

chromosomes serve as centromeres and spindle fibers. The copper spindle fibers are passed through holes in the petri dishes and are pulled to simulate chromosome movement. Nested petri dishes are sometimes used to represent cytoplasm that divides.

This work is supplemented by manipulation of realistic models of cells. Some purchased and others are made from modeling clay.

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Animals in the Classroom: Another View

When I began teaching secondary science in the early 1950s, biology was usually taught as a vocabulary course—read about, talk about, observe a few dead specimens, and dissect a few smelly animals. After Sputnik came NSF Training Institutes, BSCS, and a refreshing rejuvenation in the high school biology curriculum. The BSCS curriculum attempted to help students understand what science really is and what the real world of energy and life is like. Dissection of preserved animals and plants and use of prepared slides were replaced by investigations using living organisms whenever possible. I think anyone who has taught secondary biology both ways would readily agree that (1) it is considerably more demanding and time-consuming to teach with living organisms; and (2) it is much more satisfying for both teachers and students. The increase in interest, excitement, and learning among students studying a pithed, physiologically live frog as compared with a preserved frog is undeniable and overwhelming. The present trend away from the use of living specimens in high school biology apparently because of pressure from such groups as the Humane Society and the Animal Welfare Institute is tragic. Some of the statements made in Wayne Moyer's "Animals in Biology Education" [ABT 41(9):519] are

not exactly reassuring either. Harried high school biology teachers already have difficulty convincing students of the necessity to experience living things first-hand. The statement that "procedures involving pithing frogs, nutritional experiments, cancer induction... have no place in beginning biology education" is, to say the least, unhelpful if not downright discouraging.

I have tried to hypothesize why the controversy about the use of live animals in high school biology exists. I believe it is primarily because more people are further removed from the reality of nature than ever before (this includes biology teachers). Because they are so far removed from the predator-prey experience, they cannot imagine any animal dying. They have not had the experience of seeing a chicken, a pig, a rabbit, or a steer be slaughtered for food. Animals must be sacrificed continually to provide us with food; why is it considered so cruel, then, to sacrifice some animals for essential education experiences that illustrate dynamic life processes?

One objection Moyer raises to sacrificing a frog in high school biology is that "all life is based on an identical genetic code. We are one life on this planet. We look at a frog, and it is us..." But wait a minute! If one objects to animal use on this basis, obviously s/he must also object to plant use because plants also have a genetic code, of course. What then happens to the "living biology course?"

I completely agree that we must not tolerate cruelty to animals (or plants). However, in all my years of contact with high school biology teachers, I have seen no sadists among them. I know none now. The criticism from outside groups is unjustified. An effective, meaningful high school biology course must allow students as many real life experiments with plants and animals as possible. Such a course will include pithing, animal dissection, and nutrition experiments—all performed under the professional guidance of

the teacher. If paper-and-pencil, read-about, talk-about biology course promoters are not subjugated, high school biology will be set back forty years. Today's high school teachers need all the affirmation they can get. Let's give it to them.

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Moyer Responds

Some years ago, I was responsible for teaching a laboratory for freshman college students, most of whom were planning to become doctors or nurses. The lab on frog physiology included observations on swimming, jumping, eye movements, and breathing, followed by pithing and study of peristalsis, spinal reflexes, heart action, and chromatophores of the skin. After three semesters, I eliminated most of the lab because my students were so upset by the procedure of pithing that they lost sight of the biology I was trying to teach. Hence my sympathy with biology teachers who feel that pithing of frogs by students has no place in *beginning* biology education.

Arthur Meyer may well be correct to blame the present controversy about use of animals on our cultural isolation from the predator-prey reality of nature, an isolation which increased as Americans left farms for cities, and spent their youth reading endless stories about anthropomorphic animals. However, I believe that the ecology ethic, with its emphasis on the interrelatedness of nature, is playing an equally important role. Humans are now viewed as part of nature, in contrast to past generations that viewed them as separate from and opposed to nature. I urge that we examine our teaching practices in beginning biology courses in light of this new understanding.

I am not opposed to sacrificing animals for teaching, gustatory, or other purposes, provided it is done with compassion. I believe that teachers have a particular responsibility to treat life with reverence.