

## 130 Immunology questions and answers

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Directions (Questions 387-474): Select the ONE lettered answer that is BEST in each question.

387. Which category of hypersensitivity BEST describes hemolytic disease of the newborn caused by Rh incompatibility?

A. atopic or anaphylactic

B. cytotoxic

C. immune complex

D. delayed

388. The principal difference between cytotoxic (type II) and immune complex (type III) hypersensitivity is

A. the class (isotype) of antibody.

B. the site where antigen-antibody complexes are formed.

C. the participation of complement.

D. the participation of T cells.

389. A child stung by a bee experiences respiratory distress within minutes and lapses into unconsciousness. This reaction is probably mediated by

A. IgE antibody.

B. IgG antibody.

C. sensitized T cells.

D. complement.

E. IgM antibody.

390. A patient with rheumatic fever develops a sore throat from which beta-hemolytic streptococci are cultured. The patient is started on treatment with penicillin, and the sore throat resolves within several days. However, 7 days after initiation of penicillin therapy the patient develops a fever of 103°F, a generalized rash, and proteinuria. This MOST probably resulted from

A. recurrence of the rheumatic fever.

B. a different infectious disease.

C. an IgE response to penicillin.

D. an IgG-IgM response to penicillin.

E. a delayed hypersensitivity reaction to penicillin.

391. A kidney biopsy specimen taken from a patient with acute glomerulonephritis and stained with fluorescein-conjugated anti-human IgG antibody would probably show

A. no fluorescence.

B. uniform fluorescence of the glomerular basement membrane.

C. patchy, irregular fluorescence of the glomerular basement membrane.

D. fluorescent B cells.

E. fluorescent macrophages.

392. A patient with severe asthma gets no relief from antihistamines. The symptoms are MOST likely to be caused by

A. interleukin-2.

B. slow-reacting substance A (leukotrienes).

C. serotonin.

D. bradykinin.

393. Hypersensitivity to penicillin and hypersensitivity to poison oak are both

A. mediated by IgE antibody.

B. mediated by IgG and IgM antibody.

C. initiated by haptens.

D. initiated by Th-2 cells.

394. A recipient of a 2-haplotype MHC-matched kidney from a relative still needs immunosuppression to prevent graft rejection because

A. graft-versus-host disease is a problem.

B. minor histocompatibility antigens will not be matched.

C. minor histocompatibility antigens will not be matched.

D. complement components will not be matched.

395. Bone marrow transplantation in immunocompromised patients presents which major problem?

A. potentially lethal graft-versus-host disease

B. high risk of T cell leukemia

C. inability to use a live donor

D. delayed hypersensitivity

396. What is the role of class II MHC proteins on donor cells in graft rejection?

- A. They are the receptors for interleukin-2, which is produced by macrophages when they attack the donor cells.
- B. They are recognized by helper T cells, which then activate cytotoxic T cells to kill the donor cells.
- C. They induce the production of blocking antibodies that protect the graft.
- D. They induce IgE which mediates graft rejection.

397. Grafts between genetically identical individuals (i.e., identical twins)

- A. are rejected slowly as a result of minor histocompatibility antigens.
- B. are subject to hyperacute rejection.
- C. are not rejected, even without immunosuppression.
- D. are not rejected if a kidney is grafted, but skin grafts are rejected.

398. Penicillin is a hapten in both humans and mice. To explore the hapten-carrier relationship, a mouse was injected with penicillin covalently bound to bovine serum albumin and, at the same time, with egg albumin to which no penicillin was bound. Of the following, which one will induce a secondary response to penicillin when injected into the mouse 1 month later?

- A. penicillin
- B. penicillin bound to egg albumin
- C. egg albumin
- D. bovine serum albumin

399. AIDS is caused by a human retrovirus that kills

- A. B lymphocytes.

