

Name: \_\_\_\_\_

SSN: \_\_\_\_\_

Microbiology 461

IMMUNOLOGY

Examination 1

September 29, 2000

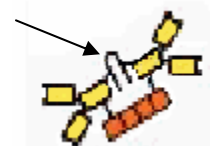
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**Instructions:** on the scan sheet, fill-in the bubble corresponding to the one sentence or phrase that best answers the question or correctly completes the sentence

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1. **C**Cytokines are
  - a. any cells involved in an immune response
  - b. the cells that constitute an inflammatory response
  - c. hormones of the immune system
  - d. intracellular parasites (e.g., viruses)
  - e. any parasite that invades the body
2. **B**Which cells are most directly responsible for the symptoms associated with inflammation (i.e., which cells directly control symptoms such as redness, swelling, heat and pain)?
  - a. macrophages
  - b. endothelial cells
  - c. neutrophils
  - d. T helper cells
  - e. cytotoxic T lymphocytes
3. **B**The ability of the immune system to respond exclusively to the foreign antigens that are present and not respond antigens that are absent is attributed to a phenomena commonly known as
  - a. clonal deletion
  - b. clonal selection
  - c. immune regulation
  - d. gene rearrangements
  - e. class switching
4. **A**When B cells are activated they proliferate and differentiate into
  - a. memory cells and plasma cells
  - b. memory cells and dendritic cells
  - c. T<sub>H</sub>1 and T<sub>H</sub>2 cells
  - d. T<sub>H</sub>2 cells and plasma cells
  - e. none of the above answers are correct
5. **C**When comparing a primary antibody response to a secondary response, which of the following is not true? Secondary responses
  - a. yield more antibody to the antigen
  - b. have antibodies with higher affinity
  - c. have antibodies with higher specificity
  - d. produce high amounts of antibody faster than primary responses
  - e. differ from primary responses in all of the above characteristics
6. **D**Which of the following binds to processed antigen presented on professional antigen presenting cells?
  - a. antibody
  - b. B cells
  - c. both a and b
  - d. T<sub>H</sub>1 cells
  - e. macrophages
7. **A**Which of the following is not a professional antigen presenting cell (APC)?
  - a. T<sub>H</sub>2 cell
  - b. B cell
  - c. macrophage
  - d. dendritic cell
  - e. none of the above (all of the above are professional APCs)
8. **E***Humoral immunity* is another term for
  - a. long-term immune protection
  - b. adaptive immunity
  - c. innate immunity
  - d. T cell mediated immunity
  - e. antibody mediated immunity

9. **D**The first vaccine in Europe was made and administered by E. Jenner in 1798. The vaccine protected against
- polio
  - pertussis (whooping cough)
  - rabies
  - small pox
  - tetanus
10. **C**Which of the following is not part of innate immunity?
- macrophages
  - neutrophils
  - B cells
  - cytokines
  - certain enzymes such as lysozyme
11. **E**Which of the following is not derived from a pluripotent hematopoietic stem cell
- T cell
  - macrophage
  - neutrophil
  - red blood cell
  - none of the above (all of the above come from a common precursor)
12. **D**Which of the following are phagocytes?
- macrophages
  - neutrophils
  - some T cells
  - a and b above but not c
  - a, b and c above
13. **A**The B cell antigen receptor is sometimes called
- antibody
  - TCR
  - cytokine receptor
  - CD 4
  - MHC
14. **B**The “T” in the name “T cells” is used because
- “A” through “S” were already taken by a variety of cell types
  - T cell development requires the thymus
  - T cell development requires thyroid hormones
  - it honors Thucydides, the Greek historian
  - rejection of tissue transplants requires these cells
15. **A**In humans, the part of B cell development that occurs before antigen is present takes place in
- bone marrow
  - bursa of fabricius
  - lymph nodes
  - Peyer’s patches
  - all of the above
16. **E**Which of the following are effector cells?
- B cells
  - plasma cells
  - activated cytotoxic T lymphocytes
  - activated macrophages
  - b, c, and d but not a
17. **D**Which of the following is the place where you are most likely to find the molecule depicted below?
- thymus
  - lymph node
  - kidney
  - mouth
  - blood
18. **D**In the picture to the right, the arrow points to a “U” shaped object. This polypeptide chain is also found on?
- the surface of B cell
  - some IgGs
  - T cell receptor
  - secreted IgM but not on membrane IgM
  - the membrane form of all immunoglobulins



picture for questions 17 and 18

19. **B** Sometimes an antibody binds to a virus and the binding itself renders the virus non-infective (perhaps by blocking its ability to bind to cells) or it binds to a toxin rendering it non-toxic (perhaps by binding to the active sites on the molecule). This is called
- antigen inactivation
  - neutralization
  - direct inhibition
  - inhibitory antibody
  - anti virulence antibody

