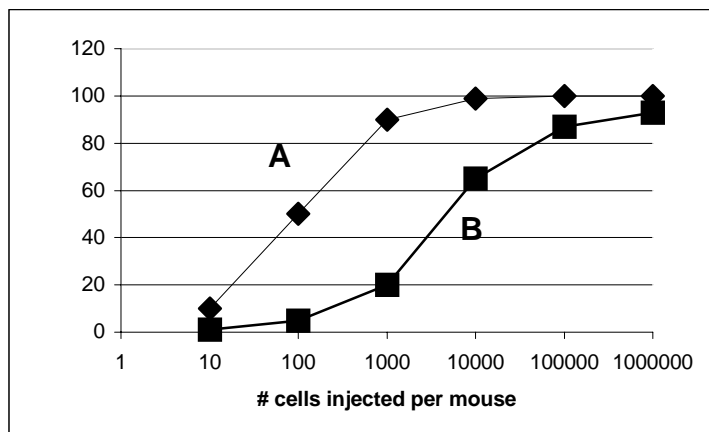


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1. Which of the following regions of the gastrointestinal tract has the largest population of bacteria?
  - a. stomach
  - b. ileum
  - c. colon
  - d. duodenum
  - e. jejunum
  
2. The pathological state in which a large number of bacteria invade the bloodstream is known as \_\_\_\_\_?
  - a. hemolysin
  - b. bacteremia
  - c. flatus
  - d. siderophore
  - e. nosocomial infection
  
3. Which is the correct lineage for a macrophage?
  - a. stem cell → myeloid precursor → mast cell → macrophage
  - b. stem cell → myeloid precursor → monocyte → macrophage
  - c. stem cell → lymphoid precursor → mast cell → macrophage
  - d. stem cell → lymphoid precursor → monocyte → macrophage
  - e. stem cell → monocyte → mast cell → macrophage
  
4. A term to describe the disease incidence that occurs simultaneously at very high frequency throughout the world is called:
  - a. compromised
  - b. endemic
  - c. epidemic
  - d. pandemic
  - e. pedantic
  
5. A phagolysosome is a:
  - a. name for a type of B cell
  - b. name for a type of T cell
  - c. name for a type of C cell
  - d. vacuole secreted by host cells that acts as a filter to entrap a bacterial pathogen
  - e. fusion of a lysosome with a “phagosome” vesicle derived from phagocytosis (engulfment of the infecting bacterium).

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6. Which of the following steps is NOT associated with immunological memory?
- Upon initial exposure to a foreign substance, a host's phagocytes digest the substance into pieces termed antigens.
  - These antigens are presented to T cells, and a subset of T cells stimulates a subset of B cells to produce antibodies that bind specifically to the antigen.
  - The host uses the antibodies to find, destroy and/or remove the foreign substance from the body.
  - Subsequent exposure of the host to this foreign substance (even years later) stimulates production of large quantities of a highly specific protease that rapidly degrades the antigen recognized earlier.
  - Repeat exposure to the foreign substance stimulates clonal growth of the B cells and produces a burst of antibodies specific to that substance.
7. The leading cause of "Strep (sore) throat" is:
- Streptococcus mutans*
  - Streptococcus faecalis*
  - Streptococcus aureus*
  - Streptococcus lactis*
  - Streptococcus pyogenes*
8. Which of the following traits is not associated with gnotobiotic animals?
- They have elevated blood serum antibody titers responsible for maintenance of germ-free conditions.
  - Their lymphatic tissue is under-developed.
  - They have abnormally thin and under-developed intestinal walls.
  - They are highly susceptible to infection by pathogens.
  - They typically exhibit no dental caries.
9. Two types of microorganisms were isolated from emergency room samples. Cultures of these microorganisms were grown, serially diluted, and carefully enumerated. Known numbers of each strain were injected into several mice and the percentage of mice killed by each inoculated combination (microbe type and number) was determined. On the basis of information provided in the figure shown below (strain A = diamonds, strain B = squares), which statement is valid?



- Strain A must produce an exotoxin.
- Strain B has undergone attenuation.
- Both strains produce a leukocidin.
- Strain A is more virulent than strain B.
- Strain A is more invasive than strain B.