B. lymphocyte stem cells.

C. CD4-positive T lymphocytes.

D. CD8-positive T lymphocytes.

400. Chemically-induced tumors have tumor-associated transplantation antigens that

A. are always the same for a given carcinogen.

B. are different for two tumors of different histologic type even if induced by the same carcinogen.

C. are very strong antigens.

D. do not induce an immune response.

401. Polyomavirus (a DNA virus) causes tumors in "nude mice" (nude mice do not have a thymus, because of a genetic defect) but not in normal mice. the BEST interpretation is that

A. macrophages are required to reject polyomavirus-induced tumors.

B. natural killer cells can reject polyomavirus-induced tumors without help from T lymphocytes.

C. T lymphocytes play an important role in the rejection of polyomavirus-induced tumors.

D. B lymphocytes play no role in rejection of polyomavirus-induced tumors.

402. C3 is cleaved to form C3a and C3b by C3 convertase. C3b is involved in all of the following EXCEPT

A. altering vascular permeability.

B. promoting phagocytosis.

C. forming alternative-pathway C3 convertase.

D. forming C5 convertase.

403. After binding to its specific antigen, a B lymphocyte may switch its

- A. immunoglobulin light-chain isotype.
- B. immunoglobulin heavy-chain class.
- C. variable region of the immunoglobulin heavy chain.
- D. constant region of the immunoglobulin light chain.

404. Diversity is an important feature of the immune system. Which one of the following statements about it is INCORRECT?

- A. Humans can make antibodies with about  $10^8$  different  $V_H \times V_L$  combinations.
- B. A single cell can synthesize IgM antibody, then switch to IgA antibody.
- C. The hematopoietic stem cell carries the genetic potential to create more than  $10^4$  immunoglobulin genes.
- D. A single B lymphocyte can produce antibodies of many different specificities, but a plasma cell is monospecific.

405. C3a and C5a can cause

- A. bacterial lysis.
- B. vascular permeability.
- C. phagocytosis of IgE-coated bacteria.
- D. aggregation of C4 and C2.

406. Neutrophils are attracted to an infected area by

- A. IgM.

B. vascular permeability.

C. phagocytosis of IgE-coated bacteria.

D. aggregation of C4 and C2.

407. Complement fixation refers to

A. the ingestion of C3b-coated bacteria by macrophages.

B. the destruction of complement in serum by heating at 56°C for 30 minutes.

C. the binding of complement components by antigen-antibody complexes.

D. the interaction of C3b with mast cells.

408. The classic complement pathway is initiated by interaction of C1 with

A. antigen.

B. factor B.

C. antigen-IgG complexes.

D. bacterial lipopolysaccharides.

409. Patients with severely reduced C3 levels tend to have

A. increased numbers of severe viral infections.

B. increased numbers of severe bacterial infections.

C. low gamma globulin levels.

D. frequent episodes of hemolytic anemia.

410. Individuals with a genetic deficiency of C6 have

- A. decreased resistance to viral infections.
- B. increased hypersensitivity reactions.
- C. increased frequency of cancer.
- D. decreased resistance to Neisseria bacteremia.

411. Natural killer cells are

- A. B cells that can kill without complement.
- B. cytotoxic T cells.
- C. increased by immunization.
- D. able to kill virus-infected cells without prior sensitization.

412. A positive tuberculin skin test (a delayed hypersensitivity reaction) indicates that

- A. a humoral immune response has occurred.
- B. a cell-mediated immune response has occurred.
- C. both the T and B cell systems are functional.
- D. only the B cell system is functional.

413. Reaction to poison ivy or poison oak is

- A. an IgG-mediated response.
- B. an IgE-mediated response.
- C. a cell-mediated response.
- D. an Arthus reaction.



414. A child disturbs a wasp nest, is stung repeatedly, and goes into shock within minutes, manifesting respiratory failure and vascular collapse. This is MOST likely to be due to

- A. systemic anaphylaxis.
- B. serum sickness.
- C. an Arthus reaction.
- D. cytotoxic hypersensitivity.

415. "Isotype switching" of immunoglobulin classes by B cells involves

- A. simultaneous insertion of VH genes adjacent to each CH gene.
- B. successive insertion of a single VH gene adjacent to different CH genes.
- C. activation of homologous genes on chromosome 6.
- D. switching of light-chain types (kappa and lambda).

416. Which one of the following pairs of genes is linked on a single chromosome?

- A. V gene for lambda chain and C gene for kappa chain
- B. C gene for gamma chain and C gene for kappa chain
- C. V gene for lambda chain and V gene for heavy chain
- D. C gene for gamma chain and C gene for alpha chain

417. Idiotypic determinants are located within

- A. hypervariable regions of heavy and light chains.
- B. constant regions of light chains.
- C. constant regions of heavy chains.

D. the hinge region.

418. A primary immune response in an adult human requires approximately how much time to produce detectable antibody levels in the blood?

