

in which issues of sign or factors of 2 are tricky. The instructor can check that the student obtained the correct sign or factor at the correct point, rather than changed it at some arbitrary step, and thus grade accordingly. Substantial partial credit should be given for a calculation presented honestly with the wrong sign or factor and a 0 for the correct answer presented dishonestly. In addition to teaching our students physics, it is also valuable to teach them to correct those misunderstandings about what is proven and what is speculated that arise from different personality types.

Laughlin asserts that the recent frauds at Bell Labs "are noteworthy only because of Bell's special stature in American science and its reputation, both partly attributable to Bell's having been shielded from [economic] pressures by the old AT&T monopoly." I assert that it is noteworthy that, despite its immediate economic stress, the present Bell Labs did the right thing. That benefits Bell's long-term economic interest.

The private companies that hire Oregon State University students report that OSU's most important lesson is ethics.

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The frightening trend of industrializing our universities is, I believe, the single greatest threat to the integrity of higher education in this country (and probably all countries). The topic was hotly debated 30 or 40 years ago, but as the money has flowed, the concern seems to have waned. To better tap industrial largess and to appease state legislatures, university administrations have turned to the business model, which, as Laughlin so eloquently wrote, "is such a terrible idea."

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So pervasive are the contradictions in Robert Laughlin's disingenuous view of research in industrial laboratories that it is not easy to know where to begin the counterargument.

Having spent many years as a researcher and manager in an industrial laboratory, I came to understand that companies investing in basic research do not think of it as "charity

or part of an advertising budget." For a century, corporation-funded basic research has been a prolific driver of the technical revolution on which the world's economy is increasingly built, human health improved, and national security enhanced. Without these impacts, it would be hard to justify the large investments, by both government and industry, in both basic and applied science. And contrary to Laughlin's assertion, basic research continues to flourish in corporate laboratories where it is embedded in a balanced

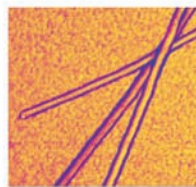
research portfolio and is highly valued by its corporate investor.

I discount Laughlin's assertion that "research linked to property has a built-in conflict of interest toward the truth" as being even less credible than it would be if "personal success and recognition" were substituted for "property." True, research is linked to property; something of economic value is created. However, it is patently false and contrary to experience that "intellectual property—knowledge that one can sell— . . . must be kept secret." Were it so, it

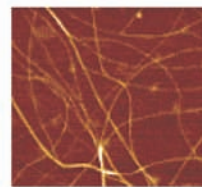
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would be hard to understand how the top industrial laboratories developed their reputations as generators of knowledge.

Patents are often used by both industry and universities to obtain a fair return on the commercial use by others of their knowledge and invention. The patent ensures that the knowledge is not kept secret but is freely shared. It is only the commercial exploitation of that knowledge that raises the subject of royalties. Thus it seems naive and a barrier to clear thinking to believe that “we

must choose between creating knowledge and creating property.” Whenever we create knowledge, we create property; the issues are about what is done with that knowledge. And let us look to the individual and to our broader values as we seek to understand the fortunately rare cases of scientific dishonesty. It is simplistic, and contrary to the evidence, to attribute the problem to the corrupting influence of industry and the contrasting purity of the academic environment.

I am not sure what message Laughlin sends his students. Is it

that doing basic science in an industrial setting is not possible? Is it that, in the creation of knowledge, researchers should avoid having knowledge become useful property out of fear that they might turn into “willing deceivers”? I hope his students will see a more realistic and balanced picture of the opportunities in the world to which they have committed their careers.

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According to Robert Laughlin, “making universities over into businesses may generate more patents,” but it “also corrupts scientific traditions” and leads to mediocrity and dishonesty. His suggestion that physicists “take the high ground and turn [themselves] into the gold standard of truth” is a laudable one. I hope he can convince his physics colleagues at Stanford University.

Rebecca Lowen has pointed out that, at the start of Stanford’s rise to national prominence in the 1950s, “the physics department was the last, rather than the first, university department to permit faculty members to be hired with government rather than university funds.”¹ If the department takes Laughlin’s suggestion, the physicists can now be the first, rather than the last, to turn down private money that might distort their dedication to scientific truth. In doing so, however, they will be swimming upstream against both past and current trends at Stanford. For example, a \$225 million award to Stanford from a group of international energy companies—ExxonMobil Corp, General Electric Co, and the German company E.ON—was recently announced. This money will fund a 10-year project, to be directed by a professor in petroleum engineering, to study climate change and energy.²

Although most physicists would probably agree with Laughlin that “economics is not fundamentally what science is about,” economic considerations nevertheless play a major role in research planning and funding decisions. Laughlin thinks the scientist ultimately faces a choice “between creating knowledge and creating property.” To him the choice is clear because “only one is science.” But the processes by which knowledge and products are created are so interrelated and interdependent that separating science and technology is neither possible nor desirable.

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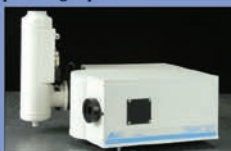
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