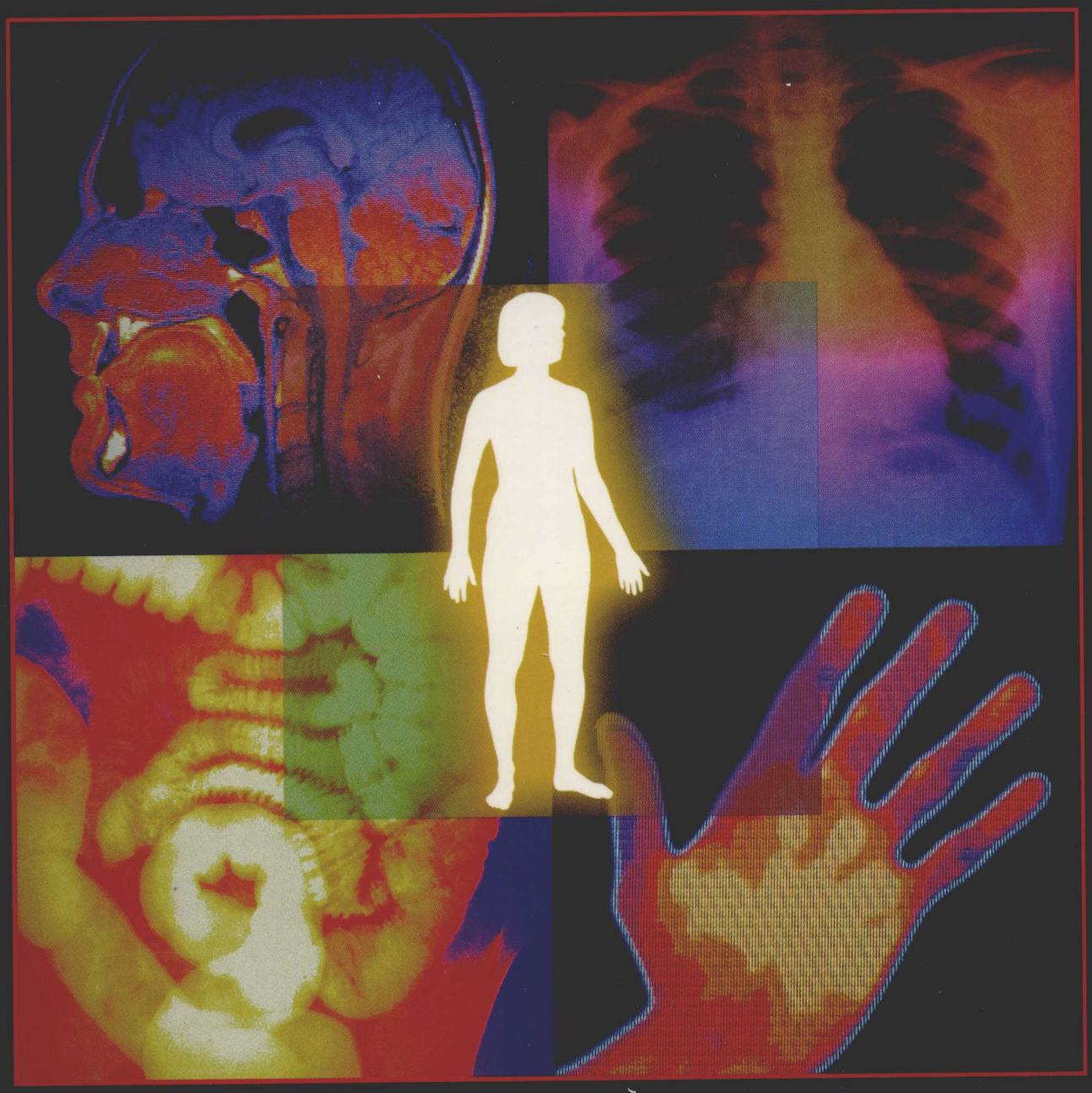

Kevin Patton

Anatomy & Physiology

LABORATORY MANUAL

SECOND EDITION

ANATOMY AND PHYSIOLOGY LABORATORY MANUAL,

Second edition

Original drawings by Eileen M.A. Draper

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Preface

Anatomy and physiology laboratory courses provide the essential hands-on learning opportunities required for a thorough understanding of the human body. This manual contains a series of 42 exercises that provide several guided explorations of human structure and function. These activities include:

- **Labeling exercises** provide opportunities to identify important structures learned in the laboratory and lecture portions of the course. Once completed, they provide guidance to laboratory examinations of models and specimens. Students are encouraged to *write out* the labels so that the terms are more easily learned.

- **Coloring exercises** are becoming the most popular, and most effective, way for many learners to grasp the essential spatial relationships of anatomical structures. This manual contains an accurate and comprehensive collection of human anatomy coloring plates.

- **Dissection of anatomical models** and examination of charts are an integral part of any beginning anatomy and physiology laboratory experience. This manual's instructions give valuable guidance for the effective use of models and charts.

- **Dissection of fresh and preserved specimens** of tissues, organs, and whole organisms enhances each student's appreciation of anatomical and functional relationships. Examination of tissues and organs is suggested in specific exercises throughout this manual. The last unit offers a complete dissection of the laboratory rat (which can be used at any point in the course), as well as a guide to a live or taped demonstration with a prosected human cadaver.

- **Physiological experiments** emphasizing a variety of functional processes of the human body offer students immediate and dramatic examples of physiological concepts. When possible, these activities center around examination of the student's *own* physiological processes.

- **Optional computerized experiments** allow students to use the latest and most accurate methods for observing and measuring important physiological phenomena.

