Harr Microbiology Practice Test (Sample)

Study Guide

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Questions

1. **At what temperature does Mycobacterium marinum optimally grow on Lowenstein-Jensen agar?**
   - **A. 30°C**
   - **B. 37°C**
   - **C. 42°C**
   - **D. 25°C**

2. **What is the routine laboratory test for diagnosing Treponema pallidum infections?**
   - **A. Culturing**
   - **B. Serological analysis**
   - **C. Acid-fast staining**
   - **D. Gram staining**

3. **A culture from a leg wound for a 70-year-old man indicated lactose-negative colonies on MacConkey agar. What is the most probable organism based on the biochemical reactions?**
   - **A. Proteus vulgaris**
   - **B. Serratia marcescens**
   - **C. Proteus mirabilis**
   - **D. Enterobacter cloacae**

4. **How can the subspecies Haemophilus influenza (biogroup) aegyptius be differentiated?**
   - **A. Indole and xylose tests**
   - **B. Glucose and urease tests**
   - **C. Oxidase and catalase tests**
   - **D. ALA test and oxidase tests**

5. **How can Hepatitis B virus be transmitted?**
   - **A. Acupuncture**
   - **B. Tattoos**
   - **C. Sexual contact**
   - **D. All of these options**

6. Which swab is ideal for recovering Corynebacterium diphtheriae from the nasopharynx?

A. Cotton swab

B. Flexible calcium alginate nasopharyngeal swab

C. Plastic nasopharyngeal swab

D. Wooden stick swab

7. Bacillus anthracis can be differentiated from Bacillus cereus by which of the following tests?

A. Motility and B-hemolysis on a blood agar plate

B. Oxidase and B-hemolysis on a blood agar plate

C. Lecithinase and glucose

D. Lecithinase and catalase

8. What is the most distinguishing feature between E. coli and Shigella based on their biochemical reactions?

A. Urease production

B. Indole test

C. Presence of gas in TSI

D. Citrate utilization

9. A gram-positive coccus from a wound culture shows B-hemolytic colonies. The most likely identification is?

A. Staphylococcus aureus

B. Staphylococcus epidermidis

C. Micrococcus spp.

D. Streptococcus spp.

10. A 29-year-old male with skin ulcers and a poorly staining coccobacillus is indicative of which organism?

A. A. Pseudomonas aeruginosa

B. B. Pseudomonas fluorescens

C. C. Chryseobacterium spp.

D. D. Francisella tularensis

Answers

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

Explanations

1. At what temperature does Mycobacterium marinum optimally grow on Lowenstein-Jensen agar?

A. 30°C

B. 37°C

C. 42°C

D. 25°C

Mycobacterium marinum is known to thrive at a temperature of approximately 30°C, which correlates with its natural habitat. This species is typically associated with aquatic environments, making the slightly lower temperature optimal for its growth compared to other Mycobacterium species that prefer higher temperatures, such as Mycobacterium tuberculosis, which optimally grows around 37°C. The use of Lowenstein-Jensen agar, which is specifically formulated for the isolation of mycobacteria, supports aerobic growth and provides the necessary nutrients for Mycobacterium marinum under these optimal conditions. Understanding the temperature requirements of different mycobacteria is crucial for accurate laboratory identification and for ensuring successful culture conditions.

2. What is the routine laboratory test for diagnosing Treponema pallidum infections?

A. Culturing

B. Serological analysis

C. Acid-fast staining

D. Gram staining

The routine laboratory test for diagnosing Treponema pallidum infections is serological analysis. Treponema pallidum is the bacterium responsible for syphilis, and it cannot be cultured in the laboratory because it is a highly fastidious organism requiring specific conditions to grow. Serological tests are utilized to detect antibodies produced by the immune system in response to the infection. These tests can include non-treponemal tests, such as the Rapid Plasma Reagin (RPR) and Venereal Disease Research Laboratory (VDRL) tests, as well as treponemal tests that more specifically identify antibodies directed against Treponema pallidum. The presence of these antibodies in a patient's serum indicates an active or previously resolved infection. Acid-fast staining is specifically used for identifying mycobacterial infections, such as tuberculosis, and would not be effective for diagnosing Treponema pallidum. Similarly, Gram staining is primarily used for categorizing bacteria based on their cell wall characteristics, but Treponema pallidum is a spirochete that does not retain the gram stain well due to its unique structure. Culturing for Treponema pallidum is not a standard diagnostic approach due to the organism's growth

3. A culture from a leg wound for a 70-year-old man indicated lactose-negative colonies on MacConkey agar. What is the most probable organism based on the biochemical reactions?

