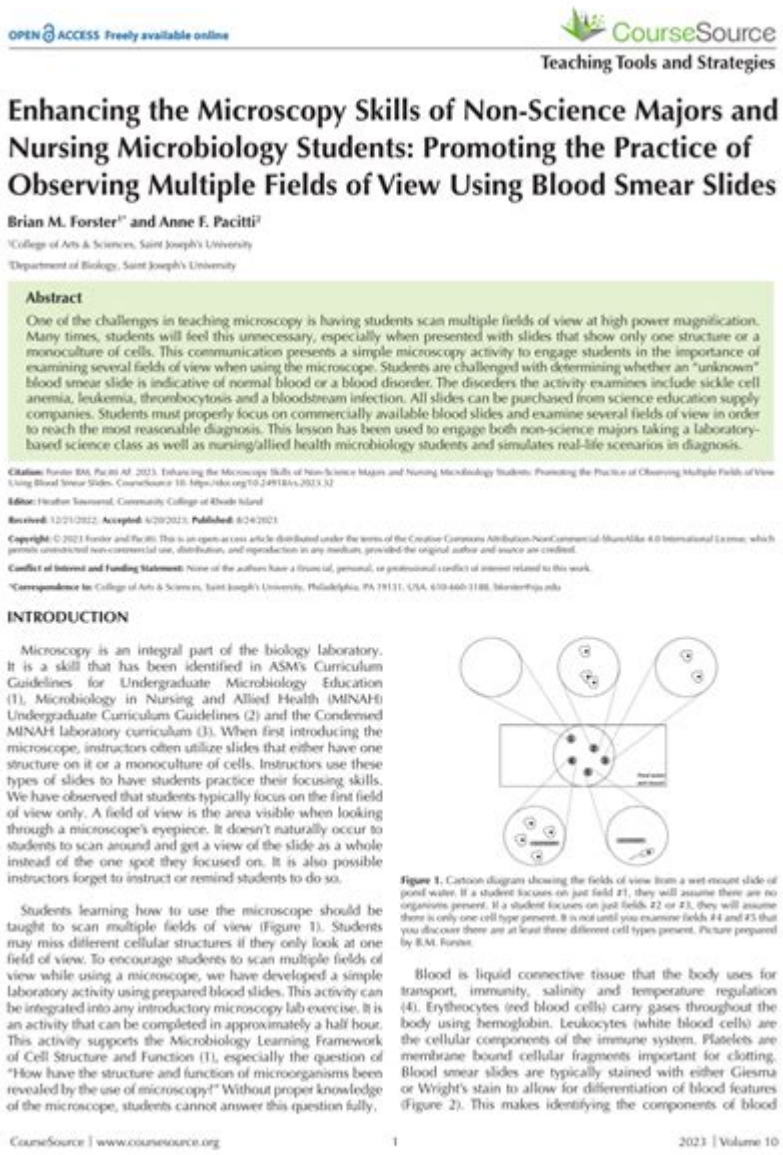
Microbiology For Non Science Majors



OPEN ACCESS Freely available online

CourseSource

Teaching Tools and Strategies

Enhancing the Microscopy Skills of Non-Science Majors and Nursing Microbiology Students: Promoting the Practice of Observing Multiple Fields of View Using Blood Smear Slides

Brian M. Forster[1*] and Anne F. Pacitti[2]

[1]College of Arts & Sciences, Saint Joseph's University

[2]Department of Biology, Saint Joseph's University

Abstract

One of the challenges in teaching microscopy is having students scan multiple fields of view at high power magnification. Many times, students will feel this unnecessary, especially when presented with slides that show only one structure or a monoculture of cells. This communication presents a simple microscopy activity to engage students in the importance of examining several fields of view when using the microscope. Students are challenged with determining whether an "unknown" blood smear slide is indicative of normal blood or a blood disorder. The disorders the activity examines include sickle cell anemia, leukemia, thrombocytosis and a bloodstream infection. All slides can be purchased from science education supply companies. Students must properly focus on commercially available blood slides and examine several fields of view in order to reach the most reasonable diagnosis. This lesson has been used to engage both non-science majors taking a laboratory-based science class as well as nursing/allied health microbiology students and simulates real-life scenarios in diagnosis.

