  A. B-lymphocytes
  B. Cytotoxic T cells
* C. Neutrophils
  D. T-helper cells

  Innate mechanisms of disease resistance are the body’s first response. These act against any foreign or altered material or cells. They are important, not only as the first lines of defense against infection, but also play a major role in wound healing and surveillance for neoplasia (cancer). When successful, their action results in removal of the offending material and recovery of the host. <p>First Lines of Defense include
physical barrier skin, mucous membranes sloughing, mucous secretion, normal flora, cilia, pH
move cough, sneeze, vomit, defecate, urinate
soluble factors in tears, saliva, mucus, milk, other body fluids lysozyme, lactoferrin, interferon, acute phase proteins, complement, tumor necrosis factor, fibronectin, ficolin
Phagocytes : Neutrophils, macrophages, eosinophils, basophils, thrombocytes (avian only)
Cytotoxic cells : Natural killer cells, Cytotoxic T-cells
<p><a href="http://nobelprize.org/educational_games/medicine/i

2) The order in which phagocytosis occurs is

  A. adherence, ingestion, digestion, chemotaxis
* B. chemotaxis, adherence, ingestion, digestion
  C. chemotaxis, ingestion, adherence, digestion
  D. adherence, chemotaxis, ingestion, digestion

  The stages of phagocytosis include
Chemotaxis - microbial products, factors released from damaged cells, products of immune reactions (includes C3a, C5a) attract phagocytes
Adherence - trapping, surface phagocytosis, hydrophobicity, opsonins - phagosome formation digestion - phagosome:lysosome fusion = phagolysosome

  A. B-lymphocytes
  B. Neutrophils
* C. T-lymphocytes
  D. Monocytes

  Natural Killer cells are related to T cells but do not require thymus processing (CD2+, CD3-, CD 4-, CD8 +/-). They spontaneously kill altered host cells, including virus infected and neoplastic cells (failure of the target cell to express self MHC 1 is one signal, another is expression of stress proteins, such as heat shock protein, on the surface of infected, damaged or otherwise altered cells). They also kill some bacteria and fungi.<p>Mech of killing include CD95L (fas-ligand) on NK cell binds CD95 on target cell, inducing apoptosis
production of perforins and granzymes (mechanism like T cytoxic cells)
<li of cytotoxic lymphokines (TNF-alpha, TNF-beta)
<p>NK cells are
present regardless of immunization status, respond quickly
responsible for 'immune surveillance' transiently and in small numbers in blood (15% of circulating lymphocytes) widely distributed in secondary lymphoid organs (lymph nodes, spleen) and in tissues<

4) With respect to antigens and immunogenicity, which of the following statements is <u>false</u>?

  A. The immune response is not directed against the molecule as a whole, but involves reaction with specific exposed areas on the molecule called epitopes
  B. The immune response to microbes and eukaryotic cells is often the summation of several simultaneous responses against each of many molecules presented by the organism.
  C. An epitope may be part of a single molecule, or can result from adjacent parts of different molecules that are close to each other
  D. Immunogens are antigens that are able to induce an immune response
* E. Epitopes recognized by B cells and T cells are often the same

  For any given antigen molecule there will be a range of responding lymphocytes with specificity for each of the antigenic determinants. Each responding cell will clonally proliferate, giving a polyclonal response. Different lymphocytes may bind the same epitope, often with differing affinity (strength of binding). Epitopes recognized by B cells and T cells usually differ.<p>An epitope is the part of a macromolecule that is recognized by the immune system, specifically by antibodies, B cells, or cytotoxic T cells. Although epitopes are usually thought to be derived from nonself proteins, sequences derived from the host that can be recognized are also classified as epitopes. Most epitopes recognized by antibodies or B cells can be thought of as three-dimensional surface features of an antigen molecule; these features fit precisely and thus bind to antibodies. The part of an antibody that recognizes the epitope is called a paratope. <p><a href="http://nobelprize.

5) Immunogenicity is the ability of an antigen to stimulate an immune response. Which one of the following factors reduces immunogenicity?

  A. Larger size
  B. Stability
  C. High 'foreignness'
  D. Structural rigidity
* E. Low structural diversity

  Factors that influence immunogenicity include
Size - smallest 750 daltons molecular weight - most > 10,000 daltons
structural diversity/chemical composition - complex molecules are better than polymers with repeating subunits
Structural rigidity - stable conformation is important since receptors recognise a specific sterochemical shape. Flexible molecules are poor immunogens (e.g. gelatin)
Stability (degradability) - readily degradable substances are poor immunogens because the antigen does not persist long enough to stimulate response. Inert substances are also poor since some degradation and "processing" of antigen by antigen presenting cells (APCs) is needed
Foreignness - recognition of microbial carbohydrate structures not found in eukaryotic cells. Also, some non-mammalian DNA sequences are immune stimulating and upregulate response to other antigens of that organism

  A. Polysaccharides, because of their repeating subunits
  B. Nucleic acids, because they are easily degraded
  C. Lipids, because of their size and complexity
* D. Protein, because of their size, complexity and structural rigidity

  Most proteins are highly immunogenic because of their large size, complexity, structural rigidity, and level to which they are degradable (not too much, not too little). The following are examples : most microbial antigens (toxins, flagellae, viral capsid, protozoan cell membrane), snake venom, milk proteins, serum proteins (including immunoglobulins) have moderate immunogenicity because they are structurally mobile and have repeating subunits (polymers like starch, glycogen). They can improve immunogenicity by cross-linking to increase rigidity; also, if linked to protein (e.g. glycoproteins in cell membranes) or lipid (e.g. lipopolysaccharides found in Gram negative bacterial cell wall). <p>Lipids are generally poor because of their simple structures. They work better when linked to protein (lipoprotein) or polysaccharide (glycolipid, Lipopolysaccharide) <p> Nucleic acids are poor because they have simple structures, are flexible and are readily degradable. <

7) Which of the following statements best describes a hapten?

  A. It marks foreign organisms so that the immune response can be triggered
  B. It is capable of initiating an immune response by itself but becomes more potent when coupled to a carrier.
* C. It is incapable of initiating an immune response by itself but becomes immunogenic when coupled to a carrier.
  D. It is an inert foreign substance that stimulates macrophages to release cytokines

  A Hapten is a substance, typically of low molecular weight, that is incapable of initiating an immune response by itself but that becomes immunogenic when coupled to a carrier. The carrier:hapten complex will stimulate an immune response directed against the hapten . The hapten, with or without the carrier, can then be bound specifically by the resulting antibodies (or specific T cells). Examples of haptens include penicillin (needs serum proteins), nickel, poison ivy (need dermal proteins). Haptens are antigenic but not immunogenic!<p> More, at Wikipedia

8) Different antigens may have similar epitopes. Consequently, antibodies created in reaction to one antigen may be directed against the other. This is called

  A. Antibody heterogenecity
* B. Cross-reactivity
  C. Piggy-backing
  D. Antigen crossover

  Cross-reactivity has been exploited to determine the "relatedness" of similar molecules but can cause problems when apparently unrelated substances crossreact:
anti-erythrocyte antibodies in humans (the AB antigens important in blood transfusions) are actually cross-reacting antibodies to commensal intestinal bacteria.
antibodies to Streptococci may cross-react with heart or synovial tissue.
antibodies to Yersinia give a false positive test for Brucellosis.
Further, cross-reactions are not necessarily reciprocal. Antibodies to human measles virus will neutralize canine distemper virus but not vice-versa.