A. 12 hours

B. 3 days

C. 1 week

D. 3 weeks

419. The membrane IgM and IgD on the surface of an individual B cell

A. have identical heavy chains but different light chains

B. are identical except for their CH regions

C. are identical except for their VH regions

D. have different VH and VL regions

420. During the maturation of a B lymphocyte, the first immunoglobulin heavy chain synthesized is the

A. Mu chain.

B. gamma chain.

C. epsilon chain.

D. alpha chain.

421. In the immune response to a hapten-protein conjugate, in order to get anti-hapten antibodies it is essential that

- A. the hapten be recognized by helper T cells.
- B. the protein be recognized by helper T cells.
- C. the protein be recognized by B cells.
- D. the hapten be recognized by suppressor T cells.

422. In the determination of serum insulin levels by radioimmunoassay, which one of the following is NOT needed?

- A. isotope-labeled insulin
- B. anti-insulin antibody made in goats
- C. anti-goat gamma globulin made in rabbits
- D. isotope-labeled anti-insulin antibody made in goats

423. Which one of the following sequences is appropriate for testing a patient for antibody against the AIDS virus with the ELISA procedure? (The assay is carried out in a plastic plate with an incubation and a wash step after each addition except the final one.)

- A. patient's serum/enzyme substrate/HIV antigen/enzyme-labeled antibody against HIV
- B. HIV antigen/patient's serum/enzyme-labeled antibody against human gamma globulin/enzyme substrate
- C. enzyme-labeled antibody against human gamma globulin/patient's serum/HIV antigen/enzyme substrate
- D. enzyme-labeled antibody against HIV/HIV antigen/patient's serum/enzyme substrate

424. The BEST method to demonstrate IgG on the glomerular basement membrane in a kidney tissue section is the

- A. precipitin test.
- B. complement fixation test.
- C. agglutination test.

D. indirect fluorescent-antibody test.

425. A woman had a high fever, hypotension, and a diffuse macular rash. When all cultures showed no bacterial growth, a diagnosis of toxic shock syndrome was made. Regarding the mechanism by which the toxin causes this disease, which one of the following is LEAST accurate?

A. The toxin is not processed within the macrophage.

B. The toxin binds to both the class II MHC protein and the T cell receptor.

C. The toxin activates many CD4-positive T cells, and large amounts of interleukins are released.

D. The toxin has an A-B subunit structure--the B subunit binds to a receptor, and the A subunit enters the cells and activates them.

426. A patient with a central nervous system disorder is maintained on the drug methyl dopa. Hemolytic anemia develops, which resolves shortly after the drug is withdrawn. This is MOST probably an example of

A. atopic hypersensitivity.

B. cytotoxic hypersensitivity.

C. immune-complex hypersensitivity.

D. cell-mediated hypersensitivity.

427. Which one of the following substances is NOT released by activated helper T cells?

A. interleukin-1

B. gamma interferon

C. interleukin-2

D. interleukin-4

428. A delayed hypersensitivity reaction is characterized by

- A. edema without a cellular infiltrate.
- B. an infiltrate composed of neutrophils.
- C. an infiltrate composed of helper T cells and macrophages
- D. an infiltrate composed of eosinophils.

429. Two dissimilar inbred strains of mice, A and B, are crossed to yield an F1 hybrid strain, AB. If a large dose of spleen cells from an adult A mouse is injected into an adult AB mouse, which one of the following is MOST likely to occur? An explanation of the answer to this question is given on p. 24.

- A. The spleen cells will be destroyed.
- B. The spleen cells will survive and will have no effect in the recipient.
- C. The spleen cells will induce a graft-versus-host reaction in the recipient.
- D. The spleen cells will survive and induce tolerance of strain A grafts in the recipient.

430. This question is based on the same strains of mice described in the previous question. If adult AB spleen cells are injected into a newborn B mouse, which one of the following is MOST likely to occur? An explanation of the answer to this question is given on p. 24.

- A. The spleen cells will be destroyed.
- B. The spleen cells will survive without any effect on the recipient.
- C. The spleen cells will induce a graft-versus-host reaction in the recipient.
- D. The spleen cells will survive and induce tolerance of strain A grafts in the recipient.

431. The minor histocompatibility antigens on cells

- A. are detected by reaction with antibodies and complement.

- B. are controlled by several genes in the major histocompatibility complex.
- C. are unimportant in human transplantation.
- D. induce reactions that can cumulatively lead to a strong rejection response.

