Vitalizing Biology With A Live Animal Project

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This article outlines a group of experiments illustrating the use of a live animal project in teaching elementary, college biology.

Since these projects were conducted on the college level in a biology survey course, a brief description of the course is given. Biology which is a part of general education at Albany State College is required of all students. It extends over two quarters and its total credit value is ten quarter hours. In the conduct of the course, time is alloted for student laboratory work—the main core of which is *not* "dissecting and drawing."

Textbooks, selected laboratory work, group discussions, periodical reading list, library assignments, and an extensive use of audio-visual aids comprise the major working tools of the course.

The nature of the course and the frequency of distributions of topics listed for study follows the pattern for such courses as indicated by the studies of Goldsmith (*1*), Miller (*2*), Bullington, (*3*), Andrews and Breukelman (*4*).

At least two points in the writer's thinking give ample latitude for such a project:

1. At the secondary level students have had very little if any contact with live animals in the laboratory. Abbott's (*5*) and Cole's (*6*) articles both give support to this idea.
2. By becoming a working part of such a project, students are given the opportunity to get practice in problem solving and to develop an understanding of how the scientific method works.

The impetus for starting our animal project or "Operation Rat House" was gained from questions raised by students during a class discussion.

The topic of discussion centered around thirst, hunger, diet, essential foods and vitamins. The determination of what foods were essential for good nutrition led to a discussion of the use of laboratory animals in testing food nutrients. Questions which were frequently asked were: "Why are albino rats almost always used for dietary studies?" "Could white mice be used to the same advantage?" "What are the differences between white mice and rats other than size or species?" "Could we raise a few of both in this course as a project?"

This show of interest and curiosity led us to believe that a live-animal project might be worthwhile. The project of animal breeding was started by obtaining a pair of albino rats, albino mice, and chocolate mice. Each pair contained a virgin female. Groups of students were selected to care for the animals. One group for rats, another for mice. Eventually such chores as filling water fountains, feeding, cage cleaning, weighing and recording animal weights, were experienced by all. The fecundity of the rodents soon had us looking for space to house our cages. Fortunately an unused store room was found and converted into an animal house.

Listed below are the experiments carried out:

1. *Nutrition Experiments Using Balanced and Deficient Diets.* Since the literature concerned with the dietary requirements of the rat is so voluminous, the purpose of this segment of our work should be clarified. The core purpose of our dietary experiments using the albino rat was to give the student a tangible understanding of the role of diet in maintenance of normal physiological functions, and a recognition of a deficiency symptom.

Commercially prepared diets both sufficient and insufficient were used. A few animals were divided as to sex and weight and placed in control and experimental groups. Our con-

FIGURE 1. A student and laboratory instructor feed and water experimental animals.

cern was nutrients provided in the basic foods, vitamin A and B and a mineral sufficient diet consisting of basic minerals without trace needs. Other interesting results were obtained by using protein, carbohydrate, and fat diets over a six weeks period. Pictures were made at the end of the dietary experiments.

A working understanding of the relationship of copper to iron in hemoglobin formation was achieved by feeding rats a diet of skimmed milk which produced nutritional anemia, milk being deficient in both copper and iron. Because this study was not quantitative, blood serum or mineral analysis was not necessary. No post mortem examination of tissues was made. We were content with such symptomology as stunted growth, swelling of the abdomen, weight loss, disturbances of the eyes, loss of vigor, and unhealthy appearance of hair coat.

Since these feeding experiments demand weighing animals and record keeping, it affords a practical approach to developing an understanding of an important step of the scientific method, that of collecting, organizing, and coordinating data of the experiments for the purpose of discovering relationships. Photographs were made of animals from both groups which served for records and to show finer points of comparison. Directions for carrying out these experiments were gained from a booklet, entitled, *Laboratory Experiments in Nutrition* which was secured from the General Biological Supply House, Chicago, Illinois.

2. *Dissection of Diaphragm.* This dissection, made by the instructor, gives an excellent chance for students to see the location of the diaphragm and to get a clearer concept of its function in animal respiration.

3. *Reproduction and some Associated Terminology.* Some aspects of the reproductive process, along with associated terminology such as gestation, parturition, ovulation, and estrus cycle, may be well shown with the rat project.

