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Surgical Techniques in High School Biology

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Greene

INTRODUCTION

The fundamentals of surgical techniques were taught by doing a thyroidectomy on 3-day old cockerel chicks.



Westermann

To many people, the words "surgical technique" may bring to mind elaborate equipment, sophisticated techniques, and some previous surgical experience. However, it is a fairly simple experiment

and can readily be performed by the senior high school biology student.

Although it is not known if such surgical techniques have ever been utilized at the high school level, it is the intention of the author to indicate the feasibility and need for its introduction at this level.

Some of the reasons for innovating this particular technique in the senior high school biology class are as follows:

1. To obtain, by active participation, a basic understanding of surgical techniques for the student's own self-satisfaction. As almost everyone will experience surgery sometime in their life, a greater sense of security could be obtained by knowing more about

the procedure involved. It is generally agreed that what we usually fear the most is that which we do not understand.

2. To provide a valuable experience for the prospective professional biologist (physician, nurse, veterinarian, research biologist, teacher, etc.) early in life. With a greater number and variety of experiences, we may open the doors for the undecided student, or keep them open for those who have already anticipated such a profession.

3. To make biology, the study of living things, more meaningful. Although we utilize many living organisms in biology, too often the biologist



Fig. 1. Rearing pen with chicks and equipment.

will depend on the use of dead, pithed, or "pickled" specimens. Biology is a living science and should be treated as such. In fact, many of the biological concepts and understandings can be investigated in no other way.

METHODS AND MATERIALS

Construction of Rearing Pen

A rearing pen (Fig. 1) was constructed from a number of large cardboard boxes. It was made large

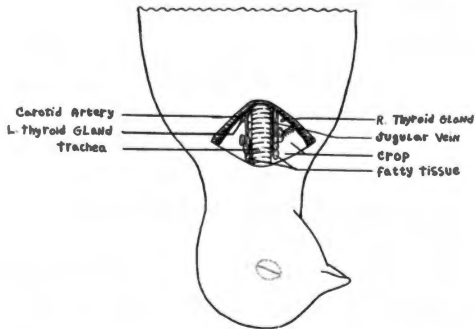


Fig. 2. Diagram of chick showing relative size and position of the thyroid glands.

enough to hold two experimental chicks and one control chick for each team. The floor was covered with sawdust and equipped with drinking containers, feeding trays, and a heat lamp.

Designation of Surgical Teams

The class was divided into "surgical teams" consisting of two members each. One member was the "surgeon" and operated on the chick while the other was his "assistant" and was responsible for getting the chick ready for surgery. After completing a thyroidectomy on one chick, the two members exchanged roles and did a thyroidectomy on a second chick. In this way, each student experienced every surgical tech-

nique involved.

Studying the Chick's Anatomy

The thyroid glands are very small and can easily be confused with fatty tissue (Fig. 2). Therefore, before attempting the surgical operation on a live chick, the exact location of the thyroid glands were ascertained. Before each student was allowed to do a thyroidectomy on a live chick, he had to successfully locate and remove the thyroid glands from two dead chicks.

Caring for the New Chicks

The newly hatched chicks were obtained from the hatchery and placed in the rearing pen. The chicks were given food and water immediately but were taken off the feed on the second night. This was to insure that their crops would be empty during surgery on the following day.

Pre-Surgical Preparation

a. "Assistant". The team assistant anesthetized the chick and cut off the feathers around the point of incision. A mild antiseptic (ST-37) was applied to the incision area. The assistant kept the chick anesthetized, with an ether mask (Fig. 3), until the "sur-

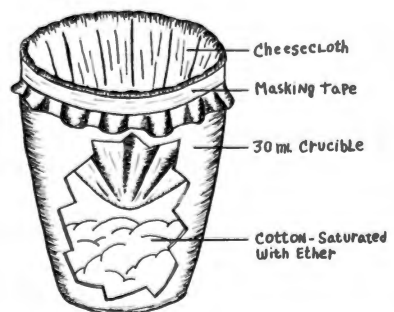


Fig. 3. Diagram of ether mask used in keeping chick anesthetized.

geon" was ready for surgery. Because the chick can easily be killed by over-anesthetization, the ether mask was applied for only a few minutes.

b. "Surgeon". The surgeon equipped the sterile chamber with the necessary materials while the chick was being prepared for surgery. This consisted of the following materials: 50 ml of 25% ethanol, two sharp-pointed forceps, a dissecting probe, scissors, suture needle with thread, and an ether mask. The ethanol solution was used to wash the debris from the surgical equipment. After equipping the sterile chamber, a fine mist of ST-37 was sprayed on the walls and equipment inside. The surgeon washed his hands and arms with soap and water. After a final rinse with propanol, a small amount of ST-37 was applied to the hands.

