"Yet in a paper delivered at the recent American Educational Research Association meeting, Robert Haven, Director of EPIE's TESS database of educational software, draws just the opposite conclusions:

1. Far from all of the programs needed having been produced, less that half of what would be desirable is available.
2. Rather than taking advantage of the unique, powerful capabilities of microcomputers to implement new, more effective pedagogy, most commercial software efforts are mired in the timeworn approaches rooted in the limitations of the old media.
3. Rather than reaching levels of excellence, overall software quality improved through 1982 but then leveled off on a plateau best described as barely adequate (while a modest number of excellent products is available, they are the exception).

"In summary, the educational software field, although having great potential for improving education,. . . has a lot of growing to do.

"Haven's conclusions are drawn from analysis of the TESS database of 6,126 commerical programs intended primarily for education and from a subset of 2,757 programs issued with copyright dates.

"Haven reports a preponderance of high structure/low learner control software (such as tutorials) and anticipates an even higher proportion in the future. He projects that the proportion of programs with drill and practice, game, data retrieval and computational tool components will hold steady at their current levels. Tutorial programs will increase, and simulation programs will decrease. For educators who had hoped educational computing would take advantage of learning methodologies that offer an alternative to those traditional in print-based media, the increase in tutorial programs and the decrease in simulations is bad news."

Editor's Comments

Haven's reports makes it more and more evident that the expense of producing high quality software will continue to discourage its development unless we solve some of the problems cited in the earlier article (Spain 1985) and in the discussion above.

Labs

Who Needs Labs in Biology?

Don Igelsrud
Department Editor

Let's face it, labs are a lot of trouble for everyone. You put in hours of extra effort preparing for them and half of the time they don't work. The students don't read the directions, the materials aren't reliable or don't arrive on time, and the costs are getting out of sight. If you need help, nobody seems to know the answers, they're never in the textbooks or manuals, and no one cares if you put in the extra time. We would eliminate a lot of headaches if we eliminated labs.

Welcome to a new *ABT* department! Over the years, and especially in the early ones, ABT has published many fine articles that have helped biology teachers in the laboratory. However, because many biology teachers lack laboratory experience due to the reduction in lab courses at colleges and universities, much of what we've learned about lab teaching has been forgotten. The current interest in computer assisted learning and in teaching the methods of science has put lab teaching on the back burner. The problems indicated in the beginning of this column have caused many people to turn the burner off completely. To quote Bill Leonard (ABT 43: 445): "Laboratory instruction is on trial!"

Many of us strongly believe that biology and the lab are an undivorceable marriage—if you don't have a lab you can't teach biology. In order to understand what it means to be alive, you must become intimately involved with living things. The purpose of this new department will be to help biology teachers understand and solve the problems they confront in the broadest sense of the word "labs."

Saving Time

Bruce Oakley and Rollie Schafer, in their model laboratory manual *Experimental Neurobiology* (The University of Michigan Press 1978), state, "Laboratories are a notorious time sink." More communication among biology teachers about the problems of laboratory teaching can greatly improve this situation. I spent many of my early years in teaching trying to get the basic experiments in biology to work. I assumed the problem was with me or the students and not with the experiments. As I began to talk with colleagues at other universities and colleges and with scientists working in the field, I discovered that the problem was with the experiments.

In the late 1970s I initiated the formation of The Association for Biology Laboratory Education (ABLE) in order to develop communication among laboratory biology teachers at undergraduate institutions. This organization, primarily through its annual workshop/conference and proceedings has done much to improve laboratory instruction at the post secondary level. However, even at the university level, time restrictions have forced ABLE members to restrict their communication to the annual meeting. Needless to say, time imposes even more restrictions on teachers at the precollege level.

Therefore, I would like to use this column to develop discussion and cooperation among biology teachers about lab problems. By addressing your major problems we may be able to give you more time to help others solve theirs. I can begin this column by addressing the questions I believe to be the major ones facing biology lab teachers; however, since everyone has a different perception of what those problems are, it would be better if you submitted questions and I tried to find the best answers to them. Undoubtedly, many of you have found excellent solutions to many of these problems and we could alert others to them via this column. Most of you probably have many little tricks to the trade you've learned that don't merit an article in ABT, but if you send me a note, I can group them together under various topics as they are discussed and communicate them to your colleagues. In short, here is an easy way for you to help solve many of the practical problems of lab teaching. Remember, a quick, simple note (perhaps with a copy of a handout you use) is all you need to send me, I'm not looking for more than a few minutes of your time–it could save others hours!

