gether, instead of giving away what we consider to be excess baggage.

The "lifeline ethic" would lead to a more equitable world government; and until we have such an array of juxtaposed lifeboats, all floating together and providing far greater buoyancy, each lifeboat will exploit every other lifeboat. In the face of increasingly depleted resources, any species of higher animal begins to war. It will become crucial for all lifeboats to merge before the threshold for aggression is surpassed. We must construct international inhibitions to warring, as we have constructed social inhibitions to overt aggression. Otherwise no lifeboat will remain afloat. It is foolish to think otherwise.

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DUBIOUS METHODOLOGICAL VALIDITY

Once before I wrote to indicate my concern about the publication in *ABT* of research studies that have dubious methodological validity. The September issue in another case in point with the article by L. A. Seymour et al. on "A Successful Inquiry Methodology" (ABT 36[6]:349). The small differences between IRA and non-IRA students could easily be accounted for by the fact that the two samples were not random samples. There is a good probability that the teachers who were selected or volunteered to use IRA materials were either better teachers or were in more favorable school settings. This kind of potential systematic bias completely vitiates the conclusions drawn in the study.

My concern is to increase the number of educational decisions we make on the basis of valid research results. If we continue to publish in *ABT* studies that are of dubious validity, we discourage the use of such studies as a basis for decision making in the long pull. Increasingly, teachers learn that from decade to decade there are new fads, all backed by some kind of "research" findings, and they begin to lose faith in this approach to decision making. Granted that good research studies are very hard to find (I found only about 20 in some 600 I reviewed for the ERIC summary of research published recently), but we must keep on trying.

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L. A. Seymour comments:

The "small differences between IRA and non-IRA students" were actually quite large in the case of cognitive inquiry and associated attitudes. The IRA students exceeded the non-IRA students by wide margins, despite the fact that non-IRA students had superior abilities as measured by the Differential Aptitude Test. Covariance was not used and thus the differences in favor of the IRA students were, in fact, larger.

The teachers designated IRA and non-IRA were in the same high schools. They were recommended by their supervisors as having similiar abilities and experience. Because funds were limited, however, extensive data were not collected on the teachers to determine which group may have been "better." Also, funds were inadequate to randomly assign a large number of teachers in a national sample. This procedure would obviously be preferred.

Let me remind you of the *four* questions raised and answered in the article: (i) Can students develop inquiry skills? (The answer was definitely yes.) (ii) How does development in the inquiry-oriented class compare with development in other biology classes? (See the preceding discussion.) (iii) Do students prefer classroom settings in which inquiry is emphasized and developed. (The answer was definitely yes.) (iv) Can teachers learn and execute the new methodology adequately to attain the intended outcomes? (Again, the answer was definitely yes.) You comment directly on only one of these four questions. I would welcome your comments on all four.

"FROG CONSERVATION"

The Committee on Social Responsibility of the Society for Developmental Biology conducted a workshop last summer to discuss the decrease in supply of living leopard frogs (*Rana pipiens*) and the poor general vigor of animals which are captured in the wild. Biologists and commercial suppliers have offered many suggestions about probable causes of this "frog problem." It seems likely that decreased habitat (especially drainage of breeding ponds), increased pollution by agricultural runoff, recent unusual spring weather in some production areas, as well as various undetermined factors, have lowered the frogs' resistance to common bacterial and viral pathogens. Not only has the adult population been affected; there are reports of unusually high incidences of developmental arrests in egg masses in the field.

Normally, heavy harvesting does not seem to affect frog population sizes significantly, but the present situation may be a special one. The very frogs which could be the hardy core of a regenerating population seem to be the ones most easily harvested now because they are able to carry on normal activities in traditional collecting areas. With this in mind, we appeal to biologists to consider reducing their current use of living frogs.

Although the large populations that have supported heavy harvesting have been badly depleted, no expert we consulted believes that *Rana pipiens* is in immediate danger of extinction. In addition, it is highly unlikely that conservation by biologists will be a major factor in bringing about a quick return to former population levels. Nevertheless, responsible biologists should contribute to efforts to conserve this organism, which has served so many of us so well in teaching and in research. Because there are an estimated five frogs used in teaching for every one used in research, a heavier responsibility falls on those of us who use *Rana pipiens* in teaching laboratories.

