palliation through insight. The only really effective method, however, is prevention, and this is the sad thing: that we cannot lead our children through the undergrowth of life experience into their places in an orderly, free, and responsible society without somehow passing on to them our own prejudices, fears, and bigotry. These hobbling traits are not acquired in graduate school; they are taught to us as children. Therefore, we must somehow contrive to change our ways at all levels of education, remembering that that process—like charity—begins at home.

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Junior Scientists' Problem

I would like to call attention to a disconcerting trend in the sales policy of some of the major scientific and biological supply companies serving schools and colleges. Such companies more and more will serve institutions only, not individuals. In New York, for example, the major source of biological and chemical supplies of good quality, but in smaller quantities than are offered by the "professional" suppliers, will no longer meet the needs of the enthusiastic student or amateur. I suppose that it is much more profitable to confine one's business to large orders, but it is a pity that the needs of the young have to be sacrificed. Those young people with their "nuisance" orders of a dozen test tubes or two flasks are often enough the scientists of tomorrow. At least they will become those interested and informed laymen the community of scientists so urgently requires.

Happily, there are exceptions to this trend among suppliers, but I am beginning to wonder how long they will hold out.

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Rhythm Method and Mate Selection

In trying to meet my criticism (Letters, 6 Mar., p. 995) of the rhythm method of birth control as a method that selects for its own failure, R. C. Baumiller (24 Apr., p. 365) proposes a model that makes the criticism not less but more telling. He suggests that perhaps some day "intelligent, responsible and self-sacrificing" males will select as mates "only those women who have regular cycles." Even if we grant this somewhat implausible method of choosing a wife, we cannot agree with the author's conclusion that "thus selection may soon turn in favor of regular ovulatory cycles."

Baumiller is proposing a system in which mating is selective rather than at random. It is a basic principle of population genetic theory that selective mating alters the frequency of genotypes without altering gene frequencies. When gene frequencies are altered, it is because of differential fertility among the genotypes. What differentials would we expect to find among the genotypes in the Baumiller model?

Since he says that in the unions postulated "the natural method of conception control [would] become even more effective," we can only suppose that the productivity of couples composed of altruistic males and regular females would be below that of other couples in the population, whom (by inference) we are surely justified in identifying as composed of nonaltruistic males and irregular females. Thus natural selection would lead precisely to the conclusion suggested in my letter: the progressive elimination of regular women. The introduction of mate selection would merely insure a parallel rapid elimination of "intelligent, responsible and self-sacrificing males." Perhaps Baumiller would call this process "natural"—a word which, I note, he uses without quotation marks; but surely he would agree that it would produce a result not devoutly to be wish'd.

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Since only a finite amount of time is available for editorial chores, the amount of care budgeted to the editing of letters, articles, or reports submitted to *Science* should, in some measure, parallel the potential social impact of the content. More explicitly, scientific matters which pertain directly to the issues of peace and nuclear war; the "population explosion," birth control, and the future evolution of man; and automation, in so far as it may effect serious economic and cultural upheavals, should receive priority in editorial scrutiny. . . .

It was therefore with amazement and dismay that I read the letter of R. C. Baumiller pretending, in a jesting manner, to weaken the serious, lucid, and valid argument of Garrett Hardin's letter on the "Ultimate failure of rhythm" as a birth-control method for world population control. . . .

That the editors of *Science* . . . overlooked the semantic bobble of the interchange of two very different meanings of the term "selection"—the selection of a mate by an individual, as opposed to natural selection, which ultimately "selects" the members of future generations by virtue of their greater-than-average reproductive efficiency—is inexcusable.

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Credit Due

The College of the University of Chicago deserves, I believe, much more credit than it ever gets in such histories of curriculum reform as John Walsh's article (8 May, p. 642). Certainly this is the case in regard to mathematics. I remember my own surprise, as a young assistant professor at Purdue around 1945, when I became aware that Chicago was teaching to freshmen and, even worse, to high school juniors concepts and approaches in mathematics that I myself had had only as a graduate student. At the time, I was engaged in proposing such revolutionary ideas as that engineering freshmen could start their first course with quadratic equations. The result of Chicago's pioneering work was to make very many younger mathematicians intensely dissatisfied with what they were teaching.

I could list many names of workers in mathematical curriculum reform who were influenced by Chicago's work. I know that the college also had novel programs in the other sciences. Did they have a similar impact?

