much more vertical than that in the humanities. If this point is granted, the need for a reconsideration of college curricula will necessarily follow. I am naturally delighted that Marshall Brown, "a professional humanist," reads *Science*, and I agree that it is not the appropriate journal in which to engage humanists in the important debate on curricula; I shall certainly try to go further. Brown states as "Fallacy 1" my thesis that "Science is vertical whereas other fields are horizontal." He then goes on to state that "Humanities courses are not sequential, but they are cumulative." I couldn't find a better way to explain just what I mean by the distinction between vertical and horizontal learning. This is the heart of the matter.

Later in my article I wrote, "Which will be easier to learn without instruction in later life, *more* Shakespeare or molecular biology?" (emphasis added). The word, "more," carries the firm implication that students will at least be exposed to some. Brown somewhat misquotes me as saying that "One can 'learn' Shakespeare more easily than molecular biology 'without instruction in later life.' " There is no danger that a humanist will not be exposed to enthusiastic teaching of Shakespeare (and other literature, for which "Shakespeare" serves as proxy), but perhaps he or she could sacrifice some part of it for a course in calculus or general biology or elementary chemistry. Finally, Brown criticizes me for claiming that "Students should learn science, not how scientists think." Can anyone really be educated in this modern world without a reasonable knowledge of some of the major generalizations of science? And I deny that one can learn how scientists think without having a good portion of the meat of science to chew on.

In his letter, Alexander Astin agrees that we need more science in undergraduate curricula, but contends that "learning is no less cumulative and no less hierarchical when it comes to such 'soft' fields as foreign languages, communication . . . and artistic technique . . . ." I am enthusiastic about teaching foreign languages, and learning in foreign languages is certainly vertical as compared with that in history or literature, although probably still less vertical than that in physics or molecular biology. But fortunately much of the cultural value of foreign literature, at least for nonspecialists, can be obtained from translations. Even George Steiner used translations in preparing his highly regarded treatise *Tolstoy or Dostoevsky* (Knopf, New York, 1959). Mathematics may be the language of science, but regrettably no one has yet found a way to translate it. The distinction between vertical education in science and horizontal education in the humanities is not absolute, but on balance the distinction stands.

Astin writes, "A more fundamental consideration in trying to adjudicate competing claims on curricular time should be social and national need: what are the critical problems of our time, and which disciplines are in the best position to shed light on these problems?" My Policy Forum contained a list of some of the intellectual and practical problems of our day that depend on science; isn't it fascinating to find a humanist arguing for the practical application of knowledge and a scientist arguing for better understanding? No one is asking that our students give up history and psychology and economics. Certainly scientists want a base in these areas for future learning. My suggestion is that humanists should spend 80% of their time in college, rather than 94% of it, with these subjects and increase their effort (or at least their time) in science from 6% to 20%. This may, of course, be what Astin had in mind anyway when he agreed to more science in our curricula.

C. Tyler Burt asks that "our future elite . . . should have 4 years of peace to delve into the pure world of thought. . . ." Peace? Avoiding instruction in science is "peace"? Science and mathematics have no place in "the pure world of thought"? Burt's letter illustrates why we need curricular reform.

Finally, and thankfully, Jeffry Mallow has written that Loyola University will ask their students to learn more mathematics and science. Yale has also expanded its science requirements. May they lead us out of the wilderness. Science isn't easy, but there is still no royal road to learning.

F. H. WESTHEIMER
Department of Chemistry, Harvard University, Cambridge, MA 02138

Erratum: The first sentence of the second paragraph of Richard A. Kerr's Research News article "Halocarbons linked to ozone hole" (5 June, p. 1182) should have read, "Using a technique borrowed from galactic astronomy, the Stony Brook researchers believe that they have detected roughly 0.5 to 1.5 parts per billion of chlorine monoxide within the deepening hole. . . ." The article incorrectly referred to "0.5 to 1.5 parts per million."

Erratum: In the article "Space station price climbs higher" by Eliot Marshall (News & Comment, 17 July, p. 242), Herbert Friedman, a member of the National Research Council panel studying the space station, was incorrectly identified as a former presidential economic adviser. He is emeritus scientist, Naval Research Laboratory and Martin Marietta Fellow of the National Air and Space Museum.