Lippincott Microbiology Practice Exam (Sample)

Study Guide

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Questions

1. What unique feature is associated with chlamydiae?

A. Requirement of an obligate intracellular habitat.

B. Replicative cycle has two morphologic forms in cytoplasmic vacuoles.

C. Passenger lack of detectable peptidoglycan.

D. All of the above.

2. What is one characteristic of Nocardia infections?

A. They are transmitted via respiratory droplets.

B. They are often initiated by trauma.

C. They can be treated with penicillin.

D. They are prokaryotic but not filamentous.

3. Which technique is used to determine antibiotic resistance in bacteria?

A. Polymerase chain reaction

B. Western blotting

C. Antimicrobial susceptibility testing

D. ELISA

4. When does the initial infection with human cytomegalovirus most commonly occur?

A. During early childhood, by exchange of body fluids

B. In utero, by transplacental transmission from an infected mother

C. By transfer of saliva between young adults

D. By sexual intercourse

5. Which statement regarding Actinomyces and Nocardia is accurate?

A. Both organisms are prokaryotes.

B. Neither can be cultured in the laboratory.

C. Nocardia infections are often initiated by trauma.

D. Neither is sensitive to antibacterial drugs.

6. How is viral replication different from bacterial replication?

A. Viruses can replicate independently in any environment

B. Bacteria do not require energy for replication

C. Viruses must enter a host cell to replicate

D. Bacterial replication occurs through binary fission only

7. What unique growth characteristic does Listeria monocytogenes possess?

A. It is catalase negative

B. It can grow at refrigerator temperatures

C. It is strictly a human pathogen

D. It is a gram-negative coccus

8. What is the phenomenon called when a subtype of influenza replaces another, as seen with H1N1 and H2N2?

A. Viral interference.

B. Phenotypic mixing.

C. Antigenic shift.

D. Antigenic drift.

9. Which of the following diseases is caused by a virus?

A. Coronary artery disease

B. Tuberculosis

C. Influenza

D. Strep throat

10. How do antibiotics like penicillin function in bacterial cells?

A. By disrupting protein synthesis

B. By inhibiting DNA replication

C. By inhibiting the synthesis of bacterial cell walls

D. By increasing cell membrane permeability

Answers

1. B
2. B
3. C
4. B
5. A
6. C
7. B
8. C
9. C
10. C

Explanations

1. What unique feature is associated with chlamydiae?

A. Requirement of an obligate intracellular habitat.

B. Replicative cycle has two morphologic forms in cytoplasmic vacuoles.

C. Passenger lack of detectable peptidoglycan.

D. All of the above.

Chlamydiae are indeed unique microorganisms with several distinctive features, one of which is their replicative cycle that involves two morphologic forms: the infectious element called the elementary body (EB) and the replicative form known as the reticulate body (RB). The elementary body is responsible for the initial infection of host cells, while the reticulate body is metabolically active and divides within the cytoplasmic vacuoles of the host cell. This biphasic life cycle is essential for their pathogenesis and survival, allowing them to adapt to the intracellular environment effectively. The other features mentioned, such as the requirement for an obligate intracellular habitat and the lack of detectable peptidoglycan, are indeed associated with chlamydiae as well. However, the distinguishing aspect of their biology lies in the unique replicative cycle with its specific morphologic forms. Understanding these features is crucial for recognizing the characteristics and the clinical implications of chlamydial infections, which can be significant in various disease processes.

2. What is one characteristic of Nocardia infections?

A. They are transmitted via respiratory droplets.

B. They are often initiated by trauma.

C. They can be treated with penicillin.

D. They are prokaryotic but not filamentous.

Nocardia infections are primarily associated with the ability of the bacteria to enter the body through breaks in the skin or through pre-existing conditions that allow for opportunistic infections. Trauma plays a significant role as these bacteria can be introduced into the body through open wounds, surgical sites, or other forms of skin damage. This capability to establish an infection at the site of entry emphasizes the importance of understanding the routes of transmission and infection risk associated with Nocardia. While Nocardia can also be acquired through inhalation, especially in immunocompromised individuals or those with underlying lung issues, the characteristic that often highlights how the infection starts is indeed related to trauma. This facet makes it crucial to recognize Nocardia's unique transmission and infection patterns in clinical microbiology, highlighting its behaviors compared to other common pathogens. The other options, while they may have some relation to general microbial characteristics or other types of infections, do not accurately represent the distinctive behaviors or treatment guidelines associated with Nocardia. For instance, they cannot be treated with penicillin, as they are resistant and typically require alternative antibiotic treatments like sulfonamides or tetracyclines. This understanding of Nocardia's behavior and treatment is essential for proper management of infections caused by this

