

Prevalence of Student Dissection-Choice Policies in U.S. Schools

• SAMANTHA SUITER, JAN OAKLEY, JUSTIN GOODMAN



ABSTRACT

Although animal dissection is common in classrooms, growing concerns for animal welfare and advances in nonanimal teaching methods have prompted the creation of policies that allow students to choose humane alternatives to classroom animal use. We assessed the prevalence and content of policies that allow students to opt out of animal dissection in states and large public school districts across the United States – data that have not previously been collected or analyzed. We found that such policies exist at the state level in 22 states (plus the District of Columbia) and in many large public school districts in the other remaining states. These data illustrate that at least 63% of students in U.S. public schools have access to some kind of dissection choice, although the content of these policies varies widely. We discuss these results and recommend components of a comprehensive student dissection-choice policy.

Key Words: Animal dissection; policy development; dissection choice; schools; science classroom.

○ Introduction

Animal dissection is a long-standing, yet long-contested, science classroom practice. Although dissection remains common in North American schools, growing concern for animal welfare and advances in nonanimal teaching methods have prompted the creation of policies that allow students to choose humane alternatives to classroom animal dissection. These policies give students (1) the choice to opt out of animal-based classroom activities or demonstrations that they object to on ethical, religious, or moral grounds; and (2) access, without penalty, to ways of learning that do not involve the harmful use of animals or the use of purpose-killed animals for dissection.

Objections to dissection likely date as far back as the practice itself, which began in schools in the 1920s (Orlans, 1993). Choice

Animal dissection is a long-standing, yet long-contested, science classroom practice.

policies, however, began to emerge in the 1980s in response to increasing student objections. One of the earliest well-publicized cases of dissection objection was that of Jenifer Graham, a tenth-grade student in California who, in 1987, refused to dissect a frog in her biology class on ethical grounds (Beauchamp et al., 2008). When Graham, a vegetarian, was told she would receive a poor grade in the course if she did not dissect, she legally challenged the school's dissection policy. It was argued that her ethical beliefs were equivalent to a religion and that the school district was violating her right to freedom of religion (Beauchamp et al., 2008). Her case was settled and not fully adjudicated, but it resulted in legislation, signed by the governor of California in 1988, that mandated that students in the state have the right to conscientious objection to educational projects involving the harmful use of animals (Hepner, 1994). The bill also stated that, in the case of such objections, teachers and students should work together to develop an alternative. Graham's case set precedent for subsequent challenges to schools on the grounds of refusal to accommodate students' objection to dissection (Kramer, 2007). In turn, this contributed to the development of dissection-choice policies across the country.

Today, dissection-choice policies exist in many states, districts, schools, and classrooms across the United States, but they vary significantly in their content. Duncan (2008) and Balcombe (2000) discuss components of an "ideal" dissection choice law or policy:

- It should be written into course syllabi and accompanied by discussions in class.
- There should be an explicit awareness among students that there is no penalty for choosing alternatives.
- Comparable alternatives must be made available.
- There should be no demand on students to obtain parental consent to substantiate their choice.

Having all of these components in place makes for a desirable choice policy because it means that students know their options, and that teachers are prepared to offer alternatives.

According to a majority of teachers who conduct animal dissections, there is an increasing number of objections to animal-based research and invasive procedures on animals (Almy et al., 2001; Capaldo, 2004; King et al., 2004; Lopresti-Goodman, 2012; Knight, 2014; Funk & Rainie, 2015). As such, choice policies mean that students and teachers can mitigate conflict about dissection in the curriculum and determine an alternative method for learning the lesson being taught.

There are other reasons why offering a choice in dissection and developing choice policies is desirable. One is that students who object to dissection but are forced to do it anyway will learn little from the process – and in some classrooms, students who object to dissection still feel pressured to participate in it (Oakley, 2013). Furthermore, when a student's emotional welfare is compromised, so too is their learning. For example, if a student feels disgusted by the prospect of dissection, their motivation to learn will be negatively affected (Holstermann et al., 2009; Randler et al., 2013). Negative classroom experiences such as these can result in compassionate people turning away from further studies in the life sciences (Solot & Arluke, 1997; Capaldo, 2004) – despite the fact that dissecting animals is rarely, if ever, a curricular requirement in secondary schools; nor is it a prerequisite for post-secondary studies; and other means of learning are widely available. Dissection-choice policies counter the message that objectors may receive, that their beliefs and values do not have a place in science. Such policies also contextualize conscientious objection as rooted in positive cultural values, including respect for life and a commitment to not harming animals – values that should be encouraged in a science classroom (Jukes & Chiuiia, 2003).

