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COMMENTS ON QUESTIONS

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DEND 215
MEDICAL MICROBIOLOGY AND IMMUNOLOGY
EXAM I
FALL 2002

I. Multiple Choice Questions: Choose the best answer

1. Which of the following would be a characteristic of botulinal toxin toxoid?

A. A specific immunoglobulin in the blood of an individual immunized against the exotoxin of *Clostridium botulinum*
B. The specific cytokine that activates B cell lymphocytes to produce an immunoglobulin against *Clos. botulinum*
C. The active form of the potent exotoxin produced by *Clos. botulinum*
D. The detoxified form of the botulinal exotoxin used to immunize individuals to form immunoglobulins that bind and detoxify botulinal toxin
E. The endotoxin of the cell wall of *Clos. botulinum* that is a potent neurotoxin

2. A patient comes to your operatory for scheduled surgical procedure to replace a failed titanium bone screw used to stabilize a mandibular bone fracture. During your work up in preparation for the procedure, the patient tells you that he thinks he's "coming down with something". When you question him about why he thinks that, he tells you: " well, my body kinda' hurts all over – like my muscles ache - ; I've got this headache; my throat feels like it's getting sore; I couldn't even think about eating breakfast this morning; I feel like I've got a little temperature; and I just feel lousy". In preparation for the surgery, you have results of standard hematology workup for the patient obtained the day before that indicate all parameters are within normal limits.
What is your assessment of this patient and response?

A. The patient is exhibiting acute stage symptoms of an infectious disease; surgery should be postponed.
B. The patient is exhibiting incubatory stage symptoms of an infectious disease; proceed with surgery using prophylaxis with a broad-spectrum antibiotic.
C. The patient is exhibiting prodromal stage symptoms of an infectious disease; surgery should be postponed.
D. The patient is exhibiting convalescent stage symptoms as the result of his prior tibial surgery; proceed with with the surgery
E. The patient is exhibiting acute stage symptoms of systemic inflammation; begin immediate antibiotic therapy and obtain blood specimen for gram stain; if no organisms are seen on slide, proceed with surgery.

3. Which of the following descriptions is most applicable to West Nile Virus disease in humans?

A. Acquired by airborne transmission, zoonoses, commonly produces a severe meningitis even in normal adults, does not produce symptomatic disease in reservoirs

B. Usually produces only mild flu-like symptoms in normal adults with cutaneous lesions at the primary infection site, transmitted by direct contact with horses or birds

C. Does not produce symptomatic disease in immunocompetent humans or birds but always is symptomatic in horses, transmitted to humans by contact with infected birds or by the bite of a mosquito vector

D. Virus is a nonenveloped DNA virus that is capable of transmission to humans through the bite of any infected blood sucking arthropod that has fed on an infected horse, capable of causing a severe meningitis only in immunodeficient humans and a latent infection in all other humans

E. Zoonoses that usually causes only a mild infection in humans but may produce a severe encephalitis in debilitated or immunocompromised humans, transmitted from infected birds or horses by mosquito

4. Which of the following would most likely be associated with producing endotoxic septic shock?

A. Toxic Shock Syndrome strains of *Staph aureus* growing in a local infection site in the body
B. Activation of the Classical Complement pathway in the blood
C. Gram negative septicemia
D. Gram positive bacteremia
E. All of the above

5. Which of the following immunoglobulin classes has the ability to cross the placenta and activate the Complement cascade?

IgG

A. IgA
B. IgE
C. IgG
D. IgM
E. C and D above

6. Finding antibodies against the Varicella-Zoster virus in the blood of an individual who has no history of chickenpox but who is suffering from the condition of shingles now at the age of 64 years of age, would indicate which of the following?

A. She has lost the Ts clone of lymphocytes controlling against formation of the B cell antibody producing clone
B. She has acquired a CD4 Th clone of lymphocytes necessary to produce the antibody
C. She must have had a subclinical case of chickenpox earlier in her life
D. She had no immunity to the Varicella-Zoster virus and has acquired a primary acute infection on exposure to an infected individual
E. She has had an unrecognized chronic infection caused by this virus for some long period of time

7. The Complement System component C4 is active in which phase of which Complement pathway?

A. Membrane damage late component phase of Classical pathway
B. Recognition phase of Alternative pathway
C. Early activation phase of Alternative pathway → C3
D. Early activation phase of Classical pathway
E. Recognition phase of Classical pathway → C1

8. Which of the following represents the fully differentiated immunoglobulin-producing cell; what cell line is it differentiated from; and where would you expect to find it?

