Personalized Resources on Animal Biology in U.S. Veterinary Medical Education

Lynette A. Hart 1, William A. Storm 2, Laura Ducceschi 3, Mary W. Wood 1, Fern Tablin 1, V. Michael Lane 1, and Melissa J. Bain 1

1 University of California, Davis, California, USA; 2 Davis Unified School District, Davis, California, USA; 3 Animalearn, Jenkintown, Pennsylvania, USA

Summary
As a result of administrative support for developing technology, lobbying by students, and faculty innovations, U.S. veterinary schools have shifted toward mainstreaming alternatives that do not require animal euthanasia. These combined efforts have generated an impetus toward developing teaching alternatives and strategies that enhance student learning. New curricular approaches offer personalized learning tools and focus on facilitating opportunities for lifelong learning. The strong initiative to improve learning opportunities in veterinary education supports teaching approaches that do not involve consumptive uses of animals. Students experience immersion in clinical settings, handling and training companion animals, working with visualization and tactile resources, all of which facilitate deeper, integrated learning and problem solving. U.S. veterinary schools are shifting responsibility for learning to the students, providing an impetus toward learning from alternative resources. Teaching biology in secondary schools and to undergraduates also can evolve toward computer-assisted learning for better retention and use of the material learned.

Keywords: teaching resources, veterinary education, alternatives

1 Introduction

The veterinary profession oversees and provides essential leadership in all areas of animal care. Veterinarians comprise a small group at the apex of many professions that acquire some knowledge of animal biology. In fostering the proficiency of students, veterinary medical education necessarily provides some contact and hands-on experience with animals, but the exact nature of the curriculum and teaching methods for sufficient preparation of students is an evolving process.

Despite its large sphere of responsibility, the small veterinary profession has only 28 schools in the United States, contrasting with the 159 medical or osteopathy schools. The 2600 veterinary graduates per year now are predominantly women (e.g., more than 85% women at the University of California, Davis), contributing to the pool of fewer than 54,500 veterinarians (Bureau of Labor Statistics, 2010), again contrasting with more than 660,000 physicians and surgeons in the U.S. in 2008 (Bureau of Labor Statistics, 2008).

Within the broad veterinary profession, it is the laboratory animal veterinarians who provide care for the animals used in research, teaching, and testing. While only a fraction of veterinary students enter the specialty of laboratory animal medicine, we find that lab animal medicine attracts some of our brightest veterinary students, who seek to improve the lives and care of animals in laboratories. There is a critical shortage of laboratory animal veterinarians (Colby et al., 2007). A small number of veterinarians oversee animal care in the U.S.: 789 diplomates in the specialty of the American College of Laboratory Animal Medicine and a few hundred in the allied veterinary association of the American Society of Laboratory Animal Practitioners (AVMA, 2010). Slightly more than half of these veterinarians work in academic settings (Huneke et al., 2009).

2 Background

Curricular changes
As the knowledge base expanded in recent decades, veterinary curricula became overloaded with various electives in attempts to prepare students for increasingly sophisticated practice. Students’ schedules became intolerable, leaving no time for them to maintain balance in their lives. The unwieldy curricula at veterinary schools have brought a growing awareness of increased stress – including a high suicide rate within the veterinary profession. This trend is best documented and addressed within the U.K. (e.g., Veterinary Benevolent Fund, 2011), but indicators suggest the situation is not unusual in other countries. Improved integration of the basic science and clinical material is also needed. Modifying veterinary curricula has become a necessity to better prepare students to keep their lives in balance while in school and in the future, when they become veterinarians. For the above reasons, and to better equip veterinarians for an increasingly complex and rapidly changing discipline, many
U.S. veterinary schools have been shifting to a case-based or problem-based learning, with one of the major goals being to assure good lives for the students. The curricular overhaul at the University of California, Davis, School of Veterinary Medicine, in construction for more than five years, is now being initiated with the 2011-2012 first year class. The revised curriculum is designed to integrate the material and make it more relevant to the needs of a practicing veterinarian. The number of student hours per week has been reduced, largely by removing electives, but the curriculum for the first two years does not meet the original target of 20 scheduled hours per week. Emphases now are on self-directed learning, clinical experience, small group discussions, individual study, and problem-based learning.

