

**STUDENT
LABORATORY
GUIDE**

**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.	
INQUIRY 1-3	Measuring the Invisible	8
	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. If living plant tissues are to be used for an introduction to plant cells, this inquiry can be made basic, and Inquiry 3-1 can become optional.

28

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.

28

INQUIRY 4-1 A Chemical Reaction of Living Systems

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

29

INQUIRY 5-1 An Enzyme in Plant and Animal Tissues

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

32

INQUIRY 5-2 Food Energy

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

34

INQUIRY 5-3 Compounds of Living Organisms

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

36

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.

38

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.

40

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.

43

INQUIRY 6-3 The Environment of an Enzyme 45

An inquiry establishing the importance of homeostasis. Different conditions of pH, temperature, and enzyme concentration are investigated in relation to the efficient action of the enzyme.

INQUIRY 6-4 The Closed Box Mystery 43

How do materials move in and out of cells? Enlarged models with closed membranes are used to investigate the problem.

INQUIRY 6-5 Reactions of Cells in Changing Environments 51

Living cells are investigated directly in an extension of Inquiry 6-4.

INQUIRY 7-1 Mitosis and Genetic Continuity 52

A basic inquiry into cellular reproduction and the mechanisms important in genetic continuity.

INQUIRY 8-1 An Analysis of DNA 55

An inquiry classed as optional because of its requirement for use of a shorter-wave ultraviolet source. With proper precautions, the inquiry provides a rewarding direct experience with DNA and its components. Paper chromatography, with ultraviolet illumination of the chromatogram, is used in making the identifications.

INQUIRY 8-2 Trailing a Virus 58

An inquiry into procedures for detecting ultramicroscopic organisms through the effects they produce.

INQUIRY 8-3 Investigating Differences in Peas 59

An investigation of morphologically different peas and the action of some of their enzymes, to determine whether a genetic basis exists for their differences in appearance.

INQUIRY 8-4 Levels of Biological Organization 62

A broadening of perspective from the cellular level to other organizational levels — tissues, organs, and micro- and macroorganisms.

INQUIRY 9-1 Microbiological Techniques 63

The essential techniques of laboratory work with microorganisms — basic to use of the immediately following inquiries.

INQUIRY 9-2 A Disease of Bacteria 69

An investigation related to Inquiry 8-2 and similarly concerned with the effects of viruses upon their hosts — in this case, bacteria.

INQUIRY 10-1	Distribution of Microorganisms	70
	Where around us are microorganisms found? A basic inquiry into a surprisingly extensive domain.	
INQUIRY 10-2	Staining and Observing Bacterial Cells	72
	The Gram stain technique and its use in microscopic studies of bacteria.	
INQUIRY 11-1	Descendants of a Single Cell	74
	An investigation showing how to keep track of reproducing microorganisms and how to obtain pure cultures.	
INQUIRY 11-2	War on Bacteria	77
	An opportunity to test the relative effectiveness of known drugs on bacteria.	
INQUIRY 11-3	The Environment of a Microorganism	78
	An optional inquiry related to Inquiry 6-3, replacing tissue cells 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	80
	An investigation of differences in the metabolism of several types of microorganisms—specifically in their utilization of sugars.	
INQUIRY 12-1	A Plant-Animal?	82
	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	83
	An optional investigation of types of fungi.	
INQUIRY 13-1	Comparison of Plants—Simple or Complex?	85
	The basis for plant classification, and an introduction to plant phylogeny.	
INQUIRY 13-2	Green Algae—Simple and Complex	89
	A search for reasons why green algae are central to considerations of the evolution of green land plants.	
INQUIRY 14-1	Alternation of Generations	90
	An investigation of a prominent pattern in the life cycles of both green algae and green land plants. Mosses are the laboratory example.	

