by the orbit of Mercury than by light bending, although the latter was discovered only after having been predicted from the theory. Second, as subsequent attempts to explain light bending along Newtonian lines failed, scientists came to regard light bending as carrying greater evidential weight. The lesson is that empirical evidence for a new theory counts more heavily when it cannot be handled by, but bears on principles central to, existing theory. The basic point has, of course, been familiar since Kuhn's discussion of anomalies in 1962, but Brush provides an important example which makes clear that merely forecasting a new phenomenon by itself provides only weak support for a new theory.

Thus, Brush shows Popper was wrong in his interpretation of the importance of light bending, but it should be plain that this has nothing to do with the soundness of the falsifiability criterion. A theory so flexible that one can always find a way to explain any phenomenon, whether before or after the fact, is not scientifically interesting or useful. However, this criterion does not demand prediction of novel phenomena in advance. In short, the question of falsifiability concerns the nature of acceptable theory in natural science, whereas the issue of prediction of novel phenomena in advance has to do with the historical process of theory change.

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Brush's use of the word "fact" (for example, "subsequent evaluations of [Einstein's] theory in the technical literature do not seem to give greater weight to the prediction of novel facts than to the persuasive deduction of known facts") undercuts his argument. Since the word "fact" implies immutable truth, use of phrases such as "known facts" undercuts such statements as "observations are not intrinsically more reliable sources of knowledge than theories. . . ." More appropriate words than "fact" would include "observation," "data," and "theory," which imply incompleteness and falsifiability.

This mutability is the basis of the superiority of science as an explantory-predictive system—scientists' observations and theories can be progressively corrected by scientists' further attempts at explanation and prediction, that is, there is a knowledge feedback loop. The use of "fact" to describe an observation or theory undercuts the system's strength by making a dynamic process into something static.

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Brush notes that the initial surprise over gravitational light bending—and the initial power of this result in support of Einstein's general relativity theory—soon dissipated when alternative explanations of the phenomenon were tested. This may be an example of what psychologists have studied as "hindsight bias"; uncertain events are rated less surprising after they occur than the same events are rated before they occur (*1*). It appears that physicists initially reacted to light bending in terms of its prospective surprise value, but moved easily to a reduced surprise in retrospect. If they did not go so far as to say they "knew it all along," many were soon a long way from admitting they "never would have guessed it" (*2*).

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REFERENCES

1. B. Fischoff, *J. Exp. Psychol. Hum. Percep. Perform.* **1**, 288 (1975).
2. S. Hoch and G. Lowenstein, *J. Exp. Psychol. Learn. Mem. Cognit.* **15**, 605 (1989).

Response: Wilson says that the criterion of falsifiability "does not demand prediction of novel phenomena in advance." Although some philosophers of science agree with him, others do not. My reading of the Popper texts cited in my article is that Popper himself does (most of the time) demand novel prediction [see, for example, (*1*, p. 117)] and that this was the reason for his original objection to Darwinian theory (*1*, p. 340). In any case that is the interpretation that has been widespread in the popular scientific literature and has been used to denigrate the scientific legitimacy of evolutionary biology, psychoanalysis, and so forth.

Bergmann dislikes my use of the word "fact" because it implies "immutable truth." I agree that scientists should try to use other words suggesting vulnerability to revision. As a historian I observe that scientists do talk as if light bending and the advance of Mercury's perihelion are "facts."

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REFERENCES

1. K. Popper, *Conjectures and Refutations* (Basic Books, New York, 1962).

Water Temperatures

In a helpful and informative article about

the new ITS-90 temperature scale (Research News, 23 Mar., p. 1411), Robert Pool correctly lists the triple point of water as 273.16 K, but incorrectly as 0°C. The triple point is defined by the mutual thermodynamic equilibrium between pure water vapor, liquid water, and ice. The ice point of water, saturated with air at one standard atmosphere and in equilibrium with ice, is a thermodynamically distinct point and defined 0°C on the Celsius scale of temperature; but this is no longer used as a fixed point. The triple point defines 0.01°C (and part of the Celsius scale of temperature) and is consistent with the older, obsolete definition based on the ice point.

Pool's statement about what "any cook knows" is reminiscent of Aristotle's "knowledge" that women had fewer teeth than men, although he never looked inside the mouth of a healthy woman. Many authors' wives or husbands will readily share the knowledge that water boils at a *lower* temperature when air pressure is lower—95°C (203°F) will start the pot bubbling in Denver, but not in Honolulu. I invite the reader to consider at what temperature water would boil when exposed to the near-perfect vacuum (zero pressure) of outer space; its boiling point is not very high.

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Response: My thanks to the many readers who have written or called to let me know that my foray into the kitchen left me with egg on my face. I've tried to use this blooper to convince my editor that I need a research trip to the mountains, preferably during ski season, but so far he's not biting.

—ROBERT POOL

Erratum: In Marcia Barinaga's article "Loma Prieta: Saved by a short, sharp shock" (15 Dec., p. 1390), the legend for the figure at the bottom of page 1390 should have indicated that the map was adapted from the work of S. E. Hough *et al.* at Columbia University's Lamont-Doherty Geological Observatory. In that map, the top part of the line representing the Nimitz Freeway from point A to point B should not have been drawn to the right of the boundary between the mud and the alluvium.

Erratum: In the Research News article by Robert Pool, "Heart like a wheel" (16 Mar., p. 1294), the Purkinje fibers were incorrectly identified as a system of nerves. They are instead modified heart muscle cells that are specialized for high-speed conduction.

Erratum: In the Table of Contents for 30 March 1990 (p. 1524), the letter by H. L. Robinson and M. Somasundaran, "Correction: Copy numbers of HIV-1 RNA," was inadvertently omitted.

Erratum: In the Author Index to volume 247, January–March 1990, the entry for "Spencer, Roy W. and Christy, John R." was incorrect. It should have read, "Precise monitoring of global temperature trends from satellites. p1558 30 Mar 1990."