A. Cytotoxic T cell; CD4 T cell line; peripheral circulation
B. Tdth cell; CD8 cell line; in tissues at site of antigen-labelled cells
C. NK cell; Macrophagic cell line; spleen
D. Plasma cell; T cell line; peripheral circulation
E. Plasma cell; B cell line; cortical germinal centers of lymph node

9. Which of the following would be capable of initiating the binding of a C1qrs component of the Complement system?

A. An Fab fragment of an IgM immunoglobulin in blood circulation
B. The Fc region of an IgG immunoglobulin monomer that had attached to its antigenic determinant
C. An IgE immunoglobulin monomer bound to the surface of a mast cell by an Fc-epsilon receptor
D. The Fc region of an IgA immunoglobulin dimer attached to a viral antigenic determinant in the mucosal layer of the respiratory tract
E. More than one above

10. The hinge region of an IgG monomer is found on which of the following?

A. Constant region of gamma-type heavy chains
B. Variable region of gamma-type heavy chains
C. Intrachain disulfide bonding region of of mu-type heavy chains
D. Interchain disulfide bonding region of gamma-type light chains
E. Fc fragment of any type of immunoglobulin monomer

11. If a child is born with a deficiency in the ability to synthesize cellular myeloperoxidase, what resistance capacity would you expect to be reduced in that child?

A. Ability to carry out phagocytosis
B. Ability to synthesize MHC class II surface antigens
C. Ability to kill phagocytized bacteria
D. Ability to differentiate mature B cells
E. Ability to synthesize IL-2

12. Which of the following cells would not be expected to be carrying MHC class II antigens displayed on its surface?

A. B cell lymphocyte
B. Activated Th lymphocyte
C. Activated macrophage
D. Mature neutrophil
E. All of the cells above would have surface HLA class II antigens

13. Which of the following organs is classified as a primary organ of the immune response system?

A. Thymus
B. Spleen
C. Inguinal lymph node
D. Dendritic cell system of the skin
E. Head and neck lymph nodes

14. Which of the following situations would not be expected to produce tolerance to Antigen-1 (Ag-1)?

A. Contact with Ag-1 in high dosage during fetal development
B. Presence of clone of Ts CD8 cells specific for Ag-1
C. Lack of clone of Th CD4 cells specific for Ag-1
D. Presence of Ag-1 in a sequestered site in the fetus and postnatally
E. All of the above would be expected to produce tolerance to Ag-1

15 Which of the following cytokines plays a prominent role as an endogenous pyrogen?

A. IL-1
B. IF-
C. IL-4
D. IF-alpha
E. IL-2 receptor

16. If you wanted to develop an immunization that would protect against an airborne viral infection, you would want to make sure that the immunizing agent elicited the formation of:

A. IgM immunoglobulins
B. IgA immunoglobulins
C. IgG immunoglobulins
D. IgE immunoglobulins
E. Tc lymphocytes

17. Cytotoxic T cells have what marker on their surface and recognize their specific epitope on a target cell when it is displayed on the surface of a cell associated with which class of MHC antigen?

A. CD8; MHC I
B. CD4; MHC II
C. CD3; MHC II
D. CD1; MHC I
E. IL-2; MHC III

CD8 MHC I

18. Arrange the following events in the local inflammatory response reaction into the proper chronologic sequence:

a. Cellular exudation
b. Vascular dilation
c. Cellular phagocytosis
d. Cellular injury
e. WBC margination
f. Fibroblast infiltration

d, b, e, a, c, f

A. d, a, f, e, c, b
B. f, d, e, b, a, c
C. d, b, e, a, c, f
D. a, c, d, b, e, f
E. d, e, b, a, f, c

19. Arrange the following cells in the specific immune response reaction into the proper chronologic sequence of their involvement in the synthesis of specific IgG immunoglobulin synthesis.

a. Plasma cell
b. Th cell synthesis of cytokines
c. B cell with IgM/IgD specific for antigen on surface
d. Macrophage with antigen displayed on surface
e. Activated B cell with IgG specific for antigen on surface

