Chapter 5: Antibodies and Antigens

1. Which of the following generates inflammation and promotes microbial phagocytosis and lysis by binding to Fc portion of the antigen-complexed IgG or IgM:
   A. IgE
   B. IgG
   C. C1q
   D. C3a

2. Isotype (class) switching involves what portion of the B cell antibody:
   A. CH
   B. CL
   C. VH
   D. VL

3. How many CDRs are there on an antibody?
   A. 4 on each heavy chain, 2 on each light chain
   B. 2 on each heavy chain, 4 on each light chain
   C. 2 on each heavy chain, 2 on each light chain
   D. 3 on each heavy chain, 3 on each light chain

4. Compared to antigen binding of the TCR and the MHC molecule, antigen binding by antibodies consist of a:
   A. Slow on-rate, slow off-rate
   B. Slow on-rate, fast off-rate
   C. Fast on-rate, fast off-rate
   D. Fast on-rate, variable off rate

5. Papain digestion of IgG produces:
   A. 2 Fab + 1 Fc
   B. 2 Fab + 2 Fc
   C. F(ab’)2 + 1 Fc
   D. F(ab’)2 + peptide fragments

6. A healthy 70-kg adult produces what quantity of antibodies every day?
   A. 10-15 g
   B. 2-3 g
   C. 1-5 mg
   D. 6-7 g
7. Which of the following antibodies is produced in the largest quantity daily?
A. IgG  
B. IgA  
C. IgM  
D. IgD

8. What is the half-life of IgE in circulation?
A. 7 days 
B. 30 days 
C. 1 day 
D. 2 days

9. To what receptor does IgG bind to prolong its half-life?
A. FcεRI  
B. CD28  
C. Neonatal Fc receptor (FcRn)  
D. FcγRII

10. What is the name of the range of relative concentrations at which antibodies and antigens form a cross-linked network of attached molecules?
A. Valency of interaction  
B. Linear determinant  
C. Zone of equivalence  
D. Affinity maturation

Answers
1. C, page 104
   “…Another Fc-dependent effector mechanism of humoral immunity is activation of the classical pathway of the complement system. The system generates inflammatory mediators and promotes microbial phagocytosis and lysis. It is initiated by the binding of a complement protein called C1q to the Fc portions of antigen-complexed IgG or IgM.”

2. A, page 105
   “When B cells are activated by foreign antigens, they may undergo a process called isotype (or class) switching in which the type of \( C_H \) region, and therefore the antibody isotype, produced by the B cell changes, but the V regions and the specificity do not…”

3. D, pages 93-4
   “Most of the sequence differences and variability among different antibodies are confined to three short stretches in the V region of the heavy chain and to three stretches in the V region of the light chain. These diverse stretches are known as hypervariable segments…[T]he hypervariable regions are also called complementarity-determining regions (CDRs).”

4. D, page 90, Table 5-1

5. A, page 93, Figure 5-3
6. B, page 90
“A healthy 70-kg adult human produces about 2 to 3 g of antibodies every day.”

7. B, page 90
“Almost two-thirds of [daily antibody production] is...IgA, which is produced by activated B
cells and plasma cells in the walls of the GI and respiratory tracts....”

8. D, page 100
“IgE has a very short half life of about 2 days in the circulation (although cell-bound IgE
associated with the high-affinity IgE receptor on mast cells has a very long half-life).”

9. C, page 100
“The long half-life of IgG is attributed to its ability to bind to a specific Fc receptor called the
neonatal Fc receptor (FcRn)...”

10. C, page 104, legend to Figure 5-14
“Large complexes are formed at concentrations of multivalent antigens and antibodies that are
termed the zone of equivalence...”

Allergy and Immunology Review Corner: Chapter 6 of Cellular and Molecular Immunology
(Seventh Edition), by Abul K. Abbas, Andrew H. Lichtman and Shiv Pillai.

Chapter 6: MHC Molecules and Antigen Presentation to T Lymphocytes

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1. Which of the following is true regarding T cells?
   A. They only recognize proteins bound to chemical haptens.
   B. They only recognize conformational determinants of antigens.
   C. They only recognize specific antigens presented by specific MHC molecules.
   D. They can function as antigen presenting cells.

2. The phenomenon of cross-presentation refers to:
   A. The ability of dendritic cells to present antigens from virus-infected cells to CD8+ T cells.
   B. The ability of CD8+ T cells to present antigens to other CD8+ T cells.
   C. The ability of CD8+ T cells to present antigens to CD4+ T cells.
   D. The ability of dendritic cells to cross-link with other APCs during antigen ingestion.

