

Microbiology Sample Items

1. A 45-year-old woman comes to the physician because of progressive facial swelling and pain during the past week. She has a 10-year history of poorly controlled type 1 diabetes mellitus. Physical examination shows ecchymoses over the left orbital and periorbital regions with proptosis. There is a necrotic lesion with a black eschar in the left naris. Findings on microscopic examination of material from the lesion include broad, irregularly shaped, nonseptate hyphae with branches at right angles. Which of the following is the most likely cause of the nasal lesion?

 - (A) *Histoplasma capsulatum*
 - (B) *Rhizopus oryzae*
 - (C) *Sporothrix schenckii*
 - (D) *Torulopsis glabrata*
 - (E) *Trichophyton rubrum*
2. A 21-year-old woman who is a college student is brought to the emergency department 2 hours after the onset of fever, chills, severe headache, and confusion. Her temperature is 39°C (102.2°F), respirations are 16/min, and blood pressure is 100/60 mm Hg. Physical examination shows numerous petechial lesions over the upper and lower extremities. There is resistance to neck flexion. Analysis of cerebrospinal fluid shows numerous leukocytes and gram-negative diplococci. Administration of which of the following vaccines is most likely to have prevented this patient's condition?

 - (A) *Haemophilus influenzae* type b vaccine
 - (B) Meningococcal conjugate vaccine, 4-valent
 - (C) Pneumococcal conjugate vaccine, 7-valent
 - (D) Pneumococcal polysaccharide vaccine, 23-valent
 - (E) Varicella vaccine
3. A sexually active 37-year-old woman comes to the physician because of a 2-day history of pain in the area of her genitals. Pelvic examination shows shallow, small, extremely tender ulcers with red bases in the vulvar and vaginal regions. A Tzanck smear shows the presence of multinucleated giant cells. Which of the following infectious agents is the most likely cause of these findings?

 - (A) *Candida albicans*
 - (B) *Chlamydia trachomatis*
 - (C) Herpes simplex virus
 - (D) *Treponema pallidum*
 - (E) *Trichomonas vaginalis*
4. During an experimental study, an investigator develops a new member of the class of non-nucleoside reverse transcriptase inhibitors. This new drug most likely inhibits HIV infection through which of the following mechanisms?

 - (A) Binding to reverse transcriptase
 - (B) Binding to RNase H
 - (C) Blockade of integration
 - (D) Incorporation into viral DNA
 - (E) Phosphorylation of nucleoside triphosphates
5. A 35-year-old woman delivers a newborn who develops meningitis. The mother has a streptococcus isolated from her vagina. The organism agglutinates with antiserum directed against type B surface carbohydrate. The virulence of this organism is related to a bacterial constituent that interferes with which of the following host phagocyte functions?

 - (A) Aggregation
 - (B) Chemotaxis
 - (C) Ingestion
 - (D) Intracellular killing
 - (E) Pseudopod formation

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6. A 33-year-old woman contracts malaria while on a 3-month business trip to a Central American country. She is treated with a full course of chloroquine and recovers uneventfully. Four months after returning to the USA, she has another febrile illness that resembles malaria. A peripheral blood smear shows ring forms in her erythrocytes. Which of the following species of *Plasmodium* is most likely to have caused the second febrile illness?
- (A) *P. falciparum*
 - (B) *P. knowlesi*
 - (C) *P. malariae*
 - (D) *P. vivax*
7. Three weeks after traveling to California to study desert flowers, a 33-year-old man develops fever, chest pain, and muscle soreness. Two days later, red, tender nodules appear on the shins, and the right ankle is tender and painful. An x-ray of the chest shows a left pleural effusion. Which of the following is the most likely diagnosis?
- (A) Blastomycosis
 - (B) Coccidioidomycosis
 - (C) Histoplasmosis
 - (D) *Mycobacterium marinum* infection
 - (E) *Mycoplasma pneumoniae* infection
8. At a banquet, the menu includes fried chicken, home-fried potatoes, peas, chocolate eclairs, and coffee. Within 2 hours, most of the diners become violently ill, with nausea, vomiting, abdominal pain, and diarrhea. Analysis of the contaminated food is most likely to yield large numbers of which of the following organisms?
- (A) *Enterococcus faecalis*
 - (B) *Escherichia coli*
 - (C) *Proteus mirabilis*
 - (D) *Salmonella typhimurium*
 - (E) *Staphylococcus aureus*
9. A 35-year-old woman is admitted to the hospital because of fever and dry cough for 3 days. An x-ray of the chest shows abnormal findings. Laboratory tests show cold agglutinating antibodies in serum. Results of routine cultures of blood and sputum are negative. Which of the following is the most likely pathogen?
- (A) Influenza virus
 - (B) *Mycobacterium tuberculosis*
 - (C) *Mycoplasma pneumoniae*
 - (D) *Staphylococcus aureus*
 - (E) *Streptococcus pneumoniae*
10. A mutation that causes the loss of the 3', 5' exonuclease activity of DNA-dependent DNA polymerase is most likely to also cause *Escherichia coli* to have problems with which cellular process?
- (A) Replacing misincorporated bases
 - (B) Segregating sister chromosomes
 - (C) Supercoiling of DNA
 - (D) Synthesizing an RNA primer
 - (E) Transferring DNA strands during conjugation

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11. A 69-year-old woman comes to the emergency department because of a 2-day history of increasingly severe fever and back pain; she also has a burning sensation with urination, and there is an aromatic smell to the urine. She has had three urinary tract infections treated with ciprofloxacin during the past year. Her temperature is 39.1°C (102.3°F). Physical examination shows right flank tenderness. Laboratory studies show:

