

The Autopsy of Squirrel Doe

Timothy T. Dick, Ph.D.
Jason Watson

Owensboro Community and Technical College
4800 New Hartford Road
Owensboro KY 42303
Tim.Dick@kctcs.edu

Abstract: Introductory biology laboratory experiences frequently rely on preserved chordates for anatomical study. Unfortunately, these preserved organisms rarely reflect the appearance of a living creature. Since community colleges are generally prohibited the use of live chordates, this paper describes the autopsy of a “road kill” squirrel to facilitate the learning experience of biology majors. In addition to the improvement in basic anatomy test scores, the students also learned teamwork, microbiology assays, and hazardous material protection.

Key words: animal dissection, dissection alternative, road kill

Introduction

The Owensboro Community and Technical College offers a two-semester course for biology and pre-professional majors. The first semester covers cell biology, metabolism, genetics, embryology, and immunology; whereas, the second semester examines evolution, botany, and zoology. Each course has a three-semester hour lecture component and a two-semester hour laboratory experience. This series has been used for twelve years and has never had more than one section of each. The class average is 15 students. The chordate section of the zoology portion of the laboratory consists of traditional methods such as the use of models and the dissection of preserved chordates. The rationale for the use of preserved chordates centers on the perceived need for future scientists and health care professionals to be familiar with the anatomy and physiology of such organisms.

Unfortunately, preserved chordate dissection exercises frequently fail to provide desired education outcomes as preserved animals show little evidence that they were once living organisms. Such preserved animals show no signs of disease, effects of aging, do not bleed, feel like plastic, and smell like disinfectant. For a true experience of chordate anatomy and physiology, students might participate in the necropsy of a laboratory-euthanized chordate such as a rodent, cat, or dog. However, legal restrictions prevent such experiences in introductory laboratories in a

community college setting. Community colleges generally do not have the appropriate facilities for the housing and care of chordates and are therefore prohibited such use. This paper introduces the idea that fresh road kills certainly may serve as an effective and desirable pedagogical alternatives to chemically preserved chordates.

Methods

In an effort to explore alternatives to the traditional use of preserved animals for dissection, science majors in biology lab were provided the opportunity to conduct an autopsy of a wild squirrel found in the college’s parking lot. Based upon the lack of rigidity of the corpse, Squirrel Doe was found within two hours of death.

Students should be given a brief presentation on the collecting and use of road-killed animals. This should include information about the collecting procedures from the State Department of Natural Resources (DNR). An individual collecting road kills is required to have a Salvage Permit. The DNR will also indicate which animals cannot be collected. Collected animals should be placed in plastic bags and upon arrival at the school placed in a refrigerator or freezer depending on the period of time between collecting and use. Students should wear plastic gloves when collecting and dissecting organisms. The

organism and its parts should be disposed of in the proper manner after examination.

The carcass was immediately placed on ice and rushed to the lab where the OCTC radiography instructor took x-rays. Students were permitted four laboratory meetings to conduct the autopsy of Squirrel Doe. To pique interest and give the students focus, students were asked to find the cause of death. Using a photographic atlas of squirrel anatomy for reference, students were instructed to identify all major organs and bones. Students were instructed in appropriate biohazard safety precautions and additionally instructed to perform a microbiology exam of the body cavity, conduct a parasite search, and then from all the information gathered, determine the cause of death.

X-rays showed a young male with no major broken bones except for two caudal vertebrae and a slight splintering of the right scapula. Careful external examination of the squirrel showed a bulging of the nose, left eye, left ear, and mouth (both incisors were broken). A large tear extended from the anus to the scrotum. The testes were full of blood and the bladder was ruptured having released urine into the abdominal cavity. The lower right appendage appeared to have been broken and the right ear lobe torn (probably due to an old injury as the tear was healed). The last sacral vertebra directly above the tail protruded through the skin and appeared damaged.

Starting at the tear from the anus to scrotum, an incision was made vertically to the juncture of the trunk and leg allowing the skin to be spread apart along the inside of each leg. By making subsequent incisions around each ankle, the skin was easily removed from each hind limb. Upon removal of the skin, internal injuries were apparent: the abdominal cavity was torn, the large intestines protruded through the muscular wall of the abdomen and the gall bladder was ruptured. Careful examination of the squirrel's internal organs revealed that the large intestines had ruptured causing massive amounts of internal bleeding. The internal organs were then carefully removed, weighed, and dissected to rule out further injuries. As the fragments of the skull were removed, a massive amount of blood was revealed in the left cerebral hemisphere which indicated a severe hemorrhage.

Results

From the autopsy, it was concluded that the cause of death was due to massive internal and cerebral hemorrhaging. Although Squirrel Doe's organs were examined for parasites and bacterial infection, nothing unusual was discovered.

Anonymous comments from five of the student participants follow.

