Building Your Knowledge

1) What is immunocompetence?

Which cells are most important in the development and maintenance of immunocompetence?

2) Where do B cells mature?

Where do T cells mature?

3) B cells produce _____ in response to antigen.

4) What two features most characterize acquired immunity?

5) Put the following events in order and describe each process.

Event	**Order (first, second, etc.)**	**Description of Event**
Antigen Presentation and Clonal Selection		
Activation and Clonal Expansion		
B-Cell and T-Cell Response		
Lymphocyte Development		

6) Receptors are found on cells. What are 4 major functions of receptors?

7) A specialized group of receptors are MHC antigens. What does MHC stand for?

Draw an MHC I and an MHC II molecule.

MHC I MHC II

Which cells express MHC I and which cells express MHC II?

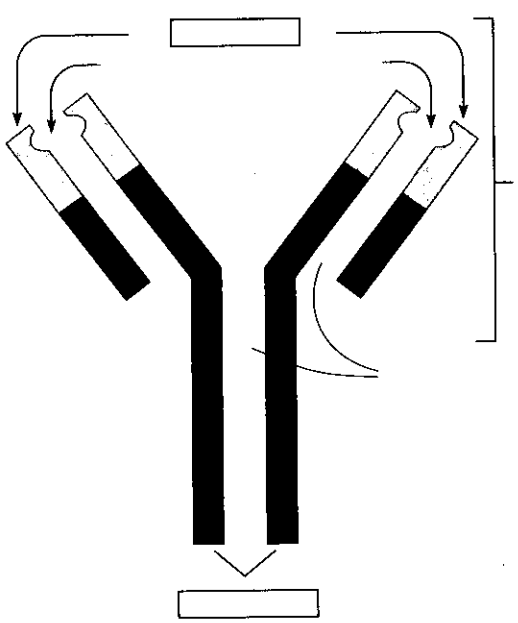
8) What is the clonal selection theory?

Do lymphocytes change their antibodies or other receptors to match a given antigen? Explain.

9) What is immune tolerance and how does it occur?

10) What are immunoglobulins and which cells produce them?

11) Label the figure shown at right, indicating the location of 3 disulfide bonds, heavy chains, light chains, variable regions, constant regions, the antigen-binding site, the Fab area and the Fc region.



12) How are T-cell receptors similar to immunoglobulins?

How are they different?

13) Where do B cells mature in birds?

Where do they mature in humans?

14) Where do B cells go after maturation?

Do B cells circulate or "home" to a particular region?

15) Where do T cells mature?

Do T cells circulate in the blood or home to a specific area?

16) What is an antigen?

In general, what traits make a good antigen rather than a poor antigen?

What is a hapten?

How do you produce antibodies against a hapten?

17) Differentiate between auto-antigens and allo-antigens.

Which are of concern to transplant specialists?

18) What are superantigens and which group of lymphocytes do they directly stimulate?

19) How do most antigens enter the body?

Where are they gathered up and concentrated after entry?

20) What are antigen presenting cells (APC) and how do they present antigen to the body?

Which T cells do APC present antigen to?

21) If an APC presents an antigen to a T-helper cell, how does the APC activate the T cell? How does the T cell then activate a B cell?

22) Do B cells present antigen to T cells on their antibodies? Why or why not?

23) What signals do B cells require to activate?

Where do these signals come from?

24) What happens to a B cell after activation?

25) What may antibodies do to eliminate a pathogen? (list 4 specific things)

a. _____

b. _____

c. _____

d. _____

26) List and differentiate between the 5 different classes of antibody.

Antibody Class	**Description**

Which is most prevalent in the blood?

