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Authors

Hart, Lynette A
Wood, M W

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Uses of Animals and Alternatives in College and Veterinary Education at the University of California, Davis: Institutional Commitment for Mainstreaming Alternatives

Lynette A. Hart and Mary W. Wood

UC Center for Animal Alternatives, School of Veterinary Medicine, University of California, Davis, Davis, CA, USA

Summary — The use of animals in teaching for college, veterinary and medical education in the USA has sharply declined in recent decades. Economic disincentives and public discussions have diminished this use of animals, as well as the growing availability of alternative resources for teaching. In the USA, the use of live animals in teaching at the post-secondary level requires a protocol review similar to that used for research, whereas protocols are not required for the use of non-living specimens. Many outstanding alternatives have been created that supplant some uses of animals. Creating alternatives for a comprehensive biological or veterinary curriculum can best be addressed by a long-term commitment of leadership at the institutional level, leading to an incremental development of alternatives. Economic realities and the demonstration of educational results equal to, or exceeding that of the consumptive uses of animals support supplanting the more traditional methods. Committed leadership at the University of California, Davis, has facilitated the development of teaching tools and the mainstreaming of alternatives within the standard undergraduate and veterinary curriculum. The institutional culture supports these resources, and finding further solutions requiring less consumptive uses of animals. We introduce here a web-based tool providing improved access to these resources: www.vetmed.ucdavis.edu/Animal_Alternatives/main.htm.

Key words: *alternatives, animal use, veterinary education.*

Address for correspondence: *L.A. Hart, UC Center for Animal Alternatives, University of California, Davis, Davis, CA 95616, USA.*
E-mail: *lahart@ucdavis.edu*

Introduction

Many major advances toward developing and implementing alternatives in education have come about from the contributions of individual scientists. For example, David Dewhurst over many years has systematically compared the performance of students participating in live animal laboratories versus those using simulations via computer-assisted learning (1–3). One veterinary faculty member, Cathy Greenfield, has succeeded with colleagues in creating model organs with a texture similar to actual tissue; these have been used successfully in teaching suturing techniques to veterinary students (4–7). Robert Leighton, a professor emeritus of veterinary surgery at the University of California, Davis (UC Davis) for a decade has focused his attention on creating teaching tools for surgery. His "bone box" now introduces UC veterinary students to the tools and procedures used in bone plating before the students conduct any surgery on live animals.

Another method of significant advance occurs through the longstanding commitment of organisations to the effort of furthering alternatives in education, as can be seen in the work of the Fund for the Replacement of Animals in Medical Experiments (FRAME; 8) and the Universities Federation for Animal Welfare (UFAW; 9). Among academic institutions, the University of Utrecht (10) stands out in establishing a strong longstanding commitment to improved teaching and training concerning animal use and involving a variety of faculty members while offering the mandatory training course for all individuals working with animals. Access to information on the growing pool for teaching resources is facilitated by specialised websites that are updated regularly (11–14).

In university settings, emphasis on alternatives in education is typically associated with single individuals. Yet an individual cannot single-handedly alter the academic cultural environment such that everyone embraces and contributes to the development and utilisation of alternatives on an on-going basis. In this paper, we characterise some elements of the culture at the UC Davis School of Veterinary Medicine for more than a decade that have facilitated the continuing creation and implementation of alternatives in teaching. This culture consists of student lobbyists, creative technicians and professors, and administrators making supportive decisions. Each of these three groups is comprised of talented and committed individuals providing leadership toward valuing alternatives as enhanced teaching resources that improve learning.

Students as Lobbyists

For the past decade, veterinary students have actively pressed for developing teaching methods that would not require terminal surgery. Students faced a personal dilemma in the stressful, either-or, decision with regard to whether or not they chose to conduct a terminal surgery prior to their first survival surgery. Students seek to gain the best educational preparation available, yet they wish to avoid causing harm or death to animals. Since students had differing opinions and priorities regarding these issues, selecting an alternatives track versus a non-alternatives track sometimes polarised students and created social dissension among them. These dilemmas that students face have propelled them to be active in advocating for on-going improvements in the curriculum that would not require terminal surgeries. Students created and organised clubs, the Animal Welfare Club and Students Against Pet Overpopulation. A support group of some students troubled by these issues met during the early 1990s. The concern and lobbying of students have been a major force advocating for *mainstreaming* new methods of instruction that do not require a terminal use of animals.

Additional lobbying, while less direct, came from the external public discussion and the shifting expectations and growing options for instruction available elsewhere. Tufts University and Washington State University publicised courses featuring alternatives. Each summer, a few UC Davis veterinary students attended the Washington State University alternatives surgery course at their own expense to acquire additional preparation in surgical techniques. Further, society at large increasingly placed a growing value on animal life.