- **Content and concept review** questions and fill-in tables in each Lab Report and throughout the text of various exercises encourage students to reinforce and apply their knowledge of human structure and function.

- **Modern anatomical imaging** techniques such as computed tomography (CT), magnetic resonance (MR) imaging, and ultrasonography are introduced where appropriate. In each special presentation of imaging technology, students are challenged to interpret actual images of the human body.

- **Practical applications** to exercise and athletics, clinical situations, and everyday experiences increase student motivation and place important concepts in a useful context. Each practical example includes application questions that encourage students to think about how concepts apply to the situation described.

This laboratory manual also offers other features that enhance learning and ensure a safe and effective laboratory experience:

- **Special reference supplements** are included where appropriate to help students in their examination of laboratory specimens. The HISTOLOGY MINIREFERENCE offers numerous full-color, labeled examples of commonly seen histology specimens. The ANATOMICAL ATLAS OF THE RAT in Exercise 41 includes a complete series of labeled anatomical drawings of the laboratory rat.

- **Learning objectives** presented at the beginning of each exercise offer a framework for learning.

- **Complete lists of materials** for each exercise give the students and instructor a handy reference for efficient set-up of laboratory activities.

- **Boxed hints** provide students with special tips on handling specimens, using equipment, and otherwise managing their laboratory activities.

- **Safety tips** are highlighted in special boxes to remind students of potential hazards, such as fire, chemical spills, cuts, or biological contamination.

- **Numerous illustrations** of proper procedures complement the text's complete description of laboratory activities.

The design of this laboratory package not only makes the laboratory course fun and effective for the student but also provides essential support for the instructor and lab preparation technician. Here are some examples of elements designed to aid instruction and preparation:

- **A comprehensive instruction and preparation guide** is provided to each adopting instructor. The guide contains a complete set of hints and special notes and instructions for each laboratory exercise. The guide provides a list of materials broken down by exercise, and a comprehensive list of all materials suggested for the course. Substitutions and special sources are given where appropriate. Lists of solution-preparation guidelines and other aids are found throughout the guide. Reproducible handouts to supplement certain exercises are also provided in the guide.

- **Modular organization of laboratory exercises** allows their use in virtually any order required by the needs of individual courses. Comprehensive cross-references in the instruction and preparation guide alert instructors about other Lab Exercises that may involve similar material. For example, the Hormone Exercise may be more appropriately done near the reproductive-system exercises in some courses. The major dissection unit is isolated at the end of the manual for easy reference if dissection specimens are to be used throughout the course or at any particular point in the course.

- **Complete instructions for lab activities** are given to the student, freeing the instructor to interact with laboratory students on an individual basis rather than spending a great deal of time introducing the lab procedure to the whole class.

- **Easy-to-evaluate Lab Report formats** allow instructors to check on student work or assign grades in an efficient manner. The Instruction and Preparation Guide provides correct answers to objective questions in each Lab Report.

Production of this lab manual was a team effort in many ways. Illustrator Eileen Draper contributed many of the coloring plates and other figures. Mosby's editorial staff provided support and encouragement as well as professional savvy.

Steve Schacht of Intelitool provided information and advice for the computer-based alternate lab activities.

My sincerest thanks to everyone involved.

Kevin T. Patton

Welcome to Anatomy and Physiology Laboratory

Anatomy and physiology laboratory challenges you to learn a great deal about human structure and function in a rather informal, practical atmosphere. Despite its informality as a learning situation, laboratory work does require some appreciation of the scientific method in general and laboratory policy and procedure in particular. Read this introductory section carefully. It will introduce you to laboratory science and will give you tips on how to complete this course with great success.

The scientific method

The **scientific method** is merely an approach to discovery. From its early days as a discipline, science has relied on this very simple, logical method for gaining an understanding of the universe. The basics of the scientific method can be summarized as a set of steps that are followed in scientific discovery:

Hypothesis. First, one makes a tentative explanation, called a **hypothesis**, about some aspect of nature. A hypothesis is a reasonable guess based on previous informal observations or on previously tested explanations.

Initial experimentation. After a hypothesis has been proposed, it must be tested. The testing of a hypothesis is called **experimentation**. Scientific experiments are designed to be as simple as possible, to avoid the possibility of errors. Often, **experimental controls** are used to ensure that the test situation itself is not affecting the results. For example, if a new cancer drug is being tested, half the test subjects will get the drug and half the subjects will be given a harmless substitute. The group getting the drug is called the *test group*, and the group getting the fake is called the *control group*. If both groups improve, or if only the control group improves, the drug's effectiveness hasn't been proven. If the test group improves, but the control group doesn't, the hypothesis that the drug works is tentatively accepted as true. Experimentation requires accurate measurement and recording of data.

Interpretation and conclusion. After an experiment, or series of experiments, the researcher analyzes all of the experimental data. If the results support the original hypothesis, it is tentatively accepted as true, and the researcher moves on to the next step. If the data does not support the hypothesis, the researcher tentatively rejects the hypothesis. If an experimental error is suspected, the hypothesis may not be rejected but retested. Knowing which hypotheses are untrue is almost as valuable as knowing which are true. Every rejected hypothesis brings the scientific community a little closer to the truth.

Replication. This step in the scientific method is the one least appreciated by non-scientists. After a hypothesis is tested and accepted, it is retested over and over to make sure that it is true. Because researchers often make minor mistakes in the design or execution of experiments, it is important that other scientists verify the original work. Usually, initial research experiments and their results are published in scientific journals so that others in the same field of research can benefit from them and verify them. If experimental results cannot be replicated (recreated) by other scientists, the hypothesis is not widely accepted. If a hypothesis withstands this rigorous retesting, the level of confidence in the hypothesis increases. A hypothesis that has gained a high level of confidence is called a **theory** or **law**.

