The following is the abstract of the article discussed in the subsequent letter:

Fawver, Amy L., Charles E. Branch, Landa Trentham, B. T. Robertson, and S. D. Beckett. A comparison of interactive videodisc instruction with live animal laboratories. Am. J. Physiol. 259 (Adv. Physiol. Educ. 4): S11-S14, 1990.—This study compared interactive videodisc-simulated laboratories with two types of traditional labs: a traditional general cardiovascular physiology participation lab and a traditional fibrillation/positive pressure ventilation demonstration lab. The two laboratory sections (a total of 85 first-year veterinary medical students) were divided into 12 lab groups of 3-4 students per lab section. These groups were randomly assigned to either a traditional live animal laboratory or an interactive videodisc-simulated laboratory to compare the effectiveness and efficiency of these methods in teaching physiology. A 22-item, multiple-choice/short answer test was given to all students after the laboratories. In both the participation and the demonstration laboratories, there were no significant differences between group test scores of the interactive videodisc groups and the live animal laboratory groups, but there were differences in time spent by both students and instructors. It was concluded that the interactive videodisc-simulated lab was as effective as the traditional live-animal labs and was more time efficient than the traditional participation lab.

Performance on multiple-choice/short answer tests is not a sufficient criterion for evaluating the educational value of live animal laboratories in the teaching of physiology.

To the Editor: We would like to make you aware of our reaction to the above article by Fawver et al. As we understand it, the objective of this study was to determine whether first-year veterinary medical students would perform as well on a multiple-choice/short-answer test on the physiological concepts covered in live animal laboratory exercises if these exercises were presented instead by an interactive videodisc-simulated laboratory. We are satisfied that the analysis that the authors carried out was appropriate to answer the specific question that the authors posed. However, we feel that the question itself is not the most important question to ask relative to the educational value of the live animal laboratories. The authors imply in their paper that since students did as well on the examination when the simulation was substituted for the animal laboratory, the simulation is an adequate replacement. They also provide arguments that the simulation exercise is actually preferable because it is more efficient in terms of faculty time and because animal experiments do not always work as predicted. In our opinion, these points do not address the key educational objectives of animal laboratory exercises. We would like to express what we believe are important issues that also need to be considered relative to the value of animal laboratories.

Typically in medical and veterinary medical schools the physiology courses provide varied kinds of learning experiences. These include lectures, clinical correlation conferences, discussion groups, reading assignments, computer simulation exercises, and animal laboratory exercises. The different kinds of experiences are offered to help accommodate different learning strategies among students and to take advantage of the fact that different approaches tend to stress different aspects of the material, thus helping the student to obtain a broader perspective and deeper understanding of the material. Our job as educators is to provide these varied opportunities and to help the students to take advantage of them. One of the important tools that we use to help the students concentrate and learn from these opportunities is the examination. The positive and negative reinforcement that the test performance can provide helps to focus the students' attention. The examination procedure has relatively little intrinsic pedagogical value. Its major value is to help motivate the students to take advantage of the learning opportunities. To write an unambiguous multiple-choice/short-answer test one must select from relatively circumscribed aspects of the total learning experience. Test questions tend to come from the conceptual material common to the different kinds of learning experiences. They generally involve factual information that can be learned by reading a textbook, from lecture, from an interactive simulation, or from a live animal laboratory. Transmission of the particular set of factual information that is readily adapted to the multiple-choice/short-answer test may or may not be the key objective of the particular learning experience. Commonly the best one can hope for is that such factual information is closely enough related to the objectives that the anticipation of a test on that information will help focus the students' attention.