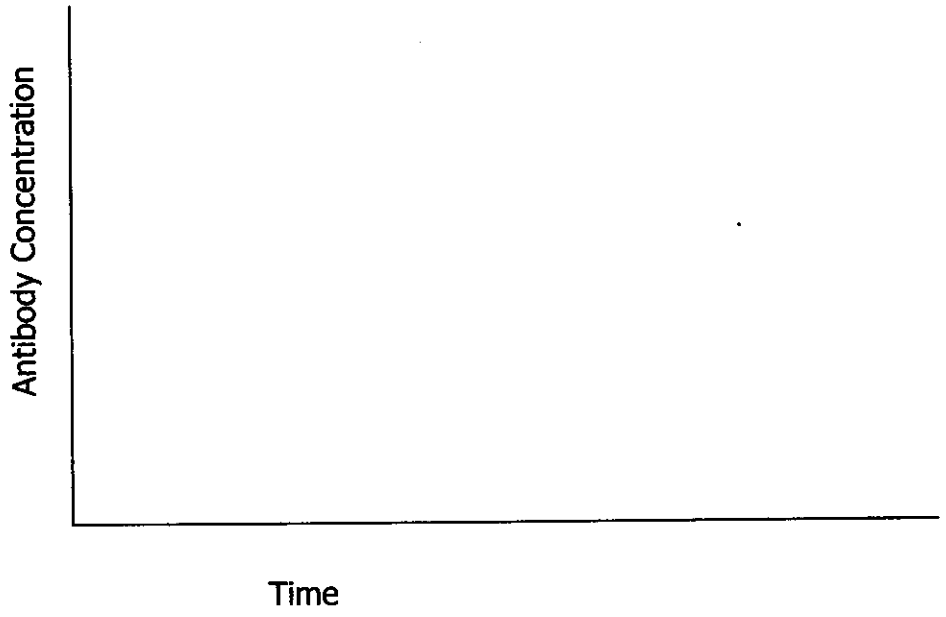
Which is found on mucous membranes?

Which serves as a B-cell receptor?

Which causes allergy?

Which is produced first, upon exposure to antigen?

27) Draw an antibody titer graph, with the primary and secondary response. Label the IgM curve, the IgG curve and the latent period.



28) A secondary immune response is stronger, longer and quicker than a primary response. Why?

29) Differentiate between monoclonal and polyclonal antibodies.

30) How are monoclonal antibodies made?

How are monoclonal antibodies used? (list 4 ways)

a. _____

b. _____

c. _____

d. _____

31) There are many different types of T cells. List 3 and their function.

T-cell subset	Function
TH1	
TH2	
TC	

32) Differentiate between active and passive immunization.

Which is quicker?

Which is longer lasting?

33) Differentiate between natural and artificial immunity.

34) Give examples of 4 separate types of immunization:

Immunization	Example
Natural Active	
Natural Passive	
Artificial Active	
Artificial Passive	

35) How does immunotherapy differ from active immunization?

36) What is ISG therapy?

How is it administered?

Who is it administered to?

How long does the protection last?

37) How does SIG therapy differ from ISG therapy?

38) What are 6 characteristics of an ideal vaccine?

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

39) Give an example of a killed or inactivated vaccine.

How are such vaccines prepared?

What is one drawback of killed vaccines over live vaccines?

40) Give an example of an attenuated vaccine.

What are 3 advantages of live vaccines?

What are 3 disadvantages of live vaccines?

41) Which type of vaccines are toxoids (attenuated or inactivated)?

How are toxoids made?

What do they protect against?

42) List three diseases that there is no reliable vaccine for?

a. _____

b. _____

c. _____

43) What are "Trojan Horse" vaccines and how are they constructed?

What carriers have been used?

What vaccines have been developed and used experimentally?

44) How are DNA vaccines different from attenuated or inactivated vaccines?

45) Why is there an increased interest in smallpox, anthrax, botulism and plague vaccines?

46) What are adjuvants and what are they used for?

List 3 commonly used adjuvants.

a. _____

b. _____

c. _____

47) What are the most common complications from vaccination?

48) What is herd immunity?

What does it prevent?

49) How many children in the United States have not received adequate immunization?

