six times as much polonium as the urine of nonsmokers. In the report of the Advisory Committee to the Surgeon General on "Smoking and Health" (unfortunately available to me only as reports from Swedish newspapers) it was mentioned as an as yet unexplained observation that heavy cigarette smoking is correlated with an increase not only in lung cancer but also in the bladder-cancer death rate. I want here to draw attention to the possible connections between increased polonium content in the urine and increased death rate from bladder cancer in heavy smokers. Since the tar carcinogens of cigarette smoke seem not to find their way to the urine, the role played by polonium may be a major one for smokers' bladder cancer and perhaps also greater than supposed for lung cancer.

HANNES EISLER
University of Stockholm, Sweden

Safeguarding the Biologic Record

L. F. Yntema's proposal (Letters, 3 Apr., p. 12) that field biologists and biology departments should assume a greater responsibility for the recognition and acquisition of natural areas of scientific value deserves widespread and prompt support. Our department has taken steps in this direction, and its experience might prove useful to others. A departmental committee on natural areas, composed of biologists with a field orientation, locates, visits, and evaluates representative areas of local streams, lakes, forests, and fields. Particular sites are selected for acquisition, priorities are assigned, and departmental approval is sought. The actual work of locating owners, searching titles, and purchasing is done by administrative officers.

Ideally, acquisitions should not be limited to unique biological entities such as bogs, virgin forests, or prairies, but should include large tracts, such as abandoned farmland or cut-over forests, if such are available locally. These tracts are typical of our man-dominated environment and are necessary for the study of contemporary ecological problems. Further, we are acting for future generations as well as ourselves, and such tracts, by natural processes, will ultimately develop climax characteristics.

Yntema has rightly emphasized the need for natural areas in a program of balanced biology teaching. An even stronger argument for their acquisition can be mustered if the future development of biology departments is considered. The population explosion with its environmental implications foreshadows a much greater effort in the area of environmental biology. Extensive, diverse, and well-planned holdings of natural areas will be basic to this effort. Perhaps even more important is the fact that these areas will provide a set of natural biological standards against which biologists can measure the success or failure of man in the manipulation of his environment.

F. H. BORMANN
Department of Biological Sciences, Dartmouth College, Hanover, New Hampshire

I would like to add the following comments to the dialogue stimulated by P. H. Abelson's excellent article "Trends in Scientific Research" (17 Jan., p. 222). I would first like to concur with the general tenor of commentary made by R. H. Painter (Letters, 20 March, p. 1276) against the assumption that all is known about the qualitative composition of the living world. The more support there is for scientific research, the more fields, once unattackable, many previously undeveloped, can be opened up to scientific analysis. But this does not mean that work in the more classical fields "has been largely completed." . . .

There are few geographic areas, save those near the larger universities in Europe and the United States, from which there are even partially complete analyses of the fauna and flora, even in their qualitative aspect, to say nothing of the quantitative picture. The lack of such information is unfortunate because of the great revolutionary changes in environments ushered in by wide use of pesticides, by stream pollution from expanding outputs of industrial wastes, and by air pollution from a variety of causes. It is difficult to perceive how these new factors are affecting segments of the living world when we do not know what that living world is. . . . If we do not know these things, how can we develop ideas on the effects of the new attempts—pragmatic efforts, not scientific endeavors—to modify what has evolved on this planet over countless millions of years? There are many taxonomic categories about which we know nothing, especially for marine environments. There are known taxa about which we know little, and there are very few segments of the total living world of which we can say we know all about the gross morphology of that phylum, that order, that family, or even that genus . . . vast areas of this fascinating planet are still unknown to descriptive biology.

B. H. BANTA
Department of Zoology, Colorado College, Colorado Springs

Cuba

An author (or editor) often feels like arguing with the reviewer of his book, but knows that this is not in the rules of the game. If I hope for publication of this letter, it is because Adolf A. Berle, in his review of the book *The Atomic Age*, (*Science*, 24 Jan.) ascribed to Leo Szilard a statement taken from my article in the *Bulletin of the Atomic Scientists* (Sept. 1960)—that "having mistaken Chinese communists for agrarian reformers, Americans may now be mistaking Cuban agrarian reformers for communists." Szilard has made enough controversial statements of his own; he should not be held responsible for mine!

On this occasion, I would like to say that, in my opinion, this statement has not been revealed as false by subsequent events. Anyone acquainted with the history of the Chinese Communist movement and with the writings of its leaders had no reason to expect from them anything but Communist dictatorship. Castro's revolution, on the other hand, was not predestined to make Cuba a Communist dependency. Several options were open to it, and I believe—but obviously cannot prove!—that the American tendency to treat the Cuban revolution almost from the beginning as a Communist conspiracy contributed to its throwing its lot in with Moscow.

Climbing out still farther on the limb, I suggest that even now Cuba is not irreversibly committed to the status of Moscow satellite. At present, flirtation with Peking is the only way in which Castro can show his independence and extract from Russia a burdensome tribute in support of Cuba's faltering economy. His position, how-

ever, is weak, because there is not much China can offer to Cuba. Keeping the door open for reconciliation and American assistance could conceivably lead to Cuba's breaking away from Moscow's tutelage. Castro cannot have forgotten how Moscow left him in the lurch in October 1962 and can have little belief in Soviet protection—all the loud official pronouncements notwithstanding.

