

# Presenting Data

To seek answers to problems or questions they have about the world, scientists typically perform many experiments in the laboratory. In doing so, they observe physical characteristics and processes, select areas for study, and review the scientific literature to gain background information about the topic they are investigating. They then form hypotheses, test these hypotheses through controlled experiments, record and analyze data, and develop a conclusion about the correctness of the hypotheses. Finally, they report their findings in detail, giving enough information about their experimental procedure so that other scientists are able to replicate the experiments and verify the results.

The Laboratory Investigations in *Laboratory Manual B* provide an opportunity for you to investigate scientific problems in the same manner as that of a typical scientist. As you perform these investigations, you will employ many of the techniques and steps of the scientific method a working scientist does. Some of the most important skills you will acquire are associated with the step of the scientific method known as recording and analyzing data. Three of these skills are creating and filling in data tables, making drawings, and finding averages. Another set of skills useful in presenting data is examined in the Laboratory Skills activity titled Using Graphing Skills.

It is important to record data precisely—even if the results of an investigation appear to be wrong. And it is extremely important to keep in mind that developing laboratory skills and data analysis skills is actually more valuable than simply arriving at the correct answers. If you analyze your data correctly—even if the data are not perfect—you will be learning to think as a scientist thinks. And that is the purpose of this laboratory manual and your experience in the biology laboratory.

## Data Tables

When scientists conduct various experiments and do research, they collect vast amounts of information: for example, measurements, descriptions, and other observations. To communicate and interpret this information, they must record it in an organized fashion. Scientists use data tables for this purpose.

You will be responsible for completing data tables for many of the Laboratory Investigations. Each column in a data table has a heading. The column headings explain where particular data are to be placed. The completed data tables will help you interpret the information you collected and answer the questions found at the end of each Laboratory Investigation.

### EXERCISE 1

Given the following information, complete Data Table 1. Then interpret the data and answer the five questions that follow.

*Information:* The following hair colors were found among three classes of students:

Class 1: brown—20	Class 2: brown—18	Class 3: brown—15
black—1	black—0	black—4
blond—4	blond—6	blond—15

#### Data Table

Hair Color	Class 1	Class 2	Class 3	Total
Brown				
Black				
Blond				

1. What type of information is being gathered?

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2. Which hair color occurs most often?

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3. From the information in the Data Table, can you give the number of boys with black hair?

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4. What information can you give about the number of students with black hair?

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5. Which class has the most blond students?

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6. How many students made up the entire student population?

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## EXERCISE 2

Given the following information, organize the data into a table. Use the blank area provided in Figure 1 to draw in the necessary columns and rows. Then interpret the data and answer the questions that follow.

*Information:* On an expedition around the world, several scientists collected the venom of various snakes. One of the tests that the scientists conducted determined the toxicity of the venom of each snake. Other data obtained by the scientists included the mortality percentage, or relative death rate, from the bites of various snakes.

The snakes observed were the (1) southern United States copperhead, (2) western diamondback rattlesnake, (3) eastern coral snake, (4) king cobra, (5) Indian krait, (6) European viper, (7) bushmaster, (8) fer-de-lance, (9) black-necked cobra, (10) puff adder.

The mortality percentage of people bitten by the snakes varied from 100% to less than 1%. The scientists noted the mortality percentage for each of the snakes was (1) less than 1%, (2) 5–15%, (3) 5–20%, (4) greater than 40%, (5) 77%, (6) 1–5%, (7) usually 100%, (8) 10–20%, (9) 11–40%, and (10) 11–40%.



**Figure 1**

1. Which snake's venom has the highest mortality rate?

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2. Which snake's venom has the lowest mortality rate?

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3. From the information recorded, can you determine the snake whose venom works the most rapidly? The least rapidly?

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4. Which two snakes' venom have the same mortality rate?

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5. How many types of snakes were observed?

