Under the Knife: Animal Dissection as a Contested School Science Activity

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Responses

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Abstract

This article offers a review of recent research literature that discusses opposition to dissection in the context of North American school science classes. The arguments against dissection are divided into four themes: social concerns, animal-focused ethical concerns, pedagogical concerns, and health and environmental concerns. In discussing these dimensions of the dissection debate, this article outlines dominant concerns associated with dissection and argues for a critical reconsideration of the practice.

Introduction

The science education activity of animal dissection has been challenged on various fronts: social, ethical, pedagogical, and environmental. Questions have been posed whether it is moral, useful, or even worthwhile for students to cut open animals' bodies in the name of science. Educational researchers, science and humane educators, philosophers, students, parents, and individuals involved in animal advocacy have contributed to these discussions by asking questions, such as: *What are the impacts of dissection on students? Is dissection an ethical activity? Is it a pedagogically sound one? What are its environmental and ecological impacts? Does it remain a necessary practice, in light of the many educational alternatives now available?*

In this article, I review literature that raises concerns about the practice of dissection in North American school science classes. The discussion is divided into four themes: social concerns, animal-focused concerns, pedagogical concerns, and health and environmental concerns. These four areas of concern reflect the multi-dimensional nature of the dissection debate. Collectively, they outline why the practice is in need of critical reconsideration.

I approach this research from a humane education perspective. Humane education is a form of education that emerged from humane societies in the 1800s, focusing on animal protection, child protection, and education for more "humane" human-animal relations (Antoncic, 2003; Unti & DeRosa, 2003). In recent years, the focus of humane education has broadened to encompass education related to human rights and environmentalism, and how these intersect with issues of animal protection (Selby, 1995; Weil, 2004). Considering dissection from a humane education perspective involves examining its impacts on animals, students, and the environment, as well as critically considering the educational value of the activity and what humane alternatives exist to it.

Background

Dissection became a part of school curricula in the 1920s, and has since become the traditional way for students to learn about, and be exposed to, animal structure in science education (Orlans, 1993). Today it is estimated that 75-80 percent of North American students will dissect at least one animal during their

Kindergarten-Grade 12 school years, with multiple dissections being common (Balcombe, 2000). Surveys of prospective and established biology teachers suggest that significant numbers of teachers continue to use dissection: for example, one survey of 242 prospective biology teachers at a South African university found that 71 percent said they would expect students to conduct a dissection in their classrooms (de Villiers & Sommerville, 2005), while another survey of 494 American middle and high school biology teachers found that 79 percent used dissection in their classes (King, Ross, Stephens, & Rowan, 2004). Similarly, a survey of 667 Massachusetts life science teachers found that 78 percent said they had offered dissection at least once in the last five years (Almy, Goldsmith, & Patronek, 2001).

There is immense variety in the species of animals dissected in classrooms. Frogs are the most commonly dissected animals, although this may be changing in light of the global decline in amphibians due to habitat loss, disease, climate change, and other unknown causes (Cormier, 2008; Souder, 1998). Other animals dissected include fetal pigs, rats, minks, earthworms, turtles, grasshoppers, rabbits, birds, snakes, cats, guinea pigs, crayfish, perch, starfish, and a range of insects. Further, in some classroom dissections, animal parts such as cows' eyes, sheep lungs, and bull testicles are used (Bowd, 1993; Hart, Wood, & Hart, 2008; King et al., 2004).

Many teachers procure the animals through biological supply companies, where "it seems that virtually any animal specimen imaginable is available for purchase" (Hart et al., 2008, p. 160). Many specimens sold through these companies are wild-caught from natural environments, while others come from animal breeders, animal dealers, shelters, pounds, fur farms, and slaughterhouses (Balcombe, 2000). In total, it is difficult to determine the number of animals killed for dissections each year because schools are not required to maintain records on animal use; in the United States, however, estimates range from 6-12 million animals per annum (Orlans, 1993; Rosenberger, 1998). Clearly, the traffic in animals for dissection is a significant business, with millions of animals' lives on the line.