9) Antigen presentation is NOT carried out by which cells

* A. T-lymphocytes
  B. B-lymphocytes
  C. Macrophages
  D. Dendritic cells
  E. Reticuloendothelial cells

  Induction of an antigen specific immune response requires appropriate processing and presentation of each antigen to lymphocytes. Specialized Antigen Presenting Cells (APC) include: dendritic cells, reticuloendothelial cells, macrophages and to a lesser extent B lymphocytes. Antigens are taken up, fragmented, and presented on the surface of the APC by glycoprotein structures known as major histocompatibility (MHC) markers. Immunogenici is directly related to an epitope’s ability to be bound and presented by either MHC I or MHC II on the surface of an APC. Also, see Wikipedia

  A. MHC I presentation by most cells requires endogenous processing
  B. Antigens presented by MHC I are recognized by CD8+ T cells
  C. Antigens presented by MHC II are recognized by CD4+ T cells
  D. MHC I is found on all nucleated cells
* E. MHC II is found on all nucleated cells

  The MHC proteins act as "signposts" that display fragmented pieces of an antigen on the host cell's surface. They may be self or nonself. If they are nonself, there are two ways by which the foreign protein can be processed and recognized as being "nonself". If the host is a leukocyte, such as a monocyte or neutrophil, it may engulf the particle (be it bacterial, viral, or particulate matter), break it apart using lysozymes, and display the fragments on Class II MHC molecules. On the other hand, if a host cell is infected by a bacterium or virus, or is cancerous, it may display the antigens on its surface with a Class I MHC molecule. In particular, virus infected and cancerous cells have a tendency to display unusual, nonself antigens on their surface. These nonself antigens, regardless of which type of MHC molecule they are displayed on, will initiate the specific immunity of the host's body. It is important to note that cells constantly process endogenous proteins and present them within the context of MH

A. Antigens presented by MHC I are recognized by CD8+ T cells
B. Only antigens of live organisms produced in infected host cells are presented by MHC I
C. It is comprised of an alpha chain which is anchored in the cell membrane and a smaller closely associated molecule, b2 microglobulin, that serves to stabilize the structure.
* D. It typically processes antigens exogenously
E. MHC I is found on all nucleated cells

MHC I is found on all nucleated cells, but is especially abundant on the surface of APCs (antigen processing cells). It is comprised of an alpha chain which is anchored in the cell membrane and a smaller closely associated molecule, b2 microglobulin, that serves to stabilize the structure. The antigen fragment (Ag) is held in a peptide binding groove on the most exterior part of the alpha chain. Alpha chains show great polymorphism in discrete areas of the antigen binding region, providing the possibility for presentation of many different antigens. <p>For MHC I presentation by most cells, the foreign antigenic peptide must be synthesized within the presenting cell at the time the alpha chain is being synthesized, a phenomenon termed endogenous processing. Therefore, only antigens of live organisms produced in infected host cells are presented with MHC I. However, dedicated APCs (cells that also express MHCII) can also present exogenous antigens on MHCI, in a process similar to MHCII presentation. Antigens

12) With respect to MHC II molecules, which of the following statements is <u>FALSE</u>?

A. MHC II is comprised of two non-covalently linked chains, alpha and beta, both anchored in the cell membrane.
B. Expression of MHC II molecules can be upregulated, and is greatest on dedicated APCs (Antigen presenting cells)
C. MHC II molecules are expressed by all leukocytes (and in rare circumstances endothelial cells)
* D. Antigens presented by MHC II are recognized by CD8+ T cells

MHC II molecules are expressed by all leukocytes (and in rare circumstances endothelial cells). Expression on these cells can be upregulated, and is greatest on dedicated APCs. MHC II is comprised of two non-covalently linked chains, alpha and beta, both anchored in the cell membrane. The antigen binding groove is formed jointly by the terminal ends of the alpha and beta chains, regions which demonstrate considerable polymorphism. APCs phagocytize the antigen which is then degraded (processed) in the phagolysosome. Antigen fragments are picked up by MHC II molecules on the phagolysosome membrane which then fuses with the cell membrane resulting in external presentation. Both live and dead antigens can be processed in this way, and the phenomenon is termed exogenous processing. Antigens presented by MHC II are recognized by CD4+ T cells

13) Antigen-specific or Acquired Immunity is mounted by

  A. Only B lymphocytes
  B. Neutrophils, dendritic cells and macrophages
  C. Only T lymphocytes
* D. Both B and T lymphocytes

  When non-specific immune mechanisms fail the offending material it is processed by antigen presenting cells (dendritic cells, macrophages) for stimulation of a specific immune response. This response is mounted by lymphocytes, small round cells found in the circulation and the predominant cell in lymph nodes, spleen and thymus. Lymphocytes express surface receptors that recognize antigens in a highly specific manner, by binding to specific antigenic determinants called epitopes. There are two major lymphocyte populations that are morphologically identical by light microscopy but differ functionally - B lymphocytes and T lymphocytes.<p><a href="http://nobelprize.org/educational_games/medicine/immunity/immune-d
The basics

14) The Bursa of Fabricius is a site where

* A. B-cell maturation occurs in birds
  B. T-cell maturation occurs in birds
  C. T-cell maturation occurs in ruminants
  D. B-cell maturation occurs in ruminants

  The sites of lymphocyte maturation are called primary lymphoid organs because they are the location of the first (prime) event in lymphocyte activation: the maturation of immature lymphocytes into functional cells. These include the thymus in all animals (T-cells), the bursa of Fabricius in birds (B-cells), ileal Peyer’s Patches in ruminants (B-cells), and bone marrow in other mammals (B-cells). As they mature, lymphocytes express their antigen receptors and other markers that distinquish them as T or B cells. About 30% of circulating lymphocytes are B cells.

15) Thymic education is related to

  A. the process of expression of antigen receptors in the thymus
  B. the process of regulation of other T and B lymphocytes
* C. the turning off or dying of T cells that express "self antigens" (antigens in the thymus).
  D. the process of expression of antigen receptors in the bloodstream

  As T cells mature in the Thymus, they express their antigen receptors. Those that recognize antigens present in the thymus (self antigens) are turned off or die; a mechanism termed thymic education which prevents potentially harmful autoimmunity. <p>The "blood-thymic barrier" is a thick walled vascular endothelium and basement membrane that is believed to prevent circulating foreign antigen from entering the thymus where they could affect T cell maturation and self tolerance. <p>Congenital absence of thymus is usually a fatal condition. Virus induced damage after birth eg. canine parvo, feline leukemia, leads to immune deficiency. <p>Mature T cells recognize antigens only when presented by MHC I or MHC II (this is called MHC restriction), and are responsible for Cell Mediated Immunity (CMI). T cells are also essential for regulation of both T and B cell responses.<p>
The basics

16) A helper or effector T cell is uniquely identified by which marker?

  A. CD4
  B. CD2
  C. CD3
  D. CD8
* E. None of the above

  T cells are differentiated into effector and regulatory purely by function. Effector and regulatory T cells have either CD4+ or CD8+ markers (along with CD2 and CD3). <p>T-effector cells mediate (effect) immune response. They are of 2 types : Helper cell (TH1) - CD4+ (MHC II). It releases lymphokines to activate other cells involved in the immune response, particularly macrophages, B & T-lymphocytes and NK cells
Cytotox cell - CD8+ (MHC I). It kills antigen-bearing target cells (e.g. virus infected cells) <p>Regulatory T-cells regulate the immune response
Helper cell (Th) - CD4+. These produce many lymphokines that up-regulate or enhance immune response by stimulating other T-lymphocytes, B-lymphocytes and NK cells
Suppressor (Ts) - CD8+. These down-regulate the immune response. Mechanisms are poorly understood.
<p> : More recent classification based on recognized cell surface markers has revealed that T cells form two major

  A. T stem cell
  B. Natural Killer cell
  C. Helper T cell
* D. Suppressor or Cytotoxic T cell

  [Found Shewen notes confusing. This, from Wikipedia] <p>Several different subsets of T cells have been described, each with a distinct function.
<u>Cytotoxic T cells</u> (Tc cells) destroy virally infected cells and tumor cells, and are also implicated in transplant rejection. These cells are also known as CD8+ T cells, since they express the CD8 glycoprotein at their surface. <u>Helper T cells</u>, (Th cells) are the "middlemen" of the adaptive immune system. Once activated, they divide rapidly and secrete small proteins called cytokines that regulate or "help" the immune response. These cells (also called CD4+ T cells) are a target of HIV infection; the virus infects the cell by using the CD4 protein to gain entry. The loss of Th cells as a result of HIV infection leads to the symptoms of AIDS. <u>Memory T cells</u> are a subset of antigen-specific T cells that persist long-term after an infection has resolved. They quickly expand to large numbers of effector T cells upon re-expos

18) The most probable site for initiation of an immune response is

  A. Tertiary lymphatic organs
  B. Primary lymphatic organs
  C. The circulatory system
  D. The respiratory system
* E. Secondary lymphatic organs

  The complex cellular and molecular interactions that form the basis of an antigen-specific immune response take place within the organized architecture of secondary lymphoid organs and tissues. These include lymph nodes
spleen bone marrow bursa fabricius
lymphoid tissue lining the respiratory, alimentary and urogenital tracts. These organs/tissues are termed 'secondary' since lymphocytes travel to one of these to react with antigen after maturation in a 'primary' organ. Such organs are rich in antigen presenting cells (APCs), including both a framework of reticuloendothelial cells and dendritic cells, to trap and process antigens, and in T and B cells. Various types of lymphocytes have a tendency to "home" to different regions in lymphoid organs.

