

****Please note that some of these questions were not written by me. Some were taken from official course practice exams, as well as Jose B.'s practice exams. This sheet is intended to aid in final review and should NOT be used as the only resource for studying.****

1. In what order are the following complement pathways activated? Order then from earliest to latest.
 - a. Alternative > Lectin > Classical
 - b. Classical > Lectin > Alternative
 - c. Alternative > Classical > Lectin
 - d. Lectin > Alternative > Classical
2. TF: The innate immune response is flexible, specific and has memory.
3. Which is the darkest staining lymphocyte?
 - a. Eosinophils
 - b. Basophils
 - c. Neutrophils
 - d. Macrophages
 - e. None of the above
4. TF: Jenner used the variola virus to induce immunity against the vaccinia virus.
5. TF: The activation of the classical system relies on the adaptive immune response.
6. Which of the following is true?
 - a. Naive B cells can secrete IgA
 - b. Mature B cells have IgM and IgD on the surface
 - c. Naive B cells can have IgM and IgD on the surface
 - d. A & B
 - e. B & C
7. Which PAMP is associated with Pseudomonas?
 - a. LTA
 - b. LPS
 - c. TA
 - d. None, it's a virus
8. What is the first barrier against infection?
 - a. Skin
 - b. Neutrophils
 - c. Mucosal surface
 - d. Macrophages
 - e. A & C
 - f. A, B, & D
 - g. B & D
9. What is the most abundant leukocyte in the blood?
 - a. Monocyte
 - b. Macrophage
 - c. Neutrophil
 - d. Basophil

- e. Lymphocytes
10. What is another name for macrophage-like cells in the liver?
- a. Monocytes
 - b. Kupffer cells
 - c. Microglia cells
 - d. Inflammation anergic macrophages
11. What is the golden standard of vaccination?
- a. Opsonization
 - b. Neutralization
 - c. None of the above
12. Which of the following is the most potent anaphylatoxin
- a. C3a
 - b. C5a
 - c. They are both equally potent
13. Which of the following is a zymogen in the alternative pathway?
- a. Factor P
 - b. Factor I
 - c. Factor B
 - d. DAF
14. When C3b is formed on a human surface, it can rapidly be disrupted by the action of:
- a. DAF
 - b. Factor P
 - c. MCP
 - d. A&B
 - e. A&C
15. CR-1 can:
- a. Act as an opsonin
 - b. Be found on the surface of pathogens
 - c. Induce phagocytosis by binding to C3b
 - d. A&C
 - e. None of the above
16. TF: Scavenger receptors are receptors found on macrophages that result in cytokine signaling.
17. CR3 is a that recognizes such as
- a. PAMP ; PRR ; C3b
 - b. PAMP ; PRR ; LPS
 - c. PRR ; PAMPs ; C3b
 - d. PRR ; PAMPs ; LPS
18. Macrophages release specific inflammatory cytokines after recognizing a pathogen. Which of the following is NOT one of those cytokines
- a. INF- γ
 - b. TNF- α
 - c. IL-6
 - d. IL-1

- e. CCL-2
19. Which cytoplasmic receptor is expected to recognize degradation products of viruses? Further, identify the receptor below that would recognize an intracellular viral infection within the cytoplasm.
- a. NOD 1
 - b. MyD88
 - c. MDA5
 - d. RIG 1
 - e. A&D
 - f. A, C, & D
 - g. C&D
20. TF: A BCR can potentially have one L-chain isotype on the left arm and another L-chain isotype on the right arm.
21. TF: The BCR V-D-J genes on chromosome 22 are rearranged to form the light chain.
22. For a single FAB on an antibody, there are CDRs and HVs present.
- a. 3 ; 6
 - b. 4 ; 12
 - c. 6 ; 3
 - d. 3 ; 3
 - e. 6 ; 6
23. All of the following statements about somatic recombination are false except:
- a. The heavy chain is observed to undergo rearrangement before the light chain
 - b. Rearrangement of the genes will occur within the constant domain of the body
 - c. To rearrange and combine V,D, and J segments, AID must be used
 - d. The $\frac{1}{2}$ turn rule ensures TLR gene segments are aligned in the correct order
 - e. CDR1 & CDR2 encoding for the L-chain is accomplished via different D segments
24. During a Bcell's life, many changes are expected to happen, some of which can be reversed. Identify which of the following is matched incorrectly with its outcome.
- a. Isotype switching: irreversible
 - b. Somatic recombination: irreversible
 - c. Junctional diversity: reversible
 - d. Somatic hypermutation: Irreversible
 - e. RNA splicing/processing: reversible
25. For the development of B cells and T cells, you would expect which of the following enzymes to be utilized, leading to junctional diversity?
- a. RAG $\frac{1}{2}$
 - b. AID
 - c. Catalase
 - d. TdT
 - e. A&D
 - f. A,B, &D
26. TF: Secreted TCRs require MHC to recognize antigen.
27. TF: The heavy chain of a TCR is composed of V, D, and J segments.

