By Larry Edward Penley

Bringing Technology into the Laboratory

Not long ago, a Colorado State University veterinarian student found himself—in the middle of the night, in the middle of a Wyoming snowstorm—trying to perform a cranial examination on a cow. The student sent an urgent e-mail to one of his professors, Dr. Ray Whalen, who offered clinical advice. But Professor Whalen also did something unusual: he asked the student to get a recording of the exam. The enterprising student complied, and that blizzard-bound test case is now one of many digitized examples used to prepare future veterinarians for the sort of real-world challenges they're likely to encounter after graduation.

How to effectively make technology an ally in the college/university curriculum remains a pedagogical challenge in most disciplines, and particularly in those that depend on hands-on field and laboratory learning experiences—disciplines such as medicine and veterinary medicine, with dissection and clinical analysis. A flat PowerPoint presentation is no more compelling than an old-fashioned textbook in helping students synthesize the various elements of their academic education into the ability to understand why an animal or a person is exhibiting certain physical symptoms; it will most certainly not help them learn how those symptoms should be treated. But today, colleges and universities are able to adopt and support digital learning technologies that complement and extend the demands of the learning process, whether in classroom teaching or lab instruction.

This isn't news to U.S. colleges and universities, but the lack of novelty does not diminish the challenge of transforming the learning process with digital tools. For the twenty-eight schools of veterinary medicine in the United States, the challenge is particularly pressing. Without question, veterinary medical education has been of critical importance to the country's health and well-being, principally because of its contributions to science, medicine, food safety, and public health. But veterinary medicine is playing an increasingly large role in biosecurity and zoonotic diseases—those diseases that are naturally communicable to humans from animals. U.S. Senator Wayne Allard, himself a veterinarian, recently wrote: "We must stand strong against those who do us harm; veterinarians have an important role to play in this defense. Those in veterinary education must optimize the training of students to meet this critical obligation."[1]

Today, higher education institutions with veterinary medicine programs graduate about 2,100 students a year and enroll more than 8,500. About 75 percent of these students are women, predominantly from urban backgrounds. A typical vet student spends about 4,000 hours in classroom, laboratory, and clinical study.[2] The era when most student veterinarians came to school having grown up on a farm and could expect to "master" all branches of this diverse profession is long gone; like medical education, veterinary medicine is increasingly specialized. And whereas society demands these students graduate with the highly specialized knowledge and competencies, it also expects veterinarians to address everything from feline leukemia to "mad cow disease."

Conscious of this contradiction, veterinary schools across the country have been exploring ways to revolutionize instruction. Several decades ago, that meant an increased reliance on multimedia—as opposed to single-source—learning. Dr. Billy Hooper, of Oklahoma State University, described the changing expectations: "During the 1970s, a great deal of instructional material was prepared as audio-visual presentations containing both pictures and sound tracks. While multimedia in the literal sense, it provided only a sequence of images or information in a pattern determined by the instructor. Today the word 'multimedia' means a very broad range of visual materials, audio materials, simulations, algorithms, evaluations, feedback on learning patterns and use of time. . . . But perhaps more importantly the word 'multimedia' means immediate access to a tremendous body of information that allows the student to control the instructional process through posing questions as information is needed."[3]

Today, "multimedia" implies the use of digital technology—which brings me back to Dr. Whalen. A professor of biomedical sciences and a Distinguished Teaching Scholar at Colorado State University, Whalen recalls his own student experience in neuroanatomy as "pure drudgery." Whalen's passion for veterinary neurology wasn't ignited until he worked his first clinical case and had the chance to see firsthand how all the aspects of a living system interacted in an animal that depended on his care. This realization helped transform him into an evangelist of sorts, determined to inspire first-year vet students with that same passion and enthusiasm right from the beginning—but with the support of newly enabled

digital technology. Working with an equally impassioned team of students, he set out to create software that would complement traditional anatomy instruction. The result of their efforts was the "virtual canine." This software "allows students to view images of canine anatomy . . . in three-dimensional detail. Using the program, they can rotate images on their computer screen and peel away layers of virtual skin, muscle, and fat to reveal hidden structures and bone."[4] Rather than the linear, step-by-step approach of even the finest textbooks, the software is relational, allowing users to ask questions as they occur and to gain answers that integrate knowledge from osteology to gross anatomy and more. Users can focus on any part of the virtual canine and, with the click of a mouse, access additional information about that part of the animal: case studies, typical pathologies, and even surgical approaches.

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The learning goals of this innovative instructional software are many, but they are addressed only when the technology is added to the real anatomy lab. Faculty can use the software to add context and depth as students engage in actual dissections. As a result, the laboratory becomes more than a place where students learn the structures of an animal's anatomy. Now, the lab is a forum in which students and faculty can make direct associations between what they see on the table and the signs and behaviors they might observe in a live animal. Faculty no longer find themselves providing short lectures as a part of the dissection process or assisting students with relatively mundane identification of anatomy; the digital adjunct to the lab resolves these issues. Instead, faculty members can extend the learning environment with questions about various scenarios that students may encounter later, in practice.

Unlike the real lab environment, the software is portable; it is accessible by students for subsequent study and analysis from the comfort of their homes or from seats in the library. Today, a student who might examine a cow in a Wyoming snowstorm needs only a handy laptop to cross-reference her observations with a wealth of clinical research and experience. The software also provides a tool that can assist veterinarians from the first year of their vet curriculum through their passage into clinical practice.

Such advanced digital teaching tools add depth and interaction to the learning process, enhance laboratory interaction between student and instructor, reduce—without replacing—the use of laboratory animals in instruction, and have the potential to make field and laboratory learning experiences available to students at all levels worldwide. But the development of such tools requires a strong institutional commitment. Whalen notes that his work has been made possible only through collaboration among instructional technologists, education specialists, and faculty and students in various disciplines and with required financial support from his department, the university, and the state of Colorado.

Making technology an ally in the higher education curriculum requires ongoing commitments from numerous people, organizations, and institutions. But the results, in terms of the learning process and students' preparation for challenging and changing professions, are well worth the investment.

Notes

1. Senator Wayne Allard, "An Agenda for Action for the Veterinary Profession and Veterinary Education," *Journal of Veterinary Medical Education*, vol. 30, no. 2 (summer 2003): 91.
2. American Veterinary Medical Association, Education and Research Division.
3. Billy E. Hooper, "Ongoing Curricular Change in Veterinary Medical Colleges," *Journal of Veterinary Medical Education*, vol. 21, no. 2 (fall 1994), <http://scholar.lib.vt.edu/ejournals/JVME/V21-2/hooper.html> (accessed January 20, 2004).
4. "Virtual Reality Goes to the Dogs in Anatomy Lab," *Insight*, Colorado State University College of Veterinary Medicine and Biomedical Sciences (fall 2003), <http://www.cvmbs.colostate.edu/Insight/2003/fall2003/anatomylab.htm> (accessed January 20, 2004).

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