19) Lymphoid follicles

  A. are found in all primary lymphoid organs
* B. are composed of B cells arranged in nodules in secondary lymphoid organs
  C. are composed of T cells arranged in nodules in secondary lymphoid organs
  D. that are quiescent have many germinal centers, but they are not active

  Lymphoid follicles: are found in all secondary organs and tissues. They are composed of B cells arranged in nodules (primary follicles) that appear to be homogeneous by light microscopy. After antigen exposure, follicles enlarge into germinal centers (secondary follicles), surrounded by a dense mantle of T cells in a donut-like conformation. Active secondary organs/tissues have many germinal centers, while quiescent tissues have few or none.

20) Antigens introduced into tissues are most likely to stimulate an immune response in

  A. bone marrow
* B. a lymph node
  C. the spleen
  D. circulating blood

  Typically, an immune response is stimulated in lymph nodes by antigens introduced into tissues drained by the corresponding lymphatics
The spleen and bone marrow respond to antigens carried in the blood Lymphoid tissues lining mucosal surfaces respond to antigens that cross the local mucosa. Lymphocytes originating from clonal proliferation in peripheral lymph nodes or spleen tend to migrate preferentially to other peripheral lymph nodes and spleen (systemic immune response), while lymphocytes originating from mucosal lymphoid tissues "home" back to mucosal sites (common mucosal immune response). This is due to preferential binding to the specialized receptors (above) on endothelial cells in each location.

21) Lymph node swelling during infection occurs because of

  A. Inflammation
  B. Lymphocyte proliferation in response to the antigen
  C. Lymphocyte trapping that is monokine mediated
* D. Both lymphocyte trapping and lymphocyte proliferation in response to the antigen

  Lymphocyte trapping occurs soon after antigen enters lymph node or spleen. Circulating lymphocytes no longer pass through freely (monokine mediated) resulting in concentration of potential antigen sensitive cells near antigen. Trapped cells are released after approx. 24 hr. There is then an increased output of cells for approximately 7 days. Both lymphocyte trapping and lymphocyte proliferation in response to antigen contribute to in swelling of the node or spleen, that is typically palpable.

  A. medulla
  B. cortex and medulla respectively
* C. medulla and cortex respectively
  D. cortex

  Primary Response - first exposure: Antigen in the afferent lymph drains to the medulla where it is trapped by medullary macrophages. These migrate to the cortical follicles and present antigen directly or donate it to reticulorendothelial cells. Antigen reactive lymphocytes entering via afferent lymph recognize presented antigen and respond. Daughter cells move to the medulla and produce antibody (plasma cells) or leave via efferent lymph to seed other areas and /or react with antigen in the rest of the body. <p>Secondary Response - subsequent exposures: The APCs which form the reticular framework of the cortex bind antibodies, formed in the primary response, to their cellular processes thereby permitting antigen trapping. When antigen entering afferent lymph is trapped in the cortex by these cells, a rapid and heightened immune response occurs. There are two stages to this response: Stage 1 - Monokines produced by APCs and released when the antigen is trapped, induce residual committ

23) The largest mass of lymphocytes is located in the

  A. Bone marrow
* B. Mucosal lymphoid tissues of the intestine
  C. Blood
  D. Tonsils
  E. Spleen

  Approximately 70% of all lymphocytes are located in mucosal lymphoid tissue of the intestine. Other points of interest
Normal lymph circulation is 500 ml/hr, 100 million cells/ml.
The number of cells in efferent lymph from a responding node may be increased by 2 or 3 orders of magnitude over the number before stimulation. Lymp spend only 2-12 hr in blood before migrating into tissues via post capillary venules. Lymphocytes in blood account for less than 10% of the lymphocytes in the body, the majority of lymphocytes are in constant motion through tissues and secondary lymphoid organs.

24) An INTRAVENOUS particulate antigen is most likely to be

  A. catabolized by macrophages
  B. trapped in lymph nodes
  C. trapped in tissue, triggering inflammation
* D. trapped in sinusoids of the spleen or bone marrow and also in micro-circulation of the lung

  The fate of antigens within the body is as follows :
Intravenous particulate antigens : trapped by macrophages/dendritic cells in the sinusoids of spleen, and bone marrow also in micro-circulation of the lung. Intravenous soluble antigens:
if aggregates form spontaneously or by reaction with pre-existing antibody, they are trapped as particulate matter (above) if non-aggregated, they are distributed by the circulation throughout body and if small (<100,000 MW) into extracellular fluid. They are often catabolized and therefore may be poorly immunogenic in this form.
<intramuscular, subcutaneous etc.
insoluble, aggregated antigens: retained in tissue. Causes local damage or inflammation resulting in the infiltration of neutrophils and/or macrophages. Carried by phagocytic cells via lymphatics to stimulate an immune response in the draining lymph node. soluble antigens: carried in tissue fluid or by migrating dend

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  A. retained in tissue to be attacked by neutrophils
  B. catabolized by macrophages
  C. trapped in sinusoids of the spleen or bone marrow and also in micro-circulation of the lung
* D. carried by lymphatics to lymph nodes and could trigger local responses

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  A. trapped in sinusoids of the spleen or bone marrow and also in micro-circulation of the lung
  B. carried by lymphatics to lymph nodes and could trigger local responses
  C. catabolized by macrophages
* D. Action is variable, depending on their size

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28) Immunity is

* A. an immune response that is sufficiently rapid to abort infection before any clinical signs
  B. the ability to mount an immune response
  C. the ability to ward off infection
  D. the ability of the body to prevent intrusion by microorganisms

  Anamnestic (or secondary) immune responses may occur months or even years after primary exposure, even though there may be no detectable evidence of prior reaction to antigen (eg. no antibodies in serum). Often, the anamnestic response is sufficiently rapid to abort infection before the onset of clinical illness; thus, infection occurs but there is no disease. It is this phenomenon, resistance to clinical illness, that is commonly referred to as "IMMUNITY".