432. Which one of the following is NOT true of class I MHC antigens?

- A. They can be assayed by a cytotoxic test that uses antibody and complement.
- B. They can usually be identified in the laboratory in a few hours.
- C. They are controlled by at least three gene loci in the major histocompatibility complex.
- D. They are found mainly on B cells, macrophages, and activated T cells.

433. An antigen found in relatively high concentration in the plasma of normal fetuses and a high proportion of patients with progressive carcinoma of the colon is

- A. viral antigen.
- B. carcinoembryonic antigen.
- C. alpha-fetoprotein.
- D. heterophil

434. An antibody directed against the idiotypic determinants of a human IgG antibody would react with

- A. the Fc part of the IgG.
- B. an IgM antibody produced by the same plasma cell that produced the IgG.
- C. all human kappa chains.
- D. all human gamma chains.

435. Which one of the following is NOT true of the gene segments that combine to make up a heavy-chain gene?

A. Many V region segments are available.

B. Several J segments and several D segments are available.

C. V, D, and J segments combine to encode the antigen-binding site.

D. A V segment and a J segment are preselected by an antigen to make up the variable-region portion of the gene.

436. When immune complexes from the serum are deposited on glomerular basement membrane, damage to the membrane is caused mainly by

A. gamma interferon.

B. phagocytosis.

C. cytotoxic T cells.

D. enzymes released by polymorphonuclear cells.

437. If an individual was genetically unable to make J chains, which immunoglobulin(s) would be affected?

A. IgG

B. IgM

C. IgA

D. IgG and IgM

E. IgM and IgA

438. The antibody-binding site is formed primarily by

A. the constant regions of H and L chains.

B. the hypervariable regions of H and L chains.

C. the hypervariable regions of H chains.

D. the variable regions of H chains.

E. the variable regions of L chains.

439. The class of immunoglobulin present in highest concentration in the blood of a human newborn is

A. IgG.

B. IgM.

C. IgA.

D. IgD.

E. IgE.

440. Individuals of blood group type AB

A. are Rh(d)-negative.

B. are "universal recipients" of transfusions.

C. have circulating anti-A and anti-B antibodies.

D. have the same haplotype.

441. Cytotoxic T cells induced by infection with virus A will kill target cells

A. from the same host infected with any virus.

B. infected by virus A and identical at class I MHC loci of the cytotoxic T cells.

C. infected by virus A and identical at class II MHC loci of the cytotoxic T cells.

D. infected with a different virus and identical at class I MHC loci of the cytotoxic cells.



E. infected with a different virus and identical at class II MHC loci of the cytotoxic cells.

442. Antigen-presenting cells that activate helper T cells must express which one of the following on their surfaces?

A. IgE

B. gamma interferon

C. class I MHC antigens

D. class II MHC antigens

443. Which one of the following does NOT contain C3b?

A. classic-pathway C5 convertase

B. alternative-pathway C5 convertase

C. classic-pathway C3 convertase

D. alternative-pathway C3 convertase

444. Which one of the following is NOT true regarding the alternative complement pathway?

A. It can be triggered by infectious agents in absence of antibody.

B. It does not require C1, C2, or C4.

C. It cannot be initiated unless C3b fragments are already present.

D. It has the same terminal sequence of events as the classic pathway.

445. In setting up a complement fixation test for antibody, the reactants should be added in what sequence? (Ag = antigen; Ab = antibody; C = complement; EA = antibody-coated indicator erythrocytes.)

A. Ag + EA + C/wait/ + patient's serum

B. C + patient's serum + EA/wait/ + Ag

C. Ag + patient's serum + EA/wait/ + C

D. Ag + patient's serum + C/wait/ + EA

446. Proteins from two samples of animal blood, A and B, were tested by the double-diffusion (Ouchterlony) test in agar against antibody to bovine albumin. Which sample(s) contain horse blood? An explanation of the answer to this question is given on p[dse2] . 24.

A. sample A

B. sample B

C. both samples

D. neither sample

447. Complement lyses cells by

A. enzymatic digestion of the cell membrane.

B. activation of adenylate cyclase.

C. insertion of complement proteins into the cell membrane.

D. inhibition of elongation factor 2.

448. Graft and tumor rejection are mediated primarily by

A. non-complement-fixing antibodies.

B. phagocytic cells.

C. helper T cells.

D. cytotoxic T cells.

449. Which one of the following properties of antibodies is NOT dependent on the structure of the heavy-chain constant region?