Reducing consumptive uses of animals
In addition to the curricular changes stemming from content overload, U.S. veterinary medical education made a dramatic transition away from uses of animals requiring euthanasia. This change has come about primarily through developing multimedia approaches, increasing clinical experiences, and shifting to survival surgeries. The creative leadership of educators developing new resources and teaching methods spearheaded this movement, which was widespread, with contributions from virtually all veterinary schools and supported by lobbying students and administrators allocating budgetary assistance for creating new resources (Hart et al., 2005). Many formerly traditional uses of animals in veterinary teaching have been replaced with alternative methods or resources. The expansion of subject matter that must be learned, combined with economic pressures in delivering veterinary instruction, has accelerated these developments, further harnessing the opportunities offered by web-based instruction for students’ personalized curricular access. Increasingly, specific information is delivered to the student upon request whenever needed, often in bite-sized pieces. An analogy that comes to mind is the manner by which students acquire their own personal music collections.

3 Results

Cultural change and a new curriculum
The faculty set a course for overhauling the curriculum at UC Davis by developing guiding principles. The curriculum would foster self-directed learning rather than primarily didactic teaching. Topics would be addressed in context with basic and clinical material integrated and woven together longitudinally. Scientific and evidence-based methods would be emphasized to foster critical thinking and problem solving skills. An overarching goal would be to engender excitement for lifelong learning. Access to web-based resources would be provided to students for their lifetimes, allowing them to revisit their instructional materials.

The faculty voted on a basic approach for constructing a new curriculum, a process that required cultural changes for faculty and students. The number of student contact hours was to be reduced, with course material being reconstructed from the ground up, now delivered as integrated basic science-clinical blocks oriented on body systems. The abundant electives are being disbanded in the phase-over. Faculty members have taken workshops to learn techniques in problem-based learning and have sought other opportunities to learn about mentoring in the small groups now typical of much instruction.

The experience and learning opportunities students have with animals and clients are increased, beginning immediately in the first year. Didactic instruction is reduced. Students interact with faculty in small groups, often in several sessions over several weeks. Students have responsibility for directing their own learning; to facilitate this, their resources for learning and the access to them have been improved.

Students experience four major avenues for learning: 1) physical, hands-on contact with animals or models; 2) visual interactions with computer programs designed to clarify specific topics; 3) didactic lectures or individual review of published research literature; and 4) participation in clinical rotations for interactions with clients and patients. These experiences continue through the four years. All students are scheduled in a similar program for the first two years, with some selection of paths beginning in the third year. When students enter clinical practice, they will select their own refresher activities or continuing education, drawing from these same four avenues for learning.

The cultural shift has required major adjustments for our faculty, and it also has surprised the students. The general pattern of shifting responsibility to the students for their learning is now characteristic of many U.S. veterinary schools. A student who just entered the Western University School of Veterinary Medicine neatly encapsulated the reactions of many veterinary students encountering the emerging curricula: “I love the problem-based learning, but it’s also difficult not being able to rely on having information given to us. There aren’t any required textbooks, either. Instead, faculty and older students give recommendations, and we decide which texts we want to purchase, if any. There are a few lectures a week, but they include a lot of class discussion so we’re not just sitting there writing things down. We also start working on our clinical skills right away; some groups have already gone through a few hours at Banfield” (Alisha Tran, private communication, August 2011; Banfield is a collaborating system of veterinary practices that help mentor students).

Specific features of the new veterinary curriculum
Newly admitted veterinary students immediately begin practicing their communication skills and spending time shadowing cases in the veterinary teaching hospital for a full day every few weeks. They are provided a wallet-sized card entitled: “Wise Coach: Exam Room Communication.” The WISE acronym refers to: Welcome the client and patient; Investigate history; Summarize information; Explore for more details; and then: perform exam. Each subtopic has bulleted reminders of essential behaviors for clinicians, such as: greet by name; use eye contact; introduce self; explain the process; display warmth, respect, and interest.

Students also study anatomy and learn the various organ systems, one block at a time, each for a few weeks. The UC Davis software team has supported instruction for more than 20 years.
(Fig. 1a,b), and the team has provided a rich array of material that is complemented by reusable plastinated specimens, pro-
sections, and models, which also are used in undergraduate courses on campus.