Organizing Your Knowledge

MHC Class	**Found on ___ cells**	**Presents antigen to:**	**Gets antigen from:**
MHC I			
MHC II			

Vaccine Type	**Advantage**	**Drawback**	**Example**
Live, Attenuated			
Killed, Inactivated			
Subunit			
Recombinant			

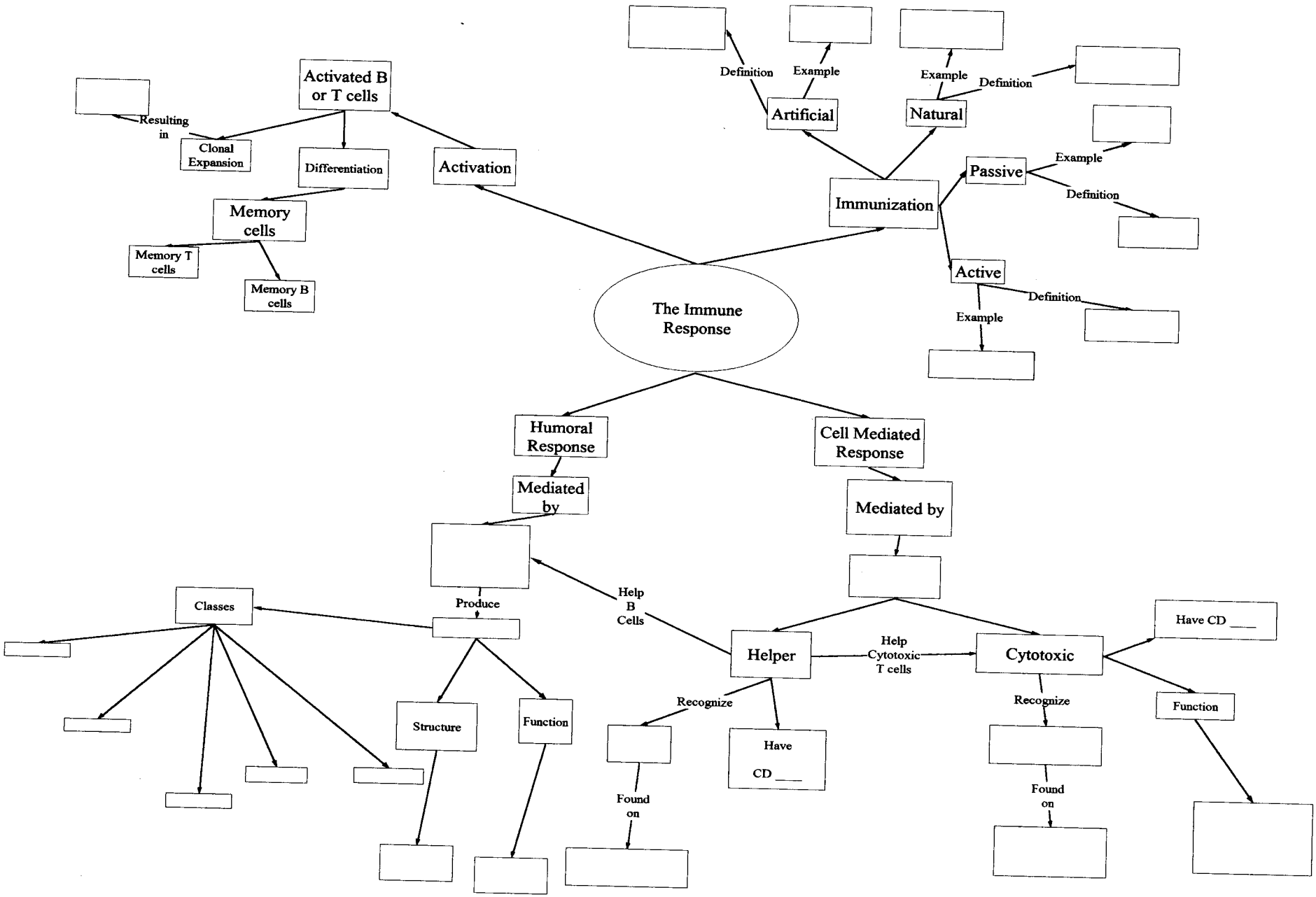
Molecules	**Good antigens?**	**Poor antigens?**
Exotoxins		
Repetitive structures		
Small molecules		
Glycogen		
Glycoproteins		
Pure DNA		
Bacterial capsules		
Large proteins		
DNA with protein		
Haptens alone		
Haptens with carriers		

Activation Event	B cells	T cells
Differentiate (to what?)		
Produce proteins (what proteins?)		
Clonal expansion (yes/no)		

Place an X in all of the cells that match the listed characteristics.

