

STUDENT LABORATORY GUIDE

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BIOLOGICAL SCIENCE

AN INQUIRY INTO LIFE

BIOLOGICAL SCIENCES CURRICULUM STUDY

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Contents

The *Student Laboratory Guide* contains 89 inquiries. Each presents different content and illustrates different aspects of an investigation or a concept. Many involve different equipment and techniques. Some are graded in terms of open-endedness, with earlier inquiries more highly structured than later ones. This variety in the inquiries increases the flexibility within the classroom and laboratory environments and necessarily involves the teacher in decisions between different inquiries as basic or supplementary.

A decision to use all the inquiries involves assigning different teams of students different inquiries at least some of the time. Whether this is feasible depends not only upon the necessary laboratory facilities and supplies but upon the degree of independence students are to have in their laboratory work. If all students are to undertake the same inquiries, some—perhaps many—of the inquiries will not be assigned, but students of high initiative will want to undertake certain optional inquiries on their own.

One suggested organization of the 89 inquiries into basic and optional categories is given in this table of contents, with optional inquiries indented. The decision of which inquiries to use, however, remains the teacher's.

INQUIRY 1-1	Life In Unexpected Places?	1
	An investigation basic to Chapter 1, to development of the need for microscopes, and to preparations for Inquiry 2-1. It may be omitted if Inquiry 2-1 will not be assigned.	
INQUIRY 1-2	The Compound Microscope—A Scientific Tool	3
	Basic techniques of microscopic observation.	
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	An optional inquiry into quantitative techniques with the compound microscope.	
INQUIRY 1-4	Types of Microscopes	10
	An optional inquiry into specialized types of compound microscopes and comparisons of their capabilities with those of the electron microscope.	
INQUIRY 2-1	Life from Nonlife?	22
	A basic inquiry continuing the investigations begun in Inquiry 1-1 and establishing their relationship to the biogenesis-abiogenesis controversy of Chapter 2.	
INQUIRY 3-1	Cork—An Investigation Into Form and Function	23
	A classical investigation of the plant part in which cells first were discovered.	

INQUIRY 3-2 Cells of Living Plants

An optional inquiry if plant cells are introduced in Inquiry 3-1. Living plant tissues are to be used for an introduction to this inquiry can be made basic, and Inquiry 3-1 can become

INQUIRY 3-3 Cells from You and Frogs

A basic inquiry into several types of animal cells and their contrasts with one another and with the cells of Inquiry 3-1 or 3-2.

INQUIRY 4-1 A Chemical Reaction of Living Systems

A classical investigation of the first-discovered enzyme—linking events in the chemistry with events in living cells.

INQUIRY 5-1 An Enzyme in Plant and Animal Tissues

An inquiry again involving an enzyme, but investigating its action and action in tissue samples rather than in its extracted, purified form. A simple calorimeter is used to help gather evidence whether enzyme-controlled reactions are taking place.

INQUIRY 5-2 Food Energy

A slightly more refined calorimeter is designed and constructed to measure energy equivalents of common foodstuffs.

INQUIRY 5-3 Compounds of Living Organisms

An inquiry introducing the need for, and use of, simple tests to help distinguish one compound from another in plant and animal tissues.

INQUIRY 5-4 Oxidation-Reduction in Living Cells

A basic inquiry into a significant pattern of chemical reactions in living systems, investigated first in a model and then in living microorganisms.

INQUIRY 6-1 Acids, Bases, and Cells

An investigation into one of the ways cells maintain their narrow range of living conditions despite a wide range of chemical changes. A basic inquiry, involving pH and buffers in tissue extracts.

INQUIRY 6-2 Amino Acid Composition of an Unknown

An inquiry into the identification of compounds for which the simple tests of Inquiry 5-3 are not adequate. Paper chromatography is introduced in an analysis for amino acids.

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An inquiry concerning the importance of environmental factors in the development of an organism and the role of the environment in the development of the organism.

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Where around us are microorganisms found? A basic inquiry into a surprising domain.

INQUIRY 10-2 Staining and Observing Bacterial Cells
The Gram stain technique and its use in microscopic bacteria.