There is a persistent assumption among many educators that dissection remains the “best” way students can learn (e.g., see Osenkowski et al., 2015), despite evidence that learning with alternatives such as computerized programs is comparable, and in some cases superior, to learning via conventional animal dissection (Waters et al., 2005, 2011; Knight, 2007; Patronek & Rauch, 2007; Motoike et al., 2009; DeHoff et al., 2011; Physicians Committee for Responsible Medicine, 2013). From a pedagogical standpoint, there is no reason not to offer students an alternative to dissection, since it is clear that students can learn principles of anatomy and physiology – in both required and elective courses – in ways other than cutting into a once-living animal. Indeed, offering a choice in dissection follows the policies and practices being used in higher education, such as medical schools that have eliminated animal laboratories from medical student training (see Physicians Committee for Responsible Medicine, 2014). In addition to student concerns, some teachers are opposed to dissection for reasons that include health and safety concerns, classroom management, learning and retention issues, cost, and the inability to justify killing animals for dissection (Oakley, 2012).

This research supports the creation of choice policies – as do the positions of leading science-education organizations. The National Science Teachers Association (NSTA) (2008), the Human Anatomy and Physiology Society (HAPS) (2012), and the National Association of Biology Teachers (NABT) (2008) all advise teachers to be

responsive to students' objections to harming animals by making humane alternatives available upon request. NSTA and HAPS also endorse teachers' decisions to completely replace animal dissection in their classrooms. Implementing dissection-choice policies allows students to know that alternatives are available and that their use is supported in the classroom.

Alternative nonanimal teaching methods such as interactive digital dissections, lifelike models, and clay modeling systems are widely available and educationally effective, as noted above. Digital Frog, a computer-based dissection simulation, includes modules on anatomy, physiology, and ecology, and provides a reference guide for educators identifying science content areas that are covered by their product offerings (see Digital Frog International, 2010). Froguts, another computer simulation, has aligned its frog, squid, sea star, cow eye, owl pellet, fetal pig, and Mendelian genetics modules with the National Science Education Standards (see Froguts, 2012). Anatomy in Clay's systems that allow students to form body systems with clay and build them onto a human skeleton have been shown to be as or more effective in comparison to using cat dissection to teach human anatomy at the college level (Motoike et al., 2009).

For more advanced biomedical education, dissection can be ethically performed and justified using ethically sourced human or animal cadavers. This includes obtaining animals who have died of natural causes, or using the bodies of deceased companion animals that have been donated to science through educational memorial programs (see Kumar et al., 2001) or through willed-body donation programs established by veterinary schools. Opportunities to work with human cadavers are also available through colleges and universities, even to high school students (Hubbard et al., 2005). Examination of actual animal and human cadavers and organs can also be achieved using plastinated specimens (Stuart & Henry, 2002).

Given the myriad reasons for supporting choice in dissection through policy creation, we sought to answer this question: How prevalent are dissection-choice policies in U.S. states and school districts today?

○ Research & Materials

Review of Existing Data

We collected publicly available information on current, state-level dissection-choice policies by researching all State Board of Education websites (using the key words “animal,” “controversial issues,” “dissection,” and “challenged materials”) and by consulting an existing database (American Anti-Vivisection Society, 2015). For states that do not have apparent state-level policies, we identified the five largest public school districts in each state (except for the sparsely populated districts in Montana, Alaska, South Dakota, and Wyoming, which all have less than five large public school districts). The five largest school districts in each state were selected because they represent the vast majority of students in each state. For example, Clark County School District, the largest in the state of Nevada, includes 70% of the state's student population (Ballotpedia, 2015). We also researched district-level policies via web searches, using the key words “animal,” “controversial issues,” “dissection,” and “challenged materials.”

