

**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.	
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	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 **25**
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.

INQUIRY 3-3 Cells from You and Frogs **28**
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 **29**
A classical investigation of the first-discovered enzyme—linking events in laboratory chemistry with events in living cells.

INQUIRY 5-1 An Enzyme in Plant and Animal Tissues **32**
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.

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

INQUIRY 5-3 Compounds of Living Organisms **36**
An inquiry introducing the need for, and use of, simple tests that help distinguish one compound from another in plant and animal tissues.

INQUIRY 5-4 Oxidation-Reduction in Living Cells **38**
A basic inquiry into a significant pattern of chemical reactions in living systems, investigated first in a model and then in living microorganisms.

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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.

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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.

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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.

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INQUIRY 27-1 Reproduction and Development in the Frog

An introduction to the processes involved in reproduction— and 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.

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A basic investigation of animal embryology and development.

INQUIRY 28-1 Growing a New Body

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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.