BIOL 4570
Spring 2008
Exam 2
Version 1
MULTIPLE CHOICE (2 points each)

1. Class I MHC is composed of:
    a. two heavy chains
    b. a heavy chain and a light
    c. a heavy chain and β2-microglobulin
    d. two light chains

2. Cytosolic proteins are normally degraded by
    a. Cathepsin-S
    b. MMP-9
    c. The proteosome
    d. Acid

3. Cytosolic peptides bind to MHC Class I in:
    a. The ER
    b. The Golgi
    c. The cytoplasm
    d. The lysosome

4. Knock out mice deficient in _____ have reduced Class I on the cell surface:
    a. DM
    b. DO
    c. Ii
    d. TAP

5. Empty MHC molecules (no peptides bound) are frequently found at the cell surface and are responsible for positive selection of T cells.
    a. True
    b. False

6. Invariant chain (Ii) is NOT responsible for:
    a. Preventing peptides from binding Class II in the ER
    b. Directing Class II to the MIIC
    c. Stabilizing newly formed Class II
    d. Catalyzing the release of CLIP

7. How many classical MHC class I genes are found in the human HLA region?
    a. One
    b. Two
    c. Three
    d. Four

8. Human MHC expression is an example of allelic exclusion, the state in which only one allele of a given gene is expressed.
    a. True
    b. False

9. What is the role of TAP?
    a. It tags old proteins for degradation
    b. It transports peptides across the ER membrane
    c. It catalyses the release of CLIP
    d. It phosphorylates the CD3 ⊗ chain

10. Peptides presented on MHC Class II originate:
    a. In the cytoplasm
    b. In the extracellular space
    c. In the ER
    d. In the nucleus

11. Which of the following MHC molecules would NOT be expressed on a mouse macrophage?
    a) H2-K
    b) H2-D
    c) IA-E
    d) DP

12. MHC polymorphisms tend to cluster in which part of the MHC molecule
    a) CD4/8 binding region
    b) peptide binding cleft
    c) beta-2 microglobulin
    d) transmembrane region

13. Superantigens:
    a. Bind in the groove of class I molecules
    b. Bind in the groove of class II molecules
    c. Crosslink TCR and MHC
    d. Are produced by the proteosome

14. How do class Ib MHC molecules differ from classical class I molecules?
    a. They are more conserved
    b. They are more polymorphic
    c. They are more numerous
    d. They are recognized by CD4+ T cells

15. MHC diversity is due to:
    a. Genetic recombination
    b. Inbreeding
    c. Somatic recombination
    d. Transposons

16. TCR ✔ and ⚹ chains contain intracellular ITAM motifs.
    a. True
    b. False

17. Which of the following transcription factors are not activated by TCR signaling?
    a. NF-✱B
    b. AP-1
    c. NFAT
    d. ZAP-70

18. Ligation of which of the following receptors along with TCR allows for activation of naïve T cells?
    a. CD4
    b. CD8
    c. CD28
    d. CD5

19. Which signaling pathway is associated with cytokine receptors?
    a. ERK
    b. Calmodulin
    c. PKC
    d. JAK/STAT

20. Mast cells express which class of Fc receptor?
    a. Fc ✔
    b. Fc ❤
    c. Fc 🎁
    d. Fc ■

21. SH2 domains bind to:
    a. MHC
    b. Phosphotyrosine
    c. Ion channels
    d. Ii

22. Fas signaling is associated with
    a. T cell activation
    b. B cell activation
    c. Apoptosis
    d. Release of Ca^{2+}

23. Which of the following molecules is upregulated on activated T cells and binds B7.1 on APC?
    a. CTLA-4
    b. Fc
    c. CD3
    d. CD4

24. Which of the following is activated by a small G protein?
    a. MAPKKK
    b. PKC
    c. Calmodulin
    d. ZAP70

25. Which enzyme cleaves PIP_2 to produce DAG and IP_3?
    a. Protein kinase
    b. Phospholipase
    c. Calcineurin
    d. CD45
    e. Protease

26. Which of the following represents the earliest stage in T cell development?
    a. DP
    b. DN
    c. SP – CD4
    d. SP – CD8

27. Which of the following represents the earliest stage in B cell development?
    a. Pre-B
    b. Pro-B
    c. Immature B
    d. Mature B

28. Ig light chain knock out mice would halt development of B cells at which stage?
    a. Pre-B
    b. Pro-B
    c. Immature B
    d. Mature B

29. TCRs with high affinity for MHC/peptide are _____ likely to undergo

negative selection

a. More
b. Less

30. Signaling through the pre-TCR results in:
    a. Rearrangement of the TCR chain
    b. Rearrangement of the TCR chain
    c. T cell activation
    d. Apoptosis

31. Ligation of surface Ig by multivalent antigen in immature B cells can lead to:
    a. Rearrangement of heavy chain
    b. Rearrangement of light chain
    c. Apoptosis
    d. Both B and C

32. T cells derived from MHC^a bone marrow selected on MHC^b thymic epithelial cells would respond to peptide presented by:
    a. MHC^a APC
    b. MHC^b APC
    c. MHC^{axb} APC
    d. Both B and C

33. In negative selection, cells that receive _____ signal through their antigen receptors die.
    a. A weak
    b. A strong
    c. an intermediate
    d. No

34. Nude mice lack
    a. T cells
    b. B cells
    c. Both T and B cells
    d. none of the above

35. People deficient in 2-microglobulin lack:
    a. B cells
    b. CD4+ T cells
    c. CD8+ T cells
    d. Antibodies

36. Children have _____ thymii than adults.
    a. Larger
    b. Smaller
    c. Less active
    d. Both B and C

Research Minute Questions

37. Prevention of fetal rejection during pregnancy may be due in part to inhibiting T cell function through:
    a. Arginase downregulation of CD3⊗ chain
    b. Upregulation of TLR 4
    c. Downregulation of Ig ✔

38. IL-7 dependent proliferation of progenitor B cells is a result of activation of
    a. STAT3
    b. IP3
    c. PKC
    d. Ras

39. Cell signaling is important in T cell selection.
    a. True
    b. False

40. Which would you expect to have more similar gene expression profiles?
    a. Pro-B cells and DN T cells
    b. Mature B cells and T cells

SHORT ANSWER Name:

41) How does MHC variability differ from TCR/Ab variability? How is variability introduced in both cases? (5 points)

42) What are the two major goals of lymphocyte development? (5 points)

43) What is the function of the pre-B-Cell Receptor and pre T-Cell receptor? (5 points)

44) Describe in detail ONE of the three main signaling pathways activated during T cell or B cell activation. Be sure to include what molecules initiate signaling, what intermediates are involved and what transcription factors are ultimately activated. (10 points)