A. ability to cross the placenta

B. isotype (class)

C. ability to fix complement

D. affinity for antigen

450. In which one of the following situations would a graft-versus-host reaction be MOST likely to occur? (Mouse strains A and B are highly inbred; AB is an F1 hybrid between strain A and strain B.)

A. newborn strain A spleen cells injected into a strain B adult

B. x-irradiated adult strain A spleen cells injected into a strain B adult

C. adult strain A spleen cells injected into an x-irradiated strain AB adult

D. adult strain AB spleen cells injected into a strain A newborn

451. In a mixed-lymphocyte culture, lymphocytes from person X, who is homozygous for the HLA-Dw7 allele, are irradiated and then cultured with lymphocytes from person Z. It is

found that DNA synthesis is NOT stimulated. The proper conclusion to be drawn is that

A. person Z is homozygous for HLA-Dw7.

B. person Z is homozygous or heterozygous for HLA-Dw7.

C. person Z is heterozygous for HLA-Dw7.

D. person Z does not carry the HLA-Dw7 allele.

452. A patient skin-tested with purified protein derivative (PPD) to determine previous exposure to Mycobacterium tuberculosis develops induration at the skin test site 48 hours later. Histologically, the reaction site would MOST probably show

A. eosinophils.

B. neutrophils.

C. helper T cells and macrophages.

D. B cells.

453. Hemolytic disease of the newborn caused by Rh blood group incompatibility requires maternal antibody to enter the fetal bloodstream. Therefore, the mediator of this disease is

A. IgE antibody.

B. IgG antibody.

C. IgM antibody.

D. IgA antibody.

454. An Rh-negative woman married to a heterozygous Rh-positive man has three children. The probability that all three of their children are Rh-positive is

A. 1:2.

B. 1:4.

C. 1:8.

D. zero.

455. Which one of the following statements BEST explains the relationship between inflammation of the heart (carditis) and infection with group A beta-hemolytic streptococci?

A. Streptococcal antigens induce antibodies cross-reactive with heart tissue.

B. Streptococci are polyclonal activators of B cells.

C. Streptococcal antigens bind to IgE on the surface of heart tissue and histamine is released.

D. Streptococci are ingested by neutrophils that release proteases that damage heart tissue.

456. Your patient became ill 10 days ago with a viral disease. Laboratory examination reveals that the patient's antibodies against this virus have a high ratio of IgM to IgG. What is your conclusion?

A. It is unlikely that the patient has encountered this organism previously.

B. The patient is predisposed to IgE-mediated hypersensitivity reactions.

C. The information given is irrelevant to previous antigen exposure.

D. It is likely that the patient has an autoimmune disease.

457. If you measure the ability of cytotoxic T cells from an HLA-B27 person to kill virus X-infected target cells, which one of the following statements is CORRECT?

A. Any virus X-infected target cell will be killed.

B. Only virus X-infected cells of HLA-B27 type will be killed.

C. Any HLA-B27 cell will be killed.

D. No HLA-B27 cell will be killed.

458. You have a patient who makes autoantibodies against his own red blood cells, leading to hemolysis. Which one of the following mechanisms is MOST likely to explain the hemolysis?

- A. Perforins from cytotoxic T cells lyse the red cells.
- B. Neutrophils release proteases that lyse the red cells.
- C. Interleukin-2 binds to its receptor on the red cells, which results in lysis of the red cells.
- D. Complement is activated, and membrane attack complexes lyse the red cells.

459. Your patient is a child who has no detectable T or B cells. This immunodeficiency is most probably the result of a defect in

- A. the thymus.
- B. the bursal equivalent.
- C. T cell-B cell interaction.
- D. stem cells originating in the bone marrow.

460. The role of the macrophage during an antibody response is to

- A. make antibody.
- B. lyse virus-infected target cells.
- C. activate cytotoxic T cells.
- D. process antigen and present it.

461. The structural basis of blood group A and B antigen specificity is

- A. a single terminal sugar residue.
- B. a single terminal amino acid.

C. multiple differences in the carbohydrate portion.

D. multiple differences in the protein portion.

462. Complement can enhance phagocytosis because of the presence on macrophages and neutrophils of receptors for

A. factor D.

B. C3b.

C. C6.

D. properdin.

463. The main advantage of passive immunization over active immunization is that

A. it can be administered orally.

B. it provides antibody more rapidly.

C. antibody persists for a longer period.

D. it contains primarily IgM.

464. On January 15, a patient developed an illness suggestive of influenza, which lasted 1 week. On February 20, she had a similar illness. She had no influenza immunization during this period. Her hemagglutination inhibition titer to influenza A virus was 10 on January 18, 40 on January 30, and 320 on February 20. Which one of the following is the MOST appropriate interpretation?