A. Proteus vulgaris

B. Serratia marcescens

C. Proteus mirabilis

D. Enterobacter cloacae

When evaluating the given scenario where a leg wound culture yielded lactose-negative colonies on MacConkey agar, it's essential to consider the characteristics of the organisms listed. Lactose-negative colonies indicate that the bacteria do not ferment lactose, which is a critical factor in differentiating among the possible organisms. Proteus vulgaris and Proteus mirabilis, both members of the Enterobacteriaceae family, are indeed lactose-negative. However, they are not typically associated with a signal for identifiable biochemical reactions beyond lactose fermentation. Serratia marcescens is also lactose-negative and is known for its distinctive red pigment and ability to produce a variety of biochemical reactions. It can grow in various stable temperatures and is notable for its involvement in wound infections, especially in older adults. The biochemical characteristics often highlight Serratia marcescens due to its unique ability to produce certain enzymes and proteins that assist in establishing infections, which could align with the presentation of a leg wound. On the other hand, Enterobacter cloacae is generally lactose-positive and therefore would not fit the description of a lactose-negative organism. The distinctive features of Serratia marcescens, along with its potential to be associated with wound infections, define it as a plausible candidate in this context

4. How can the subspecies Haemophilus influenza (biogroup) aegyptius be differentiated?

A. Indole and xylose tests

B. Glucose and urease tests

C. Oxidase and catalase tests

D. ALA test and oxidase tests

Haemophilus influenzae biogroup aegyptius can be differentiated through specific biochemical tests that assess the organism's metabolic capabilities. The correct choice involves utilizing the indole and xylose tests, which are essential in identifying certain metabolic pathways and characteristics unique to this subspecies. The indole test determines the ability of the bacterium to convert tryptophan to indole, which can be a distinguishing factor. The xylose test assesses the organism's ability to utilize xylose as a carbohydrate source. These metabolic characteristics are particularly relevant in differentiating Haemophilus influenzae biogroup aegyptius from other members of the Haemophilus genus or related species. In contrast, the other biochemical tests listed would not be as useful for this specific differentiation. While glucose and urease tests assess carbohydrate fermentation and urease activity respectively, they do not provide the distinctive characteristics needed to differentiate this particular biogroup effectively. Oxidase and catalase tests measure enzyme activities but are less specific for differentiating subspecies within Haemophilus. The ALA test, which assesses the ability to synthesize porphyrins, may not be as directly relevant to identifying H. influenzae aegyptius compared to the ind

5. How can Hepatitis B virus be transmitted?

A. Acupuncture

B. Tattoos

C. Sexual contact

D. All of these options

Hepatitis B virus (HBV) can be transmitted through several routes, making the comprehensive choice the correct answer. The virus is primarily spread through blood and body fluids, which means any activity that involves exposure to these fluids poses a risk of transmission. Acupuncture, when performed with unsterilized needles, can lead to the transmission of Hepatitis B if the needles are contaminated with blood from an infected individual. Likewise, getting tattoos can also be a risk factor if the equipment used is not properly sterilized, as the needles and ink can come into contact with infected blood. Sexual contact is another well-established route for HBV transmission. Since the virus can be found in various bodily fluids, engaging in sexual activities without protection can facilitate the exchange of infected fluids, leading to potential transmission. Since all these activities present a pathway for the virus to be spread, the most accurate response incorporates all of them, confirming that Hepatitis B can indeed be transmitted through acupuncture, tattoos, sexual contact, or any combination thereof.

6. Which swab is ideal for recovering Corynebacterium diphtheriae from the nasopharynx?

A. Cotton swab

B. Flexible calcium alginate nasopharyngeal swab

C. Plastic nasopharyngeal swab

D. Wooden stick swab

Corynebacterium diphtheriae, the causative agent of diphtheria, requires specific conditions for optimal recovery during diagnostic sampling. The flexible calcium alginate nasopharyngeal swab is ideal for this purpose because calcium alginate does not interfere with culture media, allowing for better growth of the bacteria. This type of swab is also designed to navigate the anatomical structures of the nasopharynx effectively, ensuring that samples are collected from the appropriate area where the bacteria reside. Using a cotton swab, plastic swab, or wooden stick can introduce substances that may inhibit the growth of microorganisms or might not collect samples efficiently from the nasopharynx, leading to false-negative results. Calcium alginate swabs have a softer and more flexible tip, allowing for better contact with the mucosal surfaces and ensuring adequate cellular material is obtained for culture and testing.

