

*Comprehensive*

# **LABORATORY MANUAL IN BIOLOGY**



**CLASS XII**



*Comprehensive*  
**LABORATORY MANUAL**  
IN  
**BIOLOGY**

(WITH INVESTIGATORY PROJECTS AND VIVA)

For  
Class XII

*Strictly according to new curriculum prescribed by*  
Central Board of Secondary Education (CBSE)  
and  
State Boards of Chhattisgarh, Haryana, Bihar, Jharkhand,  
Kerala, Mizoram, Meghalaya, Uttarakhand and  
other States following NCERT curriculum

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*Published by :*

**LAXMI PUBLICATIONS (P) LTD**

113, Golden House, Daryaganj,  
New Delhi-110002

*Phone :* 011-43 53 25 00

*Fax :* 011-43 53 25 28

www.laxmipublications.com

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*Price : ₹ 150.00 Only.*

*Edited by : Dr. Pragya Dixit*

*New Edition*

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T12-8950-150-COMP. LAB MAN IN BIO XII

*Typeset at :* Excellent Graphics, Delhi.

**C—7580/013/10**

*Printed at :* IPP, Noida

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## PREFACE

The practical study is a supplement to the theoretical classroom knowledge. It helps to understand the subject more precisely.

The present book entitled “**Comprehensive Laboratory Manual in Biology**” meant for class XII under 10 + 2 pattern of Central Board of Secondary Education. The subject matter of the book has been written in accordance with the latest syllabi prescribed by the CBSE and other boards of secondary education. The book has been designed as a reference rather than copy down the instruments. This book has its own identity because of the following features :

- The subject matter has been written in a simple and lucid language.
- A brief information about theoretical aspect of the experiments has been given in the beginning of each experiment.
- Each experiment has been fairly illustrated with all possible details.
- A number of viva voce questions have been given at the end of each experiment.

It is confidently hoped that the book will serve as a faithful guide and will help the students to understand the practicals in better way.

Suggestions for the improvement of the book will be thankfully acknowledged.

—**AUTHOR**



# SYLLABUS

## CLASS XII (PRACTICALS)

Evaluation Scheme	Marks : 30
One Major Experiment	5 marks
One Minor Experiment	4 Marks
Slide Preparation	5 Marks
Spotting	7 Marks
Practical Record + Viva Voce	4 Marks
Project Record + Viva Voce	5 Marks
<b>Total</b>	<b>30 Marks</b>

### A List of Experiments 60 Periods

1. Study pollen germination on a slide.
2. Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity of soil. Correlate with the kinds of plants found in them.
3. Collect water from two different water bodies around you and study the samples for pH, clarity and presence of any living organisms.
4. Study the presence of suspended particulate matter in air at the two widely different sites.
5. Study of plant population density by quadrat method.
6. Study of plant frequency by quadrat method
7. Prepare a temporary mount of onion root tip to study mitosis.
8. To study the effect of three different temperatures and three different pH on the activity of salivary amylase on starch.
9. To isolate DNA from available plant materials such as spinach, green pea seeds, papaya etc.

### Study/observation of the following (Spotting)

1. Study of flowers adapted to pollination by different agencies (wind, insect and bird)
2. Study of pollen germination on stigma through a permanent slide.
3. Study and identify stages of gamete development, *i.e.*, T.S. of testis and T.S. of ovary through permanent slides (from grasshopper/mice).
4. Study meiosis in onion bud cell or grasshopper testis through permanent slides.
5. Study of T.S. of blastula through permanent slides.
6. Study Mendelian inheritance using seeds of different colour/sizes of any plant.
7. Study prepared pedigree charts of genetic traits such as rolling of tongue, blood groups, widow's peak, colour blindness.
8. Exercise on controlled pollination—emasculation, tagging and bagging.
9. To identify common diseases causing organism like *Ascaris*, *Entamoeba*, *Plasmodium*, Ringworm through permanent slides or specimens. Comment on symptoms of disease that they cause.
10. Study two plants and two animals (models/virtual images) found in xeric conditions. Comment upon their adaptations/morphological features.
11. Study two plants and two animals (models/virtual images) found in aquatic conditions. Comment upon their adaptations/morphological features.

( x )

# **PART I**

## **INTRODUCTION**



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# 1. Introduction

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Science is a systematised study based on facts and observations. It involves curiosity, inquisitiveness and unbiased analysis. Most of the scientific work is done in a laboratory. It provides an opportunity to a person with scientific frame of mind to see and study various aspects of an object under observation. Hence, a biology student too, is obliged to attend laboratory workout with utmost sincerity, honesty and inquisitiveness. In practical classes in biology, a student studies detailed structures both morphological, histological and physiological aspects of plants and animals. The practical work includes :

1. Physiological experiments.
2. Section cutting and mountings.
3. Culture of animals.
4. Study of prepared slides.
5. Study of museum specimens.
6. Microscopic preparation of slides.
7. Core experiments and project work etc.