A. The patient was ill with influenza A on January 15.

B. The patient was ill with influenza A on February 20.

C. The patient was not infected with influenza virus.

D. The patient has an autoimmune disease.

465. An individual who is heterozygous for Gm allotypes contains two allelic forms of IgG in serum, but individual lymphocytes produce only one of the two forms. This phenomenon, known as "allelic exclusion," is consistent with

- A. a rearrangement of a heavy-chain gene on only one chromosome in a lymphocyte.
- B. rearrangements of heavy-chain genes on both chromosomes in a lymphocyte.
- C. a rearrangement of a light-chain gene on only one chromosome in a lymphocyte.
- D. rearrangements of light-chain genes on both chromosomes in a lymphocyte.

466. Each of the following statements concerning class I MHC proteins is correct EXCEPT:

- A. They are cell surface proteins on virtually all cells.
- B. They are recognition elements for cytotoxic T cells.
- C. They are codominantly expressed.
- D. They are important in the skin test response to Mycobacterium tuberculosis.

467. Which one of the following is the BEST method of reducing the effect of graft-versus-host disease in a bone marrow recipient?

- A. matching the complement components of donor and recipient
- B. administering alpha interferon
- C. removing mature T cells from the graft
- D. removing pre-B cells from the graft

468. Regarding Th-1 and Th-2 cells, which one of the following is LEAST accurate?

- A. Th-1 cells produce gamma interferon and promote cell-mediated immunity.
- B. Th-2 cells produce interleukin-4 and -5 and promote antibody-mediated immunity.



C. Both Th-1 and Th-2 cells have both CD3 and CD4 proteins on their outer cell membrane.

D. Before naïve Th cells differentiate into Th-1 or Th-2 cells, they are double-positives; i.e., they produce both gamma interferon and interleukin-4.

469. Each of the following statements concerning the variable regions of heavy chains and the variable regions of light chains in a given antibody molecule is correct EXCEPT:

A. They have the same amino acid sequence.

B. They define the specificity for antigen.

C. They are encoded on different chromosomes.

D. They contain the hypervariable regions.

470. Each of the following statements concerning class II MHC proteins is correct EXCEPT:

A. They are found on the surface of both B and T cells.

B. They have a high degree of polymorphism.

C. They are involved in the presentation of antigen by macrophages.

D. They have a binding site for CD4 proteins.

471. Which one of the following statements concerning immunoglobulin allotypes is CORRECT?

A. Allotypes are found only on heavy chains.

B. Allotypes are determined by class I MHC genes.

C. Allotypes are confined to the variable regions.

D. Allotypes are due to genetic polymorphism within a species.

472. Each of the following statements concerning immunologic tolerance is correct EXCEPT:

A. Tolerance is not antigen-specific; i.e., paralysis of the immune cells results in a failure to produce a response against many antigens.

B. Tolerance is more easily induced in T cells than in B cells.

C. Tolerance is more easily induced in neonates than in adults.

D. Tolerance is more easily induced by simple molecules than by complex ones.

473. Each of the following statements concerning a hybridoma cell is correct EXCEPT:

A. The spleen cell component provides the ability to form antibody.

B. The myeloma cell component provides the ability to grow indefinitely.

C. The antibody produced by a hybridoma cell is IgM, because heavy-chain switching does not occur.

D. The antibody produced by a hybridoma cell is homogeneous; i.e., it is directed against a single epitope.

474. Each of the following statements concerning haptens is correct EXCEPT:

A. A hapten can combine with (bind to) an antibody.

B. A hapten cannot induce an antibody by itself; rather, it must be bound to a carrier protein to be able to induce antibody.