The "facts" presented in this course are merely the latest hypotheses of how the body is built and how it functions. As methods of imaging the body and measuring functional processes improve, we find new data that causes us to replace old hypotheses with newer ones.

Measurement and data collection

Scientific experimentation is valid only when data is accurately measured and accurately recorded. In this lab course, you will be invited from time to time to execute various experiments. Your results will be meaningful only if you are careful to measure and record your results properly.

In this manual, as in nearly all scientific works, only the **metric system** of measurement is used. The metric system is useful for two important reasons: it is commonly used throughout the world, and metric units are easily converted because they are all based on units of ten.

HINT → Don't worry about being able to convert metric units to United States (English) units or vice versa. You will never be required to do that type of unit conversion in this course. It is more important that you learn to "think in metric," without regard to equivalent units in another system.

In this course, you will use metric units to measure time, temperature, length, volume, mass, and pressure. Each of these measurable characteristics has a basic metric unit that can be increased or decreased by factors of ten as needed. For example, the basic unit of measuring length is the **meter**. The meter is a useful unit in measuring the height of an elephant, 2 to 3 meters, but not in measuring the distance to the moon. Units a thousand times larger, **kilometers**, are used instead. Likewise, the diameter of a bacterial cell is measured in **micrometers**, which are a million times smaller than a meter. Different size units can be converted back and forth by multiplying or dividing by factors of ten.

Each of the tables in this section give the basic units and common alternative units for time, temperature, length, volume, mass, and pressure.

HINT → The abbreviations of metric units are given in parentheses. Note that they do not have a period (.) after them. Be careful to notice whether they are capital (upper case) letters or not.

TIME

Basic unit: second (sec)

.000001 second = microsecond (μsec)
.001 second = millisecond (msec)
60 seconds = minute (min)
3600 seconds = hour (hr)

TEMPERATURE

Basic unit: degree Celsius (°C)

No alternate units are commonly used.

LENGTH

Basic unit: meter (m)

.000001 meter = micrometer (μm)
.001 meter = millimeter (mm)
.01 meter = centimeter (cm)
1000 meters = kilometer (km)

VOLUME

Basic unit: liter (l or L)

.001 liter = milliliter (ml)*
.01 liter = centiliter (cl)
0.1 liter = deciliter (dl)

* *milliliters = cubic centimeters (cc)*

MASS

Basic unit: gram (g)

.001 gram = milligram (mg)
.01 gram = centigram (cg)
1000 grams = kilogram (kg)

PRESSURE

Basic unit: millimeters of mercury (mm Hg)

No alternate units are commonly used.

Accurate measurement means using units of measurement correctly, but it also means using measuring devices accurately. If you are not familiar with reading the markings on metric rulers, balances, thermometers, and other common measuring devices, ask your instructor to demonstrate.

HINT → A handy reference table of metric units and conversions is printed on the inside back cover of this lab manual.

How to dissect

The term *anatomy* literally means "to cut apart," so it is no wonder that dissections are commonly done in anatomy lab courses. Dissection activities recommended in this manual are not proposed without recognition of humane concerns. The purpose of these dissections is to instruct in a way that no other method can duplicate. The specimens called for are from animals raised specifically to be euthanized and used as resources. For health professionals, dissection of anatomical preparations is a necessary prerequisite to working with living bodies.

The goal of any dissection exercise is the exploration of anatomical relationships. Proper dissection requires patience and skill. Some students slice and hack away at their specimens until they have a tray of ground meat. Others hardly touch their specimen. Good technique is somewhere in the middle of these two extremes. Organs should be separated from one another only enough to see surrounding structures. Rarely should structures be cut or removed. The instructions given in this manual state when, where, and how cuts should be made.

Each dissection activity in this manual offers safety advice concerning proper handling of the dissection specimens. Protective gloves, lab coat, and eyewear may be called for when using some specimens. Always be careful when using dissection tools. Severe injuries can result from their careless use.

Figure A shows some commonly used dissection instruments. A brief discussion of each is in order here:

1. **Scalpel or knife.** The scalpel is probably the most overused instrument in an anatomy lab course. This tool should be used *seldom*, only when you want to cut all the way through a specimen. A pathology **knife**, or butcher knife, is a much more useful tool.

2. **Scissors.** Scissors are probably the most underused dissection tool. Whenever you are tempted to use a scalpel for cutting, try the scissors first. Often, your results will be much better and you will not have damaged important underlying parts.

3. **Probes.** You may want to have several types of probes. Both dull and sharp probes (dissecting needles) are useful in separating tissues, exploring cavities, tracing blood vessels, and pointing to structures.

4. **Forceps.** Forceps are one of the handiest dissection tools. They can be used to grasp small objects, to separate structures, to point to structures, to explore cavities, and to pull on structures.

5. **Ruler.** Your metric ruler should be marked in both centimeters and millimeters. It is useful in measuring organs and in many non-dissection lab activities.

6. **Dissection pins.** These are standard, heavy-duty straight pins. Dissection pins are useful in pinning membranes and other structures to a dissection board to keep them temporarily out of the way.

7. **Dissection tray.** There are many varieties and shapes of dissection tray, and your instructor will recommend the best for your situation. Dissection trays help organize the dissection activity by keeping everything together, and they protect the lab table surface. Some types can also be used for storing your specimen for later study.