INQUIRY 14-2	A Primitive Vascular Plant	92
	The study of a fern and its adaptations to its land environment.	
INQUIRY 14-3	The Importance of Seeds	94
	An inquiry into reproductive specialization in seed plants.	
INQUIRY 15-1	The Significance of Leaf Color	96
	Is chlorophyll necessary to photosynthesis?	
INQUIRY 15-2	Leaf Structure and Function	97
	An opportunity to investigate complementarity of structure and function.	
INQUIRY 15-3	The Pigments in a Leaf	98
	Chlorophyll is extracted from leaves and investigated to determine if it is one—or more than one—green pigment.	
INQUIRY 15-4	Light and Leaves	100
	An inquiry into the essential nature of the light that leaves absorb, and whether this light can be demonstrated to lead to photosynthesis.	
INQUIRY 15-5	Plants and Air	101
	An optional investigation providing experimental evidence for the role of carbon dioxide in photosynthesis.	
INQUIRY 15-6	The Gateway into a Leaf	102
	The homeostatic mechanisms of guard cell metabolism, affecting the stomata.	
INQUIRY 16-1	Stems	104
	An optional inquiry into the structure and functions of stems, following the pattern of Inquiry 15-2.	
INQUIRY 16-2	Roots	105
	An inquiry into the structure and functions of roots.	
INQUIRY 16-3	Transpiration in Plants	107
	Experimental evidence for an essential plant process, and an investigation of the physical factors involved.	
INQUIRY 17-1	Flowers	110
	A morphological study of the reproductive structures of flowering plants.	

- INQUIRY 17-2 A Simple Key to Flowering Plants** 111
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** 117
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** 119
Do plants show "behavior"? A basic inquiry that investigates responses of plants to various stimuli.
- INQUIRY 17-5 Regulation of Growth in Plants** 121
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?** 124
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*** 128
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*** 130
The hypotheses of locomotion from Inquiry 18-2 are investigated and are confirmed or rejected.
- INQUIRY 18-4 Ingestion and Digestion in *Paramecium*** 131
Several related hypotheses from Inquiry 18-2 are investigated as a *Paramecium* is fed and observed.
- INQUIRY 18-5 Contractile Vacuoles in *Paramecium*** 133
An investigation of a homeostatic mechanism associated with one of more hypotheses from Inquiry 18-2.
- INQUIRY 18-6 Reproduction in *Paramecium*** 134
The last inquiry of the initial series of investigations into basic animal processes (see also Inquiry 35-2).

INQUIRY 19-1	Animal Classification	136
	An inquiry into animal variety and classification, corresponding to Inquiries 13-1 and 17-2 for plants. If the earlier two inquiries are assigned, this one may be made optional.	
INQUIRY 19-2	Two Ways of Life	140
	How are animals adapted to their particular ways of life? Structural and functional differences in free-living and parasitic worms are explored as examples.	
INQUIRY 19-3	Animals with Jointed Appendages	143
	An extension of Inquiry 19-2, involving animals of greater complexity—the insects and other arthropods.	
INQUIRY 19-4	Form and Function in the Frog	146
	The internal structure of a vertebrate is investigated through dissection of a frog.	
INQUIRY 20-1	Protein Digestion	150
	A basic inquiry into some of the factors involved in the digestion of proteins—a process essential to the animal way of life and related to the digestion of carbohydrates and, to an extent, fats also.	
INQUIRY 21-1	A Living Invertebrate Heart	152
	A study of a living animal to investigate the environmental factors that influence heart-beat, and to determine the effects of drugs on heartbeat.	
	INQUIRY 21-2 Capillary Circulation	155
	Observation of blood flow in a closed circulatory system, and investigation of the principles involved.	
INQUIRY 22-1	Regulation of Your Breathing Rate	157
	A basic inquiry into suspected factors in the rate of breathing of humans.	
INQUIRY 23-1	Water Balance	159
	An investigation of the interaction between one homeostatic mechanism and varying conditions of the environment.	
INQUIRY 24-1	Sense Reception and the Nervous System	160
	Aspects of sensory reception in humans.	
INQUIRY 25-1	Control of Muscle Contraction	162
	An inquiry into the nerve-muscle relationship.	

- INQUIRY 25-2 Looking Inside a Contracting Muscle**
A microscopic examination of the physical differences between muscle fibers when contracted and relaxed, and an inquiry into the chemical events associated with contraction.
- INQUIRY 26-1 Effects of Reproductive Hormones**
A basic inquiry providing evidence of the influence of reproductive hormones on physiological characteristics.
- INQUIRY 27-1 Reproduction and Development in the Frog**
An introduction to the processes involved in reproduction—and the observation of growth and development of frogs from eggs. This optional inquiry may be substituted for Inquiry 27-2, if it is more 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.