INQUIRY 11-1 Descendants of a Single Cell
An investigation showing how to keep track of reproducing microorganisms obtain pure cultures

INQUIRY 11-2 War on Bacteria
An opportunity to test the relative effectiveness of known bacteria.

INQUIRY 11-3 The Environment of a Microorganism
An optional inquiry related to Inquiry 6-3, replacing it with microorganisms in a study of interaction with the environment. The use of an ultraviolet light source requires special precautions.

INQUIRY 11-4 Discriminating Microorganisms
An investigation of differences in the metabolism of several microorganisms—specifically in their utilization of sugars.

INQUIRY 12-1 A Plant-Animal?
A basic inquiry into the value of a questioning attitude instead of rigid concepts of organisms as "plants" or "animals."

INQUIRY 12-2 Fungus Among Us
An optional investigation of types of fungi.

INQUIRY 13-1 Comparison of Plants—Simple or Complex?
The basis for plant classification, and an introduction to plant phylogeny.

INQUIRY 13-2 Green Algae—Simple and Complex
A search for reasons why green algae are central to consideration of the evolution of green land plants.

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An optional introduction to the use of a key in classifying organisms—in this case, representatives of common families of flowering plants.

INQUIRY 17-3 From Seed to Seedling

An extension of Inquiry 14-3, proceeding from seeds to the growth and development of new plants; also an investigation into the source of energy for the process.

INQUIRY 17-4 Plant Reactions to Environment

Do plants show "behavior"? A basic inquiry that investigates responses of plants to various stimuli.

INQUIRY 17-5 Regulation of Growth in Plants

An analysis of a classical investigation in plant growth, leading to a pattern of evidence about one mechanism involved.

INQUIRY 18-1 Plants or Animals?

A basic inquiry that explores in greater detail the question raised by study of a single organism in Inquiry 12-1.

INQUIRY 18-2 Structure and Function in *Paramecium*

The introduction to a series of investigations of basic animal processes in a single-celled animal. Hypotheses affecting succeeding investigations are required from the initial observations.

INQUIRY 18-3 Locomotion of *Paramecium*

The hypotheses of locomotion from Inquiry 18-2 are investigated and are confirmed or rejected.

INQUIRY 18-4 Ingestion and Digestion in *Paramecium*

Several related hypotheses from Inquiry 18-2 are investigated as a *Paramecium* is fed and observed.

INQUIRY 18-5 Contractile Vacuoles in *Paramecium*

An investigation of a homeostatic mechanism associated with one or more hypotheses from Inquiry 18-2.

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The last inquiry of the initial series of investigations into basic animal processes (see also Inquiry 35-2).

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INQUIRY 26-1 Effects of Reproductive Hormones

A basic inquiry providing evidence of the influence of reproductive hormones on characteristics.

INQUIRY 27-1 Reproduction and Development in the Frog

An introduction to the processes involved in reproduction—observation of growth and development of frogs from eggs. An optional inquiry may be substituted for Inquiry 27-2, if it is appropriate for the particular classroom situation, or both inquiries may be used to study development in different animals.

INQUIRY 27-2 How Does an Egg Form a Chicken?

A basic investigation of animal embryology and development.

INQUIRY 28-1 Growing a New Body

Regeneration in an invertebrate and in a vertebrate—a basic inquiry involving principles of growth and development.

INQUIRY 29-1 *Drosophila* Technique

The techniques of laboratory work with *Drosophila*, essential if *Drosophila* is to be used in the following investigations of genetic principles.

INQUIRY 29-2 Randomness, Chance, and Probability

An investigation of the laws of chance and their relation to principles developed by Mendel. This inquiry is basic to the analysis of ratios of offspring from selective matings of *Drosophila* (or from observed crosses in corn).

INQUIRY 29-3 Inheritance of One-factor Differences

The study of a single trait and its inheritance in *Drosophila* or in corn.

INQUIRY 29-4 Independent Inheritance

The study of two traits and their inheritance in *Drosophila* or in corn.

INQUIRY 30-1 Sex-linked Inheritance

The investigation of a trait associated with genes on sex chromosomes, involving a pattern of inheritance not accounted for by Mendel.