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10. Which statement is true about botulinum toxin (a substance produced by *Clostridium botulinum*, associated with inadequately processed canned foods, used in Botox treatment to remove skin wrinkles, and a candidate bioterrorism agent)?
- It causes flaccid paralysis (due to the non-release of acetylcholine) even in the absence of bacterial infection of the host.
  - It leads to massive water and electrolyte loss (diarrhea) due to stimulation of adenylate cyclase.
  - Interrupts translation by blocking the tRNA from entering the ribosome due to chemical modification of an elongation factor.
  - It breaks down the polysaccharide that glues cells together.
  - It inactivates macrophages and thus prevents phagocytosis.
11. Which of the following statements about *Neisseria gonorrhoeae* is false?
- This Gram-positive rod typically grows in chains.
  - The cells can infect mucous membranes of the genitourinary tract, eye, rectum, and throat.
  - The microorganism is very sensitive to drying and ultraviolet light.
  - Transmission occurs by direct person-to-person contact.
  - Penicillin-resistant strains are widespread.
12. Which statement is true of *Borrelia burgdorferi*?
- This microorganism is responsible for syphilis.
  - This virus causes hemorrhagic fever.
  - The disease associated with this tick-borne bacterium was first identified in Old Lyme, CT.
  - This is the only fungus likely to be used in germ warfare.
  - This microbe is often associated with a disease caused by consumption of contaminated hamburger.
13. Which of the following is not a cytokine or chemokine?
- interleukin-2 (IL-2)
  - interferon-alpha (IFN- $\alpha$ )
  - tumor necrosis factor (TNF)
  - white blood cell deactivator-4-0 (WD40)
  - granulocyte, monocyte-colony stimulating factor (GM-CSF)
14. What effect does viral infection have on a host eukaryotic cell?
- The cell may lyse as it releases progeny virions.
  - The cell may release virions without being lysed, leading to a persistent infection.
  - The cell may grow and divide with the infecting virus, so daughter cells also contain the virus.
  - The cell may be “transformed” into a tumor cell.
  - Each of these possibilities may occur, depending on the type of virus.

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15. Herpes type 2 is a virus that infects humans and causes:

- a. measles
- b. genital lesions and blisters of the penis, cervix, vulva, and vagina
- c. a liver disease called hepatitis and characterized by jaundice, fatigue, and abdominal pain
- d. AIDS, acquired immunodeficiency syndrome
- e. Viral gastroenteritis

16. Viruses causing viral hemorrhagic fever include:

- a. HIV and Marburg virus
- b. Smallpox virus and rhinovirus
- c. Marburg virus and Ebola virus
- d. West Nile virus and Hanta virus
- e. Herpes and chickenpox

17. Which of the following statements is NOT true regarding smallpox virus?

- a. The disease caused by this virus infects only humans
- b. This virus can cause pneumonic plague, bubonic plague, or septicemic plague
- c. Fatality rates associated with smallpox are about 30%
- d. The name "smallpox" is derived from the characteristic pustules formed on the skin after infection
- e. No natural cases of the disease caused by this virus have occurred since before 1980.

18. The April 13, 2003, issue of the Lansing State Journal carried a story reporting that 3.4 million birds in Southern California have been killed by the USDA and the State Department of Public Health since September, 2002. This drastic action was deemed necessary to stop the spread of Newcastle Disease, a deadly avian (bird) disease that threatens the \$3 billion/annum poultry industry of that state. According to the terms described in class, this type of epidemiological action can be described as:

- a. quarantine
- b. herd immunity
- c. reservoir control
- d. vaccination
- e. zoonoses

19. An example of commensalism involving microorganisms would be:

- A. the predation of bacteria by protozoans or phagocytic leucocytes
- B. the unidirectional benefit of certain microbes in the normal human gut.
- C. the production of an antibiotic by an actinomycete that would increase its competitiveness for a limiting nutrient
- D. the non-obligatory bi-directional benefit of co-metabolism by 2 dissimilar microorganisms
- E. The cyanobacteria-fungus lichen symbiosis

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20. Despite the fact that sandy soils are typically aerated and well-drained, endproducts of microbial anaerobic metabolism (e.g., H<sub>2</sub>S, CH<sub>4</sub>) can be detected in these soils because:
- A. they are very high in soil organic matter content
  - B. their pores remain waterlogged after a rainfall
  - C. they contain soil aggregates that are restricted in radial O<sub>2</sub> diffusion and anoxic microenvironments that will support anaerobic catabolism
  - D. O<sub>2</sub> diffusion is 10<sup>4</sup>-fold faster in gas than through water
  - E. protozoans digest engulfed bacteria thereby increase the mineralization of organic carbon compounds
21. In the *Rhizobium*-legume symbiosis,
- A. symbiont recognition and bacterial attachment to host root hairs are mediated by the combination of host lectin and rhicadhesin, respectively.
  - B. the bacteria and plant host conduct 2-way cell-cell communication by producing and perceiving flavonoids and chitolipooligosaccharides
  - C. the bacteria within the root nodule undergo a remarkable transformation from a normal sized vegetative cell into an enlarged, pleomorphic bacteroid
  - D. the bacteroid symbiont uses plant photosynthates to produce ATP via oxidative phosphorylation, electrons to reduce N<sub>2</sub>, and carbon skeletons to assimilate some of the NH<sub>3</sub> product.
  - E. All of the above are correct.
22. Crown gall tumors are induced in plants by
- A. transfer and incorporation of the T-DNA portion of the Ti-plasmid from the wound-infecting *Agrobacterium tumefaciens* into the host plant's genome.
  - B. B. endomycorrhizal fungi
  - C. many plant growth-promoting rhizobacteria
  - D. Rhizobial inoculants for legumes
  - E. All of the above are correct.
23. Environmental factors affecting the distribution and activities of aquatic microbial communities include:
- A. concentration, mixing and movements of nutrients
  - B. dissolved O<sub>2</sub> content
  - C. accumulation of toxic waste product(s)
  - D. penetration of photosynthetically active wavelengths of light
  - E. all of the above affect the distribution and activities of aquatic microbial communities.

