The Microbial Mystery: A Choose Your Own Adventure Exam

You are a microbiologist at a hospital lab. A patient has arrived with a severe fever, and doctors suspect a bacterial infection. Your job is to **identify the pathogen** before the infection worsens.

Step 1: Examining the Sample

What is your first step in identifying the unknown bacteria?

A. Use a light microscope to examine the sample. (**Go to Step 2A**)
B. Perform a Gram stain to classify the bacteria. (**Go to Step 2B**)

Step 2A: Using the Microscope

You place the sample under a light microscope. What is the best type of microscopy for viewing **unstained, live bacteria**?

A. Brightfield microscopy (**Go to Step 3A**)
B. Phase contrast microscopy (**Go to Step 3B**)

If Incorrect → Challenge Question

What is the main advantage of phase contrast microscopy?

- **Correct Answer:** It enhances contrast in **unstained** samples. (**Go to Step 3B**)
- **Incorrect Answer:** Try again before moving forward!

Step 2B: Performing a Gram Stain

After Gram staining, you observe **purple, round cells in clusters** under the microscope. What does this tell you?

A. The bacteria are Gram-negative rods. (**Incorrect → Challenge Question**)
B. The bacteria are Gram-positive cocci. (**Go to Step 4B**)

Challenge Question for Incorrect Answer

What chemical in the bacterial cell wall **retains the crystal violet stain** in Gram-positive bacteria?

- **Correct Answer: Peptidoglycan** (**Go to Step 4B**)

- **Incorrect Answer:** Review Gram staining and try again!

Step 3A: Brightfield Microscopy

You observe rod-shaped bacteria. What is the correct term for this morphology?

A. Coccus (**Incorrect → Challenge Question**)
B. Bacillus (**Go to Step 5B**)
C. Spirillum (**Incorrect → Challenge Question**)

Challenge Question for Incorrect Answer

Which bacterial shape is typically associated with **spirochetes**?

- **Correct Answer: Spirillum** (**Go to Step 5B**)
- **Incorrect Answer:** Review bacterial morphology and try again!

Step 3B: Phase Contrast Microscopy

You successfully observe **small, motile bacteria**. What structure allows bacterial motility?

A. Pili (**Incorrect → Challenge Question**)
B. Flagella (**Go to Step 5B**)

Challenge Question for Incorrect Answer

What is the main function of bacterial pili?

- **Correct Answer: Attachment and DNA transfer** (**Go to Step 5B**)
- **Incorrect Answer:** Try again!

Step 4B: Identifying the Bacteria

Your Gram stain results suggest **Gram-positive cocci**. Which genus is the pathogen most likely from?

A. Staphylococcus (**Go to Step 6A**)
B. Escherichia (**Incorrect → Challenge Question**)

Challenge Question for Incorrect Answer

What is a key structural difference between Gram-positive and Gram-negative bacteria?

- **Correct Answer: Gram-positive bacteria have thick peptidoglycan layers.** (**Go to Step 6A**)
- **Incorrect Answer:** Try again!

Step 5B: Understanding the Cell Wall

Now that you've identified the shape, what structure gives bacterial cells their shape and rigidity?

A. The cytoplasmic membrane (**Incorrect → Challenge Question**)
B. The cell wall (**Go to Step 7B**)

Challenge Question for Incorrect Answer

What is the primary function of the cytoplasmic membrane in bacteria?

- **Correct Answer: Selective permeability and transport** (**Go to Step 7B**)
- **Incorrect Answer:** Try again!

Step 6A: Confirming Staphylococcus

Staphylococcus bacteria divide in **which type of pattern**?

A. Chains (**Incorrect → Challenge Question**)
B. Clusters (**Go to Step 8B**)

Challenge Question for Incorrect Answer

Which bacterial genus commonly forms chain-like arrangements?

- **Correct Answer: Streptococcus** (**Go to Step 8B**)
- **Incorrect Answer:** Try again!

Step 7B: The Role of Peptidoglycan

What **antibiotic class** specifically targets bacterial cell wall synthesis?

A. Penicillins (**Go to Step 9A**)
B. Macrolides (**Incorrect → Challenge Question**)

Challenge Question for Incorrect Answer

What is the main mechanism of action of macrolide antibiotics?

- **Correct Answer: They inhibit protein synthesis.** (**Go to Step 9A**)
- **Incorrect Answer:** Try again!

Step 8B: The Final Step – Cell Division

Staphylococcus bacteria reproduce through **binary fission**. What is the correct order of steps in this process?

A. DNA replication → Septum formation → Cell elongation → Cell division (**Go to Step 10A**)
B. Cell elongation → DNA replication → Cell division → Septum formation (**Incorrect → Challenge Question**)

Challenge Question for Incorrect Answer

Which cellular structure **forms the septum** during bacterial division?

- **Correct Answer: The FtsZ protein ring** (**Go to Step 10A**)
- **Incorrect Answer:** Try again!

Step 9A: Correct! Understanding Treatment

You've identified the pathogen and its cell wall properties. The doctor wants to prescribe antibiotics.

Which of the following would **NOT** be effective against a Gram-positive bacterium?

A. Penicillin (**Incorrect → Challenge Question**)
B. Polymyxins (**Go to Step 10A**)

Challenge Question for Incorrect Answer

Why are polymyxins **not effective against Gram-positive bacteria**?

- **Correct Answer: They target the outer membrane, which Gram-positives lack.** (**Go to Step 10A**)

- **Incorrect Answer:** Try again!

Step 10A: Mission Accomplished!

Congratulations! You successfully identified **Staphylococcus**, determined its Gram-positive nature, analyzed its cell structure, and selected an appropriate antibiotic treatment. **The patient is on the road to recovery!** 🚀