Starting with a few males and females, averaging better than three months in age, breeding can commence. Pregnancy can be detected in about two weeks by noting an increase in size of the abdomen and contrasting the weight before mating with the weight after two weeks. The gestation period extends over a period of about twenty-one days.

FIGURE 2. A student clocks increase in running activity of a rat.

If the animals are being bred with the idea of having several litters it is likely that parturition will be observed.

Understanding Estrus—Students may get some idea of cellular changes in the vagina which are associated with the cycle by searching several vaginal smears taken at different time intervals. The shape of epithelial and cornified cells are different enough to be observed by students not trained in histology. Smears showing a good amount of cornified cells is an indication of the onset of estrus.

This demonstration should be regarded as a special project for the instructor. It should be undertaken only when the instructor has time to make necessary preparations.

Activity and Estrus. Farris (7) has shown that variations in the running activity of the rat to be an accurate method of determining the onset, regularity, and extent of estrus.

By caging several virgin females and placing each for a time in the revolving drum we are able to clock increases in running activity which we regarded as a sign of estrus. (Figure 2.)

4. Reproductive Organs

Observations of Rat's Ovary (Instructor Demonstration)

An ovary from a female rat was removed under anesthetic, placed in saline solution in a watch glass and observed microscopically under low power or with 3.5 or 6x objective if such is available. The rat need not be sacrificed for the wound may be closed after the operation with a wound clip.

Observation of Rat Testis for Shape of Sperm

A mature, anesthetized male should be used for this demonstration. The testis, upon removal can be placed in a small beaker containing saline. One testis should be split in half, placed in a small amount of saline and centrifuged. With a clean pipette, spread a bit of clear substrate, mount, stain with methylene blue and observe. Note shape of sperm head.

5. *Heredity Study*

In pairing off a pair of virgin female albino mice with chocolate colored mice, and placing a cigar box with an open end in the cage, breeding should take place. By mere observation and periodic checking during the course,

the student can get first hand understanding about genetic ratios and the simple facts of heredity.

6. *A Study of Blood Smears Using the Tail of Mice*

In the study of a unit on blood it is always helpful to use freshly prepared smears. Good thin smears can be made by first cleaning an anesthetized albino mouse's tail with cotton saturated in 70% alcohol then gently massaging it to increase blood flow in the tail region, and with scissors clip a tip from the tail of the animal. After the smears are made, by using a little pressure with the alcohol saturated cotton, the wound may be cauterized and the animal is ready to be caged. To prevent cannibalism, it is best to place animals in separate cages.

A comparative study of blood smears, including mice and other animals may give the student some idea of species widely separated as to evolution.

These experiments can be used as class supplements, which may not be completed in a single period, but which can be useful to industrious teachers who are interested in developing a functional approach to biology in general education.

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Biology in the News

BROTHER H. CHARLES, F. S. C.
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PROWRESS OF ANIMALS, LEAPING AND RACING *Life*, Oct. 10, 1955, pp. 68-72.

Pictures and charts of the longest jumps and top speeds on record. Good bulletin board material. At least two copies should go into your permanent files.

HEART ATTACK, *Life*, Oct. 10, 1955, pp. 150-159.

Coronary thrombosis is the biggest killer of people in the United States today. Wonderful pictures and explanations of how it happens and how the heart mends itself. Good bulletin board material.

WOODCHUCK! IT'S WAR, BILL WOLF, *Sat. Ev. Post*, Oct. 8, 1955, pp. 47, 130-132.

Persons who have never seen a groundhog, as the woodchuck is commonly called, know that it comes out of its hole and looks around on February second. Does it? This is an account of the habits and methods of hunting the groundhog.

A PLEA AGAINST BLIND FEAR OF CANCER, DR. GEORGE CRILE, JR., *Life*, Oct. 31, 1955, pp. 128-142.

A controversial article suitable for reading by students with excellent judgment. This should be read after reading the comments by cancer experts.

COMEBACK IN THE WOODLANDS, *Life*, Oct. 31, 1955. pp. 110-119.

A digest of a late bulletin from the U. S. Forest Service. We are now growing more

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