3. Which technique is used to determine antibiotic resistance in bacteria?

A. Polymerase chain reaction

B. Western blotting

C. Antimicrobial susceptibility testing

D. ELISA

The technique used to determine antibiotic resistance in bacteria is antimicrobial susceptibility testing. This method assesses the effectiveness of various antibiotics against specific bacterial strains by exposing the bacteria to different concentrations of antibiotics and observing their growth. The results indicate whether the bacteria are susceptible or resistant to each antibiotic tested. Antimicrobial susceptibility testing is essential for guiding appropriate treatment options, enabling healthcare professionals to select the most effective antibiotics for infections caused by resistant bacteria. This testing can be performed using methodologies such as disk diffusion, broth dilution, or automated systems that provide detailed susceptibility profiles for specific pathogens. Each approach aims to determine the minimum inhibitory concentration (MIC) for effective treatment. In contrast, other techniques mentioned are not primarily focused on antibiotic resistance assessment. Polymerase chain reaction is a molecular biology technique used to amplify DNA sequences but does not directly test bacterial susceptibility to antibiotics. Western blotting is primarily utilized for protein detection and analysis rather than antibiotic resistance. ELISA (enzyme-linked immunosorbent assay) is a technique used to detect and quantify proteins, antibodies, or hormones, which is unrelated to testing antibiotic susceptibility in bacteria.

4. When does the initial infection with human cytomegalovirus most commonly occur?

A. During early childhood, by exchange of body fluids

B. In utero, by transplacental transmission from an infected mother

C. By transfer of saliva between young adults

D. By sexual intercourse

The initial infection with human cytomegalovirus (HCMV) most commonly occurs in utero, through transplacental transmission from an infected mother. This means that the virus can be transmitted to the fetus during pregnancy, which is a significant mode of infection. Congenital infection can lead to serious complications in the newborn, including hearing loss, vision problems, and developmental disabilities. HCMV is known for its ability to remain latent after the primary infection and can reactivate later, but the most critical concern is the impact of acquiring the virus during pregnancy. Understanding this mode of transmission is key in public health, especially in developing strategies to prevent congenital infections. While other modes of transmission such as through body fluids, saliva, or sexual intercourse also play a role in the spread of HCMV in the population, they are not the primary concern when referencing initial infections leading to congenital transmission. Thus, recognizing that transplacental transfer is the primary route for initial infection highlights the unique risks posed during pregnancy.

5. Which statement regarding Actinomyces and Nocardia is accurate?

A. Both organisms are prokaryotes.

B. Neither can be cultured in the laboratory.

C. Nocardia infections are often initiated by trauma.

D. Neither is sensitive to antibacterial drugs.

Both Actinomyces and Nocardia are indeed prokaryotes. This classification is significant in microbiology, as prokaryotes are single-celled organisms that lack a membrane-bound nucleus and other membrane-bound organelles. They belong to the domain Bacteria, with Actinomyces being a type of anaerobic bacterium typically found in the human mouth and gastrointestinal tract, while Nocardia is a genus of aerobic bacteria often found in soil. The other statements present inaccuracies. Culturing both Actinomyces and Nocardia in the laboratory is possible, although they may require specific growth conditions. Nocardia infections commonly occur after trauma or in immunocompromised hosts, making the statement about trauma-based initiation contextually relevant. Lastly, contrary to the assertion that neither is sensitive to antibacterial drugs, many strains of both organisms respond to specific antibiotics. Thus, the classification of both as prokaryotes is indeed the accurate statement in this context.

6. How is viral replication different from bacterial replication?

A. Viruses can replicate independently in any environment

B. Bacteria do not require energy for replication

C. Viruses must enter a host cell to replicate

D. Bacterial replication occurs through binary fission only

Viral replication is fundamentally different from bacterial replication in that viruses must enter a host cell to replicate. Unlike bacteria, which are living organisms capable of independent life and can reproduce on their own through processes like binary fission, viruses are considered acellular and do not possess the cellular machinery necessary for replication. When a virus infects a host cell, it utilizes the host's cellular machinery, including enzymes and ribosomes, to produce viral components and assemble new viral particles. This dependency highlights the nature of viruses as obligate intracellular parasites. They cannot replicate outside of a living host cell, making their replication process unique compared to that of bacteria, which can thrive in a variety of environments and reproduce autonomously. The other options present information that does not accurately depict the characteristics of viral and bacterial replication. For instance, while bacteria require energy for various cellular functions, including replication, they are capable of reproducing independently of a host. Additionally, bacterial replication does primarily occur through binary fission, but it's not limited to just that method, as some bacteria can also undergo other forms of reproduction under specific conditions.