## GENERAL INSTRUCTIONS

1. While coming to the laboratory for practical class you should have the practical notebook, pencil, pencil eraser, sharpner, scale and complete set of dissecting instruments.
2. Come well prepared with the work you are supposed to do in the practical class.
3. Before starting the experiment or work listen carefully to the instructions given by the teacher.
4. Do not consult your classmates for any help. Get your difficulties solved from teacher only.
5. Maintain a complete silence and working atmosphere in the laboratory.
6. Never encourage lending either to or from your classmates.
7. Keep your seat, instruments and practical record well arranged and tidy.
8. Clean and arrange your seat before you leave.

## EQUIPMENTS

Each student, while coming to the laboratory for the practical work, is required to bring certain equipments. These include :

1. A practical notebook (record book) to record various experiments and to draw the diagrams.
2. A manual (book) of practical biology to compare the details of slides, specimens and experiments with the information given in the book.
3. Drawing pencil (HB) and pencil eraser to record and draw the diagrams.
4. Two forceps, one pair of scissors, two long handle dissecting needles, a sharp razor or blade, a dropper and a brush for the preparation of slides and study of plant and animal tissues.

5. A clean and soft handkerchief to keep the equipments seat clean.
6. Any item more as per instructions of the teacher.

### CARE AND MAINTENANCE OF INSTRUMENTS

Keep the instruments, glasswares and other equipments at a proper and specified place to avoid confusion and disturbance. The glassware and apparatus used by you should be properly washed and cleaned before keeping it. Handle the instrument carefully. Carelessness will not only damage the instrument but may also cause injury to you.

### PRACTICAL RECORD

Record keeping is most important in practical. Practical record should be neat and clean and up-to-date. Draw diagrams of all the specimens, slides and the experiments and also write their comments. On the right side of the record note book, draw diagrams of the experiment with date on top of the page. Diagrams should be correctly drawn and well labelled. Notes and observations should always be written on the left side on a ruled paper. Always get the signature of the teacher in the practical note book on each day after the practical. Since some marks (generally 5 out of 30) are reserved for the practical record in the practical examination, so it must be maintained in neat and tidy form.

### STUDY OF SLIDES

While studying slides under the microscope, do not disturb the slide focussed by the teacher. If you are not able to follow, seek the help of your teacher. Draw the diagram from the slide directly and not from the book.

### STUDY OF MUSEUM SPECIMENS

Study the characteristics of the specimen from the book. Try to find out those characteristics in the specimen. Diagram should be drawn from the actual specimen. Take help of the book for comparing and labelling the various parts. Sketch line diagrams. Shading should be avoided. Write the classification and comments of the specimen on left page of the note book.

### TEMPORARY MOUNTS

Prepare the temporary mount neatly, observe the mound under the microscope and draw the diagram of the material in the note book.

### PHYSIOLOGICAL EXPERIMENTS

Device the experiment as per the instructions carefully. Record the correct observations. Do not manipulate the results. If some deviation is there, discuss it with the teacher.

### DRAWING THE DIAGRAMS

Observe and study the specimen or slide well before drawing it in the record book. Draw first a rough outline of the diagram with light pencil and then draw in firm lines. The diagram should have proportionate size of each part. Draw the diagrams in the middle of the page so that you get plenty of space for labelling its different parts. All the labels should be parallel. Draw a fine line from each part of the figure up to the label. These lines should not cross each other.

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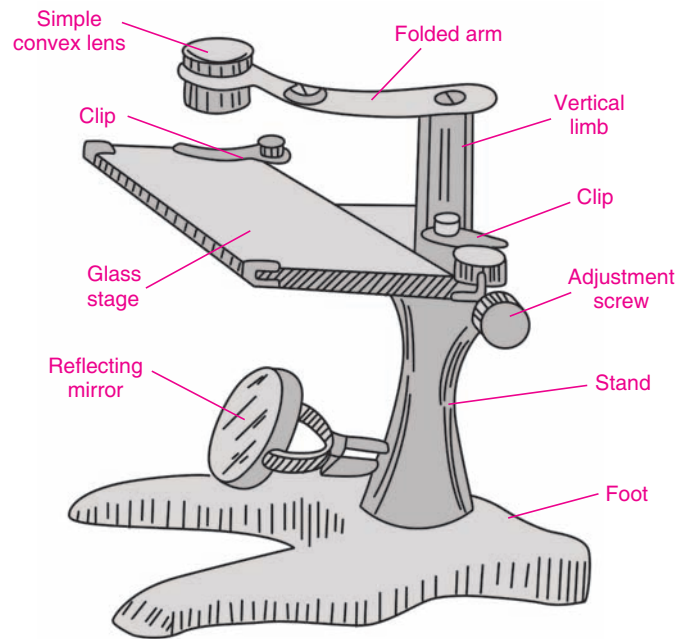
## 2. Use and Care of Microscope

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Microscope is an instrument which is widely and extensively used in the biology laboratory. It magnifies and resolves the objects, seen through it. Microscope increases the size of retinal image (the image formed on the retina of eye) of an object. The ratio of increased image to that formed on retina of an unaided normal eye is termed as **magnification** of the microscope. The term **resolution** or **resolving power** refers to the ability of a system to distinguish two close points as two separate points. Human eyes have a limited resolving power and cannot distinguish the object smaller than 0.1 mm (100 micron). To study the organisms which are smaller than 0.1 mm, different microscopes are used. At undergraduate level, dissecting microscope and compound microscope both are very commonly used by the students.