C. In both penicillin-induced anaphylaxis and poison ivy, the allergens are haptens.

D. Haptens must be processed by CD8+ cells to become immunogenic.

Answers (Questions 387-474):

387. D

388. B

389. A

390. D

391. C

392. B

393. C

394. C

395. A

396. B

397. C

398. D

399. C

400. B

401. C

402. A

403. B

404. D

405. B

406. C

407. C

408. C

409. B

410. D

411. D

412. B

413. C

414. A

415. B

416. D

417. A

418. C

419. B

420. A

421. B

422. D

423. B

424. D

425. D

426. B

427. A

428. C

429. C

430. D

431. D

432. D

433. B

434. B

435. D

436. D

437. E

438. B

439. A

440. B

441. B

442. D

443. C

444. C

445. D

446. B

447. C

448. D

449. D

450. C

451. B

452. C

453. B

454. C

455. A

456. A

457. B

458. D

459. D

460. D

461. A

462. B

463. B

464. A

465. A

466. D

467. C

468. D

469. A

470. A

471. D

472. A

473. C

474. D

Directions (Questions 475-535): Select the ONE lettered option that is MOST closely associated with the numbered items. Each lettered option may be selected once, more than once, or not at all.

Questions 475-480

A. T cells

B. B cells

C. Macrophages

D. B cells and macrophages

E. T cells, B cells, and macrophages

475. Major source of interleukin-1

476. Acted on by interleukin-1

477. Major source of interleukin-2

478. Express class I MHC markers

479. Express class II MHC markers

480. Express surface immunoglobulin

Questions 481-484

A. Primary antibody response

B. Secondary antibody response

481. Appears more quickly and persists longer

482. Relatively richer in IgG

483. Relatively richer in IgM

484. Typically takes 7-10 days for antibody to appear

Questions 485-488

A. Blood group A

B. Blood group O

C. Blood groups A and O

D. Blood group AB

485. People with this type have circulating anti-A antibodies.

486. People with this type have circulating anti-B antibodies.

487. People with this type are called "universal donors."

488. People with this type are called "universal recipients."

Questions 489-494

A. Variable region of light chain

B. variable region of heavy chain

C. Variable regions of light and heavy chains

D. Constant region of heavy chain

E. Constant regions of light and heavy chains

489. Determines immunoglobulin class

490. Determines allotypes

491. Determines idiotypes

492. Binding of IgG to macrophages

493. Fixation of complement by IgG

494. Antigen-binding site

Questions 495-498

The following double-immunodiffusion plate contains antibody prepared against whole human serum in the center well. Identify the contents of each peripheral well from the following list (each well to be used once). An explanation of the answer to this question is given on p. 24[dse3] .

495. Whole human serum



496. Human IgG

497. Baboon IgG

498. Human transferrin

Questions 499-501

A. Immediate hypersensitivity

B. Cytotoxic hypersensitivity

C. Immune-complex hypersensitivity

D. Delayed hypersensitivity

499. Irregular deposition of IgG along glomerular basement membrane

500. Involves mast cells and basophils

501. Mediated by lymphokines

Questions 502-505

A. IgM

B. IgG

C. IgA

D. IgE

502. Crosses the placenta

503. Can contain a polypeptide chain not synthesized by a B lymphocyte

504. Found in the milk of lactating women

505. Binds firmly to mast cells and triggers anaphylaxis

Questions 506-509

A. Agglutination

B. Precipitin test

C. Immunofluorescence

D. Enzyme immunoassay

506. Concentration of IgG in serum

507. Surface IgM on cells in a bone marrow smear

508. Growth hormone in serum

509. Type A blood group antigen on erythrocytes

Questions 510-513

A. IgA

B. IgE

C. IgG

D. IgM

510. Present in highest concentration in serum

511. Present in highest concentration in secretions

512. Present in lowest concentration in serum

513. Contains 10 heavy and 10 light chains

Questions 514-517

In this double diffusion (Ouchterlony) assay, the center well contains antibody against whole human serum. The peripheral (numbered) wells contain one of the following proteins[dse4]  
:

- A. Human serum albumin at low concentration
- B. Human serum albumin at high concentration
- C. Human serum transferrin
- D. Sheep serum albumin

514. Which protein is present in well No. 1?

515. Which protein is present in well No. 2?

516. Which protein is present in well No. 3?

517. Which protein is present in well No. 4?

An explanation of the answer to this question is given on p. 24.