Citation: Forster BM, Pacitti AF. 2023. Enhancing the Microscopy Skills of Non-Science Majors and Nursing Microbiology Students: Promoting the Practice of Observing Multiple Fields of View Using Blood Smear Slides. CourseSource 10. https://doi.org/10.24918/cs.2023.32

Editor: Heather Townsend, Community College of Rhode Island

Received: 12/21/2022; **Accepted:** 6/20/2023; **Published:** 8/24/2023

Conflict of Interest and Funding Statement: None of the authors have a financial, personal, or professional conflict of interest related to this work.

***Correspondence to:** College of Arts & Sciences, Saint Joseph's University, Philadelphia, PA 19131, USA. 610-660-3188. bforster@sju.edu

INTRODUCTION

Microscopy is an integral part of the biology laboratory. It is a skill that has been identified in ASM's Curriculum Guidelines for Undergraduate Microbiology Education (1), Microbiology in Nursing and Allied Health (MINAH) Undergraduate Curriculum Guidelines (2) and the Condensed MINAH laboratory curriculum (3). When first introducing the microscope, instructors often utilize slides that either have one structure on it or a monoculture of cells. Instructors use these types of slides to have students practice their focusing skills. We have observed that students typically focus on the first field of view only. A field of view is the area visible when looking through a microscope's eyepiece. It doesn't naturally occur to students to scan around and get a view of the slide as a whole instead of the one spot they focused on. It is also possible instructors forget to instruct or remind students to do so.

Students learning how to use the microscope should be taught to scan multiple fields of view (Figure 1). Students may miss different cellular structures if they only look at one field of view. To encourage students to scan multiple fields of view while using a microscope, we have developed a simple laboratory activity using prepared blood slides. This activity can be integrated into any introductory microscopy lab exercise. It is an activity that can be completed in approximately a half hour. This activity supports the Microbiology Learning Framework of Cell Structure and Function (1), especially the question of "How have the structure and function of microorganisms been revealed by the use of microscopy?" Without proper knowledge of the microscope, students cannot answer this question fully.

Figure 1. Cartoon diagram showing the fields of view from a wet-mount slide of pond water. If a student focuses on just field #1, they will assume there are no organisms present. If a student focuses on just fields #2 or #3, they will assume there is only one cell type present. It is not until you examine fields #4 and #5 that you discover there are at least three different cell types present. Picture prepared by B.M. Forster.

Blood is liquid connective tissue that the body uses for transport, immunity, salinity and temperature regulation (4). Erythrocytes (red blood cells) carry gases throughout the body using hemoglobin. Leukocytes (white blood cells) are the cellular components of the immune system. Platelets are membrane bound cellular fragments important for clotting. Blood smear slides are typically stained with either Giesma or Wright's stain to allow for differentiation of blood features (Figure 2). This makes identifying the components of blood

Microbiology is the branch of science that focuses on the study of microorganisms, which are tiny living organisms that can only be seen with the aid of a microscope. This field encompasses a wide variety of organisms, including bacteria, viruses, fungi, and protozoa. Despite their minuscule size, microorganisms play a critical role in the environment, human health, and various industries. For non-science majors, understanding the basics of microbiology can provide valuable insights into daily life, health, and the world around us.

What Are Microorganisms?

Microorganisms are living entities that are typically too small to be seen with the naked eye. They can be classified into several categories:

Bacteria

- Single-celled organisms that can be found in various environments, including soil, water, and the human body.
- Bacteria can be beneficial (e.g., gut flora) or harmful (e.g., pathogens that cause diseases).

Viruses

- Much smaller than bacteria and cannot reproduce on their own; they require a host cell to replicate.
- Viruses can cause a range of illnesses, from the common cold to more serious diseases like HIV/AIDS and COVID-19.

Fungi

- Includes yeasts and molds; they play a vital role in decomposition and nutrient cycling.
- Some fungi are beneficial (e.g., penicillin) while others can cause infections (e.g., athlete's foot).

Protozoa

- Single-celled eukaryotic organisms that can be found in freshwater, marine environments, and soil.
- Some protozoa are harmless, while others can cause diseases (e.g., malaria).

The Importance of Microbiology

Microbiology is essential for various reasons, impacting health, industry, and the ecosystem.

Human Health

- Pathogens and Disease: Understanding microorganisms helps in the identification and treatment of infectious diseases. Vaccination and antibiotics are developed based on microbiological research.
- Gut Health: The human gastrointestinal tract is home to trillions of bacteria, collectively known as the gut microbiome, which play a crucial role in digestion, metabolism, and immune function.