Leukocyte count	15,500/mm ³
Urine	
pH	9
Protein	trace
WBC	numerous
Bacteria	>100,000 colonies/mL

- A urine culture grows a urease-positive organism that displays swarming motility on nonselective agar. Which of the following is the most likely causal organism?
- (A) *Enterococcus faecalis*
 - (B) *Escherichia coli*
 - (C) *Klebsiella pneumoniae*
 - (D) *Proteus mirabilis*
 - (E) *Staphylococcus saprophyticus*
12. During an experiment, an investigator gently abrades the skin from the flank of a mouse, creating a 1 × 2-cm skin window. A glass coverslip is then placed over the area so that cells attracted to the site attach to the coverslip for assessment. Two hours later, an extravasation of cells from the vasculature is noted on the coverslip. Which of the following complement components is the direct cause of the enhanced vascular permeability and chemoattraction in the abraded skin area in this experiment?
- (A) C1q
 - (B) C4b
 - (C) C5a
 - (D) C7
 - (E) C9
13. A 35-year-old man comes to the physician for a follow-up examination. He has had persistent left upper quadrant abdominal pain for 3 weeks despite therapy with omeprazole. Upper esophagogastroduodenoscopy shows an active duodenal ulcer. Tests of gastric and duodenal biopsy specimens for urease are positive. Which of the following is the most likely causal organism?
- (A) *Campylobacter jejuni*
 - (B) *Clostridium difficile*
 - (C) *Helicobacter pylori*
 - (D) *Proteus vulgaris*
 - (E) *Salmonella typhi*
14. A 2-year-old boy is diagnosed with staphylococcal scalded skin syndrome. In vitro studies show the causal organism to be resistant to penicillin. Which of the following mechanisms of action is most likely involved in this resistance?
- (A) Active efflux of the antibiotic from the bacteria
 - (B) Decreased uptake of the antibiotic into the bacteria
 - (C) Mutation of the 30S ribosomal subunit
 - (D) Mutation of the 50S ribosomal subunit
 - (E) Production of β-lactamase by the bacteria

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15. A 3-year-old girl is brought to the emergency department by her father because of a persistent cough for 2 weeks. She sometimes vomits following a paroxysm of coughing. While she is not coughing, she appears well. She has not yet received any routine childhood vaccinations. Her temperature is 37°C (98.6°F). Physical examination shows petechiae over the sclera and face. Which of the following is the most likely diagnosis?
- (A) Diphtheria
 - (B) Influenza
 - (C) Pertussis
 - (D) Plague
 - (E) Tularemia
16. An investigator injects an experimental animal with a newly discovered bacterial strain to evaluate T-lymphocyte activation. It is found that bacterial engulfment by macrophages results in the presentation of bacterial-derived peptide ligands to CD4+ T lymphocytes. Which of the following cell-surface molecules on the macrophage is most directly involved in the presentation of the processed peptides?
- (A) CD28
 - (B) Class II MHC
 - (C) Fcε receptor
 - (D) Interleukin-2 (IL-2) receptor
 - (E) Membrane immunoglobulin
17. An investigator conducts an experiment on *Clostridium perfringens* and then sterilizes the culture dishes by autoclaving. This method of sterilization is most appropriate because it ensures that which of the following bacterial structures are inactivated?
- (A) Adhesion factors
 - (B) Endotoxins
 - (C) Fimbriae
 - (D) Pili
 - (E) Spores
18. A 52-year-old woman living in Maryland comes to the physician because of a 1-week history of low-grade fever, fatigue, and a red rash over the skin behind her left knee. She is an avid hiker. Her temperature is 38°C (100.4°F). Physical examination shows an 8-cm, warm, nontender, erythematous lesion with partial central clearing over the skin of the left popliteal area. Which of the following is the most likely causal organism?
- (A) *Borrelia burgdorferi*
 - (B) *Ehrlichia chaffeensis*
 - (C) *Francisella tularensis*
 - (D) *Rickettsia rickettsii*
 - (E) *Streptobacillus moniliformis*
19. An 8-month-old girl is brought to the emergency department because of a 1-day history of rapid breathing. Her temperature is 38.4°C (101.1°F), pulse is 160/min, respirations are 60/min, and blood pressure is 100/68 mm Hg. Bilateral expiratory wheezing and crackles are heard on auscultation. A chest x-ray shows areas of atelectasis and hyperinflation. Which of the following is the most likely causal virus?
- (A) Measles virus
 - (B) Respiratory syncytial virus
 - (C) Rhinovirus
 - (D) Rotavirus
 - (E) Varicella-zoster virus

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20. A 45-year-old man comes to the physician because of fever and night sweats for 8 days. He has Crohn disease treated with infliximab. His temperature is 39°C (102.2°F). Physical examination shows diffuse cervical lymphadenopathy. A biopsy specimen of the nodes shows caseating granulomas. No organisms are identified on Gram stain. Which of the following is the most likely causal organism?
- (A) *Aspergillus niger*
 - (B) *Brucella abortus*
 - (C) *Francisella tularensis*
 - (D) *Mycobacterium tuberculosis*
 - (E) *Treponema pallidum*

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Answer Form for Microbiology Sample Questions

(Questions 1–20)

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Answer Key for Microbiology Sample

Questions (Questions 1–20)

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| 1. | B | 11. | D |
| 2. | B | 12. | C |
| 3. | C | 13. | C |
| 4. | A | 14. | E |
| 5. | C | 15. | C |
| 6. | D | 16. | B |
| 7. | B | 17. | E |
| 8. | E | 18. | A |
| 9. | C | 19. | B |
| 10. | A | 20. | D |