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24. True marine heterotrophic microorganisms are adapted to tolerate which environmental stresses:
- A. desiccation, radiation, and low nutrient concentrations
  - B. salinity, high barometric pressure, low temperatures, and competition for nutrients present in low concentrations
  - C. top predators, antibiotics, and toxic levels of  $\text{H}_2\text{S}$
  - D. discharge of domestic, untreated sewage
  - E. All of the above are correct.
25. The activated sludge process in the domestic sewage treatment plant
- A. is an example of secondary treatment because it relies on a microbiological process to oxidize the organic carbon compounds in sewage
  - B. involves the microbial formation of activated sludge, flocs or zooglea
  - C. is maintained under aerobic conditions by forced aeration to accelerate the microbial decomposition process
  - D. produces oxidized inorganic compounds and microbial biomass, some of which is recycled as inoculum to maintain the process
  - E. all of the above are correct.
26. Which of the following are important criteria used to select an indicator microorganism as an index of fecal pollution?
- A. It must ferment lactose with the production of gas at  $44.5^\circ\text{C}$
  - B. It must be killed by the chlorination step in secondary treatment of domestic sewage.
  - C. The methods to detect and enumerate the organism should yield results within 4 days.
  - D. Its normal habitat should be the gut of warm-blooded animals, it should be present whenever enteric pathogens are present, and it should survive longer than the hardiest enteric pathogen
  - E. It must be able to grow in foods consumed by humans.
27. In the biogeochemical N cycle, the microbial oxidation of  $\text{NH}_3$  into  $\text{NO}_2^-$  is called:
- A. nitrogen fixation
  - B. ammonia assimilation
  - C. nitrosification
  - D. denitrification
  - E. assimilatory  $\text{NO}_3^-$  reduction
28. Assimilatory sulfate reduction is a process of the biogeochemical S cycle carried out by:
- A. only anaerobic sulfate-reducing bacteria like *Desulfovibrio*
  - B. all microorganisms that can use  $\text{SO}_4^{2-}$  as a sole S source for nutrition, regardless of whether they are aerobic or anaerobic bacteria
  - C. only aerobic bacteria
  - D. all microorganisms that can use  $\text{H}_2\text{S}$  as a sole S source for nutrition
  - E. All of the above are correct.

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29. Microbial abundance in rhizosphere soil can be measured by what methods of microbial ecology:
- A. direct microscopy combined with computer-assisted image analysis
  - B. measurement of cell constituents, e.g., ATP, muramic acid
  - C. viable enumeration techniques, e.g., plating, MPN
  - D. quantitative PCR of certain DNA/RNA sequences using phylogenetic probes
  - E. all of the above are correct.
30. What would ultimately happen to the biosphere if microbiologically mediated methane oxidation would cease to exist?
- A. Since all biogeochemical cycles are stable, homeostasis would continue to prevail.
  - B. CO<sub>2</sub> would accumulate to a level in which its greenhouse effect would heat and kill all life
  - C. CH<sub>4</sub> would accumulate and corresponding CO<sub>2</sub> levels would decline, significantly diminishing photoautotrophic primary productivity needed to sustain life on Earth as we know it
  - D. Nitrogen fixing bacteria would rise in dominance to become the most abundant group of microorganisms within the biosphere
  - E. None of the above consequences would happen.
31. Describe the two competing fates of CO<sub>2</sub> and H<sub>2</sub> produced microbiologically within the termite gut .
- A. These compounds participate in cellulose depolymerization or methanogenesis
  - B. These molecules are used to produce acetate or propionate, which are the volatile fatty acids that termites can utilize for carbon nutrition
  - C. These chemicals facilitate formation of the endosymbiosis between spirochetes and flagellated protozoa or they are used in gluconeogenesis from acetate
  - D. These gases are used for methanogenesis or acetogenesis
  - E. Two of the above answers are correct.
32. Ruminants, e.g. cows, sheep, goats, depend on which microorganisms to degrade the plant cellulose that they ingest so it can be further metabolized into carbon sources that the animal can assimilate?
- A. anaerobic cellulose-degrading bacteria and protozoa
  - B. anaerobic nitrogen-fixing bacteria like *Clostridium perfringens* and free-living spirochetes
  - C. anaerobic protozoa and their methanoarchaea endosymbionts
  - D. anaerobic bacteria and archaea that produce acetate, propionate, and butyrate
  - E. None of the above are correct.
33. Recent studies have found a new, agriculturally important ecological niche for *Rhizobium*, namely:
- A. its ability to form an intimate association with fungi resulting in a lichen symbiosis
  - B. its natural endophytic association with roots of major cereals, e.g. rice, with the production of phytohormones that stimulate root growth thereby enhancing plant nutrient uptake
  - C. its ability to induce nitrogen-fixing root nodules on legumes of agricultural importance
  - D. its association with mycorrhizae resulting in biological control of root-infecting fungal pathogens
  - E. its production of siderophores that enhance the uptake of iron into the plant.