Surveys. In districts for which policies were not found, we e-mailed survey letters to administrators during 2011–2014, asking the following questions:

- Is animal dissection included in [District’s] classes or included in the curriculum? (Yes or No)
- For classes that include animal dissection or other procedures involving animals or animal parts, does [District] have a policy allowing students with religious, ethical, or other objections to these exercises to opt out and be provided with nonanimal methods (e.g., computer software)? (Yes or No)
- Is this policy formal or informal?

Combining data from these surveys and online research, we categorized the confirmed dissection-choice policies of all school districts by type: Informal Practice, Dissection Specific, Religious Exemption, Controversial Issues, Challenged Materials, and Exemption/Exclusion from Instruction. Informal Practice policies, as confirmed by surveys to administrators, are practices in which the district reportedly allows students to opt out of animal dissection but does not have a published policy. Dissection Specific policies are formal statements that explicitly address animal dissection, a student’s right to opt out, and a requirement for teachers to offer an alternative activity. Religious Exemption policies are those that allow students to opt out of classroom activities that are contrary to their religious beliefs. Controversial Issues policies are more general and allow students to be excluded from instruction that is determined to be controversial in nature, such as using animals for classroom dissection or sex education, and be provided with an alternative activity. Similarly, Challenged Materials policies allow parents to formally challenge materials they deem unsuitable for their child, and require teachers to offer an alternative learning activity. Exemption/Exclusion from Instruction policies also allow parents to exclude their child from classroom activities that are contrary to their beliefs, but do not necessarily require teachers to provide an alternative activity.

○ Results

State-Level Policies

A growing number of states have policies in place for students who are opposed to classroom animal dissection. We identified 22 (45%) states, plus the District of Columbia, that have state-level policies in place (see Table 1), which represents choice-in-dissection for 31.2 million public school students in the United States (Ballotpedia, 2015). Among these 22 states plus the District of Columbia, 18 of the state-level policies are dissection-specific and 5 are formal educational policies that allow students to opt out of objectionable material on moral, religious, or ethical grounds. None of the policies exempt choice in dissection for elective science courses.

District-Level Policies

In the other 28 (55%) states without state-level policies, we researched the five largest districts ($n = 128$) in each state, which represent the vast majority of the student population. Exceptions were the sparsely populated districts in Montana (researched 1 district), Alaska (3 districts), South Dakota (2 districts), and Wyoming (2 districts). Among these 128 large public school districts, we identified 23 formal policies at the district level. For the remaining 105 districts, we sent survey letters to district administrators and followed up, as applicable, with e-mails. In total, we received 37 responses. We categorized the responses from responding school districts and the existing policies from our research into six groups: Informal Practice (40%), Controversial Issues (18%), Challenged Materials (13%), Dissection Specific (18%), Exemption/Exclusion from Instruction (7%), and Religious Exemption (3%) (see Table 2).

Among the responses we received, not a single district indicated that animal dissections are compulsory for required or elective science courses. Some reported that the district curriculum includes instructions for offering alternative assignments, while

Table 1. States with a state-level choice policy.

| No. | State | Type of Policy |
|-----|---|---------------------|
| 1 | Arizona (Arizona State Legislature, 2014) | Formal policy |
| 2 | California (California Statutes, 1999) | Dissection specific |
| 3 | Connecticut (Connecticut Statutes, 2013) | Dissection specific |
| 4 | District of Columbia (District of Columbia Office of the State Superintendent of Education, 2012) | Dissection specific |
| 5 | Florida (Florida Statutes, 1985) | Dissection specific |
| 6 | Hawaii (Hawaii State Department of Education, 2012) | Formal policy |
| 7 | Illinois (Illinois Statutes, 2000) | Dissection specific |
| 8 | Louisiana (Louisiana State Resolution, 1992) | Dissection specific |
| 9 | Maine (Maine Office of the Department of Education and Cultural Services, 1990) | Dissection specific |
| 10 | Massachusetts (Massachusetts State Board of Education, 2005) | Dissection specific |
| 11 | Michigan (Michigan State Board of Education, 2014) | Dissection specific |
| 12 | Minnesota (Minnesota Statutes, 2014) | Formal policy |

