gives me to elaborate. I agree that what we call a general theory, such as quantum chromodynamics (QCD), can never be proved absolutely true in all possible cases. But after a long string of successful tests, a theory is generally considered true, and it will have to be incorporated in any theory that may supersede it. For example, the somewhat more limited statement that quarks exist will always be true in some context. It has become a "scientific fact."

Yes, the quarks we recognize today are substantially more than what Murray Gell-Mann predicted in 1964. Our physical idea of quarks has been extensively elaborated since then—especially by the emergence of QCD, as Reiland notes. Theories indeed play the central role in establishing the physical meaning of our concepts, and thus their meaning evolves. But I do not agree that they play the *only* role in this normal historical process.

Even when today's dominant standard model of particle physics is replaced by a wider, better theory in the near future, as many physicists expect, I am certain that quarks will continue to exist in some sense. Protons and neutrons did not cease to exist just because we discovered quarks in the 1960s and 1970s. But our physical picture of them changed dramatically.

Despite Juan Pablo Pardo-Guerra's objections, I will continue to assert that theorists who generate physical models that cannot be reasonably tested are engaging in metaphysics rather than physics. But I am not, as he claims, denigrating the philosophical underpinnings of science, for which I have a high regard. Where he uses "metaphysics," I prefer the word "philosophy," which for me has a slightly different, broader meaning.

As Gerald Holton and other historians of science have noted, our deep philosophical predispositions have long guided theory choice—even the selection of what physical problems are worth addressing. My own favorite scientific philosophy happens to be pragmatism. Although it may not be an a priori better choice than other philosophies, it is certainly a more effective philosophy in that worthy scientific theories are required to have observable consequences. They have to *do* things, not just be. Most practicing scientists share this philosophical prejudice, consciously or not.

In my Opinion piece, I protested what I see as the emerging divorce of theory from experiment: Mathematically adept theorists are increasingly publishing ideas that may have no observable consequences. And like any divorce, this one can originate on either side. Raw Baconian empiricism, devoid of theoretical interpretation, is also not science. Perhaps I was a bit too strident in championing experiments in my article; I seem to have been misinterpreted as being against theory. Modern physics, I admit, cannot exist without it.

What natural philosophers developed in the 17th century, the marriage of ideas and observations, is an immensely powerful intellectual process that has radically altered human activity and, with it, our physical landscape. It has sometimes been a difficult marriage, but it has been a very rewarding one, too—and one that physicists must continue to live with, for better or for worse.

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Carefully Chosen Words on Antievolutionism

The November 2003 decision of the Texas State Board of Education to reject demands made by antievolutionists is good news for science. However, the report of this decision in the December issue of PHYSICS TODAY (page 36) uses language that will offend some supporters of evolution and could be useful to the enemies of science.

The article refers to the textbook critics as "antievolutionist," "creationist," and "social conservative." The first two terms are pertinent, since those critics are challenging the correctness of evolution and promoting creationism or intelligent design as alternatives. The term "social conservative" is irrelevant and misleading.

A social conservative may be a supporter of evolution, an opponent of evolution, or a person who is unconcerned about evolution. The number of physicists and readers of PHYSICS TODAY who think of themselves as social conservatives is not negligible. Use of this characterization gives the appearance of criticizing supporters and potential supporters based on unrelated considerations. Thoughtless language is poor public relations.

The introduction of social and political terminology into the December story aids dangerous opponents of science. The following words, written by science historian Michael Riordan, appear on page 51 of the August 2003 issue of PHYSICS TODAY: "Without such a rigorous standard of truth, science will have little defense against the onslaughts of the creationists and postmodernists, for whom it is just one of many ways to grasp the world." Darwinian evolution is included in the biology curriculum because it is the accepted scientific interpretation of biological facts. Injecting social and political considerations supports the claim of postmodernists that the conclusions of science are socially determined.

Science cannot avoid interaction and conflict with various forces in society. Riordan's statement calls attention to threats that confront science from two different sources—postmodernism and religious fundamentalism. In addressing these threats, I urge consideration of the following facts. First, postmodernism is a threat to both science and religion. Second, within the sphere of religion, only fundamentalism is a consistent opponent of science. Most people who believe in God accept science as true and regard as allegorical those elements of the Bible that conflict with science. Third, belief systems are not always based on religion—social conservatism is an example—and do not necessarily determine a person's view of science.

Science might have more support if its institutions and centers of power were more diplomatic. I offer two recommendations. First, avoid linking science concerns with unrelated social and political disagreements. Second, when communicating about public issues of concern to both science and religion, avoid extending the conflict with religious fundamentalism to include religion in general.

Stephen Hawking's immensely successful book *A Brief History of Time* (Bantam Books, 1988) provides an outstanding example of how to achieve that second objective. His text presents physics to a general audience in a manner that avoids showing disrespect for religion and demonstrates sensitivity to its concerns. Perhaps some eminent biologist will write *A Brief History of Life* in the same spirit.

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