Environmental Impact

- Biogeochemical Cycles: Microorganisms are key players in nutrient cycling, breaking down organic matter and recycling nutrients in ecosystems.
- Bioremediation: Certain bacteria can degrade pollutants, making them vital for

environmental cleanup efforts.

Industrial Applications

- Fermentation: Microorganisms are used in the production of food and beverages, such as bread, beer, and yogurt, through processes like fermentation.
- Biotechnology: Microbes are harnessed for producing antibiotics, enzymes, and biofuels, showcasing their potential in various industries.

Microbial Interactions with Humans

The relationship between humans and microorganisms is complex and multifaceted.

Beneficial Microorganisms

- Probiotics: These are live bacteria that confer health benefits when consumed, mainly by improving gut health.
- Symbiotic Relationships: Certain bacteria and humans live in a mutually beneficial relationship, such as the bacteria in our intestines that help digest food and produce vitamins.

Harmful Microorganisms

- Pathogenic Bacteria: Some bacteria can cause diseases, leading to infections that require medical attention.
- Viruses: Understanding the lifecycle of viruses can help in developing vaccines and antiviral medications.

Microbiology in Everyday Life

Microbiology is not just a subject studied in labs; it is a vital part of our everyday lives. Here are a few examples of how microbiology affects daily routines.

Food Safety

- Foodborne Illnesses: Awareness of microbes helps in understanding contamination and food safety practices, such as proper cooking and storage.
- Preservation Techniques: Techniques like canning, pickling, and refrigeration inhibit the growth of harmful microbes, extending the shelf life of food.

Health and Hygiene

- Handwashing: Good hygiene practices prevent the spread of infectious diseases caused by harmful microorganisms.
- Antibiotic Use: Knowledge of how antibiotics work and the importance of completing prescribed courses can help mitigate the rise of antibiotic-resistant bacteria.

Microbiology and Technology

Advancements in technology have significantly propelled the field of microbiology forward.

Microscopy

- Light Microscopes: Allow scientists to visualize cells and microorganisms.
- Electron Microscopes: Provide much higher resolution images, enabling the study of viruses and cellular structures.

Genetic Engineering

- Techniques such as CRISPR enable scientists to edit the genomes of microorganisms, leading to innovations in medicine, agriculture, and environmental management.

Challenges in Microbiology

While microbiology has made significant strides, there are ongoing challenges that require attention.

Antibiotic Resistance

- The overuse and misuse of antibiotics can lead to the development of antibiotic-resistant strains of bacteria, making infections harder to treat.
- Strategies to combat resistance include developing new antibiotics and promoting responsible use of existing medications.

Emerging Infectious Diseases

- New diseases caused by previously unknown pathogens can emerge, as seen with COVID-19.
- Ongoing research and surveillance are crucial for early detection and response to these threats.

The Future of Microbiology

The future of microbiology is bright, with numerous possibilities for advancements that can benefit humanity.

Personalized Medicine

- Understanding the human microbiome can lead to personalized treatments based on an individual’s unique microbial profile.

Environmental Sustainability

- Microbial solutions for waste treatment and pollution cleanup will be increasingly important as environmental challenges grow.

Biotechnology Innovations

- Continued research into microbial processes can lead to the development of biofuels, biodegradable plastics, and other sustainable materials.

Conclusion

Microbiology is a fascinating and vital field that impacts every aspect of our lives, from health and hygiene to food safety and environmental sustainability. By understanding the basics of microbiology, non-science majors can appreciate the complexity of life at a microscopic level and recognize the significant role microorganisms play in our world. With ongoing research and technological advancements, the future of microbiology holds great promise for improving health, enhancing food production, and addressing environmental challenges. Embracing this knowledge empowers individuals to make informed decisions about their health and the world around them.

Frequently Asked Questions

What is microbiology and why is it important for everyday life?

Microbiology is the study of microorganisms, which are tiny living organisms such as bacteria, viruses, fungi, and protozoa. It is important for everyday life because these microorganisms play crucial roles in processes like digestion, nutrient cycling, and disease prevention.

How do antibiotics work against bacterial infections?

Antibiotics work by targeting specific features of bacterial cells, such as their cell wall or protein synthesis machinery. They either kill bacteria or inhibit their growth, allowing the immune system to eliminate the infection.

What are some common misconceptions about bacteria?