While gaining exposure to clients and animals during their days in clinics, students acquire experience in handling dogs and cats. UCD each year adopts 15 shelter dogs to spend nine months with students who gain experience in handling and training dogs. Each dog lives with a veterinary student but comes to classes and training sessions as needed. Dogs are adopted by students at the end of the academic year.

To prepare students in the techniques of drawing blood, giving injections, and placing catheters, vascular access training models were developed, including a canine head model and a canine foreleg model (University of California, Davis, 2011). Produced for instruction of UC Davis veterinary students, these also are available for purchase. Other models, cadavers, and simulators provide experiences that help students prepare for the spay-neuter surgeries they conduct in their third year. Assisting with the patient’s recovery and care enriches the experience of surgery.

**Resources for the new curriculum**

With less time for didactic teaching and more responsibility placed on students for seeking out their own learning, faculty are enhancing the instructional resources to be more informative and user-friendly. This includes an enriched and extended collection of histology slides (Fig. 2a,b). Many slides now offer virtual tours, 1-3 minute oral descriptors annotating the individual histology slides. The simple, personalized instruction is delivered in short Flash movies, via Zoomify. The professor delivers an audio tour of the slide, navigating it and zooming in on key portions of the slide. A single slide can be annotated with one or more movies and then shown at higher magnifications with additional short movies. The familiar voice guides the student in looking at complex visual material, using a pointing arrow and zooming into areas of interest, thereby leading the viewer to understand what is seen. Superb resources such as these are available to students whenever needed. Rather than sitting as passive receptacles in a large classroom lecture, students are given a personal tour whenever desired, and they can return for a refresher.

Although this slide set is not publicly available, the technique can be translated to other learning settings. Other faculty members are adding this effective method to their materials. It places learners at the forefront in choosing what to learn, and they will have lifelong access to these resources.

**4 Discussion**

**Dilemmas in animal use**

Serious challenges and creative breakthroughs arose as the instructional blocks were designed for the first two years of the new curriculum; detailed planning for the remaining two
years is in progress. One dilemma illustrates the compromises in learning that can occur when shifting to a non-animal alternative, as well as the economic and animal welfare tradeoffs that arise. Traditionally, all veterinary students have been given experience in rectal palpation of cows to learn the anatomical location of the ovaries, uterus, and cervix, and also to gain some idea of how to diagnose pregnancy in cows. The Breed‘n Betsy (http://www.breednbetsy.com.au) is one simulator available, and internal latex structures simulating various stages of pregnancy are provided. But the professor in charge finds that the inconvenience of exchanging the sets of organs and the lack of normal variation in the single Betsy cow pose serious drawbacks to the instructional value of Betsy. After an initial introduction, little is gained from further exposure to Betsy, unless the student is learning techniques for artificial insemination. Live cows offer a wide range of anatomical variation, plus exposure to cow behavior. Scheduling cows for palpation raises questions of animal welfare: how many students should palpate a cow in a single day? Recognizing that diagnosis of pregnancy, the economic basis of the food animal industries, is an important veterinary skill, what level of graduate proficiency should the new curriculum target? These questions elude simple answers, since proficiency in reaching a consistent level of expertise in palpating to assess pregnancy status requires experience with hundreds of cows (Bossaert et al., 2009).

The new curriculum, with an emphasis on animal alternatives in the first two years, continues the tradition of U.S. veterinary education for providing extensive hands-on, surgical, and clinical experience and is more integrated. With the collective experience of the faculty and the consensual examination of detailed curricular plans, choices were made for the optimal learning and welfare of students and the animals. This process will be subject to an evolving review with refinements as needed.

References
Fig. 2a: Virtual microscope slides with audio tours: opening page
In this large slide collection, many of the virtual microscope slides are annotated with a guided audio tour, with an arrow pointing to the site of interest and enlargement of the site when useful.

Fig. 2b: Virtual microscope slides with audio tours: varying magnifications and multiple tours
Many tissues are examined at multiple magnifications, with one or more personalized tours frequently offered.


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Correspondence to
Lynette A. Hart
University of California, Davis, School of Veterinary Medicine
Department of Population Health and Reproduction
1024 C Haring Hall
Davis, CA
USA
E-mail: lahart@ucdavis.edu