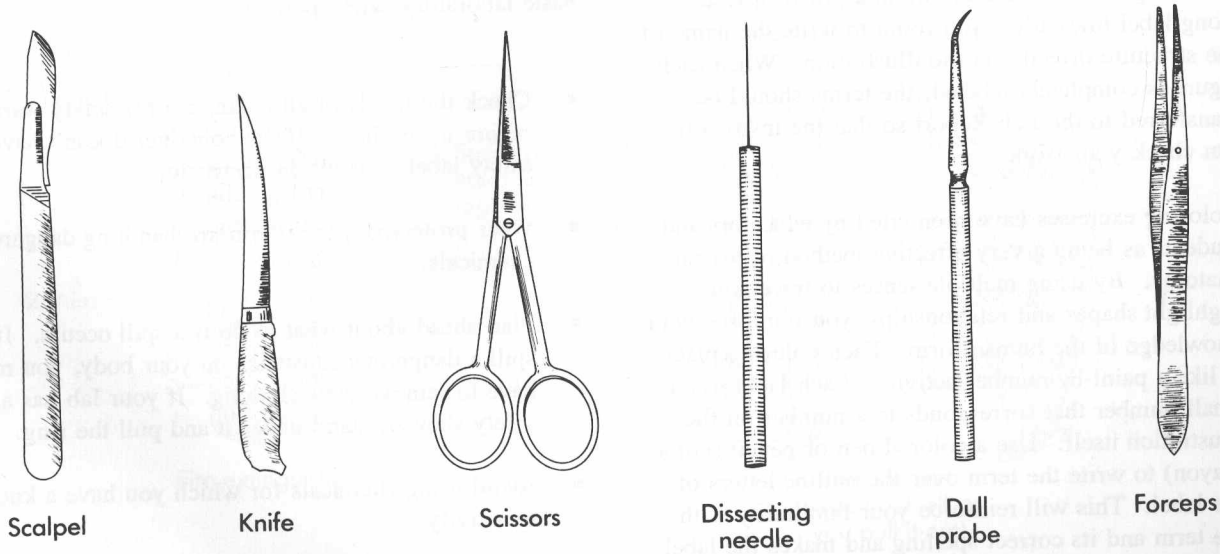


Figure A Commonly used dissection tools.

Using this manual

The format of each Lab Exercise is self-explanatory. After some brief introductory remarks, each exercise begins with a section entitled "Before you begin." This section recommends that before starting any lab activity you should:

- Read the appropriate chapter(s) in your text book.
- Set your learning goals so that you know what important concepts you should be trying to learn.
- Prepare your materials so that your lab activity will run smoothly.
- Read the entire activity before starting. In this way, you won't be surprised (and therefore unprepared) for any step in the procedure.

Each exercise contains one or more "activities." Your instructor may suggest that you do all the activities in an exercise or only one. Each activity includes some or all of these helpful features:

- Large, bold step numbers help you keep your place as your eyes move back and forth between the manual and your lab set-up. Each step number is preceded by a check-box (□) that you can use to check off each step as it is completed.
- Boxed hints, safety tips, and landmark characteristics (for identifying specimens) highlight useful information for completing the activity safely and successfully.
- Labeling exercises encourage you to apply your knowledge of human anatomy in a practical test. Long label lines allow you room to write the name of the structure directly on the illustration. When each figure is completely labeled, the terms should be transferred to the Lab Report so that the instructor can check your work.
- Coloring exercises have been cited by educators and students as being a very effective method of learning anatomy. By using multiple senses to trace and highlight shapes and relationships, you reinforce your knowledge of the human form. Each coloring plate is like a paint-by-number activity. Each label has a small number that corresponds to a number on the illustration itself. Use a colored pen or pencil (not a crayon) to write the term over the outline letters of the label. This will reinforce your familiarity with the term and its correct spelling and makes the label a "color code" so you can later find the structure by its color. After filling in the label, use the same color to shade in the matching structure in the illustration. Use contrasting colors so that parts that are next to one another can be easily distinguished. Do not attempt to color everything in realistic colors, otherwise many parts will look the same. If you use pens, make sure they won't bleed through the paper. If you use pencils, you may want to insert a piece of plain paper into your manual over each completed coloring plate so that the colors don't rub off on the facing page. The materials list in the first exercise reminds you to bring colored pens or pencils to your work area, but it is assumed that you will have these for all the lab exercises.

Each exercise ends with a Lab Report. The report includes handy tables and sketching areas for you to record your laboratory observations and results. Where appropriate, the lab report also presents objective and subjective questions for you to answer. Some of these questions drill you on your knowledge of important terms, whereas others ask you to use your basic knowledge to interpret, organize, or otherwise process basic facts to ensure that you understand conceptual relationships. A number of highlighted practical application boxes in the exercise itself often ask you to apply your basic knowledge in this way. These questions, along with practice in making scientific observations, help you develop your scientific reasoning skills.

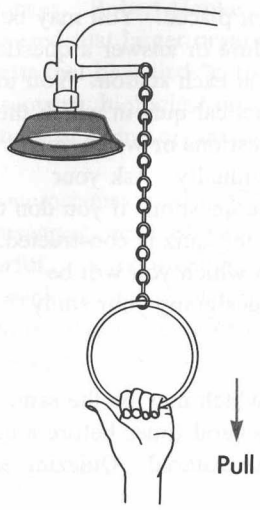
SAFETY FIRST!