7. What unique growth characteristic does Listeria monocytogenes possess?

A. It is catalase negative

B. It can grow at refrigerator temperatures

C. It is strictly a human pathogen

D. It is a gram-negative coccus

Listeria monocytogenes has the unique growth characteristic of being able to grow at refrigerator temperatures, which distinguishes it from many other bacteria that typically thrive only at higher temperatures. This ability enables L. monocytogenes to survive and multiply in cold environments, such as those found in refrigerated foods, posing a significant risk for foodborne illness. The capacity to grow at temperatures as low as 0°C to 4°C is particularly concerning for food safety, as it allows this pathogen to survive in chilled products like deli meats, unpasteurized dairy products, and even some ready-to-eat meals. This characteristic highlights the importance of proper food handling and storage practices to prevent listeriosis, especially for vulnerable populations such as pregnant women, newborns, the elderly, and immunocompromised individuals. Other characteristics mentioned in the question do not accurately represent Listeria monocytogenes. For instance, it is not catalase negative but rather catalase positive. It is not strictly a human pathogen, as it can also infect animals, and it is not a gram-negative coccus; Listeria monocytogenes is a gram-positive bacterium and typically exhibits a bacillus shape.

8. What is the phenomenon called when a subtype of influenza replaces another, as seen with H1N1 and H2N2?

A. Viral interference.

B. Phenotypic mixing.

C. Antigenic shift.

D. Antigenic drift.

The phenomenon where a subtype of influenza replaces another, as seen with H1N1 and H2N2, is referred to as antigenic shift. This process involves a significant change in the influenza virus's surface proteins, specifically hemagglutinin (HA) and neuraminidase (NA), due to genetic reassortment. When two different influenza viruses infect the same cell, they can exchange genetic material, leading to the emergence of a new subtype with distinct antigenic properties. This major change can result in new viruses to which the population has little or no immunity, making antigenic shift a key factor in the emergence of pandemic strains of influenza. The other processes, such as viral interference, phenotypic mixing, and antigenic drift, describe different mechanisms of viral evolution or interaction. Viral interference usually refers to a situation where the presence of one virus can inhibit the replication of another virus. Phenotypic mixing involves the exchange of surface proteins between different viruses without altering their genetic structure. Antigenic drift, on the other hand, describes small, incremental changes in the virus through mutations over time, which can lead to seasonal outbreaks but does not result in the emergence of entirely new subtypes.

9. Which of the following diseases is caused by a virus?

A. Coronary artery disease

B. Tuberculosis

C. Influenza

D. Strep throat

The correct answer is associated with influenza, a disease caused by the influenza virus. Viruses are unique infectious agents that require living host cells to replicate, and they can cause a variety of diseases, ranging from mild to severe. Influenza specifically is known for its seasonal outbreaks and is characterized by symptoms such as fever, cough, and body aches, caused by the viral infection affecting the respiratory system. In contrast, coronary artery disease is primarily related to factors such as high blood pressure, cholesterol, and lifestyle choices, rather than infectious causes. Tuberculosis is a bacterial infection caused by Mycobacterium tuberculosis, which primarily affects the lungs. Strep throat is caused by the bacterium Streptococcus pyogenes, and it results in a sore throat and other throat-related symptoms. Thus, influenza stands out as the only disease listed that is caused specifically by a virus, exemplifying the infectious nature of viral pathogens and their impact on human health.

10. How do antibiotics like penicillin function in bacterial cells?

A. By disrupting protein synthesis

B. By inhibiting DNA replication

C. By inhibiting the synthesis of bacterial cell walls

D. By increasing cell membrane permeability

Antibiotics like penicillin function primarily by inhibiting the synthesis of bacterial cell walls. Penicillin specifically targets the enzymes responsible for cross-linking peptidoglycan layers, which are a vital component of bacterial cell walls. By disrupting this process, penicillin weakens the cell wall, making bacteria more susceptible to osmotic pressure and ultimately leading to cell lysis and death. Bacterial cell walls are crucial for maintaining structural integrity; without them, bacteria cannot survive, especially in hypotonic environments where water influx can cause the cells to burst. This mechanism of action makes penicillin and similar beta-lactam antibiotics particularly effective against actively dividing bacteria that rely on robust cell walls for protection. In contrast, other proposed mechanisms such as disrupting protein synthesis or inhibiting DNA replication target different cellular processes that do not directly affect the structural integrity of the cell wall. Increasing cell membrane permeability is often an attribute of certain types of antibiotics, but it does not represent the primary action of penicillin and its related compounds. Hence, the ability of penicillin to specifically inhibit cell wall synthesis is what underpins its effectiveness as an antimicrobial agent.