A common misconception is that all bacteria are harmful. In reality, many bacteria are beneficial and essential for processes like digestion, decomposition, and nutrient cycling in ecosystems.

What role do microorganisms play in the environment?

Microorganisms play vital roles in the environment, including decomposing organic matter, recycling nutrients, and contributing to soil fertility. They also help in bioremediation by breaking down pollutants.

How do vaccines work to protect against diseases?

Vaccines work by introducing a harmless component of a pathogen (like a protein or weakened form) to the immune system. This trains the immune system to recognize and fight the actual pathogen if encountered in the future.

What is the relationship between microbiology and food safety?

Microbiology is critical to food safety as it helps identify harmful pathogens that can contaminate food. Understanding how to control these microorganisms prevents foodborne illnesses and ensures safe food production.

How does the human microbiome affect our health?

The human microbiome, which is the collection of microorganisms living in and on our bodies, plays a significant role in health by aiding digestion, protecting against pathogens, and influencing the immune system. An imbalance in these microorganisms can lead to health issues.

Microbiology For Non Science Majors

Jul 10, 2024 · These top-rated password managers help you make sure employees are using strong passwords for work accounts.

9 Best Password Managers for Businesses in 2025
May 9, 2025 · Our cybersecurity expert reviews and compares the best business password managers on the market to find which cybersecurity companies offer the most helpful …

The best password managers for businesses: Expert tested
Jun 5, 2025 · A secure password management system is a must for businesses of all sizes. Whether you want an enterprise-grade solution or a simple setup for a small business, these …

The Best Password Managers For Business - Expert Insights
Jul 17, 2025 · Dashlane, JumpCloud, and Uniqkey are our top business password manager picks thanks to security features, ease of use, and admin controls.

6 Best Password Managers – Forbes Advisor
Forbes Advisor evaluated the best password managers in 2025 based on cost, features and usability. Find the right solution for you.

Buyer’s guide: The 6 best password managers for business
May 11, 2023 · A password manager stores a user’s passwords and logins for various sites and apps and generates new, strong passwords, making it a valuable tool for implementing strong …

Best Business Password Managers for 2025 | Rippling
Jun 16, 2025 · Best business password managers ranked for 2025. Compare business password managers like Rippling RPass and Lastpass and for secure access, team sharing, and admin …

Best Password Managers for Businesses: 2025’s Top Picks
Jul 3, 2025 · Best Password Managers for Businesses: Our Top Picks Modern enterprises require advanced tools to protect their digital assets. PCMag’s extensive testing has identified top …

5 Best Password Manager for Business in 2025: Paid & Free
Jul 3, 2024 · Best Password Manager for Business in 2025: Top 5 Paid & Free Software List Finding the best password manager for business can be tricky with all the available options. …

10 Best Password Managers for Business of 2025 - SMB Guide
10 Best Password Managers for Business Discover the top 10 best password managers. Our expert review helps you find the best options for security, ease of use, and value. Read on for …

Die 10 Besten Pizzas in Berlin - Tripadvisor
Die Restaurants werden nach Übereinstimmung mit Ihren Auswahlkriterien sortiert. Die Gewinner von Travellers' Choice Awards (einschließlich "Best of the Best …

Call a Pizza Berlin - Lieferservice Standorte finden!
Call a Pizza ist seit über 30 Jahren dein Pizzalieferdienst in Berlin, wenn es um leckere Pizza, frisch zubereitete Burger, knusprige Snacks, leckere Pasta-Gerichte …

Domino's Pizza - Jetzt Pizza bestellen & genießen! | Domino'...
Wir bei Domino’s haben die Vision euch täglich mit frischer & hausgemachter Pizza zu versorgen – und dies schnell & einfach. Unsere erste Pizza liegt schon weit zurück…

Pizza in Berlin: Die besten Pizzerien im großen Guide
Oct 14, 2022 · Die Stadt ist geradezu zum Paradies geworden, gerade was die neapolitanische Variante anbelangt – aber …

Pizza Max • Dein Lieferservice • Einfach online bestellen!
Pizza Max ® ist der Pizza Lieferdienst Deines Vertrauens. Bei uns kannst Du aus einer Vielzahl an leckeren Pizza Rezepturen wählen oder Du stellst Dir Deine frische Pizza …

Explore the fascinating world of microbiology for non-science majors! Unlock essential concepts and applications. Learn more and enhance your understanding today!

Back to Home