Welcome to the FIT Board Review Corner, prepared by Timothy Chow, MD, and Christopher Foster, MD, senior and junior representatives of the College's Fellows-in-Training (FITs) to the Board of Regents. The FIT Board Review Corner is an opportunity to help hone your Board preparedness.

Review Questions
Allergy and Immunology Review Corner: Janeway's Immunobiology, 9th edition

Chapter 8: The Development of B and T Lymphocytes
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1. Differentiation of the multipotent progenitor cell into the common lymphoid progenitor requires signaling through which receptor?
    a. Kit receptor binding to stem cell factor
    b. IL-7 receptor binding to Il-7
    c. FLT3 receptor binding to its FLT3 ligand
    d. Notch1 receptor binding to its ligand

2. During which stage of B cell development, does the heavy chain rearrangement begin?
    a. Early pro-B cell stage
    b. Large pre-B cell stage
    c. Immature B cell stage
    d. Small pre-B cell stage

3. What is the consequence of failure to produce a functional μ chain in B cells?
    a. V-J light chain rearrangement
    b. Cell death
    c. Allelic exclusion
    d. Anergy

4. Which surrogate proteins comprise the pre-BCR light chains?
    a. λ5 and VpreB
    b. Igα and Igβ
    c. Invariant chain (I_i)
    d. β2 microglobulin
    e. pTα

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5. The signaling subunit of the pre-BCR is the
    a. ITAM containing Igα and Igβ
    b. ITAM containing ζ (zeta) chain
    c. ITAM containing λ5
    d. ITAM containing VpreB

6. Deficiency of the scaffold protein BLNK arrests B cell development at which stage?
    a. Pre B cell
    b. Pro B cell
    c. Immature B cell
    d. Mature B cell

7. Pre-BCR signaling results in allelic exclusion at the heave chain locus in B cells. The mechanism by which this occurs include which of the following?
    a. Decreased RAG 1/2 expression
    b. Targeting RAG 2 for degradation
    c. Reduced access of the VDJ recombinase machinery to the heavy chain locus
    d. All the above

8. The process of isotypic exclusion is
    a. Expression of only 1 of 2 alleles in a B cell heavy chain locus
    b. Expression of only 1 of 2 alleles in a B cell light chain locus
    c. Expression of only 1 of 2 light chains in a B cell
    d. Expression of either IgM or IgD on the cell surface

9. Surface IgM is expressed in
    a. Large Pre B cell
    b. Small Pre B cell
    c. Early Pro B cell
    d. Late Pro B cell
    e. Immature B cell

10. Final maturation step for B cells occurs in the
    a. Bone marrow
    b. Thymus
    c. Peripheral lymphoid organs
    d. Circulation

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Answers:

1. **c** (Page 298): Differentiation of the multipotent progenitor (MPP) cell into the common lymphoid progenitor cell requires signaling through the FLT3 receptor expressed on the MPP cell and the FLT3 ligand on the bone marrow stromal cells.
2. **a** (Page 299): Heavy chain rearrangement begins in the early pro-B cell stage. The pro-B cell stage is specified by the induction of B-lineage specific transcription factors (E2A, early B-cell factor), which induce the expression of several key proteins (such as RAG-1,2) of the VDJ recombinase machinery enabling initiation of the heavy chain locus rearrangement.
3. **b** (Pages 301-302): A successful heavy chain rearrangement if required to produce a pre-BCR. Signaling via the pre-BCR in the large pre-B cell stage is a required checkpoint in B cell development. Failure to produce a successful μ chain/ H chain results in elimination of the cells/ cell death.
4. **a** (Page 302): The surrogate light chains are comprised of λ5 and VpreB, which pair with the heavy chain to form the pre-BCR. The Igα and Igβ chains associate as the signaling component and these signals indicate that a productive rearrangement has been made (important checkpoint) before B-cell development can progress further.
5. **a** (page 302): signaling subunit of the pre-BCR is via ITAM containing Igα and Igβ
6. **b** (Page 303): Pre-BCR signaling requires the scaffold protein BLNK and Bruton's tyrosine kinase (Btk) and so BLNK deficiency causes arrest of B cell development in the pro B cell stage since the pre-B-cell stage requires successful signaling via the pre-BCR.
7. **d** (Page 304): Allelic exclusion at the heavy chain locus in B cells uses all the above mechanisms
8. **c** (Page 305): Expression of only 1 of 2 light chains in a B cell, such that kappa chains are rearranged first and if unsuccessful, are followed by lambda chains.
9. **e** (Page 300): Surface IgM is expressed after a heavy and light chain locus is successfully rearranged in the Immature B cell stage
10. **c** (Page 310): When B cells emerge from the bone marrow, they are still functionally immature and their final maturation from immature B cells to fully mature B cells occurs in the peripheral lymphoid organs

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