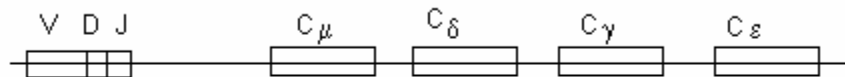
20. **C** Opsonization is
- the name of the cell-cell interaction between a B cell and a T helper lymphocyte
  - the enzymatic destruction of a invading microorganism (does not require adaptive immunity)
  - the coating of something with antibody or complement so that it can be easily phagocytized
  - the chemical attraction of macrophages and neutrophils to the site of an infection or injury
  - the term used to refer to the gene rearrangements that make antibody chain variable regions

21. **C** What is the best way for the immune system to deal with virus infected liver cells?
- destroy the virus with antibody
  - opsonization
  - kill the infected cells
  - produce interferon to kill the virus
  - all of the above are effective in dealing with the infected cells

22. **A** From serum, I isolate a molecule of IgG and a molecule of IgM. They both have the exact same specificity with the same heavy chain variable regions and the same light chains. The molecules bind to the surface of a bacterium. Which one has the highest affinity? Which one has the highest avidity?
- the IgM has the highest avidity but the affinity is the same for both
  - the IgG has the highest affinity but they both have the same avidity
  - the IgM has the highest affinity but they both have the same avidity
  - the IgM has the highest avidity and affinity
  - if the binding sites are the same then the affinity and avidity are the same for both

23. **C** What is(are) the protein(s) that is(are) likely to be made from this DNA in its current configuration? Assume NO other proteins are made from any other locus.

- IgM or IgD
- IgM only
- $\mu$  and  $\delta$
- IgG
- $\mu$ ,  $\delta$ ,  $\gamma$  and  $\epsilon$



24. **D** The table below shows the number of v, d, j and C segments in various immunoglobulin genetic loci. How many different antigen binding sites can be generated with this number of gene segments (do not consider mutation, p- or n-addition in the calculation)

segment	Light chains		Heavy chain
	$\lambda$	$\kappa$	
v	20	50	100
d	0	0	10
j	5	4	6
Constant regions	1	1	9

- between 1000 and 1,000,000
- 195
- about 120,000,000
- about 1,800,000
- 1,000,000,000 or more

25. **D**What is it that the picture to the right is likely to represent?

- a. enhancer
- b. promoter
- c. switch sequence

AAA TTC C NNN NNN NNN NNN GGG TTT CCC

N= any base

- d. recombination signal sequence
- e. c and/or d but not enough information to distinguish between c and d

26. **E**Which of the following might be a T cell receptor?

- a. CD8
- b. immunoglobulin
- c. antibody
- d. all of the above
- e. none of the above

27. **B**Which of the following occur in B cells before activation by antigen?

- a. clonal selection
- b. vj and vdj gene rearrangements
- c. somatic hypermutation in the variable region
- d. class switching
- e. none of the above (all of the above occur after antigen is introduced)

28. **E**The switch regions (or switch sequences) that are needed for class switching are found

- a. adjacent to every v d and j gene segment
- b. adjacent to every c gene
- c. in the intron upstream of  $\mu$  only
- d. in the introns upstream of  $\mu$  and downstream of the last c region gene ( $C\alpha 2$  in humans)
- e. in the introns upstream of every c gene except  $\delta$

29. **E**Which of the following cells does not have MHC class I on its surface?

- a. lung epithelium
- b. kidney cell
- c. plasma cell
- d. macrophage
- e. none of the above (all have MHC class I on their surfaces)

30. **C**Which of the following has high levels of MHC class II on their surface?

- a. T helper cells
- b. inflammatory T cells
- c. macrophages
- d. all of the above have MHC class II on their surface
- e. none of a, b or c have class II on their surface

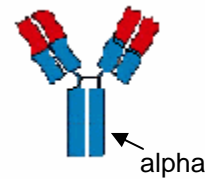
31. **B**An aggregated (clumped) form of a bacterial protein is injected into a mouse. This antigen is taken up by certain cells, processed and present in association with an MHC molecules. Which cells are likely to take up this antigen and how will it be presented?

