Letters

More Views on Ph.D. Language Requirements

I agree with Ross and Shilling (Letters, 30 Sept.) that Ph.D. language requirements should be brought up-to-date, but rather than require a candidate to have a cursory understanding of two foreign languages, I would prefer to see him learn only a single one well enough so that he could use it. It is difficult enough to find time to read all that is available in the mother tongue, let alone translate a foreign article whose language is only partially understood. There are now many abstracting and translating organizations that give us the English version of foreign articles a few months after publication. Why must we persist in these antiquated language requirements for the Ph.D. degree when they waste so much of our graduate training time and are of so little use in our future scientific endeavors?

As a substitute for the second language we should include more training in the true language of all sciences—mathematics. In the biological sciences the most usable form of mathematics for a future research scientist is in the form of statistics and computer analyses. While most graduate schools offer courses in statistics, very few offer one in practical computer analyses.

I wonder how many graduate schools in this country have already changed the Ph.D. language requirements to meet the scientific challenge of the future. Such information would greatly help in bringing about a similar modernization at other more conservative universities.

RICHARD R. GALA
Department of Physiology,
Boston University School of Medicine,
80 East Concord Street,
Boston, Massachusetts 02118

. . . Working knowledge of more than one language is increasingly desirable for Ph.D.'s in view of the expanding number of foreign publications and meetings abroad. But should graduate schools, oriented toward advanced training in specialized areas, be required to provide elementary language instruction and shepherd doctoral candidates through reading examinations? Is it appropriate that students at the graduate level divert their energies from research training to basic drill in French and German? Should the predoctoral course of study be prolonged by language requirements when the demand for places in graduate school is increasing at the present rate? I believe the answer to each of these questions is "No." Knowledge of one or two foreign languages is basic to the general education of a student who will eventually hold a doctoral degree, and this knowledge should be acquired in secondary school and college. James Conant suggested some years ago that levels of college and secondary school instruction could be raised most efficiently by pulling them up from the top through higher graduate school admission standards. As an example of this approach, a prominent medical school has recently decided to include physical chemistry among its required premedical sciences. This places a burden on the next one or two classes of undergraduate applicants to this school, who may need an extra remedial course before beginning their graduate study. Nevertheless, the decision will probably be adopted by other schools, and should lead eventually to the desired results: better training in physical chemistry at the undergraduate level, and less need to spend time on the elements of this subject in medical school courses.

The language problem might be similarly approached if a few leading universities would simultaneously set some agreed upon level of linguistic proficiency as a requirement for admission to graduate school. Such a move would also produce a temporarily awkward situation for undergraduates applying to these schools, and the adjustment to it might take 3 or 4 years. But the end result would be to encourage the teaching of language in school and college, where it belongs, and to free the graduate student for undivided attention to advanced training and research in his chosen field.

WILLIAM B. WOOD
Division of Biology, California Institute of Technology, Pasadena 91109

Wren (Letters, 25 Nov.) "having recently qualified in both French and German for the Ph.D. in business," finds it "refreshing" that Ross and Shilling discuss rationally these "high hurdles" for doctoral candidates. Despite his contentions that they "were essentially useless" and that "an equal amount of time devoted to quantitative methods or economics would have had great value," he argues that these "very serious hurdles" have a major function because "it is increasingly apparent" that enough classroom attendance adds up to undergraduate and graduate degrees in many programs.

The criteria for Ph.D. requirements should be measured not by their height, but by their relevance and potential contribution to teaching and research. If any requirement does not measure up, faculties should have the courage to drop it despite long-standing traditions.

There is no place for irrelevancies in doctoral programs which still average 10 years from the baccalaureate to completion (*1*). Moreover, hoop jumping may have two devastating consequences if the candidate believes it is irrelevant. Given enough intellectual integrity and independence, he may quit the program altogether. Worse yet, given enough cynicism and conformity, he may capitulate, bear the psychological burden, and pass it on to his own students.

HERBERT J. WALBERG
Graduate School of Education,
Harvard University,
Cambridge, Massachusetts 02138

Reference

1. L. R. Harmon, *Background and Experience Patterns of the Doctorates of 1962* (Office of Scientific Personnel, Washington, D.C., 1965).

Antiexperimentalism

Velay (Letters, 21 Oct.) expressed an opinion that experiments depriving rats of D-state but not slow-wave sleep for 96 hours (Bowers, Hartmann, and Freedman, 16 Sept., p. 1416) were objectionably cruel, and he hoped no

further experimentation along that line would be pursued.

