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MULTIPLE CHOICE

1. An antigen is described as a substance that
   a. stimulates antibody formation.
   b. has the ability to bind to an antibody.
   c. is capable of stimulating an immune response.
   d. All of the above.

   ANS: D
   An antigen is a substance that stimulates antibody formation and has the ability to bind to an antibody. Foreign substances can be immunogenic or antigenic (capable of provoking an immune response) if their membrane or molecular components contain structures recognized as foreign by the immune system. These structures are called antigenic determinants or epitopes. An epitope, as part of an antigen, reacts specifically with an antibody or T cell receptor.

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2. Cellular antigens of importance to immunologists include
   a. histocompatibility antigens.
   b. autoantigens.
   c. blood group antigens.
   d. All of the above.

   ANS: D
   Cellular antigens of importance to immunologists include histocompatibility antigens, autoantigens, and blood group antigens.

   DIF: Cognitive Level: I REF: p. 15

3. Another name for the major histocompatibility complex (MHC) in humans is
   a. human leukocyte antigen.
   b. allogenic antigens.
   c. epitopes.
   d. autoantigens.

   ANS: A
   The MHC is referred to as the human leukocyte antigen (HLA) system in humans because its gene products were originally identified on white blood cells (WBCs, leukocytes).

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4. Haptens are characterized as being
   a. able to react directly with an antibody.
   b. a large molecule.
   c. antigenic when coupled to a carrier molecule.

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d. a member of the lipid class of biochemicals.

ANS: C
Although large foreign molecules (MW >10,000 Da) are better antigens, haptens, which are tiny molecules, can bind to a larger carrier molecule and behave as antigens. If a hapten is chemically linked to a large molecule, a new surface structure is formed on the large molecule, which may function as an antigenic determinant.

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5. Antibodies are
   a. proteins.
   b. glycoproteins.
   c. carbohydrates.
   d. lipids.

   ANS: B
   Antibodies are specific glycoproteins referred to as immunoglobulins.

   DIF: Cognitive Level: I REF: p. 18

6. The primary function of an antibody in body defenses is to
   a. combine with antigen.
   b. contribute to secretions.
   c. promote phagocytosis.
   d. Either A or B.

   ANS: A
   The primary function of an antibody in body defenses is to combine with antigen, which may be enough to neutralize bacterial toxins or some viruses. A secondary interaction of an antibody molecule with another effector agent (e.g., complement) is usually required to dispose of larger antigens (e.g., bacteria).

   DIF: Cognitive Level: II REF: p. 18

7. All the following are true statements about IgM except that
   a. it is produced during a primary antibody response.
   b. it has the largest molecular weight of all the immunoglobulin classes.
   c. it fixes complement.
   d. it is capable of crossing the maternal-fetal placental barrier.

   ANS: D
   IgM has the largest molecular weight of all the immunoglobulins. This antibody is produced first in an immune response and is largely confined to the blood. IgM is effective in agglutination and cytolytic reactions.

   DIF: Cognitive Level: I REF: p. 18

8. The number of individual heavy chains found in a molecule of IgM is
   a. four.
   b. five.
   c. ten.

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d. twelve.

ANS: B
In humans, IgM is found in smaller concentrations than IgG or IgA. The molecule has five individual heavy chains, with MW of 65,000 daltons (Da); the whole molecule has MW of 900,000 Da and a sedimentation coefficient of 19S.

DIF: Cognitive Level: I REF: p. 18 | p. 19

9. Which immunoglobulin (Ig) class is the first to be manifested after antigen exposure?
a. IgM
b. IgG
c. IgD
d. IgA

ANS: A
IgM is the first immunoglobulin (antibody) to be produced in a primary antibody response.

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10. Which immunoglobulin (Ig) class is produced in the highest concentration in a secondary (anamnestic) response?
a. IgM
b. IgG
c. IgD
d. IgE

ANS: B
IgG is produced in the highest concentration in a secondary antibody response.

DIF: Cognitive Level: II REF: p. 25

11. Tears, saliva, and other body secretions typically contain
a. IgM.
b. IgG.
c. IgD.
d. IgA.

ANS: D
Immunoglobulin A represents 15% to 20% of the total circulatory Ig pool. IgA is the predominant immunoglobulin in secretions such as tears, saliva, colostrum, milk, and intestinal fluids. Secretory IgA is critical in protecting body surfaces against invading microorganisms because of its presence in seromucous secretions (e.g., tears, saliva, nasal fluids, colostrum).