In the animal laboratory our objective is for the students to gain a kind of understanding of living organisms that is not readily evaluated by multiple-choice/short-answer tests. We believe that to accomplish this objective there is no substitute for live animal experiments. Computer simulations are a valuable teaching tool, but they are no more a substitute for live animal experiments than are textbooks and lectures. In the laboratory example given by the authors, there is no substitute for the experience of touching, seeing, and hearing the living cardiovascular system. There is no simulation substitute for observing and feeling a real heart in a living animal. The tactile sensation of the fibrillating heart or the excitement elicited by returning the fibrillating heart to sinus rhythm by the use of the defibrillator are learning experiences not duplicated by simulations. In well-planned experiments, it is very rare that "experiments conducted in student labs fail to work at all." Unexpected results occur more frequently, and they are an important part of the live animal laboratory. The live animal laboratory experience is commonly enriched by unexpected
or unusual observations. The experiences of turning a stopcock the wrong way or of seeing the blood spurt from a cut artery have a value that is not revealed by performance on multiple-choice/short-answer tests. Experiencing the level of concentration required to prevent such mishaps is equally important and intensifies the learning experience. Exposure to the conceptual material within the highly stimulating environment of the laboratory results in a level of understanding that is different from that taught by the other valuable but fundamentally different teaching methods. We feel that even if the students with the animal laboratory experience had performed less well on the multiple-choice/short-answer test, such a result would not have been an argument that the interactive videodisc-simulated laboratory could replace the overall educational experience of the animal laboratory. It would have simply emphasized the fact that animal laboratory and the simulation laboratory are different experiences.

One of the reasons that we feel that these issues need to be raised is that the use of animals in teaching and research is under intense scrutiny. Commonly, the objections to these uses of animals are based on misinformation. We feel that in light of the present controversy surrounding the use of animals in teaching, and without a broader perspective than that expressed by the authors, the significance of the study in question might be misinterpreted by nonphysiologists.

Christopher A. Dawson, Allen W. Cowley, Jr., G. B. Spurr, Jeffrey L. Osborn, Hershel Raff, Hubert V. Forster, David R. Harder, Jean Francois Liard, Julian H. Lombard, and William J. Stekiel
Department of Physiology, Medical College of Wisconsin, Milwaukee, Wisconsin 53226

REPLY

To the Editor: The letter from Dawson et al. raises several valid questions regarding live animal laboratories. One important point was the suggestion that the significance of our study “might be misinterpreted by nonphysiologists.” An attempt to use our results to defend the arbitrary elimination of such laboratories would not be justified by the data.

Our study was not intended to address the many issues of animal experimentation, issues that have been debated at length elsewhere. Many of those debates focus primarily on issues that are very difficult to evaluate. Others may provide anecdotal descriptions of computer programs or other methods but give little objective information on the performance of students. Our study was simply an attempt to provide at least some objective information regarding the understanding of physiological concepts achieved by the two groups of students in one specific laboratory experience.

Interactive video programs have the potential of addressing some, but not all, of the issues raised by Dawson et al. Approximately one-third of our videodisc covers the experimental preparation. Some would argue that experimental preparation has little to do with the objectives of the laboratory, but it does at least contribute to the realism of the experience. That is supported by a previous survey of students who rated the realism of the interactive video laboratory as 4.13 on a 5-point scale.

For instance, regarding one example cited in the letter, the videodisc does illustrate bleeding from an improperly ligated artery. Such information was included on the videodisc because we agree that it has value, even though we cannot back up that feeling with objective data. In another example, atrial and ventricular fibrillation and defibrillation are presented in a demonstration laboratory at our school because of cost, a lack of equipment, and safety considerations. In a demonstration laboratory it is difficult for all students to observe the fibrillation and defibrillation, much less study the relationships of the fibrillation to blood pressure, cardiac output, or the electrical activity of the heart. In contrast, the videodisc, while not providing all the sensory input associated with a live preparation, does permit all students to observe the heart in detail in real time or slow motion, repeat the experiment at will, and study the physiology. Students can even return to the lab on their own after perhaps doing some independent study. The point is that the use of realistic video permits us to illustrate actions that may or may not have great instructional value but do at least add interest, realism, and perhaps motivation to the learning experience. The benefits of such information are very difficult to measure objectively.

In conclusion, we have not advocated the elimination of animal experiments. We would hope that such decisions would be made by educators based on educational goals, including those goals addressed by the authors. Instead, we have observed that the decisions often are made based on criteria other than educational goals. This has resulted in many schools deleting animal experiments with little or no attempt to either provide alternatives or even measure the effects of their decisions on education.

In an ideal world individual students would have access to a variety of teaching methodologies, including laboratories, textbooks, computer simulations, multimedia programs, and classroom lectures. However, given the debates with animal issues and economics facing our educational system today, realistic interactive video simulations may offer the most acceptable option if live animal laboratories cannot be used.

Charles E. Branch
Department of Physiology and Pharmacology, Auburn University, Auburn, Alabama 36849