As already mentioned, numerous boxed safety tips appear through out this manual. Entitled "SAFETY FIRST!," their large letters and urgent tone are meant to call your attention to potential hazards in the laboratory. Before beginning the course, it is essential that you learn some basic laboratory safety policies:

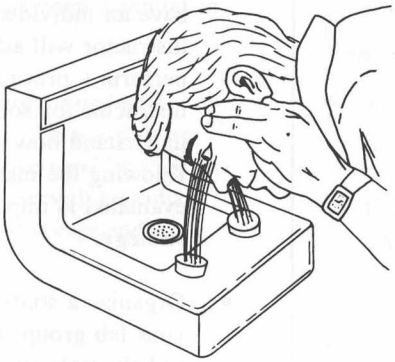
- Check the labels of all chemicals for safety warnings before using them. If the container doesn't have a safety label, consult the instructor.
- Wear protective gear if you are handling dangerous chemicals.
- Plan ahead about what to do if a spill occurs. If you spill a dangerous substance on your body, you may have to remove your clothing. If your lab has a safety shower, stand under it and pull the ring.
- Avoid using chemicals for which you have a known sensitivity.
- Locate first aid equipment in the laboratory and familiarize yourself with its use.

- Locate the nearest emergency medical help, and identify the easiest and fastest way to access it (for example, phoning an ambulance).
- Locate the fire safety equipment in your lab and familiarize yourself with its use. Locate the nearest fire alarm box, and identify the recommended primary and alternate fire exit routes.
- Always follow the directions provided with equipment and supplies, even if they are different than those given in this manual. Injuries often result from the misuse of equipment.
- Remember that absolutely no eating, drinking, or smoking is allowed in the laboratory.
- To avoid injury and/or contamination, properly dispose of, or clean and store, all lab equipment and supplies before vacating the laboratory. Wash your hands thoroughly on entering and leaving a biological laboratory.
- Always supervise experiments or demonstrations in progress. Never leave a laboratory experiment unattended.

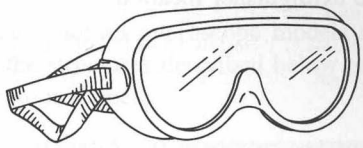
Chemical Safety



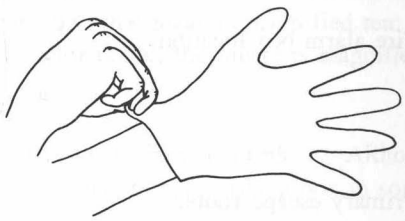
Safety shower



Eyewash
(hold eyelids open)

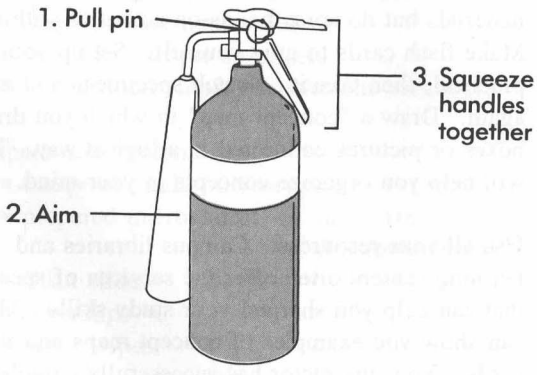


Safety goggles



Protective gloves

Fire Safety



Fire extinguisher

Fire blanket
(wrap yourself as you pull it out)

Figure B Commonly used chemical and fire safety equipment.

IMPORTANT SAFETY INFORMATION

(Use the spaces below to write in important safety information.)

Location of first aid box:

Emergency medical help:

Fire extinguisher location:

Fire extinguisher type:

Fire alarm box location:

Primary escape route:

Alternate escape route:

Weather safety shelter:

Important notes:

How to study for lab quizzes

Tips for effective studying could fill several volumes. Instead of an entire work on studying, this section presents a few tips that many students have found to be particularly helpful in the anatomy and physiology laboratory course. As with any list of study tips, you will find some useful to you and other not so useful.

- Identify the type of quizzes you will encounter. Written quizzes may involve multiple choice, matching, or other objective questions. Written quizzes may also have subjective short-answer or essay questions in which you are to interpret or restate concepts. Figures may be offered for labeling. Practical tests may involve stations at which specimens have been placed. You may be asked to perform a procedure or answer a question about the specimen while at each station. You may have an individualized practical quiz in which the instructor will ask you questions or watch you perform a procedure individually. Ask your instructor for some sample questions if you don't understand how an upcoming quiz is constructed. Knowing the manner with which you will be evaluated is important to designing your study strategy.

- Organize a study group (which may be the same as your lab group) to meet several times before a quiz to help each other with the material. Quizzing each other is useful technique.

- Spend many brief sessions reviewing specimens and other lab work, rather than one or two long sessions just before the quiz. Ask your instructor if there are open lab times or a learning center at which you can review models or specimens.

- Study actively. Don't just sit and look at your study materials but do some hands-on activities with them. Make flash cards to quiz yourself. Set up your own practical, then take it. Sketch specimens and models again. Draw a "concept map" in which you draw boxes or pictures connected in a logical way. This will help you organize concepts in your mind.

- Use all your resources. Campus libraries and learning centers often offer the services of specialists that can help you sharpen your study skills. They can show you examples of concept maps and flash cards. Your instructor has successfully completed laboratory courses and has helped numerous previous students in this course. Ask your instructor for study tips. Use the textbook and study aids in the textbook to help you learn the lab material.

Contents

The Microscope

In the seventeenth century, the amateur Dutch scientist Anton van Leeuwenhoek used one of the first microscopes to discover a whole new world of living organisms. Using a single lens, or **simple microscope**, he observed tiny organisms in pond water and other substances. Robert Hooke, an English scientist, discovered that larger organisms had small microscopic subunits that he called "cells." Ever since this early era of discovery, biological microscopy has been essential in the study of living organisms.