3. Removal of CLIP from the MHC-II molecules is carried out by:
   A. HLA-DM
   B. Cathepsin S
   C. HLA-DR
   D. CLIP lyase
4. Which of the following is true regarding the proteasome?
A. It is a multiprotein enzyme found within the lysosomes of most cells
B. Treating cells with IFN-γ will result in degradation of the 1500-kD proteasomes
C. The proteasome performs housekeeping functions through amino acid degradation
D. Proteins targeted for degradation by linkage of ubiquitin

5. Glycolipids are recognized as antigens by a special population of T cells known as:
A. NK-T cells
B. γδ T cells
C. αβ T cells
D. GLA T cells

6. Which of these mechanisms promotes antigen presentation by class I MHC molecules?
A. TAP optimally transports peptides into the E.R. that are 16 to 30 amino acids long.
B. Under the influence of interferon-gamma, the proteasomal caps preferentially recognize peptides with hydrophobic carboxy termini.
C. The peptide-binding cleft of the class I MHC is occupied and stabilized by the class I-associated peptide (CLIP) until it is replaced by antigenic peptide.
D. Tapasin protein physically links that TAP transporter to newly synthesized class I molecules.

7. Which of the following statements about the MIIC is true?
A. They are present in all nucleated cells.
B. They contain all of the components required for peptide-class II association, including proteolytic enzymes, HLA-DM and TAP.
C. They have a characteristic multilamellar appearance on electron microscopy.
D. They eventually deliver bound class II molecules and HLA-DM to the cell surface.

8. The primary function of plasmacytoid dendritic cells is:
A. Capture of antigens complexed to antibody and display to follicular B cells.
B. Antibody production
C. Capture of extracellular antigen and initiation of a corresponding T cell response.
D. Secretion of type I interferons in response to viral infections.

9. Which cell type is the most effective for activating naïve T cells?
A. Dendritic cells
B. Macrophages
C. B lymphocytes
D. NK cells

10. Where does maturation of Langerhans cells occur?
A. In the bone marrow
B. In the follicles of the draining lymph nodes
C. During migration from the skin to the regional lymph nodes
D. In the thymus
Answers
1. C, page 110
   “A single T cell can recognize a specific peptide displayed by only one of the large number of different MHC molecules that exist. This phenomenon is called MHC restriction…”

2. A, page 117
   “Some specialized DCs have the ability to ingest virus-infected cells or cellular fragments and present antigens from these cells to CD8+ T lymphocytes. This process is called cross-presentation, or cross-priming”

3. A, page 133
   “HLA-DM acts as a peptide exchanger, facilitating the removal of CLIP and the addition of other peptides to class II MHC molecules.” See also figures 6-17 and 6-19.

4. D, page 129
   “…proteins are targeted for proteasomal degradation by covalent linkage of several copies of a small polypeptide called ubiquitin.”

5. A, page 136
   “NKT cells express markers that are characteristic of both natural killer (NK) cells and T lymphocytes… NKT cells recognize lipids and glycolipids displayed by the class I-like “non-classical” MHC molecule called CD1…”

6. D, page 130
   “On the luminal side of the ER membrane, the TAP protein associates with a protein called tapasin, which also has an affinity for newly synthesized empty class I MHC molecules. Tapasin thus brings the TAP transporter into a complex with the class I MHC molecules that are awaiting the arrival of peptides…”

7. C, pages 132-3
   “The MIIC has a characteristic multilamellar appearance by electron microscopy… molecules involved in antigen presentation, such as DM, stay in the vesicles and are not expressed in the plasma membrane.”

8. D, page 115
   “The major function of plasmacytoid DCs is the secretion of large amounts of type I interferons in response to viral infections…” Answer a applies to follicular DCs (see page 20), and answer c applies to conventional DCs (page 113).

9. A, page 111, Figure 6-2
   “Dendritic cells are the most effective APCs for activating naïve T cells and therefore for initiating T cell responses. Macrophages and B lymphocytes also function as APCs, but mostly for previously activated CD4+ T helper T cells rather than for naïve T cells…”

10. C, page 116, legend to Figure 6-5
“Immature dendritic cells in the skin (Langerhans cells) capture antigens that enter through the epidermis and transport the antigens to regional lymph nodes. During this migration the dendritic cells mature and become efficient APCs…”