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## DRAWINGS

Laboratory drawings can be made using several methods. Some drawings are made in circles that represent the viewing field of a microscope or another type of magnifier. When completing these drawings, be sure to include the magnification at which you viewed the object. Other laboratory drawings represent organisms or parts of organisms. These drawings show the relative size, shape, and location of anatomical structures. When completing representative drawings, make the structures as clear and as accurate as possible.

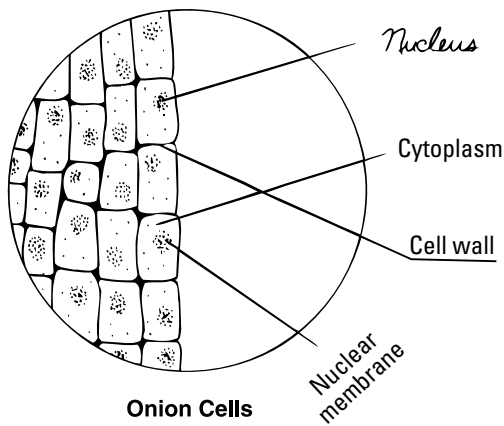
Most laboratory drawings are labeled. Use the following guidelines to help make your laboratory drawings clear and legible.

- Use a ruler to draw label lines.
- Label lines should point to the center of the structure being labeled.
- Do not write on the label lines.
- Print all labels horizontally.
- Label the right-hand side of the drawing, if possible.
- Do not cross label lines.

### EXERCISE 3

The following drawing was made without using the guidelines above. Circle those parts of the drawing that do not follow the guidelines. Then, on the lines provided, explain how the drawing should be done.

Magnification \_\_\_\_\_




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Figure 2

## AVERAGES

Occasionally you will be required to find the average of data gathered from an investigation. To find an average, add the items in the group together and then divide the total by the number of items. For example, if there were five students of different ages—12, 13, 14, 17, and 19—how would you find the average age of the group? Add the five ages together and divide the total by 5, which is the number of items (students) in the group. What is the average age of this group of students? Your answer should be 15 years old.

## EXERCISE 4

In a garden the heights of six sunflowers are 135.0 cm, 162.5 cm, 180.0 cm, 235.0 cm, 185.0 cm, and 167.5 cm. What is the average height of the sunflowers?

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## EXERCISE 5

Find the average for the following group of data. Then use the results to answer the questions that follow.

In an experiment on plant growth and overcrowding, plants of the following heights are in three equal-sized containers.

Flowerpot 1: 20.0 cm and 18.2 cm

Flowerpot 2: 12.0 cm, 10.8 cm, 11.2 cm, and 12.4 cm

Flowerpot 3: 7.5 cm, 8.0 cm, 6.0 cm, 6.2 cm, 5.8 cm, and 7.3 cm

1. What is the average height of the plants in each flowerpot?

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2. In which flowerpot did the plants grow the tallest? Explain.

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## EXERCISE 6

Find the averages for the following groups of data. Express your answers to the nearest tenth.

In a sample group of students, the number of breaths per minute was measured at rest and after exercise. The results were as follows:

*At rest*

Males: 10.1, 13.0, 12.5, 10.2, 13.1, 11.8

Females: 10.4, 13.0, 12.1, 11.9, 10.5, 12.8

*After exercise*

Males: 18.9, 23.7, 22.6, 21.3, 19.2, 20.6

Females: 25.0, 26.7, 29.0, 35.3, 33.1, 31.7

1. What is the average number of breaths per minute for males at rest? \_\_\_\_\_

Females at rest? \_\_\_\_\_

2. What is the average number of breaths per minute for males after exercise? \_\_\_\_\_

Females after exercise? \_\_\_\_\_

3. How many students make up the sample group? \_\_\_\_\_

4. What is the average number of breaths per minute for the entire group at rest? \_\_\_\_\_

After exercise? \_\_\_\_\_

5. Do males or females take more breaths per minute at rest? \_\_\_\_\_

After exercise? \_\_\_\_\_