The microscopes used in this course are **compound microscopes**, made of a set of lenses. They are more powerful, and more complex, than those used by van Leeuwenhoek and Hooke. This exercise will introduce you to the use and care of the standard compound microscope.

Before you begin

□ Read the appropriate chapter in your textbook.

□ Set your learning goals. When you finish this exercise, you should be able to

- identify each major part of a compound light microscope and describe its function
- determine total magnification at different settings
- use a microscope to observe prepared specimens
- prepare a wet-mount slide
- stain microscopic specimens
- record microscopic observations accurately

□ Prepare your materials:

- compound light microscope
- prepared microslides: *newsprint "e"*
  3 colored threads
- clean slides
- coverslips
- paper wipes
- methylene blue stain
- flat toothpicks

□ Read the directions and safety tips for this exercise **carefully** before starting any procedure.

A. Parts of the microscope

□ **1** Obtain a compound light microscope and identify each of the structures described below.

> **HINT →** Because not all microscope models are alike, some of the structures described below may be different on your scope.

□ **2** The set of lenses closest to your eye is the **ocular**, or eyepiece. The ocular magnifies an image by the factor indicated on the ocular's barrel, usually 10X. If the factor is 10X, the image is magnified ten times. If the factor is 5X, the image is magnified five times.

□ **3** The **body tube** holds the ocular in place. Although called a "tube," it may be more like a box in some models.

□ **4** At the bottom of the body tube is the **revolving nosepiece**. A turret-like circular mechanism rotates so that different lenses can be selected. *Always rotate the nosepiece by holding the outside of the revolving disk — never push on the lens barrels.*

□ **5** Each of the lens sets attached to the revolving nosepiece is an **objective**. As with the ocular, each objective is marked with its magnification factor. Microscopes may have any or all of the following objectives:

4X (scanning objective) is used for initial location of the specimen.

10X (low power objective) may also be used for initial location of the specimen. It is also used for observing specimens that don't need greater magnification.

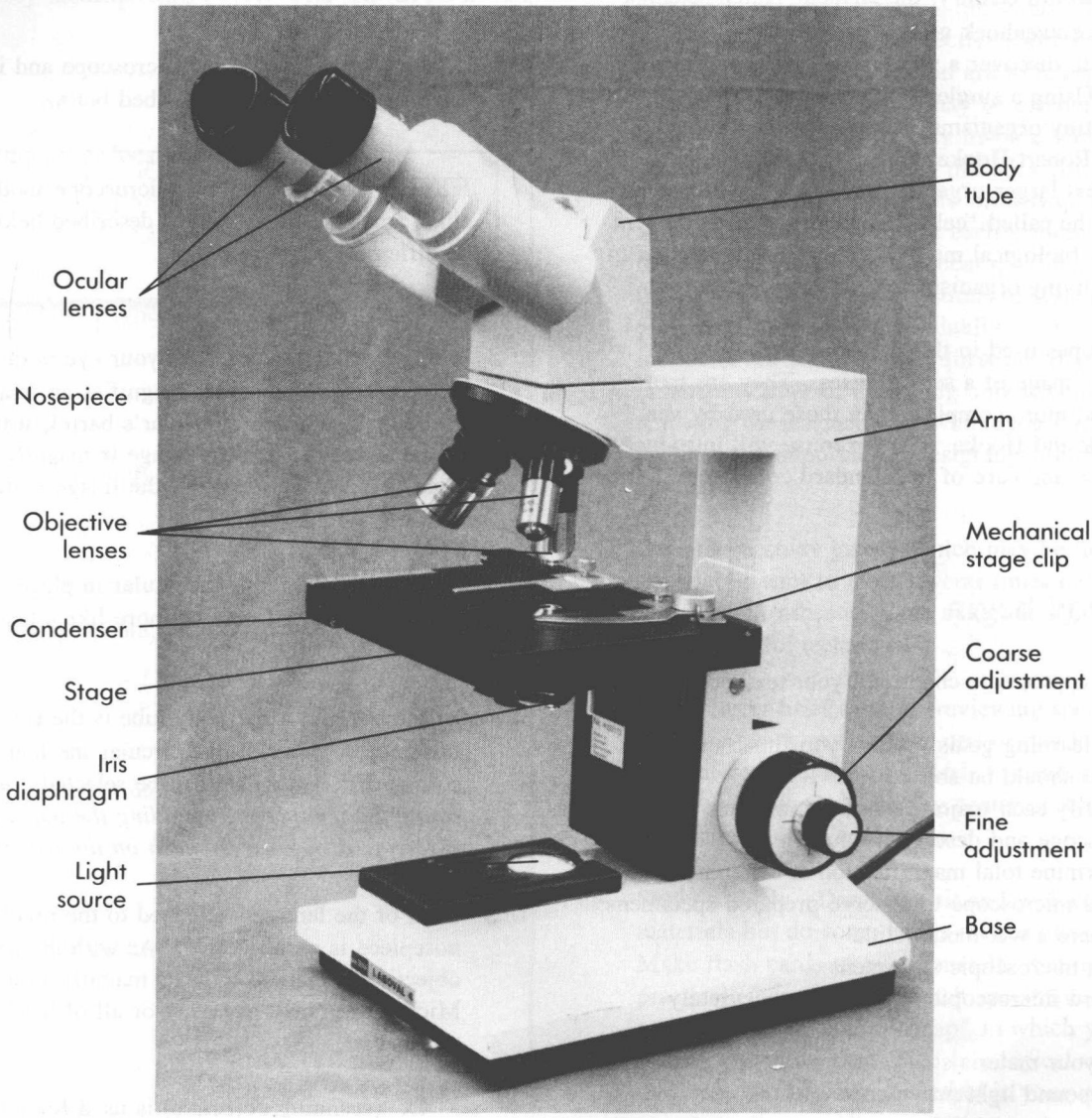


Figure 1.1 Important parts of a typical compound light microscope.