Surgery

The chick was placed on its back, inside the sterile chamber, with its head facing the surgeon (Fig. 4). An incision was made at the base of the neck and the fat and fascia was moved aside by means of the dissect-



Fig. 4. Student operating on chick in the sterile chamber.

ing probe. Once the thyroid glands were located, they were teased away from their attachment with a pair of forceps. The incision was closed by making three to five stitches with black nylon thread. The assistant was responsible for holding a source of light over the chick throughout the operation.

Post-Surgical Recovery

After the chick was removed from the sterile chamber, the incision area was again swabbed with ST-37. The chick was placed in a box under the heat lamp until it regained consciousness and began to move about. When it had fully recovered from the effects of the ether, it was placed in the rearing pen with the other chicks.

Follow-up

To determine the success of the operation, the chicks were observed every other day for a period of four weeks. Any changes in weight, behavior, plumage, and comb-factor were noted and recorded. The product of the comb height and length was divided by two in determining the comb-factor. Each student was required to evaluate the data and write a scientific paper concerning the experiment.

RESULTS AND DISCUSSION

Experimental Results

This paper was written to indicate the feasibility and necessity of surgical techniques at the high school level and not to report the findings of the experiment. However, a picture of a thyroidectomized and control chick (Fig. 5) was included to show the success of the operation. The thyroidectomized chick was smaller in stature, had immature tail feath-



Fig. 5. Thyroidectomized chick (left) as compared to control.

ers, and had a smaller comb-factor than the control chick.

General Observations

Because the students had never encountered an experience such as this, they were very enthused and excited. As the plans and procedures were being discussed, a little apprehension was noted. However, this disappeared after they had completed their "mock" operations on the dead chicks.

Everything went according to schedule on the day of the actual operation. Each student knew his assignment well and carried it out quickly and orderly.

Although all the chicks did not survive the operation (25% died), the experiment was still considered a success. The students learned from their mistakes and were careful not to repeat them when the team positions were rotated. In all but one chick, death was attributed to over-anesthetization. In this case, the jugular vein was severed while probing for the thyroid glands. Because

the jugular vein and carotid artery lie in close association with the thyroid glands, extreme caution must be exercised.

The students' most rewarding experience came when the experimental chicks revived and began walking around. It would be impossible to express their feelings or the pride they displayed on their accomplishment.

Student Reactions

A subjective questionnaire was given to the students to determine their reaction concerning the experiment. Although they expressed a number of different views and opinions, most agreed on certain points.

The students agreed unanimously that this had been one of their most valuable and exciting biological experiences.

Not only did it give them a basic understanding of surgical procedures, but also removed some misconceptions they had formulated.

Most of them felt that this experience would give them a greater sense of security if they were to have an operation, because they now knew approximately what to expect. However, this last point is debatable. Some thought they would feel more at ease but were not ready to admit that they would truly feel secure.

The students also recognized that the experiment was quite demanding. Although the surgical technique was simple in design, it constitutes a skill which requires orderliness, exactness, and patience.

Biological Implications

Although one biological experience is of little significance, we must be constantly searching for new innovations to meet the increasingly diverse

abilities, interests, and intentions of our biology students. It is really of little concern whether or not the student will become a physician, nurse, veterinarian, research biologist, biology teacher, or a member of some other field of biology. Instead, any experience which will give tomorrow's citizens a richer and fuller understanding of life is a reward in itself.

Learning the basic concepts of biology is of vital importance; the application of these concepts is equally important for it is recognized as the learner's key to comprehension and retention.

SUMMARY

1. Surgical techniques are feasible in the senior high school biology program.
2. The knowledge of surgical techniques is of value to the layman as well as the biologist.
3. More living organisms should be utilized in the study of "biology".
4. The increasingly diverse abilities, interests, and intentions of our biology students must be met.
5. The learner's key to comprehension and retention is application.

CONSTITUTION OF THE IOWA SCIENCE TEACHERS SECTION

Article III. Organization

Section 1. This organization is a section of the Iowa Academy of Science and an affiliate of the Iowa State Education Association. Its state meetings shall coincide with the annual meetings of the Academy and the Iowa State Education Association.

Section 2. Other section meetings shall include the annual Short Course cosponsored with Iowa State University and regional meetings held in each region each year under the direction of the particular regional director.

Section 3. This section is a state chapter of the National Science Teachers Association. It is also officially affiliated with the National Association of Biology Teachers. It shall designate a representative to serve as a liaison to other national science teaching societies. Ordinarily this representative will be the official membership chairman for the national society in Iowa.

Section 4. A meeting of the Board of Directors will be held on Thursday preceding the day of the fall meeting. Newly elected officers who will be installed during the meeting will be invited to attend this session of the Board. A meeting of the executive committee will be held following the sessions of the annual fall meeting for the purposes of organizing committees and other activities for the new year.

An executive committee meeting will be held in January of each year to consider committee reports, especially those concerning the forthcoming short course and the spring meeting. An executive committee meeting will also be held at the time of the short course in March.

A meeting of the Board of Directors will be held Saturday afternoon following the spring meeting. Business can be transacted by majority vote of those present. The reports of the election committee and the fall meeting committee will be considered.