

Provide New Learning Pathways to Understand the Why Behind the Science

CASE STUDY

HAND WASHING AND ASEPTIC TECHNIQUE: A CASE STUDY

You are presented with an eosin–methylene blue (EMB) agar plate that has bacterial colonies with a slight greenish, metallic sheen. Your laboratory manager explains the background for the culture you are observing on the plate: An unknown contaminate was found in a meat processing machine, and the in-house pathogen control office performed a swab and a streak on an EMB plate. After incubation and observation of the weak reaction, the manufacturers concluded that the contaminate was not *E. coli* and that no further tests were required. Upper management decided that to protect the company from potential lawsuits, they would hire the laboratory you work for to ensure that their laboratory technicians concluded correctly.

Due to cost and time restrictions, your lab is limited regarding how many assays can be performed. Using a series of biochemical tests to confirm or refute the analysis of the processing plant, you will need to determine whether the bacteria is an enteric and then whether it is an *E. coli* isolate.

Questions to Consider:

1. Does the lack of a strong reaction on the EMB plate refute the determination that the isolated bacteria are an *E. coli* culture?
2. Which series of assays would best be used to prove/disprove the *E. coli* determination?

NEW! Clinical Case Studies now within each section of the lab manual bring career relevance to the lab experiments. These open-ended cases can be used to fuel class discussion and group work about the topics covered in lab.

NEW! Further Reading Sections help students know where to look in their textbook if they need more background information to understand the science behind the experiment.

FURTHER READING

Refer to the section on antimicrobial compounds in your textbook for further information on the compounds that have an effect on bacterial cells. In your textbook's index, search under "Chemotherapy," "Antibiotics," and "Analog."

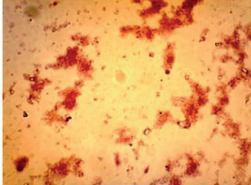
Connect Lecture and Lab with Mastering Microbiology

MicroLab Practical: Acid-fast Stain Micrograph

Analyzing Acid-Fast staining results and drawing conclusions

Part A

What can you conclude about the Acid-Fast stained specimen?



[View the image in greater detail.](#)

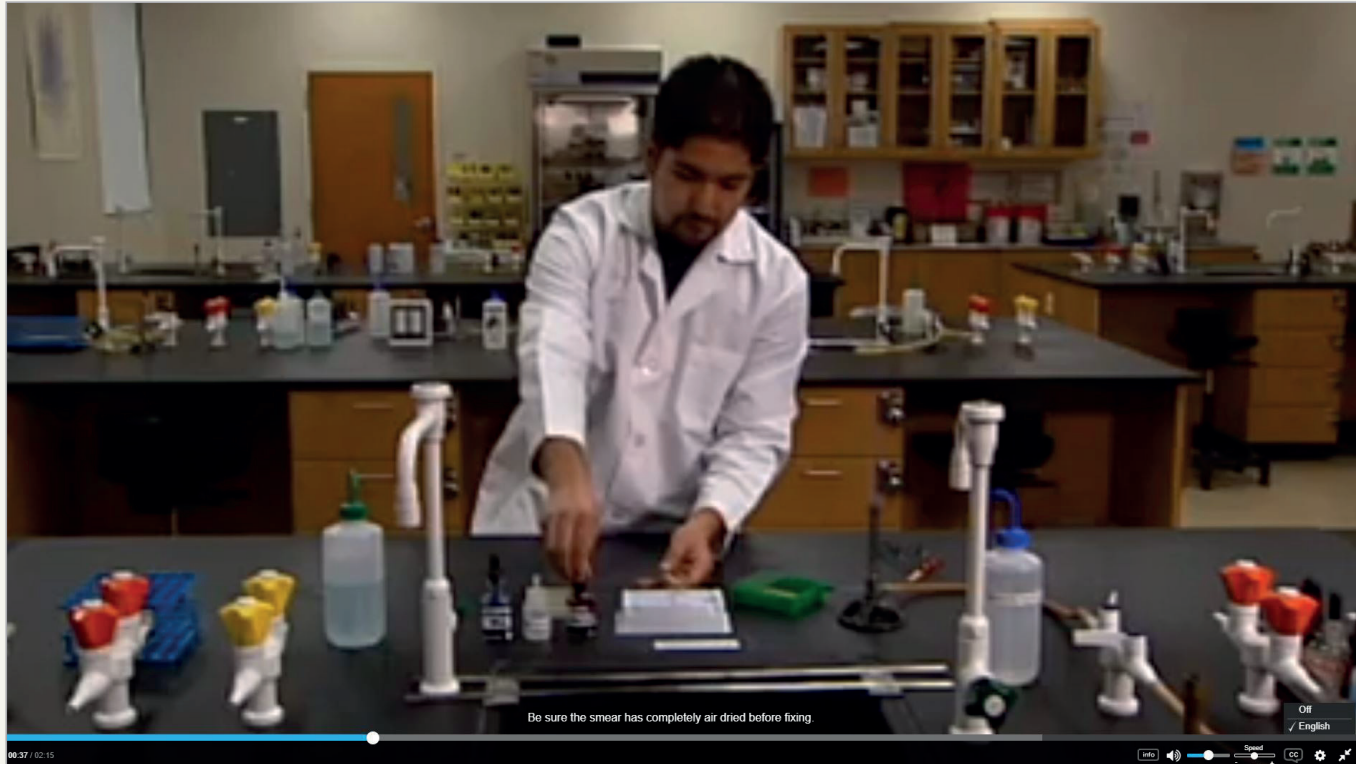
Based on your observation of this acid-fast stained specimen, select ALL appropriate statements.