40X (high-dry objective) is used for specimens requiring greater magnification. This objective is called *dry* because it does not require the use of oil, as other high-power objectives do. Some scopes have 43X or 45X high-dry objectives. List the factor on your scope's high-dry objective here _____.

100X (high-oil objective) is used for magnification of extremely small specimens, such as bacterial cells. It must be immersed in oil, so it is called the high-oil objective. This objective will not be used in this course.

In this manual, "low power" will refer to use of the 10X objective and "high power" will refer to use of the 40X objective.

□ **6** **Total magnification** is determined by multiplying the power of the ocular by the power of the objective in use. Thus, when using a 10X ocular and the low power objective, total magnification is 100X (10 × 10 = 100). List all ocular and objective combinations, then determine all the total magnifications possible on your scope and record them in the Lab Report.

□ **7** The specimen is usually mounted on a glass or plastic **microscope slide** that rests on the **stage**, a platform just below the objective. The stage has a hole so that light can pass through the specimen from below. If the stage has an adjustable bracket that moves the slide around mechanically, the stage is called a **mechanical stage**. If not, the slide is held by **stage clips** and must be moved by hand.

□ **8** Below the stage is a high-intensity **lamp**. Light rays from the lamp travel through a hole in the stage, through the specimen mounted on a slide, then through the objective and ocular, to the eye.

□ **9** A **condenser**, a lens that concentrates light, may be found between the lamp and the stage.

□**10** Sometimes the light from the lamp is too strong to see the specimen clearly. The light level may be reduced by adjusting the lamp intensity (if possible). Light intensity may also be adjusted by adjusting the **diaphragm** just below the stage. A *disk diaphragm* is a rotating disk with holes of different diameters. An *iris diaphragm* is made of overlapping slivers of metal in a pattern resembling the iris flower, as does the iris of the human eye. Like the iris of the eye, the iris diaphragm can dilate or constrict its opening. You can change the amount of light passing to the specimen by rotating the edge of the disk diaphragm or by rotating the lever projecting from the iris diaphragm.

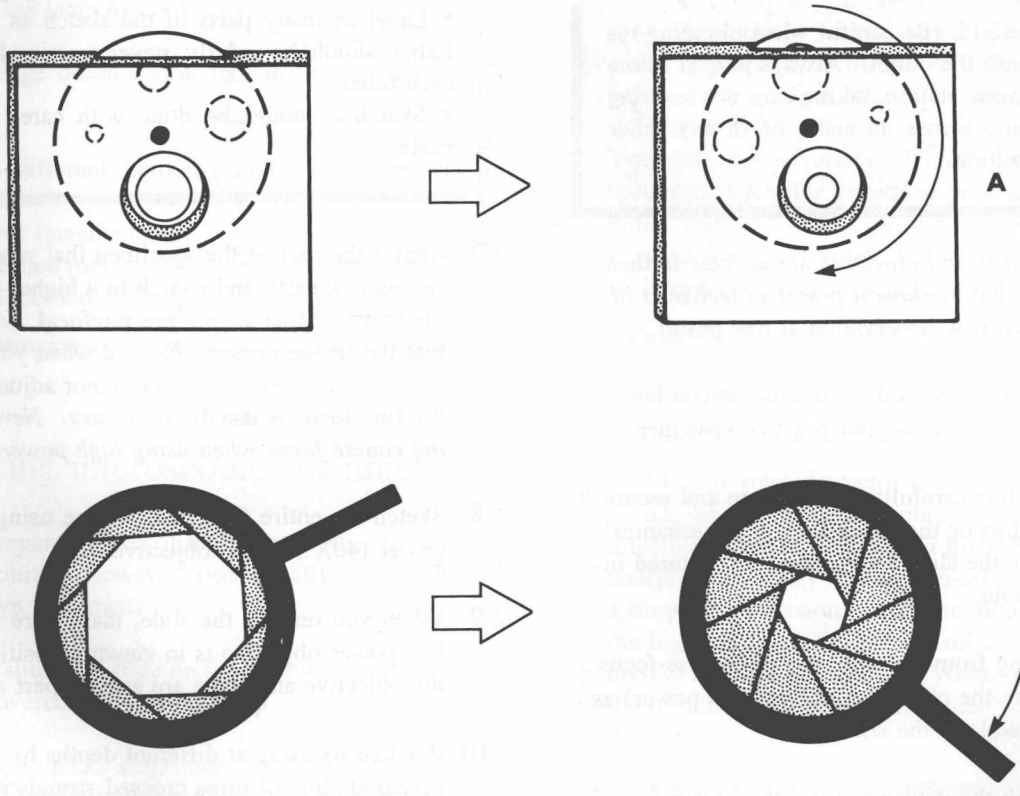


Figure 1.2 (A) Disk diaphragm set at a large opening, then at a smaller opening. (B) Iris diaphragm open, then partially closed.

□11 The entire upper assembly of the microscope is held in an upright position by a bar called the **arm**. The scope is supported by a square or horseshoe-shaped **base**. The arm may be connected to the base by a **pivot**, which allows the upper assembly to move into a more comfortable viewing position.

□12 The **coarse-focus knobs** and **fine-focus knobs** are on the arm. These knobs adjust the distance between the stage and objective, thus focusing an image of the specimen. The fine-focus knobs changes the distance very little, whereas the coarse-focus knob changes the distance greatly.