  A. 1-2 hours
  B. 10-14 hours
* C. 10-14 days
  D. 1-2 days

  <img src="Immune-Response.jpg"><p>On the initial (primary) exposure there is a lag period of 10 -14 days before mediators (antibodies, specific lymphocytes) are detected in the circulation. This is followed by a gradual increase in mediators, that peaks, then declines as antigen is eliminated. Residual antibodies are eventually catabolized and circulating reactive lymphocytes (both T and B cells) become widely distributed in lymphoid organs and tissues. This pool of lymphocytes confers memory by virtue of their response on subsequent exposures to the same antigen.<p>On subsequent exposures, the secondary (anamnestic) response can be detected within 24 - 48 hrs of antigen challenge. Because the expanded pool of reactive lymphocytes (now about 100 - 1000 per 10^6 cells) remaining from previous exposure respond, the rate of increase and ultimate peak are much higher than in the primary response. Mediators, both antibodies and lymphocytes, can also be detected in blood for a much longer period of

  A. The pool of lymphocytes can express several million different antigen receptors
* B. A single lymphocyte can express several thousand different antigen receptors
  C. A single lymphocyte can only recognize a single antigenic epitope
  D. A single lymphocyte can express several thousand antigen receptors

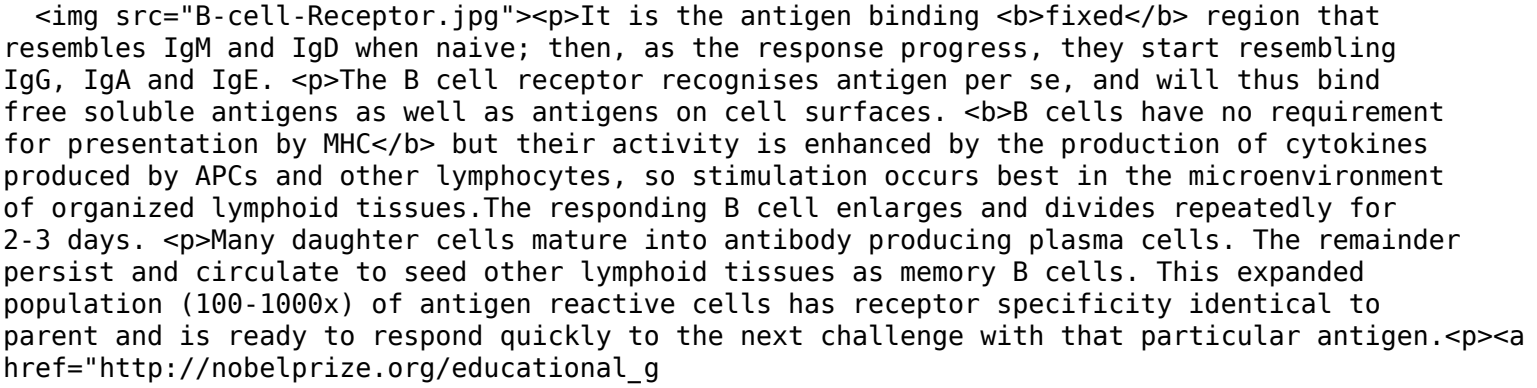
  The ability to produce an antigen-specific response depends on the presence of circulating lymphocytes that can recognise at least one of the epitopes on the offending antigen. A single lymphocyte expresses several thousand antigen receptors, but all of these are identical. Thus, any given lymphocyte recognises only a single antigenic epitope (or a group of closely related epitopes). It is this discrete recognition which confers specificity. <p>Fortunately there is sufficient variability in the genes which code for antigen receptors on lymphocytes to permit production of an adequately diverse pool of circulating lymphocytes. The number of lymphocytes that recognise a particular antigen is initially quite low (estimated 1-10 in 1m cells). However, each lymphocyte responds to an encounter with specific antigen by proliferation to produce a clone of cells identical to itself. The resultant population is sufficient to mediate antigen elimination/control and to provide an expanded reservoir of lymphocyte

31) Which of the followings statements with regards to the Clonal Selection Theory of immunity is INCORRECT?

A. The body is equipped with billions of lymphocytes each committed to respond to one specific epitope
* B. An antigen triggers the production of a number of lymphocytes, each with differing receptors
C. Antigen binding to a lymphocyte's receptor triggers proliferation and differentiation of the lymphocyte into effector and memory cells
D. The specificity for antigen of the antibodies or T lymphocytes produced is identical to the specificity of the antigen receptor on the initial responding lymphocyte

The Clonal Selection Theory, proposed by Macfarlane Burnet (Nobel Prize in Medicine 1960) has the following key points : Lymphoid stem cells differentiate randomly: each mature differentiated lymphocyte responds to a single antigenic determinant (epitope) by means of a number of identical, specific receptors.
Antigen binding to the lymphocyte receptor triggers proliferation and differentiation into effector and memory cells. [modern theory: effectors and memory cells are the same, function depends on microenviron and antigen persistence.]
The specificity for antigen of the antibodies [or T lymphocytes] produced is identical to the specificity of the antigen receptor on the initial responding lymphocyte.
Tolerance (non-responsiveness) results from deletion or suppression of specific clones.

* A. The antigen binding variable region resemble IgM and IgD when naive; as the response progress, they start resembling IgG, IgA and IgE
B. Antigen receptors consist of two identical heavy and two identical light protein chains linked by disulphide bonds
C. Antigen receptors resemble an immunoglobulin (antibody) molecule fixed to the cell membrane with antigen binding regions pointing outward from the cell
D. The most peripheral domains of the receptors constitute the specific binding sites for antigen, and vary in structure among individual B cells
E. There are 10 thousand to 100 thousand receptors per cell



<p>It is the antigen binding fixed region that resembles IgM and IgD when naive; then, as the response progress, they start resembling IgG, IgA and IgE. <p>The B cell receptor recognises antigen per se, and will thus bind free soluble antigens as well as antigens on cell surfaces. B cells have no requirement for presentation by MHC but their activity is enhanced by the production of cytokines produced by APCs and other lymphocytes, so stimulation occurs best in the microenvironment of organized lymphoid tissues.The responding B cell enlarges and divides repeatedly for 2-3 days. <p>Many daughter cells mature into antibody producing plasma cells. The remainder persist and circulate to seed other lymphoid tissues as memory B cells. This expanded population (100-1000x) of antigen reactive cells has receptor specificity identical to parent and is ready to respond quickly to the next challenge with that particular antigen.<p><a href="http://nobelprize.org/educational_g

33) With respect to plasma cells, which of the following statements is <u>false</u>?

* A. They are the, so-called, "memory cells" that allow a quicker response to subsequent challenges by the particular antigen
  B. They are found mainly in secondary lymphoid organs
  C. They are ovoid cells with eccentric nucleus with cartwheel chromatin, basophilic cytoplasm and a large Golgi apparatus (designed for protein synthesis)
  D. They have a life span of 3 to 6 days
  E. They manufacture antibodies of a single antigen specificity identical to that of their B cell parent

  <img src="Plasma-cell-Lymphocyte.jpg"><p>"Memory cells" are B-lymphocytes. <p>A plasma cell is a large ovoid cells, 8-20 m diameter, with a round eccentric nucleus with cartwheel chromatin, basophilic cytoplasm, pyroninophilic (ribosomal RNA) and a large Golgi apparatus (designed for protein synthesis [clear area near the nucleas]). It manufactures antibodies of a single antigen specificity identical to that of the B cell parent at a rate of 300 molecules/sec. It is an end stage cell with a life span 3 to 6 days found mainly in secondary lymphoid organs/tissues.

  A. The T-cell antigen receptor (TCR) is closely linked on the lymphocyte surface to CD4 or CD8, depending on T cell type
* B. Unlike B-cells, T-cells can recognize multiple antigens because their alpha-beta receptors are highly polymorphic
  C. T cell recognition is restricted to antigens presented on the surface of other cells (MHC restriction)
  D. The T cell antigen receptor (TCR) has a pair of protein chains, alpha and beta or gamma and delta, linked by disulphide bonds and fixed to the cell membrane with antigen binding sites pointing outward
  E. The amino acid sequence of the constant region is conserved and is similar for all T cells

  <img src="T-cell-action.jpg">
An individual T cell carries about 30,000 receptors for antigen, all identical. Therefore, like B cells, a single T cell recognizes only one antigen, or group of closely related antigens.
The T cell antigen receptor (TCR) has a pair of protein chains, either alpha/beta or gamma/delta, linked by disulphide bonds and fixed to the cell membrane with antigen binding sites pointing outward.
Intrac disulphide bonds produce one variable and one constant domain on each chain. The variable regions interact with antigenic epitopes. The amino acid sequence of the constant region is conserved and is similar for all T cells.
Alpha/beta receptors are highly polymorphic in the variable region, so collectively, can recognize a multitude of epitopes; each, however, is highly specific.
Gamma/delta receptors have limited diversity, but recognize families of related antigens, in many organisms. Such T cells are present in higher numbers in n

  A. cytokines that control the behavior of dendritic cells and macrophages
  B. monokines that are produced by leukocytes
* C. cytokines produced by leukocytes that also bind to leukocytes
  D. cytokines produced by APC (antigen presenting cells) like macrophages

  Cytokines are typically produced by the APCs and helper T cells, or less commonly by other lymphocytes. Cytokines produced by monocyte/macrophages/dendritic cells are called monokines. Cytokines produced by lymphocytes are called lymphokines. If these cytokines are produced by leukocytes and also bind to leukocytes (i.e. mediate signalling between leukocytes), they may be named interleukins (IL- #). Cytokines that are chemical attractants for other cells are also known as chemokines. <p> While expression of MHC I is constant, expression of MHC II is regulated by the cytokine microenvironment and is essential for antigen presentation to TH (CD4+) cells.
T Helper Cells (CD 4+, TH) up-regulate immune response by effects on APCs and other lymphocytes that have bound antigen.
APCs that are presenting antigen also produce monokines to upregulate responding lymphocytes
In addition, cytokines are produced by granulocytes hepatocytes, endothelial cells, fibroblas

36) With respect to CD4+ T cells, which of the following statements is <u>false</u>?