A. a, e, b, c, d
B. d, e, c, a, b
C. c, e, d, b, a
D. d, b, c, e, a
E. b, e, b, a, c

20. Which of the following is not a mechanism that bacteria use to avoid phagocytic destruction by WBC's?

A. Production of hemolysin
B. Production of leucocidin
C. Production of capsule
D. Production of acid fast cell wall
E. Production of coagulase

21. Which of the following would you expect to find in a child who was diagnosed with Bruton's X-linked infantile agammaglobulinemia?

a. Monoclonal single high peak in serum protein profile on + pole side of origin
b. Lack of cells in germinal centers of cortex of lymph nodes
c. Small lymph nodes and tonsils small or absent
d. Inability to mount a cell-mediated immune response
e. Lack of lymphocytes in peripheral circulation
f. Missing peak in gamma globulin fraction of serum protein profile
g. Thymic aplasia or hypoplasia
h. Increased susceptibility to bacterial pyogenic infections and pneumonias
i. Increased susceptibility to fungal infections and latent viral infections

A. a, d, e, i
B. b, c, f, h
C. c, d, g, h
D. a, b, g, i
E. e, f, g, i

22. Which of the following conditions can be traced to the inability of the proper development of the pluripotent stem cell into the lymphoblastic cell line?

A. IgA dysgammaglobulinemia
B. Acute myeloblastic leukemia
D. Chronic granulomatous disease
E. SCID

23. Which of the following blood cells is a PMN leucocyte but is **not** phagocytic?

A. Neutrophil
B. Monocyte
C. Basophil
D. CD4 lymphocyte
E. NK cell

24. The condition of chronic mucocutaneous candidiasis can be traced to a deficiency in which of the following systems?

A. T-cell
B. B-cell
C. Complement
D. PMN cell
E. Macrophage

25. Finding which of the following in a boy suffering from repeated pyogenic skin infections would allow you to diagnose the condition as transient infantile hypogammaglobulinemia rather than X-linked infantile agammaglobulinemia?

A. CD4 lymphocytes in peripheral circulation
B. B-cells in peripheral circulation
C. Neutropenia
D. Increased levels of C4 complement fraction in serum
E. Lack of IgG in gamma globulin fraction

26. Which of the following would you **not** expect to be immunogenic?

a. Glycogen
b. Haptenic antigenic determinant
c. Human albumen taken from one individual and injected into another person
d. Lipid A of endotoxin
e. Bacterial capsular material composed of polymerized fructose

A. a, b, c
B. b, d
C. a, c, e
D. All of the above would be expected to be immunogenic
E. None of the above would be expected to be immunogenic

27. Which of the following sets of surface molecules allow a T-cell to recognize and interact with its antigenic determinant when presented to the T-cell on the MHC Class II marker of a macrophage? CD4, CD3.

A. TCR, CD4, CD3
B. IgM, CD4
C. TCR, CD8
D. CD4, IgD, HLA-D
E. CD4, IL-2 receptor

28. T-suppressor cells are derived from what lymphocytic cell line?

A. CD3
B. CD4
C. CD8
D. Macrophage
E. NK

29. Which of the following cytokines would be expected to be most active in signalling final B-cell differentiation into an immunoglobulin-producing cell?

A. IL-1
B. IF- alpha
C. IL-2 — proliferation
D. IL-3 and IF-gamma
E. IL-4, IL-5

30. The recognition and attack of a virally infected cell by a cytotoxic T cell is accomplished by the Tc cell recognizing the viral antigen displayed on the surface of the infected cell in association with what? MHCI

A. CD4 marker
B. HLA Class I marker
C. HLA Class II marker
D. CD8 marker
E. IL-2 receptor

31. Which of the following is an endogenous pyrogen and is responsible for signalling acute phase protein synthesis by the liver? IL-1

A. IL-1 — TNF
B. IL-2
C. IL-6
D. IF-beta
E. C3b Complement fragment

32. An immunogen is shown to elicit the production of only IgM and no memory cells. This immunogen would be classified as what type of immunogen?

A. Lipid antigen
B. Incomplete antigen
C. T-cell independent antigen
D. T-cell dependent antigen
E. Denatured antigen

33. Introduction of an adjuvant such as Freund's adjuvant along with a weakly immunogenic antigen would be expected to produce what result?