Table 1. Continued

| No. | State | Type of Policy |
|-----|--|---------------------|
| 13 | New Hampshire (New Hampshire State Board of Education, 2014) | Dissection specific |
| 14 | New Jersey (New Jersey Statutes, 2013) | Dissection specific |
| 15 | New Mexico (New Mexico Statutes, 2009) | Dissection specific |
| 16 | New York (New York Statutes, 1994) | Dissection specific |
| 17 | Oregon (Oregon Statutes, 2005) | Dissection specific |
| 18 | Pennsylvania (Pennsylvania School Code, 1992) | Dissection specific |
| 19 | Rhode Island (Rhode Island Statutes, 1997) | Dissection specific |
| 20 | Texas (Texas Constitution and Statutes, 1995) | Formal policy |
| 21 | Utah (Utah Department of Administrative Services, 2014) | Formal policy |
| 22 | Vermont (Vermont Statutes, 2008) | Dissection specific |
| 23 | Virginia (Virginia Statutes, 2004) | Dissection specific |

Table 2. Confirmed choice policies in largest school districts in states without a state-level policy.

| No. | State | District | Type of Policy |
|-----|----------|--|--------------------------------------|
| 1 | Alabama | Baldwin County Public Schools | Dissection specific |
| 2 | Alaska | Fairbanks North Star Borough School District | Challenged materials |
| 3 | Alaska | Anchorage School District | Informal practice |
| 4 | Arkansas | Little Rock School District | Informal practice |
| 5 | Colorado | Jeffco Public Schools | Dissection specific |
| 6 | Colorado | Douglas County School District | Exemption/exclusion from instruction |
| 7 | Colorado | Adams 12 Five Star Schools | Informal practice |
| 8 | Colorado | Cherry Creek School District | Religious exemption |
| 9 | Delaware | Red Clay Consolidated School District | Dissection specific |
| 10 | Georgia | Gwinnett County Public Schools | Controversial issues |
| 11 | Georgia | Cobb County School District | Informal practice |
| 12 | Georgia | Fulton County Schools | Informal practice |
| 13 | Idaho | Joint School District No. 2 (AKA West Ada School District) | Challenged materials |
| 14 | Idaho | Boise School District | Challenged materials |
| 15 | Idaho | Coeur d'Alene Public Schools | Controversial issues |
| 16 | Indiana | Fort Wayne Community Schools | Informal practice |
| 17 | Indiana | South Bend Community School Corporation | Informal practice |
| 18 | Iowa | Cedar Rapids Community School District | Challenged materials |
| 19 | Iowa | Des Moines Public Schools | Informal practice |
| 20 | Kansas | Olathe Public Schools USD 233 | Controversial issues |
| 21 | Kansas | Blue Valley Unified School District 229 | Informal practice |
| 22 | Kentucky | Fayette County Public Schools | Challenged materials |
| 23 | Kentucky | Jefferson County Public Schools | Dissection specific |
| 24 | Kentucky | Kenton County School District | Informal practice |

Table 2. Continued

| No. | State | District | Type of Policy |
|-----|----------------|---------------------------------------|--------------------------------------|
| 25 | Maryland | Prince George's County Public Schools | Dissection specific |
| 26 | Maryland | Baltimore County Public Schools | Dissection specific |
| 27 | Maryland | Baltimore City Public School System | Dissection specific |
| 28 | Maryland | Montgomery County Public Schools | Informal practice |
| 29 | Maryland | Anne Arundel County Public Schools | Informal practice |
| 30 | Mississippi | Jackson Public School District | Challenged materials |
| 31 | Missouri | Rockwood School District | Challenged materials |
| 32 | Missouri | Springfield Public Schools | Informal practice |
| 33 | Montana | Billings Public Schools | Challenged materials |
| 34 | Nebraska | Lincoln Public Schools | Controversial issues |
| 35 | Nebraska | Papillion-La Vista Public Schools | Controversial issues |
| 36 | Nebraska | Omaha Public Schools | Exemption/exclusion from instruction |
| 37 | Nebraska | Millard Public Schools | Exemption/exclusion from instruction |
| 38 | Nevada | Clark County School District | Dissection specific |
| 39 | Nevada | Washoe County School District | Informal practice |
| 40 | North Carolina | Cumberland County Schools | Controversial issues |
| 41 | North Carolina | Charlotte-Mecklenburg Schools | Dissection specific |
| 42 | North Carolina | Winston Salem/Forsyth County Schools | Dissection specific |
| 43 | North Carolina | Wake County Public Schools | Informal practice |
| 44 | North Carolina | Guilford County Schools | Informal practice |
| 45 | North Dakota | West Fargo Public Schools | Informal practice |
| 46 | Ohio | Columbus City Schools | Controversial issues |
| 47 | Ohio | Cincinnati Public Schools | Controversial issues |
| 48 | Ohio | Akron Public Schools | Controversial issues |
| 49 | Ohio | Toledo Public Schools | Dissection specific |
| 50 | Oklahoma | Edmond Public Schools | Exemption/exclusion from instruction |
| 51 | Oklahoma | Oklahoma City Public Schools | Informal practice |
| 52 | South Carolina | Greenville County School District | Informal practice |
| 53 | Tennessee | Rutherford County Schools | Controversial issues |
| 54 | Tennessee | Knox County Schools | Informal practice |
| 55 | Washington | Seattle Public Schools | Informal practice |
| 56 | Washington | Spokane Public Schools | Informal practice |
| 57 | West Virginia | Cabell County Schools | Controversial issues |
| 58 | Wisconsin | Green Bay Area Public School District | Informal practice |
| 59 | Wisconsin | Madison Metropolitan School District | Informal practice |
| 60 | Wisconsin | Milwaukee Public Schools | Religious exemption |