The Growth of Scientific Knowledge

We live in an age where biologists argue whether a single author can write a meaningful introductory, or for that matter, advanced biology textbook. My University of Calgary colleague, Leon Browder, author of a developmental biology textbook, likes to remind people that if we expect a single student to read and comprehend it and, usually, a single instructor to teach the course, then a single author should be able to write it. Biology is a rapidly growing field and it is extremely difficult for teachers to keep up with the literature. The principles of biology, however, do not change so rapidly. Our idea about what those principles are is always in flux, but one only has to look at a book like *An Introduction to General Biology* by William T. Sedgwick of MIT and Edmund B. Wilson of Columbia, published in 1899, to realize that the majority of what we teach is still the same.

This tremendous growth in knowledge based on the exponential growth rate of publications has important consequences for biology teaching. Much has been made of the importance of teaching the processes of science because of this growth in information. Yet, any biologist who has supervised graduate teaching assistants after teaching a year-long course in biology from a text like Keeton knows the basic principles of biology are not well understood by many biologists. The practice of biology requires early specialization. For the biologist interested in laboratory teaching, this growth in knowledge has produced a wide variety of well understood biological systems that can be used to teach basic principles.

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A Multitude of Resources

I could answer many questions that beginning biology teachers face in the laboratory, however, I would like to act more as a facilitator of communication than as an authority. I could tell you how to use my favorite organism, *Vicia faba*, for studying mitosis, but it would be better if I could tell you about it and a variety of equally useful organisms others have discovered. For example, the autumn 1985 issue of the British biology teacher's *Journal of Biological Education* has an interesting article by M. E. Newton which suggests that "the nine chromosomes of the thalloid liverwort genus, *Pellia*, are ideal for teaching purposes. They are large, comparing favourably with commonly used angiosperms, and are conveniently prepared for examination of karyotype detail and all stages of mitosis." Albert D. Robinson recently published an article in *The Journal of Heredity* (73:379–380. 1982) on "Teaching meiosis with chives." If this column could alert biology teachers to inexpensive, readily available and dependable materials they could use in their classes, it would encourage lab teaching. My own experience convinces me that there is so much biological material that is readily available for teaching that none of the excuses commonly given for eliminating labs has much validity.

Necessity is the Mother of Invention

I heard a story once, that someone had planned on doing the standard glycerinated psoas muscle experiment using ATP and salts but needed more muscle. They went to the grocery store and bought some meat, and it worked! I had always wondered why there are so many recipes for foods until someone pointed out that most of these recipes were developed because people ran out of ingredients and had to substitute something new. Biology teachers have similar problems. A few have had the courage and time to experiment. We need to share these kinds of experience. I hope we can begin to do this via this column.

Everyone Needs Labs in Biology?

Many of the most excruciating questions we face today revolve around concepts related to what it means to be alive. Most biology textbooks begin with some attempt to define life and many conclude that it is, in fact, one of the main goals of the whole course. The qualities of life are not reducible to a definition or a list of attributes. The qualities of life encompass all of its diversity. Consequently, the best way to understand what it means to be alive is to become intimately involved with living systems and their diversity. Meaningful decisions about the quality of life require this kind of experience. Much of the current confusion about issues like abortion, euthanasia and animal rights comes from lack of experience with a variety of living systems. Many of these issues are decided on a philosophical basis, as they ultimately must be, without enough biological understanding to consider at what biological level of organization the decision is most meaningful. For example, the concept that human life begins at conception is based more on one's philosophical perspective than on biological fact. Life is a continuum and any decision about when it begins is arbitrary.

The important point is many of our most difficult decisions involve biological understanding which can only be gained from intimate experience with living things. Regardless of one's ethical, philosophical, or religious perspective, people need biological experience with living things in order to make meaningful decisions about these issues.

Everyone needs biological experience, including individuals with biological impairments. Handicapped students can do almost everything other students can do, with the help of a few inexpensive and ingenious devices, and many are our very best and most rewarding students. Dorothy Tombaugh has written extensively about this subject and one of her most thorough presentations is "Biology for the Visually and Orthopedically Impaired," which was published in *Tested Studies for Laboratory Teaching. Proceedings of the Third Workshop/Conference of the Association for Biology Laboratory Education (ABLE).* Dubuque, IA: Kendall/Hunt Publishing Company; 1984:1–17.

Biology is the study of life and one of the main functions of the laboratory ought to be to help people understand what it means to be alive. I hope this column will make that an easier task!

So much for intent. Next time I'll talk about frogs.