be trapped in houses and underground mines. Its radioactive decay products are carcinogenic. Indoor pollution is considered worse than outdoor pollution, partly because of cigarette smoke. Evidence for an association between air pollution and cancers, other than lung cancer and childhood cancers, is inconsistent.

**11. Physical activity reduces the risk of which type(s) of cancer? (Select all that apply.)**

- AP. ☐ *Breast* **Correct**
- AQ. ☐ *Oral*
- AR. ☐ *Liver*
- AS. ☐ *Colon* **Correct**

Physical activity has been linked to the reduction of breast cancer and colon cancer. Chronic hepatitis C infection has been linked to liver cancer. Chronic alcoholism has been linked to oral, esophageal, and liver cancers.

**12. In 2009, the National Council on Radiation Protection and Measurements reported Americans were exposed to more than \_\_\_\_\_ times as much IR from medical procedures, compared with the 1980s.**

**Seven, 7**

In 2009, the National Council on Radiation Protection and Measurements reported Americans were exposed to more than seven times as much IR from medical procedures compared with the 1980s.

## **Chapter 14-Cancer in Children**

**Which statement is *true* regarding childhood cancer?**

- A. ☐ Childhood cancer commonly occurs.
- B. ☐ It is the leading cause of death in children.
- C. ☐ It has a long latency period.
- D. ☐ **Leukemia is the most common malignancy in children. Correct**

Leukemia is the most common malignancy in children, and the most common type of leukemia is acute lymphoblastic leukemia (ALL), which represents approximately 75% of all pediatric leukemia cases. The latency period is short in childhood cancer. Although cancer in children uncommonly occurs, it is the second leading cause of death in children.

2. Which statement is *true* regarding childhood cancer?

- E. ☐ Embryonic tumors form after birth.
- F. ☐ Childhood cancer most commonly affects the brain.
- G. ☐ **Childhood cancers originate from the mesodermal layer. Correct**
- H. ☐ The most common form of childhood cancer is lung cancer.

Most childhood cancers originate from the mesodermal germ layer and give rise to connective tissue cancer. This type of cancer often involves the tissue, bone, cartilage, muscle, blood, blood vessels, gonads, kidneys, and lymphatic system. Embryonic tumors originate during intrauterine life.

3. It is *true* that embryonic tumors:

- I. ☐ Contain mature cells.
- J. ☐ **Are undifferentiated. Correct**
- K. ☐ May be diagnosed late in life.
- L. ☐ Are often labeled with the term *carcinoma*.

Embryonic tumors contain immature cells and are not well differentiated, which means that they are unable to mature or differentiate into fully developed functional cells. They are diagnosed early in life and often contain the words, *blast cell*, in their names because of the immature nature of the cells.

4. Which of the following is the *most common* solid tumor in children?

- M. ☐ **Central nervous system (CNS) tumors Correct**
- N. ☐ Ewing sarcoma
- O. ☐ Kidney
- P. ☐ Soft tissue

CNS tumors are the most common types of solid tumors in children and account for 27% of all childhood cancers. Not all brain tumors are malignant by histologic study; however, even a benign tumor can have devastating effects, depending on its anatomic location.

5. Which of the following is associated with defects of the p53 tumor-suppressor gene?

- Q. ☐ Retinoblastoma
- R. ☐ **Li-Fraumeni syndrome (LFS) Correct**

- S. ☐ Down syndrome
- T. ☐ Neurofibromatosis

LFS is an autosomal dominant disorder involving the p53 tumor-suppressor gene that significantly increases the risk of developing cancer as a child or an adult. LFS often has a familial history. Retinoblastoma is a malignant embryonic tumor of the eye. Down syndrome is linked to the development of acute leukemia. Neurofibromatosis is associated with Wilms tumor.

**6. Which virus has been linked with the development of cancer?**

- U. ☐ Measles
- V. ☐ **Epstein-Barr** **Correct**
- W. ☐ Mumps
- X. ☐ Influenza

Epstein-Barr has been linked with the development of Burkitt lymphoma, nasopharyngeal carcinoma, and Hodgkin disease.

**7. Which statement is true concerning the prognosis of childhood cancers?**

- Y. ☐ **More than 80% of childhood cancers are cured.** **Correct**
- Z. ☐ Survival rates for children of all ages have remained static.
- AA. ☐ Combination chemotherapy and multimodal treatments have not been effective in children with cancer.
- AB. ☐ Young children are not as likely to develop the long-term sequelae of cancer therapy as adults.

More than 80% of all childhood cancers are cured. The 5-year survival rate in children with cancer has improved from 59% in the 1970s to 83% today. Some of the factors leading to improved cure rates in children with cancer include the use of combination chemotherapy, immunotherapy, and high rates of participation in clinical trials. Young children are particularly prone to long-term sequelae of cancer therapy. Clinical trials are continually focusing on more effective, targeted therapies with fewer side effects.

**8. Which statement concerning a multifactorial cause is true?**

- AC. ☐ Exposure to a chemical that causes leukemia should result in all children exposed to the chemical to develop cancer.
- AD. ☐ The causes of cancer in children are well established.
- AE. ☐ **The interaction of many factors most likely produces cancer.** **Correct**
- AF. ☐ Prenatal exposure to ionizing radiation has been linked to childhood cancers.

A multifactorial cause or multiple causation concept suggests that the interaction of many factors most likely produces cancer. Not all children exposed to a chemical that causes leukemia will develop leukemia; other factors must interact with the chemical exposure to cause the disease. The causes of cancer in children are largely unknown. Prenatal exposure to ionizing radiation has been linked to childhood cancers.

9. Which drug and environmental exposures are linked to the risk of developing childhood cancers? (Select all that apply.)

- AG. ☐ Ionizing radiation **Correct**
- AH. ☐ Antibiotic use
- AI. ☐ Pesticide exposure **Correct**
- AJ. ☐ Anabolic adrenergic steroids **Correct**

Ionizing radiation, pesticide exposure, and anabolic adrenergic steroids have been associated with childhood cancer risk.

10. With regards to epidemiologic studies, the malignancy rate among adolescents and young adults (15 to 39 years of age) is \_\_\_\_\_ times higher than the rate of malignancy in children younger than 15 years of age.

#### Correct Responses

A. **Three, 3**

The incidence of cancer among adolescents and young adults represents only 2% of all invasive cancers. However, the malignancy rate in this age group (15 to 39 year olds) is three times higher than that in children younger than 15 years of age. Each year, approximately 70,000 adolescents and young adults will be diagnosed with cancer.