7. Bacillus anthracis can be differentiated from Bacillus cereus by which of the following tests?

A. Motility and B-hemolysis on a blood agar plate

B. Oxidase and B-hemolysis on a blood agar plate

C. Lecithinase and glucose

D. Lecithinase and catalase

Bacillus anthracis, the causative agent of anthrax, can be distinguished from Bacillus cereus through various biochemical tests. The key differentiating factor is the ability of Bacillus anthracis to produce a lecithinase enzyme, which is involved in breaking down phospholipids. This characteristic leads to the formation of a characteristic zone of opacity in egg yolk agar. While both Bacillus species can be observed on a blood agar plate, the correct differentiation between them primarily involves testing for lecithinase production rather than motility or beta-hemolysis patterns. Bacillus anthracis is non-motile and typically does not exhibit beta-hemolysis, whereas Bacillus cereus can be motile and is often beta-hemolytic. In testing scenarios, using lecithinase activity provides a clear distinction, with Bacillus anthracis showing positive results for this specific enzyme activity. This test is more definitive for differentiation than motility or hemolytic activity, making it crucial for accurate identification in clinical microbiology.

8. What is the most distinguishing feature between E. coli and Shigella based on their biochemical reactions?

A. Urease production

B. Indole test

C. Presence of gas in TSI

D. Citrate utilization

The most distinguishing feature between E. coli and Shigella based on their biochemical reactions is the presence of gas in Triple Sugar Iron (TSI) agar. E. coli typically ferments glucose, lactose, and/or sucrose, producing gas as a byproduct. This gas production is evident in TSI agar, where it can be observed as gas bubbles or cracks in the agar. In contrast, Shigella does not produce gas during fermentation, which is a key characteristic that aids in differentiating it from E. coli. Despite both being Gram-negative, non-lactose fermenting, and belonging to the Enterobacteriaceae family, this distinction is particularly useful in laboratory diagnostics. The ability to produce gas is a result of the fermentation of sugars in the TSI medium, and this metabolic difference is fundamental in microbiological identification and classification of these organisms.

9. A gram-positive coccus from a wound culture shows B-hemolytic colonies. The most likely identification is?

A. Staphylococcus aureus

B. Staphylococcus epidermidis

C. Micrococcus spp.

D. Streptococcus spp.

The presence of beta-hemolytic colonies is a key factor in identifying the organism in question. Beta-hemolysis is characterized by the complete lysis of red blood cells in the agar surrounding the colonies, which indicates the organism is capable of producing enzymes called hemolysins that lyse red blood cells. In this context, Streptococcus species are notable for their capacity to exhibit beta-hemolysis, particularly Streptococcus pyogenes (Group A strep) and Streptococcus agalactiae (Group B strep). This makes the identification of Streptococcus spp. in the scenario provided highly plausible. In contrast, Staphylococcus aureus is typically associated with coagulase-positive results and is usually categorized under alpha or beta-hemolytic activity depending on the strain, but often does not present in wound cultures as predominantly beta-hemolytic. Staphylococcus epidermidis is coagulase-negative and is usually associated with skin flora and does not exhibit beta-hemolysis. Micrococcus spp. tend to be coagulase-negative and do not typically show strong hemolytic activity. Thus, the identification of beta-hemolytic colonies indicates that a Streptococcus species

10. A 29-year-old male with skin ulcers and a poorly staining coccobacillus is indicative of which organism?

A. A. Pseudomonas aeruginosa

B. B. Pseudomonas fluorescens

C. C. Chryseobacterium spp.

D. D. Francisella tularensis

The presence of skin ulcers coupled with a poorly staining coccobacillus is characteristic of Francisella tularensis. This organism is a highly infectious bacterium that can cause tularemia, a disease that often manifests with skin ulcers, especially following exposure to infected animals or arthropod bites. Francisella tularensis is known for its small size and unique staining characteristics, which can make it challenging to identify using standard methods; it often requires specialized culture conditions for growth due to its fastidious nature. In the context of other microorganisms, Pseudomonas aeruginosa and Pseudomonas fluorescens are both types of bacteria that can cause various infections but are not associated predominantly with ulcerative skin lesions in the same way. Chryseobacterium spp. is a group of bacteria that could be implicated in skin infections but does not typically present with the specific ulceration pattern linked to tularemia. Thus, the clinical presentation and the characteristics of the bacteria point specifically to Francisella tularensis in this scenario.