Dissection in schools was first formally challenged in 1987 with the landmark case of California high school student Jenifer Graham. Graham refused to dissect a frog on moral grounds—in her words, she said: "I feel a strong kinship with animals to which God has given life … what I feel toward animals is what I feel toward friends: we are both alive and both have a soul, so to speak; animals are in different kinds of bodies" (quoted in Hepner, 1994, p. 67). Upon refusing to dissect the frog, Graham was given a failing grade on the assignment, which she and her mother legally challenged. Graham's case resulted in the amendment of a bill, signed by the governor of California a year later in 1988, which mandated that schools in California provide dissection alternatives to students who object to the practice on moral, ethical, or religious grounds. This set the stage for future cases concerning student choice in dissection, as well as the establishment of student choice policies giving students the right to opt out of dissection. To date, four Canadian cities (Vancouver, Kelowna, Toronto, and South Shore) and nine American states (Florida, California, Pennsylvania, New York, Rhode Island, Illinois, Virginia, Oregon, and New Jersey) have dissection choice policies in place (Frogs Are Cool, 2008; Kramer, 2007).

It is estimated that in a typical class, three to five percent of students will verbally object to dissection, and a higher number of students will be silently opposed to it (Balcombe, 2000; Hart et al., 2008). One study of 420 students aged 11-16 found that 48 percent either agreed or strongly agreed with the statement, "It is wrong to dissect dead animals for teaching" (Stanisstreet, Spofforth, & Williams, 1993), while another study of 85 students in a Grade 10 biology class found that 35 percent agreed with the statement, "During dissection, I feel like I'm being disrespectful to the animal" (Doster, Jackson, Oliver, Crockett, & Emory, 1997). Balcombe (2000) writes that many students may not want to participate in a dissection but may be unwilling to voice their opposition to it due to fear of a failing grade, fear of embarrassment in front of their peers, or fear of challenging the authority of their teacher. Going against the established curriculum may be a daunting task for students; however, a host of reasons including ethics, culture, religion, and environmental concerns can make this a problematic activity for them. For teachers, these and other

considerations need to be taken into account. The following sections outline four dimensions of opposition to dissection.[1]

Social Concerns

Some opposition to dissection emerges from concern about what the practice promotes socially, ethically, and emotionally to students. While a primary aim of dissection is to give students hands-on experience with animal anatomy (Hart et al., 2008), some question how students internalize the practice and what learning they receive through its hidden curriculum—that is, what attitudes, values, and beliefs may be passed on through it. To this end, it has been argued that dissection can promote a decreased sensitivity toward animal life and individual ethical or moral discomfort.

Some argue that asking students to work with dead animals as a form of scientific inquiry can promote an attitude of resourcism toward them. Selby (1995), for example, writes that dissection positions animals as "mere commodities, disposable resources for our curiosity and convenience, possessing no value in their own right" (p. 255), while Sapontzis (1995) suggests dissection teaches students "that animals can be killed for trivial purposes, for example, just for curiosity or just because it has become traditional to kill animals on these occasions" (p. 185). They argue that dissection teaches students not to value animal life, but instead to see it as a resource for human use.

Sabloff (2001) suggests that through dissection animals become positioned as "artifacts" for human use. She identifies four characteristics of artifacts: they are (1) made for our use, (2) not sentient, (3) discardable, and (4) excluded from the moral community. This metaphor could be applied to animals procured for dissection as they are "made" (or collected) for human purposes, are no longer sentient as they have been killed for those purposes, are discarded once they are deemed no longer useful, and are excluded from moral consideration as they procured or bred for dissection. A corollary process to turning animals into artifacts is one of fragmentation and reduction of the animal (Sabloff, 2001). As the animal's body is cut open and cut up, there is a reduction of the entire being to a few select components deemed noteworthy or interesting to the observer, while the rest of the animal is ignored. Students who dissect animals are usually asked to identify particular organs or systems in the animal, which reduces the animal to parts that are considered significant while decontextualizing those parts from the whole.

This reductionist process could leave some students desensitized toward animal life. One study showed that a desensitization process can occur during a dissection (Solot & Arluke, 1997). The study, which examined sixth-grade students' behaviours during the dissection of fetal pigs, found that many students appeared to become hardened to the procedure as it progressed, describing themselves as becoming "immune" or "adapted" to the situation. Toward the end of the dissection, some students had progressed from initial apprehension about dissecting the animals to outright mutilation of them: students were observed plunging dissection tools into pigs' heads and bodies, and decapitating the animals and parading their heads around the classroom (Solot & Arluke, 1997). The authors write that such acts of desensitization may be coping mechanisms students employ to deal with an uncomfortable situation.