### DISSECTING MICROSCOPE

Dissecting microscope is used to magnify small animals or to see large sections, or to perform dissections of small animals. It consists of (i) foot (ii) stand (iii) vertical limb (iv) folded arm (v) simple convex lens (vi) glass stage (vii) reflecting mirror (viii) clips and (ix) adjustment screw. The folded arm has lens through which upturned image of the object is seen.



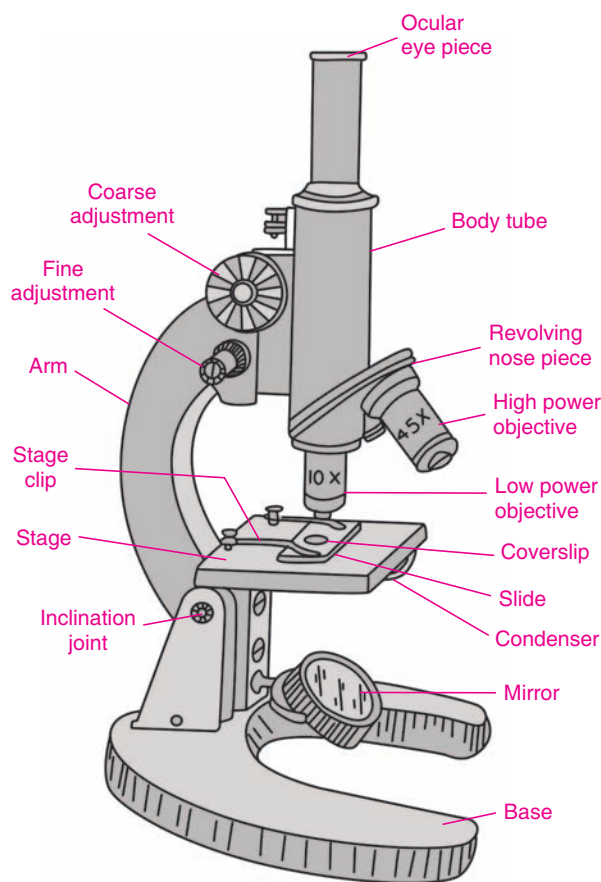
**Fig. 2.1.** Dissecting microscope.

To see any object, clean and dry the stage. Place the object on the stage of microscope. Place the eye close to one side of the lens and adjust the mirror. Turn the focussing screw up and down as the need be to get a sharp and distinct image of the object.

## COMPOUND MICROSCOPE

Compound microscope is the most commonly used microscope in biology laboratory. The microscope is built around a strong basal foot and a vertical limb. A square stage is fixed to the limb. It is provided with clip to hold the slide in position. A movable concave mirror is fixed at the lowermost part of the limb to focus a converging cone of rays at the specimen.

The body of the microscope is composed of a tube. At the upper end of the tube, is an ocular lens (eye piece) which can be changed for lower or higher values of magnifications. At the lower end of this tube is a revolving nose piece with three objective lenses. *i.e.*, low power, high power and oil



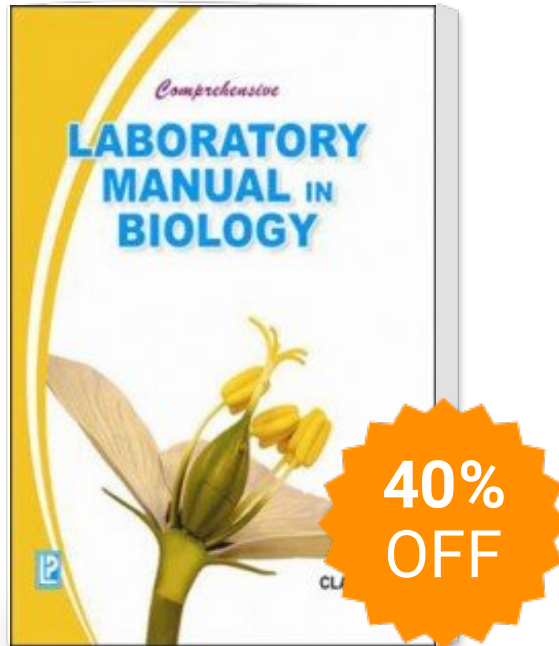
**Fig. 2.2.** Compound microscope.

immersion. Their magnification ranges from 10 X to 100 X. The magnification power of a microscope can be calculated by multiplying the powers of eye piece and objective lenses.

$$\begin{aligned}
 \text{i.e.} \quad \text{Power of eye piece lens} \times \text{Power of objective lens} &= \text{Magnification} \\
 10 \text{ X} \times 10 \text{ X} &= 100 \text{ X}
 \end{aligned}$$

The tube of the microscope is vertically movable with the help of coarse and fine adjustment screws on the limb.

# Comprehensive Laboratory Manual in Biology Class-XII



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