others noted that having alternatives to dissection is encouraged. For example, one respondent noted that

All [teachers] had methods in place to allow students optional ways to complete the assignment. We do not have a District wide [formal] policy, but do encourage through our science Curriculum Committee that teachers have alternative methods for teaching the adopted curriculum. Fortunately, virtual labs have made this both easier to accomplish and even more effective than former methods of using pictures, drawings and the like. (Anchorage School District, Alaska, 2011)

Others reported that students are allowed to opt out without consequence: “If a student wishes to opt out of any dissection activity, they may do so at any time without consequence” (Des Moines Public Schools, Iowa, 2011). Another respondent stated that dissections are communicated to students as being optional: “We emphasize that dissections are optional. If a student does not feel comfortable with a dissection, they always have an option of going to the library or an alternate location to complete a simulation or online dissection” (Guilford County Schools, North Carolina, 2012). Some respondents contextualized dissection alternatives as an ethical issue: “As a matter of ethics, virtual labs are alternatives to traditional dissection and may be used to meet course requirements” (Cincinnati Public Schools, Ohio, 2012). Others remarked that dissection is in fact discouraged in their schools: “We favor limited use of dissection. We also discourage dissection at the elementary and middle levels” (Little Rock School District, Arkansas, 2011).

There are an estimated 13,600 public school districts in the United States with a combined student population of 55.2 million (Ballotpedia, 2015). Our study of state policies and large districts found that at least 34.5 million students (63%) in public schools have access to some kind of dissection choice. This includes 92 of the 100 largest school districts in the United States (American School and University, 2014).

○ Discussion

Our data uncovered substantial variety in the content and types of policies in existence, including Informal Practice, Controversial Issues, Challenged Materials, Dissection Specific, Exemption/Exclusion from Instruction, and Religious Exemption. These varied policies ostensibly all provide students choice in dissection, but they are not consistent in either specifically addressing dissection practices in classrooms or enabling students to use an alternative without having to formally challenge the curriculum or request an exemption (or have their parents request an exemption) based on personal grounds. On the basis of these findings, we recommend that dissection-choice policies be crafted to include the previously discussed components suggested by Duncan (2008) and Balcombe (2000), which has been done in, for example, the Michigan State Board of Education’s policy on Student Options for Animal Dissection Coursework (see Michigan State Board of Education, 2014).

While our research reveals that most students in U.S. public schools have access to some kind of dissection choice, there are still many students who do not. It is increasingly important – given the increasing number of objections to harmful animal use and the

development of effective alternatives to dissection – for schools, districts, and states to be consistent with the recommendations of leading science-education organizations and to adopt choice policies that respect students’ ethical, religious, and moral objections to animal dissection.