28. Which of the following are included in the CD3 Complex:
- CD3 μ
 - CD3 γ
 - CD3 α
 - Ig α and Ig β
 - All of the Above
29. Gene Arrangements of the light chain include all of the following, except:
- At least four possible attempts for a successful rearrangement
 - Rearrangement of the kappa genes and then the lambda genes
 - If no successful rearrangements are made, then apoptosis will result
 - Rearrangement of the μ genes first then the δ genes
30. Which of the following is true about the degradation of extracellular proteins?
- The peptide products will be delivered to the CD8 T cells
 - The peptides produced will be bound to MHC I molecules
 - The peptides produced will be found in a phagolysosome
 - A&C
 - A, B&C
31. B cells that bind to self-antigens in the bone marrow can lead to...
- Anergy
 - Apoptosis
 - Receptor editing
 - A&C
 - A, B & C
32. Which of the following is true about the assembly and loading of peptides to MHC II molecules?
- The alpha and beta chains of MHC II assemble with the invariant chain
 - Ii, a protein, prohibits peptides from binding to MHC II within the ER
 - In a proteasome, the degradation of intracellular antigen will produce short peptides (8-10 amino acids) to be loaded on the MHC II.
 - A&B
 - A, B, & C
33. How is TCR diversity achieved?
- Polymorphism
 - Somatic hypermutation
 - Somatic recombination
 - Receptor editing
34. All of the following statements are true except:
- Immature B cells have Ig α and Ig β on their surface
 - B cells mature in the lymph nodes
 - A&B
 - Mature B cells have IgM and IgD on their surface
 - None of the above are true
35. The first checkpoint in B cell maturation:
- Involves a pre-BCR

- b. Checks for a function rearrangement of the light chain variable domain gene segments
 - c. Utilizes $\mu 2$ microglobulin and VpreB attached to the heavy chain
 - d. A&B
 - e. A,B&C
36. What process results in central tolerance?
- a. The first checkpoint
 - b. Receptor editing
 - c. Positive selection
 - d. Negative selection
37. How long does it take to develop a primary adaptive immune response
- a. A month
 - b. 7-14 days
 - c. 1 day
 - d. None of the above
38. Which of the following is not true regarding an MHCII molecule?
- a. It is associated with a $\mu 2$ microglobulin
 - b. It presents extracellular peptides to T cells
 - c. It is associated with a $\beta 2$ chain
 - d. It presents antigen to CD4 T cells
39. What does a Pre-BCR consist of?
- a. Heavy Chain
 - b. Surrogate light chain
 - c. VpreB
 - d. CD3 complex
 - e. A,B,&C
 - f. A,B,C&D
40. What makes up the peptide binding site in MHC class I and how many chains are present?
- a. $\alpha 1, \alpha 2$; one chain
 - b. $\alpha 2, \alpha 3$; one chain
 - c. $\alpha 1, \beta 1$; two chains
 - d. $\alpha 2, \beta 2$; two chains
41. MHC class I is loaded with peptides in the _____, while MHC class II is loaded with peptides in the _____
- a. ER ; ER
 - b. Phagolysosome ; Phagolysosome
 - c. Phagolysosome ; ER
 - d. ER ; Phagolysosome
42. MHC I can bind _____ amino acid sequences, while MHC II can bind _____ amino acid sequences
- a. 8-10, 10-25
 - b. 10-25, 8-10
 - c. 8-10, 10-23