Anecdotal research suggests that for some students, the dissection experience can evoke sadness, ethical conflict, guilt, aversion, and disgust. In the words of some students:

> When the long, miserable week [of frog dissection] was over, the class was allowed to "do as you wish" with the remainders of the bodies. So all of the boys broke bones, tore off body parts, tossed them around—it was absolutely horrible. I can still hear the bones of those poor souls breaking and cracking. I had nightmares. (quoted in Balcombe, 1997, p. 14)

[1] This paper focuses exclusively on opposition to dissection. For discussions in support of dissection's continuation in schools, see Allchin (2005), Moore (2001), and Kline (1995).

> In my high school biology class, we paired up in partners to dissect fetal pigs. At the time, the idea revolted me, and I somehow knew it didn't seem right, but I wasn't really into school enough to feel like objecting. I did the whole thing, with a numb, disgusting feeling, like I was watching myself do it. (quoted in Hepner, 1994, p. 142)

> I filled up with tears actually because I could look at it [the pig] as a baby. A life that's taken… (quoted in Barr & Herzog, 2000, p. 58)

Students who are ethically or emotionally uncomfortable with dissection and offered no alternatives to it are left to their own devices for coping with their discomfort. In response, they may employ distancing mechanisms during the procedure (such as the student, quoted above, who "did the whole thing with a numb, disgusting feeling, like I was watching myself do it"), or they may employ strategies of rationalization, telling themselves that their reactions are inconsequential because the animal is already dead (Barr & Herzog, 2000). They may also attempt to mask their feelings, using techniques such as humour or objectification (Solot & Arluke, 1997). For educators, this raises the question: Are these reactions or coping mechanisms appropriate for students to experience as a result of a science activity?

Animal-Focused Concerns

Stepping outside of a human-centred framework, dissection is obviously harmful to the millions of animals it implicates each year. Opposition to dissection due to the harm it causes animals may be rooted in a belief that it is morally wrong to kill animals for this purpose, or may be sparked by concerns about how the animals were collected and killed for this end. That animals die, and that they may endure pain and suffering in the process, are moral concerns that account for many people's opposition.

Some consider dissection an ethically questionable activity because it involves unnecessary killing. One articulation of this argument is that if viable alternatives to dissection exist and the objectives of the curriculum can be met with them, killing animals for this purpose is unnecessary. Here it is worth noting here that a proliferating market of dissection alternatives are available, including the popular computerized dissection simulations/CD-ROMS such as *Digital Frog, CatLab*, *DryLabPlus Fetal Pig,* and *Froguts.* Computerized dissection programs have become increasingly sophisticated in the past decades, with many programs allowing students to complete all stages of the dissection procedure virtually, from pinning an animal down to a dissection tray to removing and labelling the animal's parts. Students can mimic the dissection procedure by gradually "removing" layers to reveal underlying structures and tissues, and they can move from region to region of the body digitally (e.g., tracing the route of an aorta through the body or taking a "tour" inside an animal cavity). Many programs include 3D graphics, sounds and narration, picture banks with hundreds of images, videoclips showing and discussing animals in their natural habitats, explanatory textual information, assessment tools, and accompanying student and teacher handbooks (Jukes & Chiuia, 2003; Smith & Smith, 2004). Overwhelmingly, research suggests that learning with alternatives can be comparable, and in some cases superior, to learning with actual animals.[2]

In addition to concerns expressed about the necessity (or lack thereof) of using animal specimens to learn, concern has been expressed that animals suffer in the process of being turned into specimens. This is a complicated concern to investigate, because animals used in dissections are often procured from biological

[2] See for example Akpan & Andre, 1999; Kopec, 2002; Strauss & Kinzie, 1994; and Youngblut, 2001. Two meta-reviews of research measuring student learning with conventional dissection versus alternatives concluded that most learning objectives can be met with alternatives, that knowledge gain is equivalent, that costs are less, that students are generally positive when using alternatives, and that alternatives provide better support for weaker students (Balcombe, 2003; HSUS, 2008). Specifically, in Balcombe's (2003) meta-review of 30 published studies, 29 found student learning to be comparable or better with the use of alternatives. A similar study undertaken by the Humane Society of the United States reviewed 35 studies, which were broken down into three categories: those demonstrating equal or comparable student performance between dissection and alternative methods (18), those demonstrating that alternatives were more effective instructional aids than dissection (15), and those demonstrating dissection to be a more effective instructional aid than alternative methods (2) (HSUS, 2008).

supply companies that do not divulge information about the animals' backgrounds. This makes it difficult to know how the animals were treated or killed before they arrived in the classroom.

