

Biology 210 Lab Learning Objectives

LABORATORY SAFETY

Upon successful completion of the lab introduction, you will be able to

1. properly dispose of all contaminated materials and provide a rationale for each disposal method.
2. demonstrate a working knowledge of all safety equipment and procedures in the microbiology laboratory, and provide a rationale for each procedure.

EXERCISE 1—THE BRIGHTFIELD MICROSCOPE

Upon successful completion of this exercise, you will be able to

1. identify, describe the function of, and properly operate the parts of the compound microscope.
2. transport and store the microscope safely.
3. properly clean optical and other surfaces.
4. observe various specimens on microscope slides using the low, high, and oil immersion lenses.
5. define the terms listed under “*Microscopic Terminology*”.
6. calculate total magnification of any microscope, given ocular and objective lens magnifications.

EXERCISE 2—OTHER MICROSCOPES

Upon successful completion of this exercise, you will be able to

1. describe the basic differences between brightfield, darkfield, phase and fluorescent microscopy, and state advantages and disadvantages of each.
2. describe the differences between electron (SEM and TEM) and light microscopes, and state the advantages and disadvantages of each.
3. differentiate between the uses of compound microscopes and stereoscopes.
4. properly operate the stereoscope.
5. recognize specimens as being viewed with brightfield, darkfield and phase contrast microscopy.

EXERCISE 3—OBSERVING PROTOZOA, ALGAE, AND CYANOBACTERIA

Upon successful completion of this exercise, you will be able to

1. prepare wet mounts of various organisms.
2. describe the features shared by and unique to algae, protozoans, and cyanobacteria, and provide two examples of each.
3. outline the differences between prokaryotes and eukaryotes.
4. describe how a hay infusion is prepared.
5. relate the disease and source of infection to the protozoan pathogens listed in *Conclusions, Discussions and Questions*.
6. define the term parasite.
7. compare and contrast bacteria and protozoans, algae and cyanobacteria.

EXERCISE 4—OBSERVING FUNGI AND YEAST

Upon successful completion of this exercise, you will be able to

1. describe the features that place the fungi in their own kingdom.
2. outline basic fungal characteristics (as listed in *Technical Background*) and use these to recognize the five genera studied, both macroscopically and microscopically.
3. compare and contrast, and recognize examples of, zygomycetes, ascomycetes, basidiomycetes, and deuteromycetes.
4. recognize a colony on an agar plate as being either fungal or bacterial.
5. name two media commonly used for growing fungi.
6. define the term compromised host and state its importance.
7. compare and contrast the terms pathogen and opportunistic pathogen.
8. prepare a wet mount of yeast and recognize prepared microscope slides of yeast.

EXERCISE 5—OBSERVING BACTERIA

Upon successful completion of this exercise, you will be able to

1. describe and recognize microscopic differences between bacteria and other organisms studied so far.
2. describe, sketch, and recognize examples of basic bacterial cell morphologies (shapes) and arrangements.

EXERCISE 6—ASEPTIC TECHNIQUE

Upon successful completion of this exercise, you will be able to

1. define and state the importance of aseptic technique.
2. perform aseptic transfers from broth and agar culture tubes to sterile broth and agar tubes

3. properly use a Bunsen burner.
4. define the terms culture, medium, contaminant, and inoculation.

EXERCISE 7—SMEAR PREPARATION

Upon successful completion of this exercise, you will be able to

1. aseptically prepare bacterial smears from broth and agar cultures.
2. describe the importance of the air drying and heat fixing steps in bacterial smear production.
3. outline the differences in smear preparation using broth and agar cultures.
4. describe the uses of agar slants, agar plates, and broths.

EXERCISE 8—SIMPLE STAINING

Upon successful completion of this exercise, you will be able to

1. discuss the importance of bacterial staining.
2. outline and state the importance of the steps in performing a simple stain.
3. perform a simple stain from any bacterial source, including cultures and teeth scrapings.
4. define the terms pleomorphic and palisades arrangement, recognize them on simple stained specimens, and provide an example of a bacterial genus that demonstrates both.
5. provide examples of three genera of commonly encountered oral microbes.
6. describe, sketch, and recognize examples of basic bacterial cell morphologies (shapes) and arrangements.