[View Available Hint\(s\)](#)

- The pictured bacteria are acid-fast
- The pictured bacteria are non-acid-fast
- The pictured bacteria is probably Gram-negative
- The pictured bacteria are possibly a type of mycobacteria
- The pictured bacteria probably produce lipopolysaccharide (LPS), also known as endotoxin.
- This bacteria probably makes endospores
- The pictured bacteria have mycolic acid in their cell walls

[Submit](#)

MicroLab Practical Activities assess students' observation skills and give them extra practice to analyze important lab tests, procedures, and results.



Prepare for lab with **pre-lab quizzes** for each of the 72 experiments in **Microbiology: A Laboratory Manual** Twelfth Edition, and then follow up to measure comprehension with **post-lab quizzes** in Mastering Microbiology™.

And Come to Class Better Prepared for Lab



Videos and Coaching Activities

help instructors and students get the most out of lab time. Students can practice their lab skills virtually reviewing proper lab techniques with real-world applications. Live action video combined with molecular animation with assessment and feedback coach students how to interpret and analyze different lab results.



Lab Technique Videos give students an opportunity to see techniques performed correctly and quiz themselves on lab procedures both before and after lab time, improving confidence and proficiency. Assign as pre-lab quizzes in Mastering Microbiology and include coaching and feedback on a wide range of lab techniques.

Preface

Microbiology is a dynamic science. It constantly evolves as more information is added to the continuum of knowledge, and as microbiological techniques are rapidly modified and refined. The twelfth edition of *Microbiology: A Laboratory Manual* continues to provide a blend of traditional methodologies with more contemporary procedures to meet the pedagogical needs of all students studying microbiology. As in previous editions, this laboratory manual provides a wide variety of critically selected and tested experiments suitable for undergraduate students in allied health programs, as well as elementary and advanced general microbiology courses.

Our Approach

This laboratory manual helps students develop manipulative skills and techniques essential for understanding the biochemical structure and function of a single cell. Its main goal is to encourage students to apply these laboratory skills in the vocational field of applied microbiology and allied health or to study life at the molecular level.

In this manual, we begin each major area of study with comprehensive introductory material, then specific explanations and detailed directions precede each experiment. This approach augments, enhances, and reinforces course lectures, enabling students to comprehend more readily the concepts and purposes of each experiment. This also provides a review aid if the laboratory and lecture sections are not taught concurrently. The manual should also reduce the time required for explanations at the beginning of each laboratory session and thus allow more time for performing the experiments. Finally, the supplies, equipment, and instrumentation for the experimental procedures can be commonly found in undergraduate institutions.

Organization

This manual consists of 72 experiments arranged into 15 parts. The experiments progress from basic and introductory, which require minimal manipulations, to more complex, which require more sophisticated skills. The format of each experiment is intended to facilitate presentation of the material by the instructor and to maximize the learning experience. To this end, each experiment is designed with the following components:

Learning Objectives

This introductory section defines the specific principles and/or techniques students will master.

Principle

This is an in-depth discussion of the microbiological concept or technique and the specific experimental procedure.

Further Reading

This section aids the student in identifying the key terms and concepts within the textbook for continued reading on the topic.

Clinical Application

Clinical or medical applications that appear within each experiment help students connect what they are learning in lecture with what they are doing in the lab. For students who intend to have careers as nurses or in other allied health fields, Clinical Applications explain the relevance of each lab technique to their career plans.

At the Bench

This section signals the beginning of the experiment, and includes the materials, notes of caution, and procedural instructions—all of the things students will need to know at the bench throughout the experiment.