Whether the opinion is accepted or not, one may disagree with the antiexperimental hope that a relatively few laboratory animals will be spared a particular stress while countless animals and men suffering from it now and forevermore will be allowed no relief basically better than that currently available. Life presents a spectrum of stresses, the milder usually more common. I suggest that all deserve better understanding and management, and that animal experimentation is a rational means for gaining the necessary information quickly, with minimum confusion from variables of genetics, age, and environment, and without subjecting people to harmful procedures. Velay argued that sleep deprivation should not be studied experimentally with animals, because it involves no "situation crucial to mankind." He recognized no humane justification for discovering help for individual people deprived of sleep, whether by mere irritation or disaster. He recognized no survival value in learning to forestall resulting malfunction —most pointedly by emergency workers, soldiers, or negotiators deprived of sleep while protecting the rest of us from all manner of stresses, including situations "crucial to mankind." It is a tragic paradox that humane motivation, when constricted to animals and the immediate future, can turn against means for continued growth of man's capacity to be humane. It is a dangerous paradox that our society, precisely because of its humane ethic, could be misled into accepting the antiexperimental ideology and its impediments to the development of our ability to survive and prevail in contests with nature or nations less humanely motivated.

BENT G. BÖVING
Department of Embryology,
Carnegie Institution of Washington,
Baltimore, Maryland 21210

. . . What is more normal than sleep deprivation for mothers of young children! Typically, the baby awakes early for a 2 a.m. feeding just after the eldest child, fortified by a long afternoon nap, has finally settled down to sleep. As the baby finishes feeding, the next eldest child awakes with a sniffle, cough, bad dream, or just an excess of good spirits and usually doesn't doze again until the morning hour comes when Dad leaves to go to work (or fishing or duck hunting). By then it is time for the eldest to get up to go to kindergarten or first grade. During the day the children either stagger their naps, one after the other, or, on rarer days, when they choose to nap simultaneously and provide their mother with a chance to lessen her own sleep deprivation, a salesman inevitably will come knocking. Is this cruel? Who suffers more—experimental animals or mothers?

DOROTHY L. LABEN
502 Oak Avenue, Davis, California

Early Pragmatists

I have just now read this past summer's *Science* journals and wish to comment on one debate which might be entitled "the theoreticians or mathematicians versus the practical scientists." Apparently, this has been going on for some time since several quotations perhaps 50 to 100 years old come to mind.

Oliver Heaviside (1850–1925), when criticized for using operational calculus without rigid analytical proof, is reported to have said, "Should I refuse my dinner because I don't understand the digestive process?" Whether or not he was incapable of rigorously proving the operational calculus or just didn't care to bother seems unclear; apparently he found its justification in its "experimental" success and didn't need the analytical proof.

Another believer in the experimental approach was Claude Bernard, the famous French physiologist (1813–1878). He said, "A good technique sometimes renders more service to science than the elaboration of highly theoretical speculations," He, too, seems to have deplored at least some aspects of the theoretical approach.

James Clerk Maxwell of electromagnetics and "Maxwell's equations" fame (1831–1879) also seems to have been concerned with this debate when he said, "Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds." [*Nature*, **7**, 400 (1873)].

Perhaps he made a good point and perhaps too, the debate will last forever.

ERNEST E. SELLERS
University of Michigan,
2105 Copley, Ann Arbor 48104

Father of Modern Geology

Implicit in the book *Lectures in Geology* (John Walker, edited by H. W. Scott, University of Chicago Press, 1966) and in the review of it by C. C. Albritton, Jr. (Book Reviews, 28 Oct., p. 497), is an important point in the history of geology that should be made explicit lest the casual reader be misled. When word first spread of Scott's remarkable find of the manuscripts of John Walker's early lectures given at the University of Edinburgh (1779–1803), it was only natural that many would jump to the conclusion that Walker had, in fact, anticipated most, if not all, of the important ideas generally attributed to James Hutton, a contemporary of Walker. But, upon reading Scott's valuable analysis of the manuscripts, it became clear that this was not the case, though it seems inescapable that the two were acquainted. Indeed, to me it seems probable that considerable professional jealousy existed between them, partly suggested by the fact that neither seems to have acknowledged in print the existence of the other—a not uncommon 18th century oversight. Walker's reluctance to stray from the facts even a short way into interpretation contrasts sharply with Hutton's passion to erect a unifying generalization that could give meaning and direction to the embryonic science of geology. Hutton also worked from factual observations, but the two men were so intellectually and temperamentally different that it seems inconceivable that Walker was the originator of Hutton's truly revolutionary theories of the earth. Walker's importance lies chiefly in his mineralogy and teaching, but in my opinion, until some new evidence to the contrary should appear, Hutton still stands as a remarkably original and creative thinker and, more than any other single man, the father of modern geology.

R. H. DOTT, JR.
Department of Geology,
University of Wisconsin, Madison