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"Open" Reviews

I would like to present herewith some arguments in favor of open reviews of research proposals and of scientific and technical papers submitted for publica-

tion. Some members of the research community think that action taken with respect to these is sometimes arbitrary, partisan, ill-considered, and lacking in authority. All these objections, whether well founded or not, could be eliminated for the most part if reviews were open—that is, if the reviewer's name were publicly attached to his review. In the first place, the reviewer would then be more careful in making a review, so that if need be he could publicly defend it. Second, the too frequent utilization of a particular reviewer in a field would become obvious and thus the establishment of "high priests" would be reduced. Third, reviewers would find it less practical to "borrow" ideas for their own use from research proposals and submitted papers. Fourth, a more responsible attitude on the part of reviewers would eliminate a lot of "hash" research and papers. . . . It seems to me that open reviews would enhance the integrity of our research programs.

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Wild-Animal Conservation

There is pending before the current Congress a resolution, Senate Concurrent Resolution No. 60, which may be of interest to readers of *Science*. The resolution states that "the Secretary of the Interior, in consultation with the Secretary of State, should take all necessary steps to convene an international conference within one year after the adoption of this concurrent resolution for the purpose of initiating cooperative action to further conservation of wild animals on a worldwide basis."

This resolution is being sponsored by Senator Yarborough and has been referred to the Committee on Commerce.

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Explaining Insect Behavior

In his article "Microscopic brains" (13 Mar., p. 1138), V. G. Dethier appears to me to commit a clear violation of Lloyd Morgan's basic canon on the interpretation of animal behavior. His argument, although ostensibly founded on objective experimental evidence, transcends the data and builds up to a plea for anthropomorphism at its most primitive level. This is the level of thinking that places an imaginary human mind inside the bodies of other animal species, regardless of their phyletic separation from man. Dethier's final paragraph leaves the reader with a disturbing feeling that somewhere, peering through the shape-shattering compound eyes, there is a tiny homunculus trapped within each housefly.

In effect, Dethier offers us a choice of two interpretations: either we accept an anthropomorphic view of insect behavior, or we consider the insect as a miniature computer with attached servos. I submit that neither view is acceptable. Just as we study man, his structure and behavior, according to his species-specific characteristics and adaptations, we must investigate the insect, or any other organism, on its own terms and in the light of its evolutionary history.

Words such as "motivation," "drive," and "emotion" have defied precise definition by psychologists for many years. If we agree on definitions broad enough to include some of the behavioral manifestations of insects, we can then use a single word for two behaviors. What is gained? The two behaviors are not necessarily qualitatively the same, and it becomes easy to fall into the semantic trap of confusing the label with the entity.

Dethier writes:

> Motivation is a specific state of endogenous activity in the brain which, under the modifying influence of internal conditions and sensory input, leads to behavior resulting in sensory feedback or change in internal milieu, which then causes a change (reduction, inhibition, or another) in the initial endogenous activity.

Simplified, his statement reads that motivation is an endogenous nervous activity which leads to a behavior that changes the motivation. Aside from the highly suspect assumption that motivation is indeed an endogenous activity in the brain, this definition is not restrictive, as Dethier seems to think. On the contrary, it is circular, and its diameter is so broad as to encompass any behavior of any organism.

Dethier acknowledges the intrinsic differences between insects and vertebrates. His reference to Vowles supports the idea of a qualitative difference in behavior between insect and vertebrates. But then he ignores these arguments and, in some cases, his own data, and hypothesizes that such dichotomous ideas are founded on "a fear of anthropomorphism." He says that insects may be capable of motivated behavior as he defines it, and, therefore, "one need not propose a dichotomy of function." In regard to learning, the mechanisms involved in the two groups are quite different, but if we follow Dethier's reasoning, we would say that these phenomena fall within a definition of learning as a modification of behavior through experience. Therefore, "one need not propose a dichotomy of function." In fact, however, there are many different kinds of learning with different physiological and psychological bases, such as simple habituation, classical conditioning, trial-and-error, and insight learning.

I suggest that Dethier refer to the many comparative studies on learning that have been done, particularly those of T. C. Schneirla. The evidence points clearly to a "dichotomy of function."

Insects and man represent the products of two very different lines of evolution. Their common ancestors, if any, have been extinct for at least a half billion years. Consider the biological divergence of the two groups. An insect has an exoskeleton, an open circulatory system, a ganglionated nervous system, compound eyes, an endocrine system as far from homologous to the vertebrate type as can be conceived—in all, is as different from the vertebrate structure as it is possible for a terrestrial, protoplasmic life form to be. From the evidence, some of it cited by Dethier, there is every reason to believe that the two groups diverge widely in physiological and behavioral mechanisms as well. Yet Dethier proposes that we use terms and concepts rooted in human psychology to describe and, indeed, explain insect behavior.

I should hope that it is about time for animal behavior as a science to outgrow such primitive attitudes and semantic confusions. A backward step in this growth is illustrated by the statement in the recent *AAAS Bulletin* (vol. 9, no. 1, p. 2) that "Dethier said he thinks that . . . insects can learn and probably have emotions as well." The newspapers will have a field day with this one.

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