- a. uptake by macrophages and presented in association with MHC class I
- b. uptake by macrophages and presented in association with MHC class II
- c. uptake by B cells and presented in association with MHC class I
- d. uptake by  $T_H 2$  and presented in association with MHC class II
- e. 2 or more of the above answers are correct

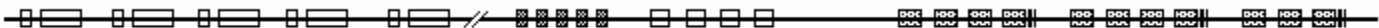
32. **A**Which of the following is true?

- a. all immunogens are antigens
- b. all antigens are immunogens
- c. the terms *immunogen* and *antigen* mean the same thing
- d. immunogens are hormones of the immune system that regulate and control responses
- e. none of the above are true

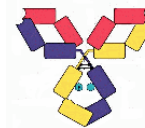
33. **D**When one talks about antibody affinity, one is generally referring to
- how large is the antibody repertoire
  - the ability (or lack of ability) of an antibody to distinguish between two or more similar antigens
  - which antigen(s) the antibody binds
  - how strongly or weakly an antibody binds to a given antigen
  - whether an antibody is bound to the surface of the B cell that made the antibody
34. **E**Which of the following is not a factor in determining whether an antigen will induce an effective antibody response?
- the size of the antigen (e.g., very small molecules not effective in inducing a response)
  - the route of injection (e.g. usually subcutaneous injections are better than intravenous)
  - similarity to self (e.g. if the antigen looks like a mouse protein, mice do not respond well)
  - the amount of antigen(one can have too much or too little antigen to induce a response)
  - none of the above (all of the above are factors in determining responsiveness)
35. **A**In some cases, antigen by itself induces little or no response. However, antigen plus certain substances induce a big response to the antigen? What do we call a substance that is added to an antigen to make it better able to induce an immune response?
- adjuvant
  - antigenic enhancer
  - antigenic promoter
  - subordinate antigen
  - immune stimulant



36. **B**What is the molecule to the right?
- immunoglobulin of unknown class
  - IgA
  - Ig alpha
  - alpha chain
  - T cell receptor
37. **C**The DNA depicted below represents
- rearranged light chain
  - germ line light chain
  - germ line heavy chain
  - rearranged heavy chain
  - not enough information to clearly distinguish two or more of the above answers



38. **C**The molecule to the right is divided into several (12) boxes. What do the boxes represent?
- exons
  - introns
  - domains
  - individual protein chains
  - antigen binding regions



39. **B**The circled part of the molecule below is best (and unambiguously) referred to as the
- Fab region
  - Fc region
  - complement region
  - binding site
  - c region

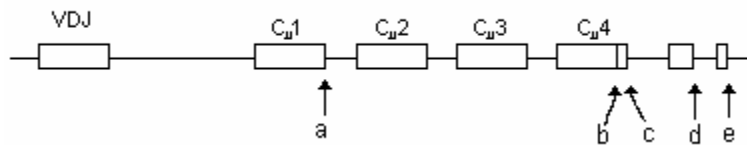


40. **D**The variable region of immunoglobulin chains is called *variable* because
- antibodies with different specificities use different amino acids in the antigen contact residues
  - there are various classes of heavy and light chains
  - the amino acid sequence can change by somatic mutation
  - comparisons of many variable regions shows amino acid differences an nearly every position
  - it is not present in all immunoglobulins

41. **A** The complementarily determining region(s) of an antibody molecule is noteworthy because it is
- the part of the molecule that actually contacts the antigen
  - the part of the molecule that can activate complement
  - the part of the molecule where the heavy and light chains interact with each other
  - the part of the molecule that determines the isotype
  - none of the above

42. **E** I inherited two genes for the C $\gamma$ 3 heavy chains. I got one from my mother and one from my father. The proteins produced from these two genes differ by a single amino acid. The differences are referred to as
- mutational differences
  - standard deviations
  - isotypic differences
  - idiotypic differences
  - allotypic differences

43. **C** Using the gene segments depicted below, where is the codon the encodes the last amino acid in the secreted form of this immunoglobulin (the carboxy terminus; not at the variable region end).



44. **E** Which of the following chemical bonds is not (or very rarely) involved in antigen binding by antibody?
- electrostatic forces
  - hydrophobic forces
  - Van der Waal forces
  - hydrogen bonds
  - covalent bonds