Technicians and Professors as Creators

Producing improved teaching resources requires focusing creative efforts toward that end. At UC Davis, from the early 1980s, software programmers, technical artists, and professors began directing their talents toward enhancing the teaching resources available for veterinary education. David Magliano and Janine Kasper won awards for their computer software for teaching osteology. These computer artists with others expanded their work into a thriving Computer-Assisted Learning Facility (CALF). Their software was so effective in informing and motivating students that other faculty members eagerly requested assistance in shifting their course material onto a software format, and the array of instructional computer software grew year by year. The talents of the entire team were recruited to produce *The Virtual Heart,* which has become the signature piece of this team. The work of CALF was complemented by the anatomy technician, Robert Parmelee. Finding formalin-fixed specimens aversive, he sought out training in plastination techniques and assembled a plastination laboratory from recycled equipment, including a discarded freezer, and began plastinating the canine organs required in the anatomy course. Plastinating more reusable specimens each year, the anatomy laboratory segued from dissection to the use of software and plastinated specimens and prosections. The group of artists involved in this effort has brought a high *esprit de corps* to the task that carried over to additional members who joined the group as years went by. The educational possibilities of plastination have been envisioned by the inventor of the method, Gunther von Hagens (15). He sees the non-consumptive process of plastination as accelerating the democratisation of biological knowledge.

Several professors also modified their laboratories or research to replace the consumptive use of animals. To teach about glomerular filtration of the kidney, Michael Bruss developed a mechanical model for the physiology laboratory. Sue Stover made productive research use of skeletal material from horses that had previously died at the racetrack. Jan Ilkew spearheaded creating animal models for vascular access. Computerised electronic animals that modelled various physiological conditions were implemented in teaching clinical skills at the Veterinary Medical Teaching Hospital to build diagnostic skills.

Department Chairs and Deans as Decision-makers

Maintaining the continuity of creating teaching resources and integrating them into the overall curriculum requires the leadership of supportive decision-makers. At the UC Davis School of Veterinary Medicine, the direction toward improved teaching resources had strong support from the Office of the Dean. The Chair of the Department of Anatomy, Dallas Hyde, provided strong conceptual leadership for CALF. Charles Plopper led the improvement of an undergraduate course, APC100, *Comparative Vertebrate Organology*, converting the laboratory in 1991 entirely to a non-consumptive format. Changes in the veterinary surgery course were spearheaded by Professor John Pascoe, who subsequently became Chair of the Department of Surgery and now serves as Executive Dean. This core group of well-funded scientists were the leaders who moved on to higher administrative levels, maintaining a strong commitment to the process of *mainstreaming* alternatives. These individuals represent a strong cohort of advocative leadership for enhancement of teaching resources and reduction of consumptive animal use. The emerging leaders were united in valuing a transition away from the

consumptive uses of animals. They were also supported by the broad base of faculty. For example, the Curriculum Committee over the years voted through the changes as the course content shifted away from consumptive use of animals.

The experience at UC Davis over the past decades illustrates that cultural change requires the teamwork of many constituencies working together toward a shared goal that is sustained over time. This has been the process for creating a growing pool of teaching resources, enhancing the veterinary curriculum, and also making the resources available to a broader community. The software and vascular models are available for purchase (16). The UC Davis School of Veterinary Medicine *mainstreamed* alternatives for all students as the improved teaching tools were created and became available.

Improving Undergraduate Courses

With the shift away from dissection and the consumptive uses of animals in laboratories, most undergraduate institutions in recent years have abandoned teaching vertebrate anatomy, due to the scarcity and cost of the required materials. One model undergraduate course at UC Davis is APC100, *Comparative Vertebrate Organology*, emphasising the functional anatomy of major organ systems in fish, birds and mammals. Transformed in 1991, the course was then developed after a Montessori concept, with laboratory sessions based on reusable specimens, slides, and models, and requiring no additional animals. Each laboratory emphasises one physiological system. Approximately 30 laboratory stations are prepared each week for students to rotate through during a half-day session.

Undergraduates at UC Davis are also eligible to enroll in CHA101, *Human Gross Anatomy*, taught by Douglas Gross, providing detailed study of the structure of the human body. Students examine prosected human cadavers in a small group format allowing extensive hands-on experience. A body donation programme at UC Davis makes this course possible.

The software produced by CALF for veterinary instruction is also useful for instruction at other levels. In one special project, *The Virtual Heart* was field-tested by 23 high school teachers in their biology classes (17). The primary reaction of teachers was that they wanted a broader software coverage of the other mammalian systems of similar quality that they could use in their teaching.

Conclusion

Administrative leadership, financial commitment and guidance can accelerate and sustain the creation of improved resources for teaching. The experience at UC Davis illustrates how this has resulted in the development and mainstreaming of alternatives into the curriculum. Additionally, producing software and models for veterinary and undergraduate education can create a ripple effect in pre-college education as teachers at all levels find it more feasible to acquire superior alternative teaching resources for biology. In order to facilitate the identification and acquisition of these resources, we have created the website, *Educational Resources for Teaching: Emphasising Alternatives:* www.vetmed.ucdavis.edu/Animal_Alternatives/dissection.htm.

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