B. Using the microscope

Skill in using the microscope is necessary for many of the exercises in this lab manual. Fortunately, learning to use the microscope is both easy and fun. Before beginning, acquaint yourself with these basic rules.

▪ Always carry the scope with two hands: one under the base and the other grasping the arm. Carry it in an upright position.

▪ Unwind the lamp cord carefully. Avoid damaging the parts around which it is coiled. Plug the cord into an outlet in a safe manner.

> **SAFETY FIRST!** Be careful when plugging the power cord into the outlet. Always plug it into a receptacle at *your* station, taking care not to string it over a chair, across an aisle, or in any other dangerous position.

▪ Make sure the stage and objective are at their farthest distance apart and that the *lowest power objective is in position*. Start each new observation at low power.

□ 1 Obtain a microscope slide with a newsprint letter *e* mounted on it. This is your practice specimen.

□ 2 Place your slide carefully on the stage and secure it with stage clips or the brackets of the mechanical stage. Move the slide so that the *e* is centered in the stage's hole.

□ 3 While looking from the side, use the coarse-focus knob to move the objective (still on low power) as close as possible to the slide.

□ 4 Look through the ocular and use the coarse-focus knob to slowly move the objective and slide apart. When the image becomes clear, switch to the fine focus knob to make the image even sharper. To avoid damaging the scope and slide, *never move the objective and stage toward each other while looking through the ocular.*

> HINT → To avoid eyestrain and a possible headache, always keep both eyes open when viewing a specimen. With binocular scopes this is easy, once you have adjusted the distance between oculars. However, it may take some practice if you are using a monocular scope. If you have trouble keeping both eyes open, try covering the unused eye with your hand.

□ 5 Adjust the light intensity by using the lamp controller or diaphragm until the detail of the image is at its clearest.

□ 6 Sketch the entire field of view in the space provided in the lab report.

> HINT → Here are some rules for recording microscopic observations properly:
>
> ▪ Label each sketch with the name of the specimen and what type of section it is.
> ▪ Label each sketch with the *total magnification.*
> ▪ Label as many parts of the sketch as you can. Labels should be orderly, never crossing lines with each other.
> ▪ Sketches should be done with care, not with haste.

□ 7 Center the part of the specimen that you wish to see more clearly and switch to a higher-power objective. Most scopes are **parfocal**, which means that the image remains focused when you change objectives. However, some minor adjustment with the fine focus is usually necessary. *Never adjust the coarse focus when using high power.*

□ 8 Sketch the entire field that you see using the high-power (40X to 45X) objective.

□ 9 When you remove the slide, make sure that the low-power objective is in viewing position and that the objective and stage are as far apart as possible.

□10 Practice focusing at different depths by using a prepared slide of three crossed strands of colored thread. The strands (one red, one yellow, and one blue) cross at the same point. Determine which is

on top, which is in the middle, and which is on the bottom. Report your results in the Lab Report.

□ **11** When you have finished for the day, return the scope to its original configuration. The low-power objective should in position. Make sure the slide has been removed.

HINT → If you can't see an image in your scope...

- Make sure the lamp is on.
- Make sure the diaphragm is open. The amount of light should be set low on low power and high on high power.
- Check for obstructions in the light path.
- Make sure the objective is seated properly.
- Check to see if the specimen is centered.
- Clean the lenses with lens paper and lens solution, not facial tissues or lab wipes.

If the image seems to fade in and out...

- Watch to see if the body tube or stage is shifting or dropping.
- Make sure the scope doesn't require a rubber eyecup for proper viewing.
- Make sure the specimen isn't in a medium that obstructs viewing.
- Check the lamp or cord for short circuits.

If the image doesn't look like the figure in the book...

- Get a different book (it may have a better figure).
- Use your imagination.
- Join the club (nobody else's specimen is identical to that in the book either).

C. Preparing microscopic specimens

We will use prepared slides of human and other tissues often in this course. However, occasionally we may be making our own specimens.

A **wet-mount** slide is a slide on which a wet specimen is placed, then covered with a **cover slip**.

Stains are used to make a specimen, or some of its parts, more visible. Some require special techniques, but most stains can simply be added to the specimen and viewed.

□ **1** Obtain some skin cells by scraping the inner surface of your cheek with a clean, flat toothpick.

□ **2** Wipe the scrapings on a clean microscope slide and put a small drop of *methylene blue* stain directly on the smear.

SAFETY FIRST! Use only fresh toothpicks and dispose of used toothpicks *immediately.* Take precautions to avoid the spread of disease through your saliva.

□ **3** Place one edge of a coverslip on the slide next to the specimen, then let it drop slowly on the specimen. This method avoids forming air bubbles.

□ **4** Absorb any excess fluid around the edges of the coverslip with the edge of a paper wipe.

□ **5** Locate some cells with the low-power objective, shift to high power, and sketch your observations in the Lab Report.

LANDMARK CHARACTERISTICS

You are looking for scattered epithelial cells. Each cell will appear as a lightly stained, flat polygon or circle with a dark center. The dark center is the nucleus of the cell. Some cells may be separate, whereas others are clumped together.

You may see a variety of *other things* in your specimen: bacteria, vegetable or meat fibers, and other matter. Don't worry; this is normal. Distinct dark circles with hollow centers that may be in motion are air bubbles.

HINT → If your instructor wants you to learn how to use an oil-immersion objective, follow these directions. After focusing on high-dry, rotate the nosepiece *half-way* to the high-oil objective. Put a drop of immersion oil on the slide, then rotate the high-oil objective into the oil drop. You may need to increase the lighting. When finished, clean the objective and other surfaces as your instructor directs.