the number of male graduate students, we should at least try. There are few mechanisms whereby recruiting more women will scare away men. Consideration should be given to alternative teaching modes that do not sacrifice intellectual rigor. Some students apparently benefit from single-sex rather than mixed classroom situations, perhaps because faculty can confuse aggressiveness with intellectual ability. Under present legal constraints, this may mean encouraging physics at the surviving women's colleges. Some students (perhaps not equally men and women) are algebraically rather than geometrically inclined. We should accept that drawing pictures and constructing free-body diagrams can be hindrances, not aids, to understanding for some students.

The largest loss of potential physics students occurs, however, in high school, not college. Students who opt out of high-school mathematics sequences without completing the algebra–plane geometry–trigonometry sequence are essentially certain not to become physicists, regardless of their other talents. The removable difficulty is that American parents erroneously (superstitiously?) believe that success in mathematics in due entirely to innate talent. In contrast, parents in many foreign nations tell their children (apparently correctly, to judge from standardized mathematics testing) that hard work is the key to success in mathematics.

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Industry's Case of Mistaken Identity

Harry Levinson (September 1987, page 114) expresses an extremely myopic viewpoint when he berates research and (if I understand the implications of his letter correctly) reduces the role of experimental physics to a teaching tool.

Although in many respects the duties of scientists and engineers overlap, the two are not the same. In the same way that engineers can and often must carry out research into fundamental phenomena, physicists can perform the duties of engineers. But to view the two as equivalent, as Levinson evidently does, is to misunderstand the role of the physical scientist. Basic research has as its primary goal the understanding of nature and not necessarily the solution of specific engineering problems, as Levinson and apparently Venkatesh Narayanamurti (in his reply to Levinson) and others believe.

The lure of a steady job and comfortable income may make engineers out of many of us who would rather be involved in the interesting and exciting work that constitutes true basic research. Despite our desire to do so, despite the more immediate benefits to be gained and despite my own belief that benefit to society is the eventual product of scientific enquiry, I frankly do not feel that physicists in general should be expected to contribute to a solution to America's current industrial problems. This is, after all, what management is paid to do.

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Reflecting on Liquid Mercury Mirrors

Per Andersen's news item (June 1987, page 23) about Ermanno Borra's exploring the potential use of liquid mercury mirrors in astronomical telescopes is interesting, but raises many questions about hazards to the health of those working around the mirrors.

The mercury pollution scares of the early 1970s led to clear documentation of very substantial, severe and cumulative health hazards stemming from exposure to mercury vapor (which is present to a dangerous degree around any open vessel of mercury).

Gallium would be a much safer choice and also has the engineering advantage of being much less dense, thereby facilitating design of a smoothly acting and more economical precision rotation system.

Not surprisingly, there are also disadvantages to gallium. First, it melts at about 30 °C, so a modest heating system would be needed to keep it molten. Second, gallium costs about 30 times as much as mercury. I calculate that a 1.5-m-diameter mirror consisting of 1 cm of gallium riding on a parabolic form would have a mass of about 104 kg. Standard 4N-purity gallium would cost about $300 000 for such a mirror. Perhaps, however, such a mirror could use slightly chemically contaminated gallium, which is commonly recycled from the GaAs and GaP industry, reducing the cost to about $200 000.

The higher materials cost and heating system cost would be partially offset by a lower cost for the precision rotation system. Additional savings would result from reduced costs of health and environmental protection

continued on page 122