References

- Almy, J., Goldsmith, M.L. & Patronek, G.J. (2001). Dissection in Massachusetts classrooms: correlation of gender, teacher attitudes, and conscientious objection. [Report.] West Barnstable, MA: Cape Wildlife Center.
- American Anti-Vivisection Society (2015). Student choice laws. Available at <http://aavs.org/animals-science/laws/student-choice-laws/>.
- American School and University (2014). 2014 AS&U 100: Largest school districts in the U.S. by enrollment, 2012–13. Available at <http://asumag.com/research/2014-asu-100-largest-school-districts-us-enrollment-2012-13>.
- Anchorage School District (2011, December 15). Personal communication: survey response to researcher.
- Arizona State Legislature (2014). 15–102. Parental involvement in the school; definition. Available at <http://www.azleg.gov/FormatDocument.asp?inDoc=/ars/15/00102.htm&Title=15&DocType=ARS>.
- Balcombe, J. (2000). *The Use of Animals in Higher Education: Problems, Alternatives, & Recommendations*. Washington, DC: Humane Society Press.
- Ballotpedia (2015). Largest school districts in the United States by enrollment. Available at http://ballotpedia.org/Largest_school_districts_in_the_United_States_by_enrollment.
- Beauchamp, T.L., Orlans, F.B., Dresser, R., Morton, D.B. & Gluck, J.P. (2008). *The Human Use of Animals: Case Studies in Ethical Choice*, 2nd Ed. New York, NY: Oxford University Press.
- California Statutes (1999). Education Code §32255-32255.6. Available at <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=edc&group=32001-33000&file=32255-32255.6>.
- Capaldo, T. (2004). The psychological effects on students of using animals in ways that they see as ethically, morally or religiously wrong. *Alternatives to Laboratory Animals*, 32(Supplement 1), 525–531.
- Cincinnati Public Schools, Ohio (2012, January 31). Personal communication: survey response to researcher.
- Connecticut Statutes (2013). Public Act no. 13-273 An act concerning dissection choice. Available at <https://www.cga.ct.gov/2013/act/pa/2013PA-00273-R00HB-06329-PA.htm>.
- DeHoff, M.E., Clark, K.L. & Meganathan, K. (2011). Learning outcomes and student-perceived value of clay modeling and cat dissection in undergraduate human anatomy and physiology. *Advances in Physiology Education*, 35, 68–75.
- Des Moines Public Schools (2011, December 7). Personal communication: survey response to researcher.
- Digital Frog International (2010). More than just frogs and field trips. Available at http://www.digitalfrog.com/resources/more_than_frogs_and_field_trips.html.
- District of Columbia Office of the State Superintendent of Education (2012). Non-regulatory guidance for local education agencies: animal dissection opt-out choice for district students. Available at http://osse.dc.gov/sites/default/files/dc/sites/osse/release_content/attachments/Animal%20dissectionn%20on-regulatory%20guidance.pdf.
- Duncan, A. (2008). To dissect or not: student choice-in-dissection laws ensure the freedom to choose. *Journal of Law and Education*, 37, 283–289.