One landmark study investigated the conditions of the capture and housing of frogs bound for dissection (Gibbs, Nace, & Emmons, 1971). The researchers found that the frogs, which were taken from a network extending thousands of miles throughout North America, were captured and stored in large sacks, up to 100 frogs per sack, for a week or more until they were transported to a supply company. During that time, their only care was being sprayed intermittently with water. Upon arrival at the supply company, the frogs were placed in large tubs of water, where they were kept for weeks to months, with no food, until a request came in for their shipment. When a request came, the frogs were sorted—at a rate of 25 frogs per minute per sorter—on the basis of size (small, medium, or large), while badly damaged, "broken," and dead frogs were discarded. Gibbs et al. note that common frog injuries included sores, reddened legs, missing toes, and bleeding eyes, which were probably caused by mishandling at least as frequently as by disease. They describe high mortality rates at each stage of the process, as frogs would perish from being crushed during capture, from overheating, from exposure to unsanitary holding tanks, and from starvation. Today, frogs that are bound for dissection are killed prior to shipment. This is done by dropping them in a solution of alcohol and water; on average, it takes 15-20 minutes for a frog to die this way (Balcombe, 2000).

A second, undercover investigation into the treatment of animals bound for dissection was conducted by employees of the organization People for the Ethical Treatment of Animals, who were hired to work for the Carolina Biological Supply Company and WARD's biological supply company for over a year. During that time, they used hidden cameras to videotape the treatment of animals at the facilities. Their video (PETA, 2006) documents callous treatment of many animals. One scene shows cats arriving at the facility in crowded wire cages and being beaten and poked with a metal rod, then prodded into gas chambers. Some cats survive the gassing and are shown still alive, weakly moving their paws, while they are being injected with formaldehyde. A dog is shown being lifted off the ground by the neck with a choke pole, then dumped into a gas chamber. Live rats are seen wriggling on restraining devices while they are being pumped with formaldehyde; one worker is shown spitting on a rat while it dies. Racks and piles of dead animals are shown strewn about the facilities, in what appears to be filthy conditions. In total, it is noted that the investigators documented 181 violations of the American Animal Welfare Act and 99 violations of Carolina anti-cruelty statutes during their investigation.

The Physicians Committee for Responsible Medicine writes that animals suffer through every step in the process leading up to their dissection, including the ways they are collected, transported, handled, raised, and killed (PCRM, 2007). Sapontzis (1995) similarly writes that "the catching, confining, transporting, handling, and killing of these animals apparently does involve significant pain, fright, deprivation, frustration, and distress" to them (p. 187). He also notes that "profit-minded companies in this business can be expected to cut corners in the care of soon-to-be-dead, throwaway animals" (p. 187). Yet, even if the animals are treated more humanely than what is outlined in the above investigations—or are treated *completely humanely* at all stages of their lives and deaths—a question of whether their deaths are justified still remains.

Pedagogical Concerns

One of prominent pedagogical questions about dissection concerns whether it remains a valid representation of contemporary biology or whether it has slipped into the role of tradition, reproduced year after year because "it has always been done." As the practice nears 90 years old in schools—and the focus of biology has shifted considerably during this time from an anatomical level down to a cellular and genetic level, and up to a ecological level—questions have been raised about whether dissection continues to have a place in the science curriculum. The fact that dissection is rarely mentioned in educational and curricular documents makes these questions especially poignant (Hart et al., 2008).

Hug (2005) writes that one way to conceptualize schools is as environments that allow students to experience ideas and practices that are accepted as valid knowledge by a particular culture. Over time, however, these ideas and practices can become "schooled," that is, they can "lose their connection to the world outside the school to find their purpose and place *within* the school" (Hug, 2005, p. 603). She asks whether the traditional practice of dissection has evolved with the changing values of school environments, or whether it has become a ritual of science carried out without critical evaluation. If it is the latter, she asks: is this a good reason for continuing the practice?

Such a question should, of course, be posed of all educational activities. Since anything included in the curriculum takes time and attention away from other potential topics, *all* curricular pursuits need to be assessed from time to time to ensure they remain relevant and appropriate. In the case of dissection, however, the question is especially timely because the activity is being questioned from various angles. To quote one science teacher:

> We must stop the ritual of dissecting as a regular part of the biology curriculum. It's not meaningful. It's a waste of our animal resources. It's expensive. And it takes time and attention away from other critical topics in biology. (quoted in DeRosa & Winiarskyj, 1990, p. 22)

The question raised here—why keep dissection as part of the curriculum?—merits critical consideration. Given that there are associated ethical concerns with dissection and proven alternatives are available, it would seem that dissection requires a new justification (Hug, 2008).