Questions 518-521

A. Class I MHC proteins

B. Class II MHC proteins

518. Involved in the presentation of antigen to CD4-positive cells

519. Involved in the presentation of antigen to CD8-positive cells

520. Involved in antibody responses to T-dependent antigens

521. Involved in target cell recognition by cytotoxic T cells

Questions 522-525

A. Fab fragment of IgG

B. Fc fragment of IgG

522. Contains an antigen-combining site

523. Contains hypervariable regions

524. Contains a complement-binding site

525. Is crystallizable

Questions 522-525

A. Severe combined immunodeficiency disease (SCID)

B. X-linked hypogammaglobulinemia

C. Thymic aplasia

D. Chronic granulomatous disease

E. Hereditary angioedema

526. Caused by a defect in the ability of neutrophils to kill microorganisms

527. Caused by a development defect that results in a profound loss of T cells

528. Caused by a deficiency in an inhibitor of the C1 component of complement

529. Caused by a marked deficiency of B cells

530. Caused by a virtual absence of both B and T cells

Questions 531-535

A. Systemic lupus erythematosus

B. Rheumatoid arthritis

C. Rheumatic fever

D. Graves' disease

E. Myasthenia gravis

531. Associated with antibody to the thyroid-stimulating hormone (TSH) receptor

532. Associated with antibody to IgG

533. Associated with antibody to the acetylcholine receptor

534. Associated with antibody to DNA

535. Associated with antibody to streptococci

Answers (Questions 475-535):

475. C

476. A

477. A

478. E

479. D

480. B

481. B

482. B

483. A

484. A

485. B

486. C

487. B

488. D

489. D

490. E

491. C

492. D

493. D

494. C

495. D

496. C

497. A

498. B

499. C

500. A

501. D

502. B

503. C

504. C

505. D

506. D

507. C

508. D

509. A

510. C

511. A

512. B

513. D

514. B

515. A

516. D

517. C

518. B

519. A

520. B

521. A

522. A

523. A

524. B

525. B

526. D

527. C

528. E

529. B

530. A

531. D

532. B

533. E

534. A

535. C

Explanation of Question 429: Spleen cells from the adult donor A will recognize the B antigen on the recipient's cell as foreign. Spleen cells from the adult donor will contain mature CD4 and CD8 cells that will attack the recipient cells, causing a graft-versus-host reaction; therefore, answer C is correct. Because the recipient is tolerant to antigen A, the donor A spleen cells will not be destroyed; therefore, answer A is incorrect. Answer B is incorrect because, although the donor cells will survive, they will have an effect on the recipient. Answer D is incorrect because the recipient is already tolerant to antigen A.

Explanation of Question 430: Because the donor AB spleen cells will not see any foreign antigen in the recipient, no graft-versus-host reaction will occur; therefore, answer C is incorrect. The immune cells of the newborn mouse do not have the capability to kill the donor cells; therefore, answer A is incorrect. Answer D is more correct than answer B because the donor cells will survive and induce tolerance to antigen A in the newborn recipient.

Explanation of Question 446: There is a line of identity between sample A and bovine albumin, therefore, sample A is bovine albumin. There is a line of identity between sample B and horse albumin, therefore, sample B is horse albumin. The answer to the question is, therefore, B. Note that there is a spur formed between the wells containing sample A and horse albumin and between the wells containing sample B and bovine albumin. The spur indicates partial identity between the two proteins. Partial identity means that there are epitopes shared between the two albumins but that, because they are from different species, there are epitopes unique to each protein, also. A spur is formed by the interaction of the subset of antibodies in the anti-bovine serum with the unique epitopes in bovine albumin. The other lines are formed by the interaction of the subset of antibodies in the anti-bovine serum with the epitopes shared by the two albumins.

Explanation of Questions 495-498: The center well contains antibody against whole human serum; therefore, well D must contain whole human serum because there are multiple lines representing some of the many proteins in whole human serum. There is a line of identity between well C and a protein in whole human serum and a line of partial identity with that same protein and well A. This indicates that well C contains human IgG and well A contains baboon IgG. The concept of partial identity is explained above in the discussion of question 446. There is a line of nonidentity between wells B and C; therefore, well B contains human transferrin, a protein immunologically distinct from human IgG.



Explanation of Questions 514-517: There is a line of identity between wells 1 and 2; therefore, they contain human serum albumin (HAS). Note that the line of immunoprecipitate is very close to well 2. This line would not form if well 2 contained the high concentration of HAS because it would be a zone of antigen excess, and the line only forms in a zone of equivalence. Therefore, well 2 contains the low concentration and well 1 contains the high concentration of HAS. There is a line of partial identity between well 2 and 3, therefore, well 3 contains sheep serum albumin (SSA). There is a line of nonidentity between wells 1 and 4 and wells 3 and 4, therefore, well 4 contains human transferrin which is immunologically distinct from HAS and SSA.