- Florida Statutes (1985). §1002.20 K12 Student and Parent Rights. Available at http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=1000-1099/1002/Sections/1002.20.html.
- Froguts (2012). Products. Available at <http://www.froguts.com/products/labs.html>.
- Funk, C. & Rainie, L. (2015). Public and scientists' views on science and society. Pew Research Center. Available at <http://www.pewinternet.org/2015/01/29/public-and-scientists-views-on-science-and-society/>.
- Guilford County Schools, North Carolina (2012, January 26). Personal communication: survey response to researcher.
- Hawaii State Department of Education (2012). Parent opt-out for child. Available at <http://www.hawaiipublicschools.org/ConnectWithUs/FAQ/Pages/Parent-opt-out-for-child.aspx>.
- Hepner, L.H. (1994). *Animals in Education: The Facts, Issues and Implications*. Albuquerque, NM: Richmond.
- Holstermann, N., Grube, D. & Bögeholz, S. (2009). The influence of emotion on students' performance in dissection exercises. *Journal of Biological Education*, 43, 164–168.
- Hubbard, C.J., Miller, J.S. & Olson, D. (2005). A new way to teach an old topic: the cadaver-based anatomy short course for high school students. *Anatomical Record B*, 284, 6–11.
- Human Anatomy and Physiology Society (2012). Animal use position statement. Available at <http://www.hapsweb.org/?page=AnimalUsePosition>.
- Illinois Statutes (2000). 105 ILCS 112 Dissection alternatives act. Available at <http://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1016&ChapterID=17>.
- Jukes, N. & Chiuiua, M. (2003). *From Guinea Pig to Computer Mouse: Alternative Methods for a Progressive, Humane Education*, 2nd Ed. Leicester, UK: InterNICHE.
- King, L.A., Ross, C.L., Stephens, M.L. & Rowan, A.N. (2004). Biology teachers' attitudes to dissection and alternatives. *Alternatives to Laboratory Animals*, 32, 475–484.
- Knight, A. (2007). The effectiveness of humane teaching methods in veterinary education. *ALTEX*, 24, 91–109.
- Knight, A. (2014). Conscientious objection to harmful animal use within veterinary and other biomedical education. *Animals*, 4, 16–34.
- Kramer, M.G. (2007). Humane education, dissection, and the law. *Animal Law*, 13, 281–298.
- Kumar, A.M., Murtaugh, R., Brown, D., Ballas, T., Clancy, E. & Patronek, G. (2001). Client donation program for acquiring dogs and cats to teach veterinary gross anatomy. *Journal of Veterinary Medical Education*, 28, 73–77.
- Little Rock School District, Arkansas (2011, December 8). Personal communication: survey response to researcher.
- Lopresti-Goodman, S.M. (2012). Towards plasticity in brain science pedagogy. *Psychology and Education*, 49(3), 25–28.
- Louisiana State Resolution (1992). Concurrent Resolution 153. [Copy available upon request.]
- Maine Office of the Department of Education and Cultural Services (1990). Advisory allowing students to refuse to do dissection and provisions for alternatives to dissection. [Received April 15, 2013 via Freedom of Access request, available upon request.]
- Massachusetts State Board of Education (2005). Policy on dissection and dissection alternative activities. Available at <http://www.doe.mass.edu/news/news.aspx?id=5621>.
- Michigan State Board of Education (2014). Michigan State Board of Education policy: student options for animal dissection coursework. Available at http://www.michigan.gov/documents/mde/FINAL_Policy_Dissection_Choice_456675_7.pdf.
- Minnesota Statutes (2014). 120B.20 Parental curriculum review. Available at <http://www.revisor.mn.gov/statutes/?id=120b.20>.
- Motoike, H.K., O'Kane, R.L., Lenchner, E. & Haspel, C. (2009). Clay modeling as a method to learn human muscles: a community college study. *Anatomical Sciences Education*, 2, 19–23.
- National Association of Biology Teachers (2008). NABT position statement: the use of animals in biology education. Available at <http://www.nabt.org/websites/institution/File/docs/use%20of%20animals.pdf>.
- National Science Teachers Association (2008). NSTA position statement: responsible use of live animals and dissection in the science classroom. Available at <http://www.nsta.org/about/positions/animals.aspx>.
- New Hampshire State Board of Education (2014). New Hampshire student choice policy. Available at <http://education.nh.gov/instruction/curriculum/science/documents/student-choice.pdf>.
- New Jersey Statutes (2013). §18A:35-4.25 Refusal to participate in certain school activities related to animal dissection, etc. Available at <http://law.justia.com/codes/new-jersey/2013/title-18a/section-18a-35-4.25>.
- New Mexico Statutes (2009). 6.29.1.11.B.8 Curriculum. Available at http://www.ped.state.nm.us/calendar/dl11/06%20of%200001_%20Amended.pdf.
- New York Statutes (1994). § 809(4) Instruction in the humane treatment of animals. Available at <http://public.leginfo.state.ny.us/navigate.cgi>.
- Oakley, J. (2012). Science teachers and the dissection debate: perspectives on animal dissection and alternatives. *International Journal of Environmental & Science Education*, 7, 253–267.
- Oakley, J. (2013). "I didn't feel right about animal dissection": dissection objectors share their science class experiences. *Society & Animals*, 21, 360–378.
- Oregon Statutes (2005). §337.300 Animal Dissection. Available at <http://www.oregonlaws.org/ors/337.300>.
- Orlans, F.B. (1993). *In the Name of Science: Issues in Responsible Animal Experimentation*. New York, NY: Oxford University Press.
- Osenkowski, P., Green, C., Tjaden, A. & Cunniff, P. (2015). Evaluation of educator & student use of & attitudes toward dissection & dissection alternatives. *American Biology Teacher*, 77, 340–346.
- Patronek, G.J. & Rauch, A. (2007). Systematic review of comparative studies examining alternatives to the harmful use of animals in biomedical education. *Journal of the American Veterinary Medical Association*, 230, 37–43.
- Pennsylvania School Code (1992). Section 1523 Pupil's right of refusal: Animal dissection. Available at <http://www.legis.state.pa.us/WU01/LI/LI/US/PDF/1949/0/0014..PDF>.
- Physicians Committee for Responsible Medicine (2013). Dissection alternatives. Available at <http://pcrm.org/research/edtraining/dissectionalt>.
- Physicians Committee for Responsible Medicine (2014). Medical schools with no live animal laboratories. Available at <http://pcrm.org/research/edtraining/meded/medical-schools-with-no-live-animal-laboratories>.
- Randler, C., Hummel, E. & Wüst-Ackermann, P. (2013). The influence of perceived disgust on students' motivation and achievement. *International Journal of Science Education*, 35, 2839–2856.
- Rhode Island Statutes (1997). § 16-22-20 Animal dissection and vivisection – Right to refuse – Alternate learning project required. Available at <http://webserver.rilin.state.ri.us/Statutes/TITLE16/16-22/16-22-20.htm>.
- Solot, D. & Arluke, A. (1997). Learning the scientist's role: animal dissection in middle school. *Journal of Contemporary Ethnography*, 26, 28–54.
- Stuart, M.D. & Henry, R.W. (2002). Plastinated specimens can improve the conceptual quality of biology labs. *American Biology Teacher*, 64, 130–134.
- Texas Constitution and Statutes (1995). Parental rights and responsibilities. Available at <http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.26.htm>.