A. Increased immune response to the antigen
B. Increased immune response to the adjuvant
C. Activation of the Complement cascade
D. Initiation of a local inflammatory response at the site of introduction
E. Suppression of the immune response to the antigen

34. What immunoglobulin isotype would you expect to find in the highest concentration in the serum of a fetus at 37 weeks of gestation?

A IgA of fetal origin
B. IgD of fetal origin
C. IgG of maternal origin
D. IgM of maternal origin
E. IgG of fetal origin

35. Immunoglobulin isotype(s) capable of crossing the placenta into fetal circulation:

A. IgG, IgM
B. IgM
C. IgG
D. IgA, IgE
E. IgE

36. If in the determination of HLA-Class I tissue type of an individual, Complement is added to a well in which the individuals lymphocytes had been treated with the monoclonal antibody against HLA-B4 and the cells underwent lysis, what conclusion would be valid?

A. The only HLA-B antigen on his cells would be HLA-B4
B. He would have HLA-B4 as one of the Class I MHC antigens on his cells
C. HLA-B4 would be ruled out as a tissue type antigen on his cells
D. He would have ABO blood type B
E. No conclusion could be drawn as to his tissue type from this test

37. What are **superantigens** and what effects do they produce?

A. They are any antigenic epitope that is abnormally processed by an antigen processing cell and over-displayed on its surface; Class-switching to IgE
B. They are bacterial peptide toxins that bind to TCR's and directly activate T cells to release cytokines; Toxic shock syndrome
C. They are antigens inappropriately presented to T cells associated with MHC Class I markers that elicit cytotoxic T cell attack; Lysis of cells presenting superantigens
D. They are antigens that activate the Complement system without the involvement of an antigen-antibody reaction; DIC
E. They are the processed antigenic determinants displayed on the MHC- Class II markers on antigen presenting cells; Activation of a CD4 cell to produce plasma cell

38. Which of the following would be an example of natural passive acquired specific immunity?

A. Immunization with the diphtheria toxoid
B. Recovery from a childhood viral disease
C. Transplacental transfer of maternal immunoglobulins to the fetus
D. Injection of IF-alpha
E. Injection of pooled human gammaglobulins into an immunodeficient patient

39. Perforins are used by what type of cell to produce cell damage on target cells?

A. Tdth CD8 lymphocytes
B. Activated macrophages
C. IgE producing B cell lymphocytes
D. Mast cells with IgE bound to their surface
E. Tc CD8 lymphocytes

40. In which of the following conditions would it be inappropriate and even potentially dangerous to treat the patient with human immune globulin?

A. Transient infantile hypogammaglobulinemia
B. Bruton's X-linked infantile agammaglobulinemia
C. IgA dysgammaglobulinemia
D. IgG2 dysgammaglobulinemia
E. SCID

Identification Questions: Identify the information sought

41. Term used to describe degree of pathogenicity:

A. Viremia
B. Toxigenicity
C. Invasiveness
D. Virulence
E. Dosage

42. The surface markers present on the surface of a Td (Tdth) cell:

A. CD4, CD3, HLA-class I, HLA-class II
B. CD8, IL-2, HLA-class I
C. IgM, IgD, HLA- class I, HLA-class II
D. CD3, TCR, HLA-class I
E. CD8

43. The basis of immune deficiency associated with Bruton's X-linked agammaglobulinemia:

A. Lack of development of thymus
B. Lack of development of pluripotent stem cell
C. Lack of development of mature B cell lymphocytes
D. Lack of ability of B cell lymphocytes to carry out class switching
E. Lack of development of lymphocytic cell line

44. Structure of functional IgM immunoglobulin in serum:

A. Monomer on surface of mast cells
B. Dimer
C. Trimer
D. Pentamer
E. Not found in blood serum

45. Immunoglobulin isotype(s) capable of crossing the placenta into fetal circulation:

A. IgG, IgM
B. IgM
C. IgG
D. IgA, IgE
E. IgE

46. What is released into circulation from the activation of a B cell immune response reaction in a regional lymph node:

A. Immunoglobulins
B. Plasma cells
C. Tc CD8 lymphocytes
D. Immunoglobulins and NK cells
E. Th CD4 lymphocytes

47. Last stage in the course of an acute primary infection:

A. Incubation
B. Crisis
C. Prodromal
D. Resolution
E. Convalescent

48. The most common presenting symptom that would lead you to suspect an immunodefiency condition in a patient:

A. High neutrophil count in differential WBC count
B. Repeated recurrent infections
C. Low RBC count
D. Elevated ESR
E. Bence-Jones proteins in urine