DIF: Cognitive Level: I REF: p. 20

12. Which of the following is a characteristic of IgD?
a. Destruction of cellular parasites
b. Complement fixation
c. Natural body defense in body fluids (e.g., tears, saliva)
d. Extremely susceptible to proteolysis

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ANS: D
IgD is extremely susceptible to proteolysis and is primarily a cell membrane Ig found on the surface of B lymphocytes in association with IgM.

DIF: Cognitive Level: II REF: p. 20

13. IgE is an important immunoglobulin because it
    a. mediates some types of hypersensitivity (allergic) reactions.
    b. is generally responsible for an individual's immunity to invading parasites.
    c. binds strongly to a receptor on mast cells and basophils and, with antigen, mediates the release of histamines and heparin from these cells.
    d. All of the above.

ANS: D
IgE is crucial because it mediates some types of hypersensitivity (allergic) reactions, allergies, and anaphylaxis and is generally responsible for an individual's immunity to invading parasites. The IgE molecule is unique in that it binds strongly to a receptor on mast cells and basophils and, together with antigen, mediates the release of histamines and heparin from these cells.

DIF: Cognitive Level: II REF: p. 20

14. Which region determines the class of an immunoglobulin molecule?
    a. VH
    b. VL
    c. CH
    d. CL

ANS: C
The class and subclass of an Ig molecule are determined by its heavy-chain type. The heavy-chain, constant region (CH) structures are associated with the different Ig classes and subclasses.

DIF: Cognitive Level: II REF: p. 21

15. An antigenic determinant
    a. is a specific chemical or molecular configuration against which the immune response is directed.
    b. can result in the production of anti-immunoglobulins.
    c. can result in the production of antiglobulins.
    d. All of the above.

ANS: D
An antigenic determinant is the specific chemical determinant group or molecular configuration against which the immune response is directed. Because they are proteins, immunoglobulins themselves can function as effective antigens when used to immunize mammals of a different species. As a result, anti-immunoglobulins or antiglobulins can result.

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16. A secondary antibody response can also be called a(n)

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a. anamnestic response.
b. response with greater concentrations of IgG.
c. memory response.
d. All of the above.

ANS: D
A secondary response can be called an anamnestic (memory) response. Although some IgM antibody is formed in a secondary response, the IgG class is the predominant type formed.

DIF: Cognitive Level: II REF: p. 25

17. A secondary function of an antibody is to
a. bind antigen.
b. fix complement.
c. transfer through the placenta.
d. Both B and C.

ANS: D
The principal function of an antibody is to bind antigen, but antibodies may also exhibit secondary effector functions and behave as antigens. The significant secondary effector functions of antibodies are complement fixation and placental transfer.

DIF: Cognitive Level: II REF: p. 25

18. In the process of agglutination
a. Particulate antigens aggregate to form large complexes in the presence of specific antibody.
b. Soluble antigen combines with soluble antibody to produce insoluble complexes.
c. Antigen and antibody react with a cellular indicator (e.g., RBCs).
d. Immune complexes that form in an in vitro system are measured.

ANS: A
Agglutination is the process in which particulate antigens (e.g., cells) aggregate to form larger complexes in the presence of a specific antibody. Precipitation reactions combine soluble antigen with soluble antibody to produce insoluble complexes that are visible. Hemolysis testing involves the reaction of antigen and antibody with a cellular indicator (e.g., lysed RBCs). The enzyme-linked immunosorbent assay (ELISA) measures immune complexes formed in an in vitro system.

DIF: Cognitive Level: II REF: p. 27

19. Monoclonal antibodies are
a. able to recognize and bind to a specific antigen.
b. derived from a single clone of cells.
c. used to deliver immunotherapy.
d. All of the above.

ANS: D
Monoclonal antibodies (MAbs) are purified antibodies cloned from a single cell. MAbs exhibit exceptional purity and specificity and are able to recognize and bind to a specific antigen. MAbs have multiple clinical applications that include delivering immunotherapy.

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DIF: Cognitive Level: II REF: p. 28

MATCHING

Match the following antigens with the appropriate description. (Use each answer only once.)

a. Poor antigens
b. Excellent antigens
c. Inferior antigens
d. Too small to function as antigens

1. Proteins
2. Lipids
3. Nucleic acids
4. Carbohydrates

1. ANS: B DIF: Cognitive Level: II REF: p. 18
2. ANS: C DIF: Cognitive Level: II REF: p. 18
3. ANS: A DIF: Cognitive Level: II REF: p. 18
4. ANS: D DIF: Cognitive Level: II REF: p. 18

Match the following physical characteristics of antigens with the appropriate description. (Use each answer only once.)

