Allergy and Immunology Review Corner: Chapter 19 of Cellular and Molecular Immunology (Seventh Edition), by Abul K. Abbas, Andrew H. Lichtman and Shiv Pillai.

Chapter 19: IgE-Dependent Immune Responses and Allergic Disease

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1. Which Ig isotype is most efficient at binding Fc receptors on mast cells and activating these cells?
   A. IgG
   B. IgA
   C. IgM
   D. IgE

2. Which of the following are features common to many allergens?
   A. High molecular weight (<200 kD) and high solubility in body fluids
   B. Low to medium molecular weight (5-70 kD) and low solubility in body fluids
   C. Low to medium molecular weight (5-70 kD), glycosylation, and high solubility in body fluids
   D. High molecular weight (<200 kD) and glycosylation

3. Which of the following features is common to both mast cells and basophils?
   A. Mature in the bone marrow
   B. Are found mainly in the tissue
   C. Express high levels of Fc Epsilon RI
   D. Mature in response to stem cell factor

4. Which of the following is a preformed mast cell mediator associated with degrading microbial structures?
   A. Histamine
   B. Chymase
   C. PGD2
   D. PAF

5. What neutral proteases do mucosal mast cells contain?
   A. Tryptase
   B. Tryptase and chymase
   C. Tryptase, chymase, and carboxypeptidase
   D. Tryptase, chymase, carboxypeptidase, and cathepsins

6. Which of the following causes activation of mast cells?
A. Binding to FcεRII  
B. Cross-linking of FcεRI  
C. Tyrosine phosphorylation of the ITAMs of the β chain  
D. Antigen binding to free IgE

7. Synthesis of lipid mediators in mast cells is controlled by which of the following?  
A. Phospholipase A$_2$  
B. Phospholipase C  
C. Protein kinase C  
D. Phosphoinositide 3-kinase

8. Approximately how many cases of asthma are associated with IgE-mediated immediate hypersensitivity?  
A. 100%  
B. 25%  
C. 70%  
D. 5%

9. Which of the following gene loci is associated with a susceptibility to atopy?  
A. IL-4 receptor gamma chain  
B. Class I MHC  
C. Chromosome 18p  
D. Chromosome 5q

10. Which of the following lipid mediators is not produced by mast cells?  
A. Leukotriene B$_4$  
B. Leukotriene C$_4$  
C. Leukotriene D$_4$  
D. Leukotriene E$_4$

**Answers**

1. D, page 427  
IgE is the antibody isotype that contains the epsilon heavy chain, and of all the Ig isotypes, IgE is most efficient at binding Fc receptors on mast cells and activating these cells.

2. C, page 427  
These features include low to medium molecular weight (5-70 kD), stability, glycosylation, and high solubility in body fluids.

3. C, page 428, Table 19.1  
Mast cells and basophils both express high levels of Fc Epsilon RI. Mast cells mature in the tissue while basophils mature in the bone marrow. Mast cells are found mainly in tissue, while basophils in the circulation. Only mast cells mature in response to stem cell factor.
4. B, page 430, Table 19.2
Histamine is associated with vascular permeability and smooth muscle contraction. PGD2 is not a preformed mediator; it is associated with vasodilation, bronchoconstriction, and neutrophil chemotaxis. PAF is also not a preformed mediator; it is associated with chemotaxis, activation of leukocytes, bronchoconstriction, and increased vascular permeability. Chymase is associated with degrading microbial structures.

5. A, page 430, Table 19.3
Mucosal mast cells contain tryptase while connective tissue mast cells contain tryptase, chymase, carboxypeptidase, and cathepsins.

Mast cells are activated by cross-linking of FcεRI molecules, which occurs by binding of multivalent antigens to the IgE molecules that are attached to the Fc receptors. The FcεRI lacks the β chain.

7. A, page 433
Synthesis of lipid mediators is controlled by activation of the cytosolic enzyme phospholipase A₂.

8. C, page 440
About 70% of cases of asthma are associated with IgE-mediated immediate hypersensitivity.

9. D, page 433-439, Table 19-4
One of the susceptibility loci for atopy is on chromosome 5q, near the site of the gene cluster encoding the cytokines IL-3, IL-4, IL-5, IL-9, IL-13 and the IL-4 receptor.

10. A, page 435. The major arachidonic acid-derived mediators produced by the lipoxygenase pathway are the leukotrienes, especially LTC₄ and its degradation products LTD₄ and LTE₄.

**Allergy and Immunology Review Corner:** Chapter 20 of *Cellular and Molecular Immunology* (Seventh Edition), by Abul K. Abbas, Andrew H. Lichtman and Shiv Pillai.

**Chapter 20:** Congenital and Acquired Immunodeficiencies

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1. Which of the following mutations is seen in X-linked Severe Combined Immunodeficiency (SCID)?
   A. IL-2 receptor α (alpha) chain
   B. JAK 3
   C. Common γ (gamma) chain
D. IL-7 receptor α (alpha) chain

2. A mutation in which of the following leads to a form of X-linked agammaglobulinemia?
   A. IgM heavy chain
   B. Btk
   C. BLNK
   D. λ5 (lambda 5) surrogate light chain gene

3. A mutation in which of the following leads to an autosomal recessive form of Hyper-IgM syndrome characterized by antibody defects and normal cell-mediated immune function?
   A. AID
   B. DOCK8
   C. CD40L
   D. NEMO

4. Which of the following defects in T lymphocyte activation results from mutations in the gene encoding the TAP-1 or TAP-2 subunit of the TAP complex (transporter associated with antigen processing)?
   A. Wiskott-Aldrich syndrome
   B. MHC class I deficiency
   C. MHC class II deficiency
   D. Ataxia telangiectasia