Utah Department of Administrative Services (2014). R277-105-5: Requests for waiver of participation in school activities. Available at <http://www.rules.utah.gov/publicat/code/r277/r277-105.htm#T5>.

Vermont Statutes (2008). VT H. 711, § 912. Pupil's right of refusal; Animal dissection. Available at <http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2008/acts/ACT154.htm>.

Virginia Statutes (2004). § 22.1-200.01. Alternatives to animal dissection. Available at <http://law.lis.virginia.gov/vacode/22.1-200.01/>.

Waters, J.R., Van Meter, P., Perrotti, W., Drogo, S. & Cyr, R.J. (2005). Cat dissection vs. sculpting human structures in clay: an analysis of two approaches to undergraduate human anatomy laboratory education. *Advances in Physiology Education*, 29, 27–34.

Waters, J.R., Van Meter, P., Perrotti, W., Drogo, S. & Cyr, R.J. (2011). Human clay models versus cat dissection: how the similarity between the

classroom and the exam affects student performance. *Advances in Physiology Education*, 35, 227–236.

SAMANTHA SUITER is the Science Education Specialist at People for the Ethical Treatment of Animals (PETA), 501 Front St., Norfolk, VA 23510, and is a Biology Professor at Trident Technical College, 7000 Rivers Ave., North Charleston, SC 29406; e-mail for correspondence: samanthas@peta.org. JAN OAKLEY is on the Faculty of Education, Lakehead University, 120 Windemere Ave. N., Thunder Bay, Ontario, Canada P7A 6B4; e-mail: joakley@lakeheadu.ca. JUSTIN GOODMAN is the Director of Government Relations at PETA, 1536 16th St. NW, Washington, DC 20036, and teaches in the Department of Sociology at Marymount University, 2807 N. Glebe Rd., Arlington, VA; e-mail: justing@peta.org.

POST-SECONDARY BIOLOGY EDUCATION

► NMU.EDU/BIOLOGY/POSTSECONDARY



A Master of Science in biology with a pedagogical emphasis

Build your credentials with pedagogical training. Complete a final semester college teaching internship. Learn from biology and education professors who are the best in their fields.



Contact the program
for more information:
Biology Department
906.227.2300
biology@nmu.edu



Visit ASHG's sessions at NABT 2016:

Finding the Genetic Basis of Diseases
and Traits: RB, CF, and BMI

Introducing Bioinformatics Resources
to Study Human Disease

**Stop by booth #214 for FREE lesson
plans, a gift, and more!**



For additional resources, visit
ashg.org/K12