- d. 10-23, 8-10
43. Select the components that make up the MHCI peptide loading complex
- a. Tapasin
 - b. TAP1/2
 - c. Li chain
 - d. Calnexin
 - e. Calreticulin
 - f. MCHI
44. Which of the following are true?
- a. Holds binding groove of MHCII open so only peptides with high affinity can bind
 - b. Connects MHCI molecule to TAP1/2 so the binding groove is accessible to peptides
 - c. Aids in the folding of the MHCI molecule
 - d. A&B
 - e. B&C
45. Which of the following is not an MHC presenting molecule
- a. HLA-A
 - b. HLA-B
 - c. HLA-DM
 - d. HLA-DQ
 - e. All of the above are presenting molecules
46. TF: T cells can present antigen on MHCI
47. What cell types can use MHCII?
- a. Macrophages
 - b. Monocytes
 - c. Dendritic cells
 - d. A&B
 - e. A&C
 - f. B&C
 - g. A,B,&C
48. Where do B-cells develop?
- a. Primary lymphoid tissue
 - b. Secondary lymphoid tissue
 - c. Bone marrow
 - d. Thymus
 - e. A & C
 - f. A, C, & D
49. You would expect a 'double negative' thymocyte to be present Positive selection and Negative selection
- a. Before; after
 - b. Before ; before
 - c. After ; before
 - d. After ; after
50. Successful rearrangement of the a-chain locus leads to:

- a. Successful; rearrangement of the delta chain locus
 - b. Deletion Of the delta chain locus
 - c. Successful rearrangement of the gamma lo cus
 - d. Deletion of the gamma locus
51. TF: Mature Tcells are longer lived than mature bcells, but will only continue their circulation for 3-4 days in the absence of their specific antigen.
52. Which of the following is a kinase involved in Tcell activation culminating in tcell proliferation and differentiation?
- a. AP1
 - b. NFkB
 - c. ZAP70
 - d. NFAT
53. Signal transducers and activators of transcription (STATs) ae That is phosphorylated by
- a. Transcription factors ; JAKs
 - b. Protein kinases ; other STATs
 - c. Cytokine receptors ; JAKs
 - d. Cytokines ; cytokines receptors
 - e. Transcription factors ; Lck
54. How is TCR and BCR signaling similar?
- a. Both have protein kinases that phosphorylate ITAMs
 - b. Both result in transcription factors being activated to change gene expression
 - c. Both use Iga and Igb in their signaling pathways
 - d. A&B
 - e. A,B&C
55. The antibody response to thymus independent antigens does not require t cell help because:
- a. Some highly repetitive epitopes cause extensive crossling of the BCRs and their co-receptors and can activate a mature naive Bcell.
 - b. The bcell uses ADCC to become activated
 - c. C3b covers the bcell surface entirely, eliminating the need for tcell help
 - d. Somatic hypermutation and isotype switching typically happens in the TCRs
56. Which cells would you expect to find in the light zone of a germinal center that hold antigen for B cells to bind to?
- a. Langerhan cells
 - b. FDCs
 - c. M cells
 - d. A&B
 - e. A,B&C
57. Mucosal epithelia of the gastrointestinal tract, respiratory, urinary, and genital tracts, and the mammary glands are protected by:
- a. Monomeric IgG
 - b. Pentameric IgM
 - c. Monomeric IgA

- d. Dimeric IgA
58. The symptoms of allergies and asthma are induced after cross-linking of IgE Abs on FcεR1 receptors found on the surface of:
- a. Basophils
 - b. Eosinophils
 - c. Mast cells
 - d. A&B
 - e. A,B&C
59. What is the main opsonin placed on pathogen surfaces?
- a. C3a
 - b. C3b
 - c. C5a
 - d. C5b
 - e. C1
60. Microfold cells:
- a. Are phagocytic
 - b. Are protected from digestive enzymes by a thick glycocalyx and a layer of mucus
 - c. Are scattered throughout the mesenteric lymph nodes
 - d. A&B
 - e. A&C