Trait	T_{H1}	T_C	T_{H2}
Recognizes MHC II			
Has CD4			
Has CD8			
Recognizes MHC I			
Regulates immune reactions			
Produces antibody			
Provides B-cell and T-cell help			
Produces perforins			
Causes late allergies			
Destroys virally infected cells			
Reduced in HIV/AIDS patients			

Attribute	T-Cell Receptor	Antibody	Both
Antigen Binding Sites			
Variable and Constant Regions			
Light or Heavy Chains			
Formed by Genetic Modifications			
Secreted			
Binds MHC and Antigen			
Found on B cells			
Recognizes Free Antigen			
Recognizes Antigen Bound to MHC			
Disulfide Bonds			


The Immune Response
Activated B or T cells
Resulting in
Clonal Expansion
Differentiation
Activation
Memory cells
Memory T cells
Memory B cells
Immunization
Artificial
Natural
Definition
Example
Example
Definition
Passive
Example
Definition
Active
Definition
Example
Humoral Response
Mediated by
Produce
Classes
Structure
Function
Help B Cells
Cell Mediated Response
Mediated by
Helper
Help Cytotoxic T cells
Cytotoxic
Have CD ___
Function
Recognize
Have CD ___
Found on
Recognize
Found on

Practicing Your Knowledge

1. Which regions of an immunoglobulin bind to antigen?
   a. variable regions of heavy chains, constant regions of light chains
   b. variable regions of light chains, constant regions of heavy chains
   c. variable regions of both chains
   d. constant regions of both chains

2. Which of the following make good antigens?
   a. starch, with its repetitive sugars
   b. tetanus toxin, since it's an exotoxin
   c. hemoglobin, with its repetitive amino acids
   d. oils, with the gycerol and fatty acids

3. B cells and T cells can make up the ___ immune response and are types of ____.
   a. specific : lymphocytes
   b. non-specific : neutrophils
   c. specific : macrophages
   d. non-specific : eosinophils

4. Attenuated vaccines are ____.
   a. live vaccines
   b. heat-killed organisms
   c. bits of immunogenic DNA
   d. made up of antigenic subunits of a pathogenic organism

5. According to the clonal selection theory, ____.
   a. lymphocytes change to match antigen
   b. naive lymphocytes are a diverse population
   c. a lymphocyte can recognize many different epitopes
   d. macrophages differentiate into T cells

6. Which of the following is NOT an antibody function?
   a. presenting antigen to T Helper cells
   b. opsonization
   c. neutralizing toxins
   d. fixing complement

7. If a dendritic cell presents antigen on MHC I, a ____ will _____.
   a. Helper T cell : boost a B cell antibody response
   b. Cytotoxic T cell : kill nearby B cells
   c. Helper T cells : boost the dendritic cells' antibody response
   d. Cytotoxic T cell : kill the dendritic cell

8. Which of the following is NOT a B-cell activation response?
   a. differentiate to plasma cells
   b. clonal expansion
   c. producing antibody
   d. kill the antigen-presenting cell

9. Vaccination strategies that are currently being tested include ____.
   a. DNA vaccines
   b. subunit vaccines
   c. Trojan Horse vaccines
   d. all of the above

10. If you had been bitten by a lethal snake and the doctor had an active or a passive immunization procedure, which would you want and why?
   a. active, so immunity would last
   b. passive, it's quicker
   c. active, it's quicker
   d. passive, so immunity would last

11. An anamnestic response :
   a. lasts longer than a primary response
   b. is stronger than a secondary response
   c. produces only monoclonal antibodies
   d. is primary IgM

12. If a B cell encounters antigen and presents it to a T helper cell, the antigen will be presented on a ____ molecule.

a. MHC III
b. antibody
c. MHC II
d. MHC I

13. B cells are __ while T cells are ____.

a. circulating : located in the thymus
b. located in the bone marrow only: circulating
c. circulating : non-circulating
d. noncirculating : circulating

14. Immunoglobulins are also called ___ and are produced by ___.

a. lymphokines : T cells
b. cytokines : B cells
c. antigens : macrophages
d. antibodies : B cells

15. If a person had high levels of IgE circulating in his or her bloodstream, this person is likely ___.

a. fighting a viral infection
b. in the middle of an allergic response
c. in the middle of a primary antigen response
d. in the middle of a secondary antigen response