* A. A major effector response is mediated through recruitment and activation of neutrophils
  B. Lymphokines released are antigen-specific, but their action is not antigen-specific
  C. When clones make contact with the specific antigen bearing target cells, they release several lymphokines that recruit (and activate) other leukocytes to the site
  D. They respond to antigens presented with MHC II by proliferation, to produce clones of identical daughter cells that enter the circulation and migrate into tissues
  E. Lymphokines released also result in chemotaxis of monocytes from circulation, maturation into macrophages and subsequent activation
  F. Recruited TH1 cells also release lymphokines that are chemotactic for other lymphocytes, and can induce proliferation, providing expansion of antigen reactive lymphocytes locally.

  Effector functions include activities such as delayed hypersensitivity, allograft rejection, anti-viral and anti-tumor immunity and graft-versus-host reactions. Two major properties are reflected in these effector functions:
the ability to secrete lymphokines (CD4+ TH1 cells)
the ability to kill other cells; ie cytotoxicity (CD8+ TC cells) Mononuclear cell infiltration (macrophages and lymphocytes predominate in the lesion) differentiates CD4 responses from non-specific inflammation in which neutrophils predominate.

37) When a macrophage is activated, all of the following will happen, EXCEPT

  A. increased expression of MHC II
  B. increased production of hydrolytic enzymes in lysosomes "foam cells"
* C. increased expression of MHC I
  D. production of more potent mediators
  E. ruffling of cell membrane, increased surface area, multiple dendrites
  F. increased bactericidal activity, increased capacity to kill target cells

  After digesting a pathogen, a macrophage will present the antigen (a molecule, most
often a protein found on the surface of the pathogen, used by the immune system for identificati
of the pathogen to a corresponding helper T cell. The presentation is done by integrating
it into the cell membrane and displaying it attached to a MHC class II molecule, indicating
to other white blood cells that the macrophage is not a pathogen, despite having antigens
on its surface.<p>Eventually the antigen presentation results in the production of antibodies
that attach to the antigens of pathogens, making them easier for macrophages to adhere
to with their cell membrane and phagocytize. [In some cases, pathogens are very resistant
to adhesion by the macrophages. Coating an antigen with antibodies could be compared
to coating something with Velcro to make it stick to fuzzy surfaces.]<p><a href="http://en.wikip
Also see Wikipedia

  A. 3-6 hours
* B. 24-48 hours
  C. within 10 minutes
  D. 2-4 hours

  Antigen injected intradermally into an immunologically primed individual who has circulating
CD4+ memory cells for that antigen, may induce a DTH skin reaction, characterized by
erythema and induration that peaks 24 to 48 hr after injection. The inflammatory perivascular
infiltrate is mononuclear (monocytes, lymphocytes) and results from the specific interaction
of circulating/wandering antigen-specific TH1 cells with antigen presented by MHCII on
Langerhans cells (macrophages). Lymphokines are released and attract lymphocytes and
macrophages (circulating monocytes) that may then become activated. This cellular infiltration
is firm, 'indurated' (fixed), and can be differentiated on palpation from other inflammatory
swelling which is typically due to fluid exudation. <p>The DTH skin reaction can be used
as an in vivo test for CMI to any specific antigen. It is also used more broadly as a
test for immune competence by injection of antigens to which most adults would be expected
to have responded, like candida

39) HIV affects which cells?

  A. CD8+
  B. Red blood cells
* C. CD4+
  D. All leukocytes

  HIV primarily infects vital cells in the human immune system such as helper T cells (specifically CD4+ T cells), macrophages and dendritic cells. HIV infection leads to low levels of CD4+ T cells through three main mechanisms: firstly, direct viral killing of infected cells; secondly, increased rates of apoptosis in infected cells; and thirdly, killing of infected CD4+ T cells by CD8 cytotoxic lymphocytes that recognize infected cells. When CD4+ T cell numbers decline below a critical level, cell-mediated immunity is lost, and the body becomes progressively more susceptible to opportunistic infections.<p> More

40) CD8+ T Killer lymphocytes

  A. respond to antigens presented by MHC II. They produce clones that bind to and destroy the target cell
  B. respond to antigens presented by MHC II. They produce clones that migrate into tissue, locate target cells, then produce lymphokines to attract other "killer" cells.
  C. respond to antigens presented by MHC I. They produce clones that migrate into tissue, locate target cells, then produce lymphokines to attract other "killer" cells.
* D. respond to antigens presented by MHC I. They produce clones that bind to and destroy the target cell

  CD8+ T Lymphocytes respond to antigens presented with MHC I, to produce a clone of identical daughter cells that enter the circulation and migrate into tissues. On contact with antigen bearing target cells (must express MHC I), they bind to and destroy the target cell. They also release some lymphokines such as IFN-gamma and a TNF-beta, which augment the effect by recruiting other cells to clear cell debris.<p>The binding of cytotoxic T cells to antigen on the surface of target cells is rapidly (minutes) followed by disruption of the organelles and nucleus of the target cell, and then cytolysis.

41) Which of the following are involved with eliminating damaged or infected host cells?

* A. ADCC
* B. CD8+ T cells
  C. Monocytes
* D. Natural Killer cells
  E. Neutrophils
  F. CD4+ T cells
* G. Macrophages

  The following cells/mechanisms are involved with host-cell cytotoxicity :
TC = cytotoxic T cells - CD8+ cells with antigen-specific cytotoxicity, recognize antigens on target cells expressed with MHC I.
NK cells = natural killer cells - large granular lymphocytes - not MHC restricted, recognize "stress proteins" on altered host cells
LAK cells = Lymphokine Activated Killer Cells, similar but not identical to NK cells - act against a wider variety of cells than NK cells.
Macrophages can be cytotoxic when activated by lymphokines or stimulated by substances
ADCC - Antibody Dependent Cell mediated Cytotoxicity - Lymphocytes (NK, K), macrophages, neutrophils, and eosinophils have receptors of antibody molecules. Antibodies mediate destruction of 'bad' cell by the cytotoxic cell.
Complement Mediated Lysis - antibodies "finger" the target, complement destroys it.

42) With regards to tissue matching for transplantation, which statement is <u>false</u>?

  A. Matching of MHC II is most critical
  B. The rejection process is complex and potentially involves the entire spectrum of specific and non-specific immune responses
  C. The chance of a sibling match is about 1:8
* D. Matching of MHC I is most critical

  CD8+ TC cells recognized foreign MHC I on transplanted cells. However, generation of TC cells requires stimulation by lymphokines released from CD4+ TH cells that recognize MHC II. Thus, if MHC II is matched there will be no TH activity to stimulate proliferation of CD8+ T cells, even if MHC I antigens are different. Therefore, matching of MHC II is most critical. Nevertheless, in selecting tissue donors it is best to achieve a complete match of MHC because any other antigens presented by MHCII could trigger release of lymphokines that up-regulate. <p>Because MHC genes are expressed co-dominantly each individual has two MHC class I types and four MHC class II types. Each set of two is derived from one maternal and one paternal gene. Therefore, a sibling is the most likely candidate for a close match. The chance of a sibling match is 1/ (2 x 4) = 1/8.

