expansion, k is coefficient, l is length—and substituting in the formula V for l .

Then if it is desired to demonstrate Charles' Law we have only to substitute in the Charles' Law formula, changing the temperature from Centigrade to absolute degrees. Or one may develop the formula from the data obtained.

The following data was obtained by the use of the above apparatus and subsequent trials gave the same readings for the initial and final volumes under the same conditions:

Initial volume of air.....	24.3 cm.
Final volume of air.....	33.2 cm.
Change in the volume of air.....	8.9 cm.
Initial temperature.....	0°C.
Final temperature.....	99.5°C.
Change in temperature.....	99.5°C.
Coefficient of expansion.....	

$$k = \frac{e}{L(t' - t)} \quad .00368$$

PROJECTS IN BIOLOGY.

BY GRACE F. ELLIS,

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The interesting article on "Projects in Biology" in the April number of SCHOOL SCIENCE suggested to me that possibly some of your readers might find the following outline of work on the same subject of interest. It is used in classes of physiology in the tenth grade, and a hundred students are now at work at it. The general outline is supplemented by whatever project the student is most interested in, and he may prove his points in the discussion which is outlined, by reference to any project carried on by his fellows. I have used most of the experiments outlined in the article and find them satisfactory and interesting to students.

In the final summing up of the work in this subject I shall use the excellent list of lantern slides put out by the Chicago Biological Supply House. I wonder if your readers know it?

EXERCISE XXV.

Problem: How are bacteria distributed?

Material: Sterilized dishes containing agar for cultures.

Directions: In every experiment count the number of bacteria and mold colonies which appear. Each colony of bacteria grew from a single bacterium. Colonies of bacteria are round, waxy-looking spots. Molds show spores and tiny fibers. When you open your dish notice whether the bacteria and molds have in any way affected the agar.

I. Does dust contain bacteria?

1. Collect a little dust from floor or furniture on a bit of stiff paper and blow it over the surface of the agar in a petri dish. Close the dish at once, seal the dish and cover together, and mark with your name, date, and material.

2. Mount a little dust in water on a glass slide, cover and examine under high power. What does it consist of so far as you can tell? Does it seem to offer a lodging place for germs? To answer this question, mounts of silk, cotton, and woolen fibers and dirt are provided.

II. Do bacteria float in the air?

1. Expose a prepared bacteria dish for two minutes to the air

of a room. Close, seal, and label as above. The room may be one of the school rooms, or a room at home or in some public building.

2. Compare air in a room with unoled floor recently swept by a broom; with vacuum cleaning; with one in which sweeping of an oiled floor is being done.

III. Do bacteria exist in the body?

1. Place a measured amount of saliva in a bacteria dish. Seal and label.

2. Scratch a finger nail across the agar and seal your dish.

Written Report.

Use ruled paper, leave margin, use numbers or headings, and report in connected theme form, on the problem which forms your subject.

I. Introduction.

Preparation. Explain how the culture medium and dishes are prepared and why so much care is taken to sterilize everything that is used.

II. Exposure.

How are the cultures exposed to the air and to dust? What does dust seem to be under the microscope? Might dust harbor germs? Is dust dangerous?

III. Results.

Which cultures yield more bacteria, dust or air? What makes the difference in this building (i. e., presence of more bacteria in air or dust)? How should this knowledge affect our treatment of floors in public buildings? Our methods of cleaning? Do you believe in the use of a feather duster? Why?

IV. Bacteria in the body.

Do you find bacteria present on the skin? In the mouth? Are these dangerous? May the mouth harbor dangerous bacteria?

V. Bacteria and disease.

Do coughing and sneezing have anything to do with their distribution? Why are colds contagious? Can you suggest any means of reducing the number of bacteria in the mouth? Why are the nose and throat so often infected?

BACTERIA¹

BY MARY WILDE,

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I. INTRODUCTION.

(a) *Preparation.*—The culture medium which was used was agar, a Japanese seaweed which is a jelly-like substance. This substance was heated until it had thoroughly dissolved; about six hours was necessary for this to take place. The bacteria dished into which this was immediately poured, so that no bacteria could possibly enter, were baked in an oven three times at intervals of twenty-four hours, so that all germs might be killed with the excessive heat. Great care was taken that no fingers touched this, or that breath reached it, so that no germs could possibly enter and that the agar might be absolutely free from germs.

II. EXPOSURE.

(a) *Cultures Exposed to Air and Dust.*—The cultures are exposed to air by leaving them open two minutes, and to dust, by quickly lifting the cover of the dish and blowing in the dust or any other substance with

¹This is one of the results of the project plan as outlined by Grace Ellis on page 607.