"During the autopsy on the squirrel, I learned about different perspectives of looking at death. I may have already known that it was the end, but some of the time it depends on how you reach it. We can always say 'I hit some squirrel or rabbit today' and move on with our lives. Do you ever wonder how that animal actually died? Did the impact kill it instantly or did it suffer first and then die? I learned that it takes a lot of work to do an autopsy on a small animal; therefore, it must take longer to do an autopsy on a human being. Probably because of the squirrel's diet of nuts and berries, the squirrel was pretty clean of parasites. I believe it would be hard to catch a parasite from a nut or a berry."

"I thought that the whole process was extremely interesting. Actually learning the step-by-step procedure from taking length and weight measurements, to having x-rays, to the weighing of all the organs, and all of the gross anatomy was instructive. I found it really interesting that just from a few abdominal swabs, we could determine that *E.coli* was spread throughout the entire abdomen. Also, I gained more respect for animals. They are so very similar to us (we are animals after all). I felt sympathy for Squirrel Doe and have reduced my driving speeds and haven't eaten meat since."

"While doing the autopsy on Squirrel Doe, I learned that sometimes an x-ray is not enough to reach conclusions as the cause of death. Once we cut open Squirrel Doe, we noticed that there had been considerable bleeding. He also had a fractured skull that wasn't noticeable on the x-ray. I came to the conclusion that looking for flukes and parasites is an extremely tedious job because I searched long and hard for one but never did find one."

"I learned exactly what does happen to an animal after it has been hit. You will see a dead animal on the side of the road and think, 'Oh, there's more road kill' but you do not really stop and think about the trauma the animal had to go through. By opening up Squirrel Doe, I saw first hand the extent of the damage. It made me feel very sorry (more so than before) for road kills. I also learned how various organs work. When the stomach was opened and the contents inspected, I could see how the food looked once it enters the stomach and had begun the digestion process. Looking at the organs, I experienced the process for myself. This was different from looking at a prepared slide since I got to see the contents naturally without any dyes or preservatives."

"I learned many new and interesting things from our autopsy of Squirrel Doe. I learned that many animals from the order rodentia have similar structures and can be used in comparison to each other. I learned

that when something is dead it may look okay on the outside but it might be very messed up on the inside. I learned that a squirrel is very complex inside and that it has similarities to humans. I learned how autopsies require more than just dissection; they include x-rays and use of microscopes to see what is inside the organs. It was an adventure to be able to explore the insides of a once living creature to see what could have caused its death.”

Conclusion

From an instructor’s perspective, this autopsy was a success. The participating students conducted the autopsy, parasitic exam, bacterial cultures, and drew conclusions from the x-rays. They also studied the squirrel for more time than the scheduled lab requirement. Students spending extra time in lab are a rare occurrence. Clearly students who were willing to go beyond the amount of time required for lab indicates the students felt engaged with the assignment.

The autopsy of a fresh specimen is of more educational value than the dissection of a purchased and preserved organism. The internal organs are

natural in appearance, blood clots are present, culture studies can be performed, and the students are intrigued by the novelty of the project.

Finally, the chordate exam scores were higher than any obtained previously with the usual dissection methods, indicating a better understanding of anatomy. For example, the chordate laboratory practical exam requires that students identify all major organs and bones. A ten-year review of scores revealed an average of 73% on this exam but the class, which conducted the autopsy of Squirrel Doe averaged 86%.

Introductory biology laboratory exercises frequently rely on rote memory and do not always spur students to think critically. But, the students accomplished more than just memorization of body parts. The exercise required teamwork, careful dissection, microbiological assays, and a creative interpretation of the data to reconstruct the cause of death. Yes, the students were able to effectively identify internal organs and bones, but the cumulative effect was a true educational experience.

Honorary Life Award

The **ACUBE Honorary Life Award** is presented to ACUBE members who have made significant contributions and/or service to ACUBE and the advancement of the society's mission. The award is presented at the annual fall meeting of the society.

If you wish to nominate a member of ACUBE for this award, send a Letter of Nomination citing the accomplishments/contributions of the nominee and a *Curriculum Vita* of the nominee to the chair of the Honorary Life Award committee:

Dr. William J. Brett
Department of Life Sciences Indiana State University Terre Haute, IN 47809
Voice -- (812) 237-2392 FAX (812) 237-4480
E-mail -- lsbrett@scifac.indstate.edu

John Carlock Award

This Award was established to encourage biologists in the early stages of their professional careers to become involved with and excited by the profession of biology teaching. The John Carlock Award provides partial support for graduate students in the field of Biology to attend the Fall Meeting of ACUBE.

The applicant must be actively pursuing graduate work in Biology. He/she must have the support of an active member of ACUBE. The recipient of the Award will receive a certificate or plaque that will be presented at the annual banquet; and the Executive Secretary will provide the recipient with letters that might be useful in furthering her/his career in teaching.

Applications, in the form of a letter, can be submitted anytime during the year. The application letter should include a statement indicating how attendance at the ACUBE meeting will further her/his professional growth and be accompanied by a letter of recommendation from a member of ACUBE. Send application information to Dr. William J. Brett above.