43) B cells bind and respond to

  A. particulate matter
  B. virus-infected host cell
  C. host cells 'marked' by macrophages
  D. bacteria
* E. soluble antigens

  <img src="B-cell-action.gif"><p>B cells bind and respond to soluble antigens. Antigen presentation by APCs facilitates the reaction but is not essential since B cells are not MHC restricted (no need for MHC presentation). Proliferation occurs when B cell antigen receptors are bound in the presence of interleukins produced by CD4+ T cells (TH). Therefore the antigen must also possess some epitopes that are MHC II presented to be recognized by TH cells. Secondary lymphoid organs/tissues provide an appropriate environment for B cell response (APCs, TH, reticular framework etc.) and most responses happen there. However, B cell replication can occur at remote sites of antigen deposition if conditions are correct (reactive TH cells are also present).<p><a href="http://nobelprize.org/educational_g
The basics

  A. B-cells
  B. Macrophages
  C. T-cells
  D. Neutrophils
* E. Plasma cells

  Like the T cell, a naive B cell responds to antigen by proliferating to produce a clone of cells identical to itself, all with the same antigen receptor and thus the same specificity for antigen. As long as antigen persists, many of these daughter cells will be driven to differentiate into antibody producing plasma cells, end-stage cells incapable of replication and with finite life-span. Other daughter cells will persist as memory B cells that circulate, seeding secondary lymphoid organs/tissues to provide immunologic memory (anamnesis) for that antigen. <p> Plasma cells are essentially protein factories with abundant endoplasmic reticulum and a prominent Golgi apparatus, so large that the nucleus is typically pushed to one side. The nuclear chromatin has a distinct cartwheel morphology, possibly related to heavy demand for expression of immunoglobulin genes. During an immune response immunoglobulin secreting plasma cells may be found in the medulla of lymph nodes, the marginal zone of spl

45) With regards to immunoglobulins, which of the following statements is <u>false</u>?

A. Immunoglobulin is a general term, referring to the entire group of antibody proteins without regard to the specific antigen reactivity of the molecules
* B. Immunoglobulins is the precise term for a specific antibody in the context of reaction with a particular antigen
C. There are 4 major isotypes or classes: IgM, IgG, IgA, IgE
D. The typical immunoglobulin structure consists of 2 identical light chains and 2 identical heavy chains held together by disulphide bonds
E. The immunoglobulin molecule has 3 regions : variable, hinge and constant

The main types of immunoglobulins are :
IgA - can be found in areas containing mucus (e.g. in the gut, in the respiratory tract or in the urogenital tract) and prevents the colonization of mucosal areas by pathogens.
IgD functions mainly as an antigen receptor on B cells.
IgE binds to allergens and triggers histamine release from mast cells (the underlying mechanism of allergy) and also provides protection against helminths (worms).
IgG (in its four forms) provides the majority of antibody-based immunity against invading pathogens.
IgM is expressed on the surface of B cells and also in a secreted form with very high affinity for eliminating pathogens in the early stages of B cell mediated immunity (i.e. before there is sufficient IgG to do the job).
IgT: IgG(T) - subclass of IgG, found in horses (produces tetanus anti-toxin)
<

46) With respect to B-cells in an anamnestic (memory) immune response, the "variable region stays constant, but the constant region varies". What does this mean?

A. Naive B cells express a monomer of Ig-G on their surface as the antigen receptor. As isotype switching occurs during progression of the immune response, B cells express a monomeric form of the new isotype, Ig-M thus keeping the same variable region while changing the constant region.
B. In the primary response a large amount of Ig-G, Ig-A and Ig-M is produced, all of which have the same constant region as the initiating B-cell but differing variable regions.
* C. In the primary response a large amount of Ig-M is produced, all of which have the same variable region as the initiating B-cell. The anamnestic response switches Ig-M to Ig-G, Ig-A or Ig-E (i.e. changes the constant region) while keeping the same variable region.
D. In the primary response a large amount of Ig-A is produced, all of which have the same variable region as the initiating B-cell. The anamnestic response changes the constant region while keeping the same variable region.

Ig-A, E, G and M are immunoglobulin isotopes, essentially varying in their 'constant' regions. In the primary response a large amount of IgM is produced, but the anamnestic response soon switches this to IgG, or A or E. <p>Isotype switching is triggered by the microenvironment of the plasma cell, mediated by T-cells. In the presence of IL2 (TH1) some sub-isotypes of IgG are produced. IL-4 secreted by TH2 cells induces production of other IgG subclasses or IgE while IL-5 (TH2) induces IgA production.

* A. Polyclonal response
  B. Monoclonal response
  C. Anamnestic response
  D. Biclonal response

  An antigen will stimulate many B cells to proliferate, all those which recognize any of its epitopes. This polyclonal response provides for a repertoire of antibodies that bind to various sites on the antigen and collectively effect its removal or control. Some antibodies may be highly specific for that antigen, others less so. The latter group may recognize epitopes that are widely shared among certain groups of antigens (eg. Gram negative bacteria), or they may recognize portions of an epitope which are similar to structures on totally unrelated molecules. This cross-reactivity can actually provide bonus protection for the host, who may consequently be at least partially immune to some organisms which it has not previously encountered.<p>A monoclonal response is usually only triggered under strict laboratory conditions. Monoclonal antibodies that are highly specific are used in immunologic assays to identify particular antigens (e.g. viral, toxin, bacterial) or as a research to

48) With respect to antigen-antibody binding, which of the following statements is <u>false</u>?

  A. During an immune response, antibodies (and B cells) compete with each other for the antigen.
  B. Avidity is defined as the strength of the collective interaction of a polyclonal response.
* C. During an immune response, antibodies complement each other in the attack on the antigen.
  D. The key binding force is hydrophobic force
  E. Affinity is defined as the strength of binding between a single epitope and idiotype.

  During an immune response, antibodies (and B cells) compete with each other for the antigen. Over time, there is "natural selection" for those which bind most strongly, resulting in a gradually shift to production of high affinity antibodies. <p>The primary intermolecular binding forces are
hydrophobic - most important; 50% of interactions
<
(ionic) - attraction between oppositely charged amino acid side chains
Vanderwaals forces (less important) - mutual attraction of closely approximated atoms, interaction of electron
hydrogen bonds (less important) - interaction of hydrogen ions, hydrophillic binding

  A. Immobilization
  B. Toxin neutralization
  C. Opsonization
  D. Virus neutralization
* E. Phagocytosis
  F. Triggering aggregation through precipitation or agglutination
  G. Preventing attachment to host cells

  IgE binds to Fce receptors on mast cells and basophils, where it sits as an antigen receptor. Binding of antigens to sufficient IgE’s on the cell surface, triggers degranulation of the cells and release of cytokines that mediate vasodialtion, increased vascular permeability and smooth muscle contraction. <p>Typical reactions for IgM, IgG and IgA include:
blocking of attachment of viruses or toxins to host cells or of bacteria and parasites to mucosal surfaces.
precipitation (soluble) or agglutination (particulate) - antigen aggregation by cross-linking with antibodies
immob - of motile organisms e.g. anti-flagellar antibody
toxin neutralization - binding to or blocking of active site of toxin
virus neutralization - interference with viral infectivity
opsonization - enhanced attachment of antigen to phagocytes bearing Fc receptors
Antibody-Dependent Cell-Mediated Cytotoxicity (ADCC) - mechanism of cell-mediated immunity whereby an

  A. There are several pathways for activation, all result in cleavage of C3, the pivotal factor for further activation of components with biological action.
  B. The Alternative pathway is an innate mechanism
  C. It is a biochemical cascade of the immune system that affects both innate immunity and acquired immunity.
* D. The Classical and Lectin pathways are antigen specific, needing antibodies for activation

