Harvey Mudd: Top Ranked

In her News article "Some small schools are big on manufacturing scientists" (Innovations on Campus, 4 Nov., p. 850), Anne Simon Moffat recognizes what we at Harvey Mudd College have known all along: small student-faculty ratios combined with a demanding curriculum that stresses hands-on laboratory experience provide undergraduates in the sciences with the education and tools to succeed at the graduate level.

However, Moffat's article may leave the impression that only the schools she lists produce high percentages of graduates who go on to earn Ph.D.'s. This is not the case. In a study prepared by the National Research Council and the U.S. Department of Education that reviewed the number and percentage of alumni from 1413 colleges and universities who graduated with bachelor's degrees between 1971 and 1980 and earned Ph.D.'s between 1979 and 1988, Harvey Mudd College ranked first in the nation in the percentage of graduates who went on to earn Ph.D.'s in chemistry and mathematics and second in physics and astronomy. The Higher Education Data Sharing Consortium study she cites does not include the Carnegie Classification—specialty engineering schools—to which Harvey Mudd College belongs; most schools in this category have outstanding science departments, as is the case at Harvey Mudd College.

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Chrysotile, Tremolite, and Mesothelioma

Five years ago (Letters, 24 Aug. 1990, p. 844), we discussed the possibility that the deaths of Quebec chrysotile miners and millers by mesothelioma might have been caused by contamination with amphibole fibers in the tremolite series. Clear evidence is now available to address this question. We recently reported that in our cohort of almost 11,000 men born between 1891 and 1920 (followed continuously since 1966), there had been 33 cases of mesothelioma among some 7300 deaths from all causes by the end of 1988 (*1*). Analysis at that stage suggested that the risk of mesothelioma was appreciably higher among miners and millers in Thetford Mines than at Asbestos, and higher still among workers in a small asbestos products factory in Asbestos. It was known that the level of fibrous tremolite contamination was several-fold higher in Thetford than in Asbestos and that crocidolite had been used in the factory.

Since then the follow-up has continued, and by the end of 1992, 37 mesothelioma deaths had been identified among 8000 deaths from all causes. Twenty-four of the 37 were from Thetford Mines and 13 from Asbestos, including five from the factory. The 24 mesothelioma cases in Thetford have now been the subject of detailed study.

First, 10 controls were sought for each subject from men in the cohort with the same year of birth who survived. In one case, only six controls could be found and, in another, only one; these two subjects and their controls were excluded from further study. From detailed employment records, the number of years worked by subjects and controls in each of 15 mines in the Thetford region were calculated. Periods of service within 20 years of death of a subject were excluded, as in the etiology of mesothelioma such exposure would probably be unimportant. It was immediately obvious that man-years of employment of the cases was concentrated in a localized area of five mines (Area A), where the ratio of man-years for controls to cases was 5.3 (1881/354), compared with 21.6 (1275/59) in the 10 mines located peripherally (Area B)—a fourfold difference. Data for the two excluded cases and their available controls had the same pattern.

The possibility that this distribution might be related to the concentration of fibrous tremolite in the two areas was then tested with data on asbestos fiber concentrations in lung tissue from 83 cohort members from Thetford Mines who had died from causes other than mesothelioma and had been examined by electron microscopy in 1988 (*2*). The number of lungs examined was 58 from Area A and 25 from Area B; the groups were similar in duration of employment (36 and 37 years) and time from termination to death (8 years in both), but estimated accumulative dust exposure was about 30% higher in group B. The geometric mean concentrations of fibers equal to or greater than 5 micrometers in length per microgram of dried lung were as follows: chrysotile, Area A, 7; Area B, 13 (not significant); tremolite, Area A, 32; Area B, 7 ($P = 0.0002$).

The more than fourfold observed difference in tremolite concentration between the two areas suggests that the relatively rare cases of mesothelioma mainly or perhaps wholly resulted from amphibole fiber contamination. These findings have important implications, but it should be emphasized that they represent the result of long,

heavy exposures 20 to 70 years ago. The geological distribution of tremolite within the Quebec chrysotile ore body may well vary in time and place and, at present levels of environmental control, any mesothelioma risk from exposure in either area A or B would be far below the limits of epidemiological detection.

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References

1. J. C. McDonald, F. D. K. Liddell, A. Dufresne, A. D. McDonald, *Br. J. Ind. Med.* **50**, 1073 (1993).
2. P. S. Sébastien, J. C. McDonald, A. D. McDonald, B. Case, R. Harley, *ibid.* **46**, 180 (1989).

Corrections and Clarifications

In the report "GDNF: A potent survival factor for motoneurons present in peripheral nerve and muscle" by C. E. Henderson *et al.* (11 Nov., p. 1062), the seventh author's name should have been "Laura Simmons." The affiliation for authors H. S. Phillips, M. Armanini, and Arnon Rosenthal should have been "Department of Neuroscience, Genentech, South San Francisco, CA 94080–4990, USA." The affiliation for B. Moffet and R. A. Vandlen should have been "Department of Protein Chemistry, Genentech," and that for Laura Simmons should have been "Department of Cell Genetics, Genentech." Alun M. Davies is at the University of St. Andrews, St. Andrews, Fife, Scotland KY16 9AJ, United Kingdom, and Vassilis E. Koliatsos is in the Departments of Pathology, Neurology, and Neuroscience and the Neuropathology Laboratory, Johns Hopkins University School of Medicine, Baltimore, MD 21208, USA. Beginning on line 19 of the first column on page 1064, the text should have read, "The average volume of the surviving motoneurons in the facial nuclei that received GDNF was 5186 ± 308 μ^3, close to that in the control nuclei (6081 ± 105 μ^3) (n = 3). In contrast, although BDNF and NT-4/5 both enhanced motoneuron survival to a similar degree as did GDNF (*2*, *3*), neither of them prevented the axotomy-induced shrinkage of facial motoneurons. In BDNF and NT-4/5–treated nuclei, the volume of the surviving motoneurons was only 65.5 ± 4% and 63.3 ± 2.6% of the control nuclei, respectively (n = 3) (*14*)."

Throughout the Research Article "Autoproteolysis in *hedgehog* protein biogenesis" by John J. Lee *et al.* (2 Dec., p. 1528) the word "disc" was incorrectly spelled "disk." In figure 4C (p. 1531), lane 9 should have been labeled "flu227," not "flu408."