5. Lack of expression of which of the following receptor leads to resistance to HIV infection?
   A. CXCR4
   B. CXCR3
   C. CCR5
   D. CCR6

6. Which of these is a mechanism of immune evasion by HIV?
   A. Error-prone reverse transcription
   B. Down-regulation of class II MHC molecule expression by Nef protein
   C. Viral expression of an IL-10 homologue
   D. Viral inhibition of the transporter associated with antigen processing (TAP)

7. X-linked lymphoproliferative syndrome can result from mutations in SAP (SLAM-associated protein). The ability of SLAM to function as a costimulatory receptor on T_FH cells is dependent on the presence of SAP to form a bridge between SLAM and what cytosolic enzyme?
   A. Btk
   B. ZAP-70
   C. Syk
   D. Fyn

8. What is the most common immune defect seen in Ataxia-Telangiectasia?
   A. Neutropenia
   B. Immunoglobulin deficiencies
   C. Defective phagosome-lysosome fusion in neutrophils
   D. Thymic hyperplasia

9. Which of these primary immunodeficiencies is commonly treated with interferon-γ?
   A. DiGeorge syndrome
B. Chronic granulomatous disease
C. Leukocyte-adhesion deficiency type 3
D. Ectodermal dysplasia with immunodeficiency

10. Which of these primary immunodeficiencies as associated with the Bombay blood group phenotype?
   A. A mutation in the gene coding KINDLIN-3
   B. A mutation in the gene coding CD18
   C. Leukocyte adhesion deficiency type-2
   D. X-linked chronic granulomatous disease

Answers
1. C, page 451
   “X-linked SCID is caused by mutations in the gene encoding the common γ (γc) chain shared by
   the receptors for the interleukins IL-2, IL-4, IL-7, IL-9, and IL-15. X-linked SCID is
   characterized by impaired maturation of T cells and NK cells and greatly reduced numbers of
   mature T cells and NK cells, but the number of B cells is usually normal or increased.”

2. B, page 453
   “X-linked agammaglobulinemia, also called Bruton's agammaglobulinemia, is caused by
   mutations or deletions in the gene encoding an enzyme called Bruton tyrosine kinase (Btk) that
   results in a failure of B cells to mature beyond the pre-B cell stage in the bone marrow. The
   disease is characterized by the absence of gamma globulin in the blood, as the name implies. It is
   one of the most common congenital immunodeficiencies and the prototype of a failure of B cell
   maturation.”

3. A, page 455
   “Rare cases of hyper-IgM syndrome show an autosomal recessive inheritance pattern. In these
   patients, the genetic defects may be in CD40 or in the enzyme activation-induced deaminase
   (AID), which is involved in heavy chain isotype switching and somatic mutation. Mutations in
   AID are generally homozygous recessive. A small fraction of mutations in the region of the AID
   gene that corresponds to the C-terminal part of this enzyme exhibit an autosomal dominant
   inheritance pattern.”

4. B, page 456, Table 20-5; Also page 131
   “Empty class I molecules, tapasin, and TAP are part of a larger peptide-loading complex in the
   ER that also includes canexin, calreticulin, and the oxidoreductase Erp57, all of which contribute
   to class I assembly and loading.”

5. C, page 460-1
   “The importance of CCR5 in HIV infection in vivo is supported by the finding that individuals
   who do not express this receptor on the cell surface because of an inherited 32-bp deletion in the
   CCR5 gene are resistant to HIV infection.”

6. A, page 467
   “HIV has an extremely high mutation rate because of error-prone reverse transcription, and in this
   way it may evade detection by antibodies or T cells generated in response to viral proteins. It has
   been estimated that in an infected person, every possible point mutation in the viral genome
   occurs every day.”

7. D, page 456
“In about 80% of cases, the disease is due to mutations in the gene encoding an adaptor molecule called SAP (SLAM-associated protein) that binds to a family of cell surface molecules involved in the activation of NK cells and T and B lymphocytes, including the signaling lymphocyte activation molecule (SLAM). SAP links the membrane proteins SLAM and 2B4 to the Src family kinase Fyn. Defects in SAP contribute to attenuated NK and T cell activation and result in increased susceptibility to viral infections.”

8. B, page 457
“The immunologic defects are of variable severity and may affect both B and T cells. The most common humoral immune defects are IgA and IgG2 deficiency, probably because of the crucial role the ATM protein plays in class switch recombination (discussed later). The T cell defects, which are usually less pronounced, are associated with thymic hypoplasia.”

“The cytokine interferon-γ (IFN-γ) enhances transcription of the gene encoding phox-91 and also stimulates other components of the phagocyte oxidase enzyme complex. Therefore, IFN-γ stimulates the production of superoxide by normal neutrophils as well as by CGD neutrophils, especially in cases in which the coding portion of the phox-91 gene is intact but its transcription is reduced. Once neutrophil superoxide production is restored to about 10% of normal levels, resistance to infection is greatly improved. IFN-γ therapy is now commonly used for the treatment of X-linked CGD.”

10. C, page 448
“Leukocyte adhesion deficiency type 2 (LAD-2) results from an absence of sialyl Lewis X… This defect is caused by a mutation in a GDP-fucose transporter responsible for the transport of fucose into the Golgi, resulting in an inability to synthesize sialyl Lewis X… This abnormality in fucosylation seen in LAD-2 also contributes to a Bombay blood group phenotype caused by the absence of all ABO blood group antigens as well as to mental retardation and other developmental defects. Fucose is an essential component of the H glycolipid that forms the core antigen in the ABO system.”