  <img src="Complement-pathway.jpg"><p>The complement system is a biochemical cascade of the immune system that helps clear pathogens from an organism, and promote healing. It is derived from many small plasma proteins that work together to form the primary end result of cytolysis by disrupting the target cell's plasma membrane. The actions of the complement system affect both innate immunity and acquired immunity.<p>The major Pathways for Complement Activation are :
Alternative Pathway (innate)
sponta C3 breakdown, stabilized by Factors B, D, Properdin
regulated by Factors H, I
in of Factor H de-regulates alternative pathway allowing activation to proceed
Cl Pathway - antigen specific binding of IgM or IgG triggers activation through binding of C1 to two adjacent Ig Fc sites
Lectin Pathway (homologous to the classical pathway, but innate) - binding of C1-like lectins to microbial sugars triggers formation of C4b2a
<p>

  A. Immune regulation
  B. Opsonization of antigen
  C. Lysis (host cells and antigen)
  D. Chemotaxis (neutrophils, eosinophils, macrophages)
* E. Tubercle formation
  F. Clotting

  The Complement system has a number of effects, including the following : Lysis - lesions produced by the MAC (membrane attack complex) usually result in cell death. Susceptible cells include most host cells, RBCs, Gram negative bacteria, viruses (especially enveloped).
Opsonization - many cells bear surface receptors for C3b: neutrophils, macrophages, B cells, non-primate platelets. Binding to C3b on the surface of the antigen enhances phagocytic cell uptake via C3b receptors (opsonization).
Cong - Relatively large quantities of C3b generated during activation induce the production of antibodies to C3b which assist in cleanup of excess C3b. In addition, this anti-C3b, known as immunoconglutinin, causes clumping or agglutination of particles (antigens) with C3b on the surface. Interestingly, ruminants also produce conglutinin, a non-Ig molecule with the same function. Chemotaxis : C3a, C5a, C567 are chemotactic for neutrophils, eosinophil

52) Disseminated intravascular coagulation, a result of a mismatched blood transfusion for example, is a result of activation of

  A. Neutrophils
  B. T-cells
* C. Complement system
  D. B-cells
  E. Delayed Type Hypersensitivity (DTH)

  Formation of soluble Immune complexes (Ag+ Ab +/-C') is a consequence of antigen:antibody interaction and elimination typically occurs in several ways: complexes bind passively to effete red cells and are phagocytized in liver and spleen; complexes can also transiently be passed via the kidney's into urine. Complex formation in the blood stream can provoke intra-vascular coagulation. In mismatched blood transfusion (recipient's antibodies bind donated red cells) and haemolytic disease of the newborn (passive maternal antibodies bind newborn's red cells) massive intravascular complement activation leads to destruction of erythrocytes, disseminated intravascular coagulation and death.

53) With respect to the measurement of antibodies (titre), which of the following statements is <u>false</u>?

* A. It is measured in kDa/litre
  B. Recent infection will result in an elevated titre
  C. The highest dilution of serum that yields a defined positive reaction is referred to as the titre.
  D. Using a fixed amount of antigen and serial dilutions of serum the amount of antibody present can be estimated (titrated)

  A titer (or titre) is the unit in which the analytical detection of many substances is expressed. It is the result of a titration. Generally, the test is performed on an undiluted sample, and then repeated when the sample is mixed with 100% water, saline, or other diluent in repeated steps (a serial dilution). If the test is still positive, then high titers of the detected substance are said to be present. Titers are expressed in their highest positive dilution, e.g. 1:1, 1:2, 1:4, 1:8 or 1:1, 1:10, 1:100, 1:1000.

* A. Passive immunity results from immunoglobulins, T-cells and B-cells received from the donor
  B. No immunological memory results from passive immunization
  C. Passive immunization occurs naturally as the transfer of antibodies from dams to their offspring
  D. Ruminants have no placental transfer while carnivore mothers transfer some (about 10%) IgG trans-placentally to their fetus
  E. The majority of passive immunization occurs through colostrum (with the exception of primates)

  Passive immunity is the transfer of active humoral immunity in the form of readymade antibodies, from one individual to another. It provides immediate protection. Passive immunity can occur naturally, when maternal antibodies are transferred to the fetus through the placenta, and can also be induced artificially, when high levels of human (or horse) antibodies specific for a pathogen or toxin are transferred to non-immune individuals. Passive immunization is used when there is a high risk of infection and insufficient time for the body to develop its own immune response, or to reduce the symptoms of ongoing or immunosuppressive diseases. <p>The mechanism of transfer varies among species. In primates IgG1 crosses the placenta and is in the newborn's circulation at birth. In ruminants there is no placental transfer, but IgG1 in colostrum (first milk) is absorbed across the gut in the first 24 hr of life. Carnivorous mammals transfer some (10%) IgG across the placenta and transfer the remainder i

55) There are a number of "compartments" within the body that are partially or wholly separated from mediators in the blood vascular system. All these are such compartments, EXCEPT

* A. Mucosal immune system
  B. Joints
* C. Liver
  D. Anterior chamber of the eye
  E. Central nervous system

  The presence or absence of antibody or antigen reactive lymphocytes in the blood does not necessarily indicate the immune status in <u>internal compartments</u> such as the anterior chamber of the eye, the joints, the central nervous system. In such compartments the blood:brain barrier and other factors limit the accessibility of circulating cells (lymphocytes, macrophages, neutrophils) and soluble substances (antibody, complement, interferon etc.) to these sites.<p>Further, major tracts (body systems) with exposure to the external environment: the respiratory, gastrointestinal, and urinogenital tracts have specialized responses important for protection of mucosal surfaces. Mediators conferring MUCOSAL IMMUNITY are present in only small quantities, if at all, in the blood.

56) The vast majority of infectious organisms enter by mucosal routes (inhalation, ingestion, coitus). Important non-specific innate mechanisms protecting mucosae include all of the following, EXCEPT

  A. Mucous coating
  B. Epithelial cell barrier
* C. Peyer's patches
  D. Peristalisis (gut)
  E. Urine flow
  F. Mucociliary movement in the lungs

  <p>Peyer's patches are secondary lymphoid organs that participate in antigen-specific immunity. Pathogenic microorganisms and other antigens entering the intestinal tract encounter macrophages, dendritic cells, B-lymphocytes, and T-lymphocytes found in Peyer's patches and other gut-associated lymphoid tissue (GALT). Peyer's patches contain specialized cells called M cells which sample antigen directly from the lumen and deliver it to antigen-presenting cells (located in a unique pocket-like structure on their basolateral side. B-cells and memory cells are stimulated upon encountering antigen in Peyer's patches. These cells then pass to the mesenteric lymph nodes where the immune response is amplified. Activated lymphocytes pass into the blood stream via the thoracic duct and travel to the gut where they carry out their final effector functions.
The intestine contains up to 70% of the total lymphocytes in the body!