There are some uses of living *Rana pipiens* for which educationally effective substitutes are not available. However, there are several common laboratory exercises for which frogs may be easily replaced by other living material. First, a significant percentage of frogs used in teaching are pithed and dissected to provide a quick overview of vertebrate structure. A number of animals could be substituted for frogs in these exercises. Young cockerel chicks, obtained from local hatcheries at very modest prices, have been used by some departments. Second, a high-consumption use of frogs is in the preparation of "spinal frogs" for demonstrating reflex responses. Why not substitute a set of exercises on human reflexes and sensory physiology for the frog work? Surely many students will consider human reflexes much more "relevant" than those of a frog. Third, the African clawed frog, *Xenopus laevis,* can be substituted in many of the developmental studies for which the leopard frog is used. This convenient organism, with its very rapid developmental rate, will no doubt gain in popularity because of the "frog problem." Finally, there is considerable mortality during the prolonged holding and shipping of live animals that can be circumvented in the use of preserved specimens. The substitution of preserved frogs for living ones, wherever possible, would cause less drain on their populations.

The needs of each biologist are unique to local situations. Yet most of us can think of ways to decrease the unnecessary killing of frogs without abandoning their use in work for which they are essential.

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AN ADVANCED PLACEMENT BIOLOGY TEACHER RESPONDS

It was most enlightening to see an example of the objective questions of "The Advanced Placement Exam in Biology" published in May (*ABT* 36 [5] :282), by William Kastrinos and Frank C. Erk. My purpose is not to criticize the test but to comment on the AP biology program as a whole. After eight years of teaching (two years of AP biology), I am becoming more convinced that while students may answer objective and essay questions with facility, a deeper probe of their answers will reveal naiveness and glaring deficiencies.

I believe the fault lies with an AP program which insists on covering every concept in biology. I applaud the College Board for recently asking department chairmen of the 100 colleges and universities regularly receiving the most AP candidates in biology to describe their introductory programs; but I cannot believe that any college has an introductory course that covers the composite courses of all 100 schools. While the AP course description booklet claims that a teacher may emphasize one area or another, the truth is, because essay and objective questions cover all areas, an AP teacher is forced to superficially race through every concept.

I would like to see the members of the College Board limit their suggested list of topics. I agree that all areas mentioned are important; however, some can be cut back. For example, isn't it asking a lot of students whose knowledge of chemistry is limited to be conver-

Essay questions from the 1971 Advanced Placement exam in biology. (Copyright © 1971 by Educational Testing Service, Princeton, N.J. All rights reserved. Reproduced by permission.)

BIOLOGY
SECTION II
Time—1 hour and 30 minutes

Answer Question 1 below.

1. The process of photosynthesis consists of two phases, the light reactions and the dark reactions. Discuss each of these groups of reactions and their interrelationships.

Answer *either* Question 2 *or* 3 below. Number your answer as the question is numbered in the examination book.

2. Describe the anatomy and physiology of the autonomic nervous system of vertebrates. How does this system help a vertebrate to survive?

OR

3. The transmission of an impulse from a nerve to the surface of a resting muscle initiates a contraction in that muscle. Biochemical and biophysical studies of muscle tissue have resulted in an explanation for muscle contraction known as the sliding filament hypothesis.

a. Describe the chemical changes that occur when a nerve impulse is transmitted to the surface of a resting muscle cell.
b. Describe the internal structure of a muscle fiber as revealed by electron microscopy.
c. On the basis of this structure, explain the sliding-filament hypothesis.

Answer *either* Question 4 *or* 5 below. Number your answer as the question is numbered in the examination book.

4. Although man spends billions of dollars annually to protect both himself and his food against bacterial activity, it is also true that life as we know it could not continue to exist on the face of our planet without the help of bacteria.

a. Discuss two ways in which the activities of bacteria and fungi are essential to the continuation of life on Earth.
b. Discuss the ways in which knowledge of these organisms has been useful to man in medicine and food processing and preservation.

OR

5. A mature forest community is completely destroyed by fire. Describe the stages of succession by which this community is restored.

END OF EXAMINATION

After completing the examination, turn to the back of your essay booklet and circle the questions you answered.

* As should have been noted with publication, the test questions published in "The Advanced Placement Exam in Biology" are the copyright of Educational Testing Service, Princeton, N.J.