EXERCISE 9—THE GRAM STAIN

Upon successful completion of this exercise, you will be able to

1. compare and contrast simple and a differential staining techniques.
2. state the purpose of the Gram stain.
3. describe the function of each step in a Gram stain, and describe how Gram positive and Gram negative cells appear after each step.
4. perform and interpret a Gram stain.
5. discuss the consequences of deviations from proper Gram staining technique.

EXERCISE 10—MISCELLANEOUS STAINING

Upon successful completion of this exercise, you will be able to

1. state purpose of the of the acid-fast, endospore, and capsule stains.
2. describe the function of each step in a acid-fast, endospore, and capsule stains, and describe how positive and negative cells appear after each step.
3. provide examples of pathogens that are characterized by positive results for the acid-fast, endospore, and capsule stain.
4. perform an acid-fast stain, name the most common genus that is acid-fast, and recognize specimens that have been stained by the acid-fast procedure.
5. perform an endospore stain and interpret slides that have been stained by the endospore procedure.
6. describe the purpose of endospores, and compare and contrast two common genera that produce them.
7. describe the purpose of a capsule.
8. perform a capsule stain and interpret slides that have been stained by the capsule stain procedure.
9. compare and contrast positive and negative stains.

EXERCISE 11—CULTURE MEDIA PREPARATION

Upon successful completion of this exercise, you will be able to

1. compare and contrast the uses of general-purpose, selective and differential media, and provide examples of each.
2. calculate proportions necessary to make different amounts of culture media when given a recipe.
3. discuss the importance of sterilization in medium preparation, state the conditions under which complete sterilization occurs, and name the equipment used to achieve it.
4. prepare nutrient agar and transfer it to Petri plates aseptically to produce nutrient agar plates.
5. state the role of the unopened plate in this exercise.

EXERCISE 12—THE STREAK PLATE AND COLONY MORPHOLOGY

Upon successful completion of this exercise, you will be able to

1. aseptically transfer from broth or agar tubes to Petri dishes.
2. describe the purpose and principle of the streak plate.
3. perform a T-streak to isolate bacteria from a mixed culture.
4. properly label and incubate Petri plates.
5. explain why Petri plates are incubated in an inverted position.

6. describe how colonies form on a Petri plate and explain why isolation is an important procedure in microbiology.
7. visually differentiate bacterial colonies based on color, size, consistency, margin, shape (elevation), and opacity. and properly apply the terms as listed in "*Technical Background*".
8. discuss possible problems encountered in performing a streak plate, including recovery of only a single bacterial type from a mixed culture and recognizing likely contaminants.

EXERCISE 13—SPECIMEN TRANSPORT & UBIQUITY OF MICROORGANISMS

Upon successful completion of this exercise, you will be able to

1. collect a sample with a specimen swab.
2. discuss different transport devices and media used for collected specimens.
3. describe the principle and purpose of RODAC plates, and apply the guidelines for evaluating degree of surface contamination.
4. describe the importance of quality control (QC) in microbiology in general, and the Gram stain in particular.
5. produce a Gram stain QC slide.

EXERCISE 14—HAND-WASHING

Upon successful completion of this exercise, you will be able to

1. state the importance of hand washing before and after microbiological procedures, including the use of disinfectant when scrubbing for a medical procedure.
2. list common microorganisms found on the human skin.
3. define the terms nosocomial, contaminant, transient and resident as they apply to microorganisms.
4. provide and recognize examples of likely sources of hand contamination.

EXERCISE 15—BACTERIAL PLATE COUNTS

Upon successful completion of this exercise, you will be able to

1. use the plate count technique to calculate bacterial density in a sample.
2. perform serial dilutions using serological and digital pipettors.
3. perform the spread plate technique of inoculation.
4. perform dilution problems.
5. define the terms CFU, aliquot, diluent, dilution factor, TNTC and TFTC.
6. explain why bacterial densities are reported as CFU/mL as opposed to cells/mL.
7. explain the convention of only counting plates that have between 30 and 300 colonies.