a. Contributes to greater effectiveness
b. The greater the difference, the better
c. The higher, the better
d. Avoidance of rapid destruction is essential

5. Foreignness
6. Degradability
7. Molecular weight
8. Complexity

5. ANS: B DIF: Cognitive Level: II REF: p. 18
6. ANS: D DIF: Cognitive Level: II REF: p. 18
7. ANS: C DIF: Cognitive Level: II REF: p. 18
8. ANS: A DIF: Cognitive Level: II REF: p. 18

Match the following terms with the corresponding description. (Use each answer only once.)

a. Antigen-binding portion of the molecule
b. Domain
c. L chain
d. Fab
e. Fc portion

9. Domain
10. Variable region
11. Antigen-binding fragments
12. Kappa and lambda
13. Relatively homogeneous and sometimes crystallizable

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9. ANS: B DIF: Cognitive Level: II REF: p. 21
10. ANS: A DIF: Cognitive Level: II REF: p. 21
11. ANS: D DIF: Cognitive Level: II REF: p. 21
12. ANS: C DIF: Cognitive Level: II REF: p. 21
13. ANS: E DIF: Cognitive Level: II REF: p. 21

Match the following terms for immunoglobulin variants with the appropriate description. (Use each answer only once.)

a. Genetically determined variations representing the presence of allelic genes at a single locus within a species
b. Heavy-chain, constant region structures associated with different classes and subclasses
c. Individual determinants characteristic of each antibody as a result of the unique structures on light and heavy chains

14. Isotype determinants
15. Allotype determinants
16. Idiotype determinants

14. ANS: B DIF: Cognitive Level: II REF: p. 22 | p. 23
15. ANS: A DIF: Cognitive Level: II REF: p. 22 | p. 23
16. ANS: C DIF: Cognitive Level: II REF: p. 22 | p. 23

Match the term for the four phases in an antibody response with the correct description. (Use each answer only once.)

a. Antibody concentration increases rapidly
b. Antibody is catabolized.
c. Antibody titer is stabile.
d. No antibody is detectable.

17. Lag phase
18. Log phase
19. Plateau phase
20. Decline phase

17. ANS: D DIF: Cognitive Level: II REF: p. 24
18. ANS: A DIF: Cognitive Level: II REF: p. 24
19. ANS: C DIF: Cognitive Level: II REF: p. 24
20. ANS: B DIF: Cognitive Level: II REF: p. 24

Match the antibody-antigen terms and the appropriate definition. (Use each answer only once.)

a. Noncovalent combination of antigen with its respective specific antibody
b. Functional combining strength of an antibody with its antigen
c. Initial force of attraction that exists between a single Fab site on an antibody molecule and a single epitope on the corresponding antigen
d. A portion of antibodies directed against one type of antigen will also react with another type of antigen.
e. Ability of a particular antibody to combine with one antigen instead of another

21. Specificity

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22. Cross-reactivity
23. Affinity
24. Avidity
25. Immune complex

21. ANS: E DIF: Cognitive Level: II REF: p. 25
22. ANS: D DIF: Cognitive Level: II REF: p. 25
23. ANS: C DIF: Cognitive Level: II REF: p. 25 | p. 26
24. ANS: B DIF: Cognitive Level: II REF: p. 26
25. ANS: A DIF: Cognitive Level: II REF: p. 26

Match the types of bonding with the correct definition.

a. Major bonds formed between antigens and antibodies
b. O–H–O, N–H–N and O–H–N bonds
c. Nonspecific forces generated by the interaction between electron clouds and hydrophobic bonds
d. Result from attraction of oppositely charged amino acids located on the side chains of amino acid residuals

26. Hydrophobic bonds
27. Hydrogen bonds
28. Van der Waals forces
29. Electrostatic forces

26. ANS: A DIF: Cognitive Level: II REF: p. 27
27. ANS: B DIF: Cognitive Level: II REF: p. 27
28. ANS: C DIF: Cognitive Level: II REF: p. 27
29. ANS: D DIF: Cognitive Level: II REF: p. 27

TRUE/FALSE

1. Red blood cells can be antigenic.

   ANS: T
   When antigen-bearing cells, such as red blood cells (RBCs), from one person, a donor, are transfused into another person, a recipient, they can be immunogenic (antigenic).

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2. Outer surfaces of bacteria can be immunogenic.

   ANS: T
   When antigen-bearing cells from one person are transfused into another person, they can be immunogenic. Outer surfaces of bacteria, such as the capsule or the cell wall, as well as the surface structures of other microorganisms, can be immunogenic.

   DIF: Cognitive Level: I REF: p. 15

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