49. Type of immunodeficiency involved in Ataxia -Telangectasia Syndrome:

A. Phagocytic cell
B. Complement
C. Stem cell
D. T cell
E. B cell

50. White blood cell normally found in highest numbers in peripheral circulation:

A. Neutrophil
B. Eosinophil
C. Basophil
D. Macrophage
E. Lymphocyte

Problem Questions: Answer the questions concerning the following clinical situation.

Problem 1

Ms Lowry is an 18-year-old street prostitute with a 5 year history of alcohol and cocaine abuse who becomes pregnant and delivers a 4lb 10oz male neonate at 32 weeks. At delivery the neonate is cyanotic and breathing is initiated with dificulty. An immediate assessment reveals facial anomalies of low-set ears and a "fish-shaped" mouth; cardiac abnormalities of a ventral septal defect is also noted. The child responds to delivery room procedures and "pinks up" and begins to breathe normally. The child is placed in an incubator unit in the NICU where he shows improvement of all vital functions and begins to breast-feed on the second day. On the third day develops muscle tetany and a seizure at which time the following laboratory results were obtained:

Hematology

RBC = 5.0 x 10^{12}/l

WBC= 5.4 x 10^{9}/l

Differential

Neutrophills- 88%

Eosinophils- 2%

Basophils- .5%

Monocytes- 4%

Lymphocytes- 5.5%

Hemoglobin= 15.0g/dl (16)

Blood glucose= 7.2mmol/l (10.0)

Na = 139mmol/l (134-145)

K = 4.2mmol/l (3.5- 5.0)

Cl = 97mmol/l (95- 105)

Creatinine = 87umol/l (70- 150)

Ca = 1.5mmol/l (2.12 - 2.65)

PO = 1.25mmol/l (0.8- 1.45)

Special Tests

Parathyroid hormone = 0.04ug/l (0.1 - 0.73)

Serum Protein Profile = Normal peaks

% T cell : B cell lymphocytes in peripheral circulation = 10%

51. The most likely diagnosis indicated in this child is:

A. Hemolytic anemia

B. SCID

C. Ataxia telangectasia

D. DiGeorge's syndrome

E. Monoclonal gammopathy

52. This child is at special risk for development of which of the following?

A. Acute pyogenic bacterial infections of the skin

B. Toxic effects of systemic infections with toxigenic bacteria

C. Systemic viral infections that spread to critical organs through the blood

D. Fungal infections of skin, lungs and GI tract

E. Severe hyperthermia caused by the release of endogenous pyrogens

53. Which of the following would also be most likely to be observed in this child?

A. Thymic aplasia or hypoplasia
B. Lack of cells in the follicles and germinal centers in lymphoid tissues
C. Increased response to antigenic challenge with a T-cell dependent antigen
D. Hypoplasia in paracortical medullary regions of regional lymph nodes
E. A and D above

Problem 2

In preparation for orthodonture you are going to have to do 4 dental extractions under general anaesthesia on a 15-year-old patient. You ask for a CBC and Differential prior to the oral surgery. When the results come back they are as follows:

WBC	-	47,000/mm^3
RBC	-	low
Platelets	-	low
Differential WBC		
Neutrophils	-	12%
Basophils	-	0 %
Eosinophils	-	1 %
Monocytes	-	1 %
Lymphocytes	-	86% with mostly atypical cells

54. What condition would you suspect in this patient?

A. Severe infection
B. Underlying autoimmune disease
C. Lymphoma
D. Lymphocyte leukemia
E. Multiple myeloma

55. Is it safe to proceed with your oral surgery?

A. Yes, as long as you provide prophylactic antibiotic therapy
B. Yes, as long as you provide antibiotic therapy to clear up the infection and then do the surgery
C. Yes, as long as you provide immunosuppressive therapy prior to and following the surgery and also provide prophylactic antibiotic therapy
D. No, you should wait until the infection is past and the WBC count returns to normal
E. No, you should cancel the elective surgery and refer the case immediately to an oncologist

Problem 3

What conclusions can be drawn from the following clinical data and test results?