Dissection is further critiqued for not being contextualized in students' lives, as is the focus of the "science for everyday living" approach to science education. For most students, dissection is one of the only times in their lives—if not the *only* time—they will cut open dead animals to observe their anatomy, as the vast majority of students will never enter a career where the dissection experience is even remotely related to their work (Orlans, 1993). A small minority of students who will go on to a career in the life sciences that relates to the dissection experience (e.g., as a veterinarian or surgeon), yet even in post-secondary contexts, alternatives to animal specimens are frequently used in lieu of animals (Hart et al., 2008). The use of alternatives is particularly mainstreamed in veterinarian education: "What we have seen in the veterinarian community is a gradual process of transitioning over to alternatives, so that by now, alternatives have been mainstreamed and have largely replaced consumptive uses of animals" (Hart et al., 2008, p. 175). In addition, the climate of the "3 Rs" of animal use in science education—pertaining to the *reduction, refinement,* and *replacement* of harmful animal use (developed by Russell & Burch, 1959)—is a tenet that has received significant attention in research pertaining to animal use in science education (Jukes & Chiuia, 2003; King, 2004; Smith & Smith, 2004). It would seem, however, that this culture of mainstreamed alternatives and the "3 Rs" has not yet filtered down from the post-secondary level to the school level.

Finally, criticisms have been raised over the likelihood that students who are uncomfortable with dissection will not learn much from the experience and may turn away from future life science and biology studies. That dissection can and does turn some individuals away from a career in the life sciences is documented (e.g., Balcombe, 2000; Bishop & Nolen, 2001; DeRosa & Winiarskyj, 1990). Hepner (1994) writes that it is an unfortunate irony that medical schools and other professional schools are looking for compassionate students who are concerned about the suffering of others, yet some of these students may turn away from such careers because of their experiences with dissection.

Health and Environmental Concerns

Jukes and Chiuia (2003) write that the "capture, breeding, housing, killing, preservation and transportation of millions of animals each year has a significant environmental impact" (p. 35). Given that many dissected animals are wild-caught, the practice of procuring animals for dissection means disruption to ecosystems. The removal of frogs from ecosystems can be particularly problematic as frogs are a keystone

species that play a major role in an ecosystem's sustainability as both predators and prey, and the presence and well-being of frogs is said to be indicative of the overall health of an ecosystem (Rosenberger, 1998; Souder, 1998). Regardless of the species of animal, however, the point remains that removing *any* animals from ecosystems creates an environmental impact, as does the process of killing them, preserving them, and eventually, disposing of their bodies.

A second environmental and health concern is related to the use of formalin solutions to preserve animals' bodies. Formaldehyde is classified as a toxic and hazardous substance by the United States Occupational Safety and Health Administration and has been linked respiratory tract injury, vision impairment, and skin damage upon contact. It is also classified as a human carcinogen that has been linked to nasal and lung cancer (OSHA, 2003). Exposure to formaldehyde thus presents potential health risks to students and teachers, and in particular to workers in biological supply companies. The use of formaldehyde is perhaps declining as biological supply companies now sell animal specimens preserved in formaldehyde-free solutions, although not all specimens can be obtained formaldehyde-free and those that are formaldehyde-free are more expensive to purchase.[3]

Conclusion

Examining the practice of animal dissection through a humane education lens reveals multi-faceted concerns with the practice. While the dissection debate is at times polarized as an issue of animal rights versus the pursuit of science, a more nuanced consideration needs to take into account ethical, pedagogical, cultural, social, religious, and environmental perspectives. Ending an animal's life should not be a decision that is made lightly in the context of today's science education. This article has aimed to reveal the complexities and debates embedded in dissection, to argue that the practice is in need of critical reconsideration.

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[3] For example, as of July 2009, according to the Boreal Northwest biological supply website, a regularly preserved fetal pig specimen costs $22.95, whereas a formaldehyde-free fetal pig costs $31.20. A regularly preserved skinned cat costs $58.00; a formaldehyde-free specimen is $75.00. A vacuum package of 10 regularly preserved rats costs $85.00; a formaldehyde-free package of rats costs $121.00. Various animals, including mice, grasshoppers, mink, clams, starfish, turtles, snakes, and crayfish are not available formaldehyde-free. The higher price and limited selection of formaldehyde-free animals may create a tension for teachers who are faced with tight budgets and must decide between costs, availability of specimens, and environmental and health concerns.

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