Letters

Bipedal Vertebrates

Roger Lewin's article about the origins of hominid bipedalism (Research News, 27 Feb., p. 969) was intriguing, but I wonder if the discussion perhaps suffered from a somewhat provincial outlook. Bipedalism of some kind has evolved repeatedly in vertebrate history (*1*). An efficient, powerful, striding gait reminiscent of that seen in hominids was particularly characteristic of bipedal dinosaurs, if one judges from skeletal and trackway evidence (*1, 2*). Although some of the highly mobile carnivorous dinosaurs may have followed the migrations of herbivorous dinosaurs, and although parental care may have been fairly elaborate in these reptiles (*3*), I think no one would argue that theropod bipedalism evolved to permit adults to carry their young. Furthermore, many herbivorous dinosaurs were at least facultative bipeds. Unless one contends that the shift from quadrupedalism to bipedalism is fundamentally different from one vertebrate group to the next, anthropologists might find it fruitful to consider what, if anything, the evolutionary histories of dinosaurs, hominids, and other bipedal vertebrates have in common.

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1. R. McN. Alexander, *The Chordates* (Cambridge Univ. Press, Cambridge, U.K., 1981).
2. J. O. Farlow, *A Guide to Lower Cretaceous Dinosaur Footprints and Tracksites of the Paluxy River Valley, Somervell County, Texas* (Field Trip Guidebook, 21st Annual Meeting, South-Central Section, Geological Society of America, Waco, TX, 1987).
3. J. A. Hopson, *Annu. Rev. Ecol. Syst.* **8**, 429 (1977).

Values and Science Curricula

College: The Undergraduate Experience in America (*1*) may be little more than pious parchment, but Daniel E. Koshland, Jr.'s treatment (Editorial, 6 Mar., p. 1125) of its recommendations for adding ethical content to curricula was less than thoughtful.

In part he misses the point. Broadening experiences through exposure to a variety of fields is useful, but does not address the problem of developing an awareness of value issues. Certainly there is little evidence that moral awareness would be developed by exposing science or engineering majors to the liberals arts. These "arts" are not, and should not be, moral exercises.

Many well-meaning and learned educators, including many scientists, have tried often and with little effect to add a moral component to modern education. This suggests that there may be a substantial need and that filling that need is difficult. It is difficult both because it is very hard to design moral curricula that have the excitement of a "deep intellectual experience," and because of the dearth of knowledge about the relation, if any, between what a person might learn in such a course and subsequent behavior over a lifetime.

While the solution to the second part of the problem must await critical (and very difficult) longitudinal research, the solution to the first may lie in involving students in moral issues at the heart of their most intellectually exciting concerns. Here the discipline of understanding thoroughly the scientific (or other intellectual) issues in a situation could be confronted by careful reflection within a framework of alternative moral or ethical emphases. How this might be accomplished is most easily seen in research touching on economic, health, or environmental issues, but there are recurrent moral issues internal to scientific activity itself.

Instead of adding new curricula in values and ethics, or requiring that theses on abstruse mathematical problems include ethical perspectives, perhaps we need little more than occasional consultants to plant questions in serious minds for later reflection. Although studying values cannot substitute for rigorous intellectual discipline, students should be led to realize that their every activity, including their science, operates within certain value assumptions. To have students reflect on this, to be aware of the alternatives, and perhaps of the arguments for each, is a legitimate objective for any educational institution.

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1. E. L. Boyer, *College: The Undergraduate Experience in America* (Carnegie Foundation for the Advancement of Teaching, Harper & Row, New York, 1987).

I thoroughly agreed with Koshland's critique of the recent Carnegie Foundation report. Loose ideas about appropriate premedical and medical school curricula date back at least to the time I graduated from medical school in 1937 and have intensified since.

The practice of medicine is certainly not a science, but, as so aptly put by the late Edgar Hull, "The art of medicine is the application of the science of medicine to the problems of the patient." At the very time when the science of medicine has been deepening and broadening so vigorously, it is fatuous to urge premedical students not to overdo the science courses, to concentrate on courses in the humanities, and to take the minimum requirements in science. The result would be a generation of physicians who are even more inadequately grounded in biology, psychology, physics, chemistry, mathematics, and illiterate in computer science. I suppose old Imhotep, there in Sakkara somewhere around the 30th century B.C., used to complain about how poorly grounded in the fundamentals his medical apprentices were. It still is sad.

I also am very much concerned about the erosion of laboratory work in the basic science courses in medical schools, which is along the same line, and about the substitution instead into the curriculum of "soft" material of dubious validity, which, as Koshland points out, "push[es] one person's set of values in preference to another's." I do not think we need "cultured dilettantes" in medicine. We do need more physicians who are well trained in the science of medicine and who will practice their art as "an intellectually exhilarating experience."

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I think it important to warn readers about the potentially negative side effects of Koshland's Pious Parchment Pile method of treating insomnia.

As a teenager, I performed the admittedly brutal experiment of using "Halliday and Resnick" (an elementary physics text) as my insomnia cure (the combined edition is at least 4 inches thick, and ponderous by anyone's standards). Unfortunately, the solution not only worked, but worked too well; from that moment on I became sleepy whenever I opened Halliday and Resnick (no matter the time of day), and the reaction generalized to large texts of other kinds. This was a tremendous problem for me all through college, since I studied organic chemistry.

Ultimately, I moved into a field (artificial intelligence) where the textbooks are small.

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Erratum: In M. Mitchell Waldrop's article "Supernova neutrinos at IMB" (Research News, 20 Mar., p. 1461), Lawrence R. Sulak of Boston University, a member of the IMB research team, was incorrectly identified as "IMB principal investigator."