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.

References

1. R. Lowen, *Creating the Cold War University: The Transformation of Stanford*, U. of California Press, Berkeley, (1997), p. 10.
2. A. Lawler, *Science* **298**, 1537 (2002).

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Robert Laughlin's article is incisive and well worth reading. The conflict of interest he described exists in other institutions too. It isn't only high-status scientists who may find themselves making inappropriate choices. A customer support engineer may have to choose between revealing valuable technical secrets to help the customer and revealing aspects of company policy that management would prefer to keep hidden. For example, it might be in the customer's interest to say, "Don't buy that product; it has problems, and we are bringing out a better model next month." But that would be disastrous for the company, because it would leave a pile of unsold merchandise in the warehouse.

Scientists sometimes exaggerate the difference between research work and jobs in other fields. They think they alone are devoted to finding the truth and that they represent some kind of "gold standard" in truth-seeking. Actually, a farmer or programmer must also learn the truth. An airplane pilot or factory worker who ignores the truth may be killed in an accident. As Rudyard Kipling wrote in "The Secret of the Machines,"

> But, remember, please, the Law
> by which we live,
> We are not built to
> comprehend a lie,
> We can neither love nor pity
> nor forgive.
> If you make a slip in handling
> us you die!

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Laughlin replies: Rather than respond to these letters individually, I will take the long view and point out that, together, they say some important things about the discipline. The sentiments expressed largely match those sent to me privately, except that my mail is more positive. Judging from anecdotal evidence, I think the positive mix more accurately reflects the sentiment among physicists generally, but that is hard to quantify. However, even with the balance in this group of letters, it is clear that there is a terrible schism among professional physicists over the whole question of scientific ownership, and there are profoundly different perceptions of exactly the same facts. Reading some of the criticism, I am reminded of the scene in Mel Brooks's movie *Young Frankenstein*, in which Dr Frankenstein asks Igor how he lives with his hump and Igor answers, "What hump?"

A design problem in writing a short piece is that insufficient space to say things defensibly inevitably generates misunderstandings. For example, I took enormous care not to impugn property but somehow managed to get labeled as anti-property anyway. So let me set the record straight by stating that I strongly support technological property and the engineering activity that generates it. I would love to be an engineer, but it is too late. I am in my fifties and—worse—am trained as a theorist. I also agree that de facto property in universities is exactly the same as private property, and that dumping on industry just because it is private is the most despicable hypocrisy.