Materials

This comprehensive checklist helps students and instructors prepare for each laboratory session. Materials appear under one of the following headings:

Cultures These are the selected test organisms that have been chosen to demonstrate effectively the experimental principle or technique under study. The choice is also based on their ease of cultivation and maintenance in stock culture. Appendix 6 gives a complete listing of the experimental cultures and prepared slides.


Media These are the specific media and their quantities per designated student group. Appendix 3 lists the composition and method of preparation of all the media used in this manual.

Reagents These include biological stains as well as test reagents. Appendices 4 and 5 present the chemical composition and preparation of the reagents.

Equipment Listed under this heading are the supplies and instrumentation that students need for the laboratory session. The suggested equipment was selected to minimize expense while reflecting current laboratory technique.

Procedure

This section provides explicit instructions, augmented by diagrams, that aid in the execution and interpretation of the experiment.

 A caution icon has been placed in experiments that may use potentially pathogenic materials. The instructor may wish to perform some of these experiments as demonstrations.

Lab Report

These tear-out sheets, located at the end of each experiment, facilitate interpretation of data and subsequent review by the instructor. The Observations and Results portion of the report provides tables for recording observations and results, and helps the students draw conclusions from and interpret their data. The Review Questions aid the instructor in determining the student's ability to understand the experimental concepts and techniques. Questions that call for more critical thinking are indicated by the brain icon.

New to the Twelfth Edition

For this twelfth edition, the primary aim was to build upon and enrich the student experience. The changes described below impart the relevance of microbiological lab techniques to published standard protocols, and enhance student understanding in the validity of each of the microbiological procedures as they apply laboratories in both the educational and industrial setting.

Clinical Case Studies

Included with each section of the laboratory manual is a Clinical Case Study, which reviews a fictitious case that illustrates the laboratory science addressed in one or more experiments within that part. These open-ended cases have accompanying questions to facilitate class discussions about the topics covered in lab.

Further Reading

This new section, found in the introductory material for each part in the manual and within each experiment, instructs students on where to look in their textbook for more background information concerning the science behind the experiment. Worded in a general manner, this section is not specific for a singular textbook but utilizes common textbook section descriptions and the nomenclature that is found in most indexes.

Check Lists

With the lengthy lists of materials, media, and organisms required in some experiments, many students have found the preparation for the experiment daunting. To aid the students in ensuring that they have acquired all of the needed materials, these lists have been converted to check-lists.

New Experiment 36: Isolation of Fungal Species

A newly designed experiment that illustrates a method for the isolation of a singular or multiple fungal species from an environmental sample. This is a generic protocol that will allow for individual customization by Instructors to fit their labs or interests.

New Experiment 46: Detection of Enteric Bacteria on Raw Meat

Loosely based on the published protocols of the United States Department of Agriculture (USDA) and Food Safety and Inspection Service (FSIS) for the cultivation, isolation, and identification of enteric bacteria on commercially prepared meat and meat products, this laboratory experiment is based on government guidelines published in MLG 4.09.

Information Concerning Governing Bodies

Where appropriate, information concerning governing bodies, such as the USDA and its regulatory agency FSIS, has been included in the introductory material for some experiments. By drawing attention to governing bodies beyond the American Society for Microbiology (ASM) that have published laboratory standards, students are introduced to the various industry standards that regulate microbiology laboratories.

Updates and Revisions

Throughout the manual, updates and revisions were made to background information, terminology, equipment, and procedural techniques, including the following:

- Experiment 1 Handwashing was added back to this edition, by popular demand.
- New or updated artwork in some experiments.
- Experiment 24 now has a combined laboratory procedure for the Methyl Red (MR) and Voges-Proskauer (VP) tests to minimize student
- Experiments 56 and 57 were combined into one new Experiment 57 that is now a multi-week bacterial Isolation and Transformation lab.
- Experiment 64 now also introduces the commercially available Enteropleuri test for identifying enteric bacteria.

Instructor Resources

The Instructor Guide (ISBN 978-0-134-29869-6) is a valuable teaching aid for instructors. It was updated to reflect changes in the main text, and provides:

- Laboratory safety protocol for the instructional staff
- Laboratory safety protocol for the technical staff

- New Additional Reading research articles for each experiment
- Detailed lists of required materials, procedural points to emphasize, suggestions for optional procedural additions or modifications, helpful tips for preparing or implementing each experiment, and answers to the Review Questions in the student manual
- Appendices with the formulas for the preparation of all media, test reagents, and microbiological stains, as well as the microorganisms required for the performance of each procedure

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Chad Welsh