56. A lymph node biopsy in a two-week-old infant demonstrates no cells in the follicular germinal centers in the cortex of the node with normal paracortical/medullary cell population.

    A. Leucopenia
    B. B-cell deficiency
    C. DiGeorge's syndrome
    D. SCID
    E. Multiple myeloma

57. 58-year-old patient with bone pain, hypercalcemia, proteinuria, thrombocytopenia, anemia, recurrent infections, and renal failure.

    A. Polyclonal gammopathy
    B. SLE
    C. Myelocytic leukemia
    D. IgA secretory deficiency
    E. Multiple myeloma

58. 16-year-old male with temperature of 101.6 F(oral), WBC = 13,400/mm , Elevated neutrophils with a shift-to-left, Elevated ESR, Positive for C-reactive protein in serum, and BP = 110/70

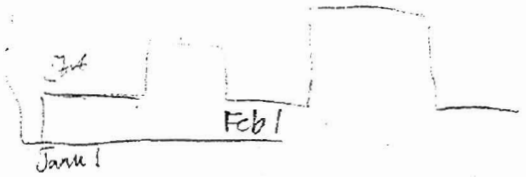
    A. Septic shock
    B. Ongoing inflammatory response of unknown cause
    C. Severe viremia
    D. Bacterial infection
    E. Probable myelocytic leukemia

59. A serum sample taken from a patient experiencing fever shows normal levels of C1 and C4, but significantly depleted levels of C3 and C5. What is indicated?

A. Autoimmune antibodies are lysing RBC
B. Developing DIC
C. Activation of the Alternate Complement pathway possibly triggered by gram negative sepsis
D. Complement deficiency in C1-inactivator in serum
E. Genetic deficiency in ability to synthesize MHC Class III proteins

60. Patient experiencing symptoms of severe nausea, vomiting, diarrhea, stomach cramps and abdominal pain for 24 hours, but vital signs including body temperature are all within normal limits. There is no elevated WBC or ESR. What is indicated?

A. Endotoxic sepsis
B. Enterotoxigenic exotoxin gastroenteritis
C. Neurotoxigenic exotoxin intoxication
D. Viremic sepsis
E. Loss of normal GI floral bacterial antagonism



Problem 4

On January 1, a 20 month old child, JEB, developed symptoms that appeared to be those of Influenza A viral respiratory infection; blood was drawn from JEB on January 2 and an anti-influenza A antibody titer in serum was shown to be 0. After seven days of symptoms the child improved without therapy. A second serum sample taken on January 15, showed a positive anti-influenza A antibody titer of 40. On February 1, JEB developed another respiratory tract infection and a third serum sample taken at that time showed a positive anti-influenza A antibody titer of 80. On Feb. 1, a sputum sample was also shown to be positive for anti-influenza A antibody as well. The child recovered from the second respiratory trat infection in 8 days without complications.On February 10, an anti-influenza A antibody serum titer of 70 was obtained. The child had no influenza immunization during the period.

61. Which of the following is the most appropriate interpretation of these findings?

A. The child was ill with Influenza A viral infection on January 1
B. The January 1 infection was not caused by Influenza A
C. The February 1 infection was caused by Influenza A
D. The child has an obvious immune deficiency evidenced by the second respiratory tract infection
E. B and C above

62. The posititive anti-influenza A antibody test in the sputum would be the result of which of the following?

A. Interferon-alpha in the sputum
B. Presence of maternal immunoglobulins transferred in mother's breast milk
C. The secondary immune response reaction
D. IgA immunoglobulins
E. IgE immunoglobulins

63. Which of the following conclusions is also indicated by these findings?

A. The February 1 infection was not caused by Influenza A
B. The rise in anti-influenza A antibody titer recorded on February 1 was the result of a secondary immune response reaction
C. The slight reduction in anti-influenza A antibody titer recorded on February 10 demonstrated that the antibody was binding the virus in the serum
D. The positive antibody activity seen in the child's serum indicates that he is capable of production of all classes of immunoglobulins against the influenza virus
E. The prinipal immunoglobulin class providing serum antibody activity in the February 1 serum sample would be IgM