  A. an Anaphylactic reaction
* B. Immune exclusion
  C. Complement activation
  D. Opsonization

  <img src="Mucosal-IgA.jpg"><p>IgA provides the first line of defense for the inner surfaces of the body against infections of the lung, the intestine, the mouth, the urogenital tract and other areas lined by mucosal membranes. Immunoglobulin-A antibodies are unique, as they traverse mucosal membranes and have the ability to inactivate microorganisms before they invade tissues of the body itself.<p>IgA protects mainly by immune exclusion. Secreted IgA blocks surface association of organisms with the epithelium (eg. anti-pilus antibody against E. coli). Additionally, antigens that cross the epithelium are bound by IgA in the lamina propria and then transported back to the surface when the IgA is secreted. IgA does not activate complement (except by the alternative pathway) and is a poor opsonizing antibody (only mucosal PMN's have IgA Fc receptors and these are thought to bind only monomeric IgA); therefore it has no mechanisms that result in killing of the organisms.<p> Typically, sites where IgA pred

* A. IgE
  B. IgT
  C. IgA
  D. IgG
  E. IgM

  <img src="MastCell-Degranulation.jpg"><p>Mucosae are also principal sites for synthesis of IgE, most of which is then bound to mast cells in tissues and circulating basophils. Mast cells and basophils carry thousands of IgE receptors (FcRe) that bind IgEs regardless of specificity (although, note that the various IgEs bound have unique, and differing, specificity to antigens). <p> Crosslinking of a critical number of IgEs by antigen(s) results in degranulation of the cell and release of mediators that affect vessels and smooth muscle. Mucosal tissues and skin are rich in mast cells, and antigen-specific degranulation of IgE bearing mast cells is of major importance in resistance to parasitic infections of the gut and respiratory tracts. <p>This is also the major mechanism mediating food allergy and pulmonary hypersensitivity. The reaction, termed Type 1 Hypersensitivity, Immediate Hypersensitivity or Anaphylaxis, requires initial exposure to antigen to generate production of IgE. If sufficient

A. The humoral response involves IgA (mainly), IgE, IgG and IgM
* B. The cell-mediated response is negligible in mucosal tissue
C. Important non-specific innate mechanisms protecting mucosae include the epithelial cell barrier, the mucous coating, ciliary movement (lung), peristalsis (gut), urine flow, and normal flora.
D. The vast majority of infectious organisms enter by mucosal routes

<p>Mucosae with opportunity for close contact with the external environment and/or heavy exposure to microbial and other antigens have mucosally associated lymphocytes and/or organized (follicular) lymphoid tissues which permit induction of local antigen specific immune response. <p>In the gut these lymphoid aggregates are found beneath the membranous epithelium of villus crypts. Membranous epithelial cells, 'M cells', take up antigen and facilitate its passage to underlying follicles. In addition dendritic cells sample antigens that cross the epithelium in villi and crypts and extend processes between villus epithelial cells into the mucus to sample antigen, then carry it to follicles. Follicles possess all components required to mount an immune response: T cells, B cells and APCs. Both cell mediated and humoral responses (IgA, IgE, predominately occur.<p> Cell Mediated Responses in Mucosal Tissues T lymphocytes and macrophages capable of mediating CMI a

A. Movement of IgA positive B cells from the intestine and lung to the mammary gland (MALT) is especially important for production of antibodies in milk that give passive protection for the suckling neonate's gut and respiratory tract
B. As well as acting as foci for mediator production, GALT and BALT export antigen reactive memory cells
C. Tonsilar immune response provides memory cells that home to intestinal and respiratory tracts, to prime these sites for possible later invasion
* D. Generalized systemic immune response can never originate from mucosal sites

As well as acting as foci for mediator production, GALT and BALT export antigen reactive memory cells that leave GALT or BALT, circulate via lymphatics to draining lymph nodes (mesenteric and bronchial) where clonal expansion occurs, then to blood. <p>From blood they "home" to other mucosal sites and exit post capillary venules in GALT, BALT, and the mammary gland (MALT). Homing is strongest to the tissue of origin, but homing to other mucosal sites provides continuity of the immune response at all mucosal surfaces. <p>Movement of IgA positive B cells from the intestine and lung to the mammary gland (MALT) is especially important for production of antibodies in milk that give passive protection for the suckling neonate's gut and respiratory tract. <p>The tonsil, a sentinel at the entrance to intestinal and respiratory tracts, samples antigen in the pharynx. Tonsilar immune response provides memory cells that home to intestinal and respiratory tracts, to prime these sites for possible later invasion. (Antibo

  A. IgE
* B. IgA
  C. IgG
  D. IgM

  IgA is the predominant mediator in mucosal areas like the gastrointestinal and respiratory epithelium (equal IgA and IgG) as well as salivary glands, vagina, urethra, male accessory glands, nasal secretions and tears. <p>Other immunological compartments :
Serum : Mainly IgG and IgM. 60% of lymphocytes are T
Interstitial tissue fluids : Mainly IgG, with IgA in submucosal tissue. All leukocytes present, numbers increasing in response to inflammation
Cerebrospinal fluid : IgG only (in low concentration). Presence of anything else indicate some sort of infection or vascular damage
Joint fluid : Mainly IgG, but also IgA. Leukocytes appear during infection.
Bile : Mainly IgA
Colostrum : IgA, IgG and IgM content variable by specie (IgG, when little placental trnsfer, else IgA)
Milk : Less than in colostrum. Mainly IgA, except ruminants where IgG predominates
Uterus : Predominantly IgG but could produce IgA or IgM if there is local stimulation.</

62) In most species, immune competence may be expected at the end of

* A. First trimester of gestation
  B. Third trimester of gestation
  C. Second trimester of gestation
  D. Weaning

  In most species immune competence may be expected at the end of first trimester of gestation. Specific antibodies and antigen specific lymphocyte proliferation can be provoked during the second trimester, if antigen is introduced in utero. [Exception: rodents are not competent until 7 -14 days after birth.] <p> Young domestic animals other than rodents are fully immune competent at birth. Development of immunocompetent cells has occurred in the apparent absence of antigen. Lymphocyte development from stem cells continues until puberty and then slowly declines with age (co-incident with atrophy of the thymus). Thereafter, lymphocytes are generated predominately by clonal expansion of the existing repertoire.

63) The newborn is susceptible to infectious disease because

  A. immune competence may only be expected a few months after birth
* B. of the unprimed state of its immune system
  C. of inability to mount an immune response
* D. the neonate may be transiently immune suppressed at the time of birth due to hormonal influences

  The newborn is susceptible to infectious disease, not because of inability to mount an immune response, but because of the unprimed state of the immune system. First exposure to antigen results in a primary immune response and therefore there is a long lag period with initial low levels of mediator production. Additionally the neonate may be transiently immune suppressed at the time of birth due to hormonal influences. Newborn animals are, thus, especially vulnerable. Transfer of immunity passively from the dam is crucial for protection of the neonate in the critical transition period needed for stimulation of its own immune system. This protection is provided for primarily by transfer of immunoglobulins from the dam’s circulation to the circulation of her offspring (passive transfer of systemic immunity).

64) Passive transfer of immunity from the bitch (dog) to her offspring occurs

* A. by the placenta and/or colostrum and from milk
  B. by the placenta only
  C. by colostrum only
  D. by colostrum and milk only

  <img src="Passive-Immunity-Tx.jpg"><p>Protection of the fetus is mediated principally by the transfer of immunoglobulin/antibody, although the transfer of lymphocytes, phagocytic cells and complement occurs and may have a role in protection. <p>Animals with hemoendothelial or hemochorial placentas such as humans, primates, guinea pigs and rabbits transfer large amounts of IgG via the placenta. <p>Carnivores, dogs and cats, with endotheliochorial placentation have about 5-10% of the total passive transfer of systemic immunoglobulin via the placenta. <p>Ruminants, with syndesmochorial placentation, and pigs and horses with epitheliochorial placentation have no placental transfer of immunoglobulin. Neonates of these species are therefore entirely dependent on IgG obtained passively by suckling colostrum. <p>Where there is little or no transplacental transfer, colostral immunoglobulins (mainly IgG) are absorbed across the intestine and into the newborn’s circulation in the first 24 to 36 hours after birth. Peak

  A. Antibodies in milk serve no purpose
  B. Antibodies in milk have nutritional value (protein)
  C. Antibodies in milk are absorbed
* D. Antibodies in milk mediate local gastrointestinal resistance

  Passively acquired intestinal Ig protects against enteric infection and may block absorption of large molecules, such as those in food, thereby preventing sensitization to normal environmental antigens. Suckling distributes milk throughout the pharynx and by retrograde movement (regurgitation) into the nose, providing passive protection of the upper respiratory tract. Continued suckling of the neonate is therefore important in protecting against disease.<p>Some other facts about passive immunity
Passive antibody may also provide negative feedback that inhibits development of an active immune response. As the amount of passive antibody declines, a window of vulnerability may exist, when passive antibody is insufficient for immunity but sufficient to interfere with the active response. During this time active immune response may be entirely blocked or incomplete (priming occurs but no additional antibody is produced).
Passive Immunity and Response to Vaccination : The presence of antibodies acq