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 9: Antigen Presentation to T Cells

1. Which of the following is true of plasmacytoid and conventional dendritic cells?
   a. Plasmacytoid dendritic cells produce abundant type 1 interferons and may act as helper cells for antigen presentation.
   b. Conventional dendritic cells link the innate and adaptive immune response.
   c. Plasmacytoid and conventional dendritic cells express the same surface markers.
   d. Flt3 and Flt3 ligand signaling is critical to the generation and expansion of conventional but not plasmacytoid dendritic cells.

2. Which of the following is FALSE regarding IL-2?
   a. It is not involved in regulatory T cell development.
   b. IL-2 signal can be transduced via 3 different signaling pathways JAK-STAT, PI3K, MAPK.
   c. It promotes differentiation of T cells into effector T and memory T cells when stimulated by an antigen.
   d. It promotes AICD (activation induced cell death).

3. Activation of T cells causes the following changes in expression of the cell surface molecules EXCEPT:
   a. Upregulation of LFA-1
   b. Downregulation of L-selectin
   c. Expression of CD45RO
   d. Expression of CD45RA

4. Several effector T cell functions are mediated by cell surface molecules on the effector cell interacting with binding partners on the target cells. In the case of the CD40–CD40 ligand interaction, effector CD4 T cells express CD40 ligand, which binds to CD40 target cells. Individuals with a genetic deficiency in CD40 ligand expression show greatly reduced antibody responses, particularly to protein antigens which require CD4 T_{FH} cell interactions with B cells. Another expected defect in these individuals would be:
   a. Reduced recruitment of eosinophils by T_H2 cells.
   b. Reduced recruitment of neutrophils by T_H17 cells.
   c. Reduced production of anti-microbial peptides induced by T_H17 cells.
   d. Reduced suppression of dendritic cells by T_{reg} cells.
   e. Reduced activation of macrophages by T_H1 cells.

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5. Which of the following is true of the subsets CD4 T cells?
    a. Th1 cells secrete IL-10 and TgF-B.
    b. Th2 cells are induced by IL-12 and secrete IFNg.
    c. Th17 cells are induced by IL-6 and secrete IL-17 family of cytokines that induce local epithelial and stromal cells to produce chemokines that recruit neutrophils to the site of infection.
    d. Tregs are induced by IL-4 and produce IL-4, IL-5, IL-13 and are involved in parasitic infections.

6. What is FALSE about the role of T follicular helper cells TFH?
    a. Produce cytokines also used by the other T cell subsets and participate in type 1, 2, 3 responses.
    b. Produce IFNg to activate B cells to produce strongly opsonizing antibodies
    c. Promote germinal center response in B cell follicles.
    d. Suppress T cell response and prevent autoimmunity.

7. Which of the following is FALSE?
    a. Integrin a4B7 is expressed on lymphocytes and responsible for T cell homing to respiratory tract.
    b. CCR7 binds CCL19 and CCL21 on TfH and B cells.
    c. Mice lacking CCR7 do not form normal T cell zones and have and impaired primary immune response.
    d. CXCR5 binds CXCL13 on T cells.

8. Migration of T cells from blood stream into the lymph node involves all of the following EXCEPT:
    a. Lymphocyte rolling initiates the contact between lymphocyte and the endothelium mediated by repeated bind-release events between selectins and their ligands.
    b. L-selectin binds to sulfated sialyl-Lewis moieties on vascular adressins CD34 and GlyCAM-1 on HEV with a firm adhesion.
    c. Following activation, integrins display high affinity binding sites which interact with intercellular adhesion molecules (ICAMs) on the vascular wall, resulting in lymphocyte halt and firm adhesion.
    d. T cells follow gradients of chemokines CCL21 and CXCL12 to pass through the HEV wall into the paracortical region of the lymph node.

9. Which of the following is FALSE regarding secondary lymphoid organs?
    a. The spleen possesses only efferent lymphatic vessels, because it only filters blood instead of lymph fluid.
    b. Lymph node development depends on the expression of TNF family proteins known as lymphotoxins.
    c. Signaling through TNFR-I receptor is required for follicular dendritic cell development, normal splenic architecture, and for lymph node development.
    d. T and B cells enter the lymph nodes through specialized blood vessels called High Endothelial Venules (HEV).

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Answers:

1. **a** (Pages 358-360): Plasmacytoid dendritic cells link the innate and adaptive immune response through their actions by producing interferon as well as acting as antigen presenting cells. Plasmacytoid and conventional dendritic cells do not express the same surface markers. Flt3 and Flt3 ligand signaling is critical to the generation and expansion of both conventional and plasmacytoid dendritic cells.
2. **a** (Pages 368-369): IL-2 is involved in T regulatory function as well.
3. **d** (Pages 371, Fig 9.27): Memory T cells express CD45RO after activation in the thymus. Naïve T cells prior activation express CD45RA. This can be used to distinguish maternal versus newborn T cells in patients being evaluated for immune deficiency.
4. **e** (Pages 369-372): CD40 ligand is particularly important for CD4 T-cell effector function; its expression is induced on T_H1, T_H2, T_H17, and T_{FH} cells, and it delivers activating signals to B cells and innate immune cells through CD40. The cytoplasmic tail of CD40 is linked downstream to proteins called TRAFs (TNF-receptor-associated factors). CD40 is involved in the activation of B cells and macrophages; the ligation of CD40 on B cells promotes growth and isotype switching, whereas CD40 ligation on macrophages induces them to secrete TNF-α and become receptive to much lower concentrations of IFN-γ.
5. **c** (Page 375, Fig 9.31): Tregs and not Th1 cells secrete IL-10 and TgF-B. Th1 and not Th2 cells are induced by IL-12 and secrete IFNg. Th2 cells and not Tregs are induced by IL-4 and produce IL-4, IL-5, IL-13 and are involved in parasitic infections.
6. **d** (Pages 374-375): Regulatory T cells suppress T cell responses.
7. **a** (Pages 352-355): Lymphocyte Peyer patch adhesion molecule (LPAM) or alpha(4)beta(7) integrin is expressed on lymphocytes and is responsible for T-cell homing into gut-associated lymphoid tissues through its binding to mucosal addressin cell adhesion molecule (MAdCAM), which is present on high endothelial venules of mucosal lymphoid organs.
8. **b** (Pages 352-355): L-selectin binds to sulfated sialyl-Lewis moieties on vascular adressins CD34 and GlyCAM-1 on HEV weakly.
9. **c** (Pages 347-350): Signaling through TNFR-I receptor is required for follicular dendritic cell development, normal splenic architecture, but not for lymph node development. Signaling through LT-B receptor is required for lymph node and follicular dendritic cell development and normal splenic architecture. The role of the TNF family members in the development in peripheral lymphoid organs is understood based on knockout mice with the receptors TNFR-I and LT-B