EUGENE RABINOWITCH
1021 West Church Street,
Champaign, Illinois

Civil Defense: Bias in Congressional Hearings

The letter by Herbert A. Sawyer, Jr. (24 Apr., p. 366), places much weight on the pro-civil-defense testimony given before the Hébert subcommittee of the House Armed Services Committee [in hearings on a bill to provide federal financial assistance for incorporating fallout protection in future construction for schools, hospitals, and certain other public buildings]. The special nature of these hearings, however, casts considerable doubt on the objectivity of this testimony. Most of the witnesses were invited by the Department of Defense, and, in the words of Representative Hébert, "We proceeded with these hearings in a most unusual manner . . . by first having [the subcommittee counsel's] memorandum, then turning the whole field open to the Secretary and letting him bring in every witness he wanted to, to tell the whole story."

Under these circumstances it would be surprising to find much dissent from the official Department of Defense position. Let us hope that the Senate informs itself *not* "as well as did the House," but much better.

TREVOR ROBINSON
University of Massachusetts, Amherst

Educational Testing

Discussions over the benefits and dangers of educational testing, as in the review by M. H. Trytten of two books on the subject (3 Apr., p. 44), seem to have confused the issue more than they have clarified it. Tests can be quite useful to the tester when used properly and at the same time be of no real value to the testee.

When cutting points are used, the tester can show that the occasional error (incorrectly labeling a capable person inept on the basis of a test score) is more than offset by the many instances in which the more able applicants are successfully distinguished from the less able. Though exceedingly rarely, an Einstein might fail to test up to his true potential, and (as indicated by Hillel Black in one of the books reviewed) a very few of the students with very high test scores turn out to be relatively uncreative and undercontributing members of society. A given testee's educational development and choice of career could therefore be adversely affected by test performance or, more properly, by any decision which he—erroneously—bases on his test score.

The general public (including many testers) should be continually reminded that to be screened in (or out) on the basis of a test score means nothing more than just that. Thus, universities and the like might well continue to find the tests useful for screening out the majority of unapt students, realizing that in dealing with large samples their successes will average well in excess of their errors. An individual student, on the other hand, can pretty much ignore his own test performance based, as it must always be, on an N of one, a highly unstable, small sample.

ROBERT WALKER
Veterans Administration Hospital,
Brockton, Massachusetts 02401

Humanoids and Proteinoids

In "The nonprevalence of humanoids" (21 Feb., p. 769), Simpson makes several points with which I agree. Terms which presuppose the existence of extraterrestrial life are understatements of our ignorance. I am glad that Simpson said this emphatically. However, . . . we can be sure that organic chemicals will be found on Mars, and knowledge of the state of molecular evolution there may be fundamentally informative.

Part of Simpson's section on "The origin of life" might have been titled "The nonprevalence of proteinoids" in view of his statement that the "synthesis of the building blocks into macromolecules, especially nucleic acids and proteins, essential for life has not yet been accomplished under realistically primitive conditions." Two papers which appeared in *Nature* (*1*) too recently to have been cited in Simpson's article offer evidence of the existence of terrestrial thermal conditions under which proteinoids would form. Even at this stage in the history of Earth, the thermal ranges which exist in the regions of over 450 active volcanoes provide an extensive number of dry and moderately hot zones having conditions such as are employed in laboratory polymerization of amino acids.

Simpson says, "It is still a far cry from the essential preliminary formation of proteins . . . to their organization into a system alive in the full sense of the word. This is the step, or rather the great series of steps, about which we now know the least even by inference and extrapolation." Continued research with the organized units which form spontaneously from proteinoid in the presence of water (*2*) permits inferences through experiments simulating natural conditions, inferences which are consistent with the concept of the self-organizing properties of macromolecules as enunciated by George Wald in the *Scientific American* in 1954, and by others. The similarities to biocells of the structural details of the experimental units are best judged from pictures, which are to be found in a number of recent publications (*3*).

Whatever coefficient of validity one places upon such an experimental model, its present development makes at least one demonstration. This is the possibility of naturalistically and experimentally accounting for the nonbiological emergence of complex macromolecules and complex protocellular forms from simple systems by processes which are terrestrially realistic. This experimental model, as yet unique in its span of an evolutionary continuum, is also unique in having emerged from theoretical studies of (protein) systematics. This investigative history is consistent with Simpson's emphasis on the value of studying facts in terrestrial organisms.

SIDNEY W. FOX
Institute for Space Biosciences,
Florida State University, Tallahassee

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3. ———, *Ann. N.Y. Acad. Sci.* **108**, 467 (1963); *J. Bacteriol.* **85**, 279 (1963); *Comp. Biochem. Physiol.*, in press; ATP-splitting activity in simulated actual conditions is described in "The Origins of Prebiological Systems," in preparation).