Attitudinal Changes Seen as Key to Scientists Changing Their Behavior in 'the Science Wars'

In 1997, PHYSICS TODAY published important and stimulating columns by David Mermin (October, page 11) and Sam Schweber (March, page 73) relating to the cluster of issues broadly termed "the science wars." Although Alan Sokal's 1996 spoof[1] may have brought the matter to the surface for many scientists and led them to speak out, those issues had been simmering for a very long time.

Both Mermin's and Schweber's essays can be read as a plea for tolerance, moderation and lack of defensiveness on the part of scientists in general and physicists in particular. However, I believe that their plea for better behavior will be ignored unless specific examples, good reasons and new ways of thinking about the issues can be offered to the community of scientists.

For me, a foundation for bringing about such change could be developed on the basis of these observations:

▷ Although we scientists are usually trained to believe that fundamental scientific laws are impersonal and describe the world independent of human beings, it is essential to appreciate that science is a human activity, as are history, anthropology, sociology and the arts and literature. It is we who are curious about the world and pose the questions, the puzzles and problems to be studied. And it is we who formulate answers to these questions and decide when the answers—the explanations and understanding, the solutions to our puzzles—are satisfactory. Surely our questions and answers depend in some ways on our human qualities—our perceptual and cognitive neurobiology, as well as our culture and history.

▷ Each area of human study or activity has its own unique questions, aims and procedures, as well as its own standards for success or satisfaction. To take an extreme example, a poet is generally not trying to solve a puzzle or to resolve, simplify or understand something, but rather to use the craft of language to stir people to see and feel deeply with all of their senses.

▷ Scientific knowledge is not the same as all other knowledge; nor do all beliefs have equal claims on the truth. What distinguishes good science (besides the unique nature of its questions, methods and answers) is

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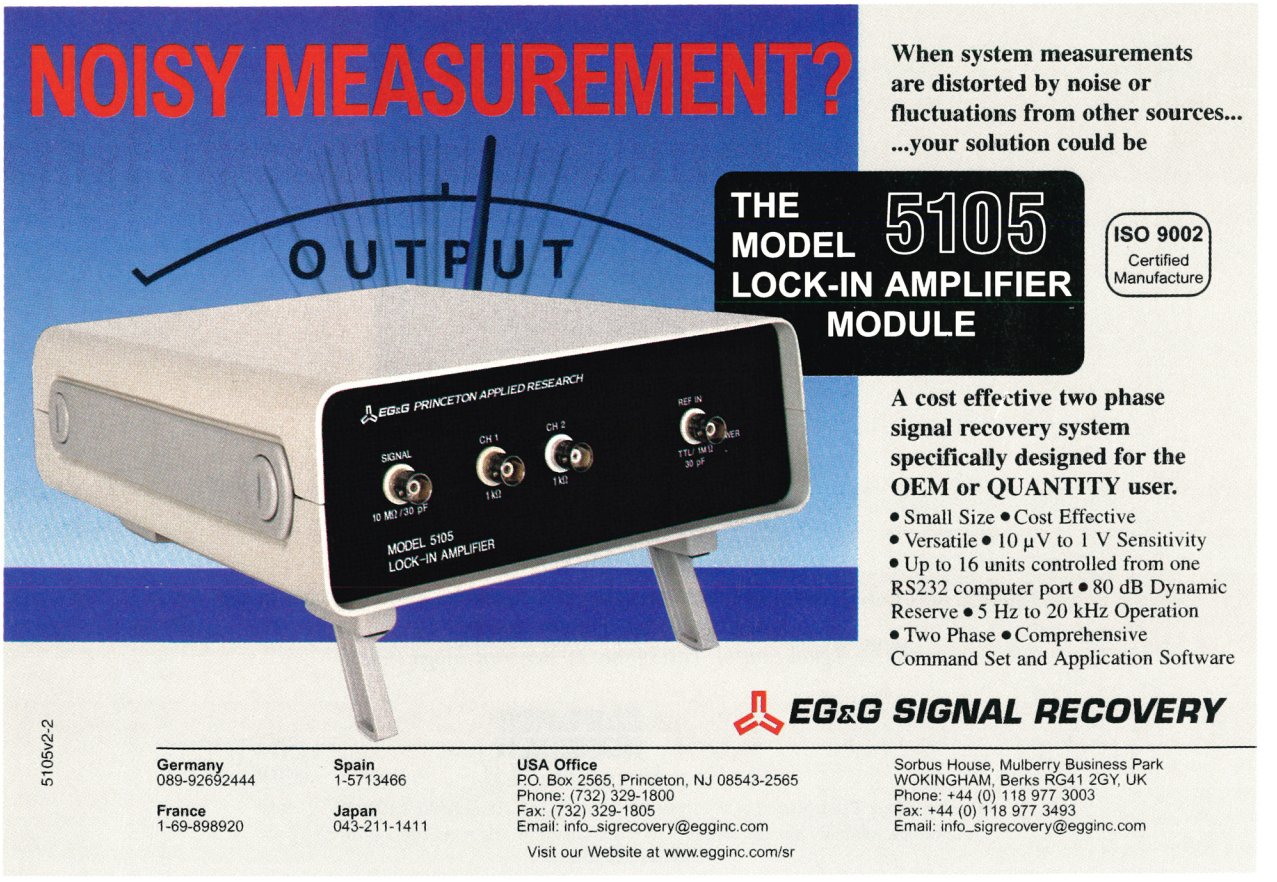

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the requirement of consensus being achieved by rigorous rational discussion among those accepted by the community of skilled practitioners.

▷ It is incorrect to view science as being objective and all other culture-based studies, including the arts, as being subjective. Rather, like all creative activities, science—though it seeks the greatest objectivity possible—results from, and is created at, the intersection of the perceived external world and the internal world of the individual. (Donald W. Winnicott, the great British psychoanalyst, referred to this region as the "transitional" or "potential" space.[2])

▷ Finally, let us agree with Mermin and not let our seriousness become a liability. Of course we have a responsibility, when it is appropriate, to point out blatant scientific errors, misrepresentations and faulty reasoning. But let's not forget (as Winnicott also reminded us) that it is the quality of playfulness that connects us to the source of much of our creativity and to the pleasure and meaning we find in our lives.

(I am grateful to Kathleen Brownback, Val Dusek, Steve Heims, Hildred Krill and Don Murray for their helpful comments in this matter.)

References

1. A. D. Sokal, Social Text, Spring/Summer 1996, p. 217; Lingua Franca, May/June 1996, p. 62.
2. See, for example, D. W. Winnicott, *Playing and Reality,* Routledge, London (1982), pp. 95–110.

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Thomson Challenged as Electron Discoverer, Alternatives Proposed

Reading with interest the article by Allan Franklin on the discovery of the electron (PHYSICS TODAY, October 1997, page 26), I was struck by the absence of any mention of the observation by Pieter Zeeman of the splitting of spectral lines in a magnetic field, and its interpretation by Hendrik Lorentz. Their work in 1896–97 was contemporaneous with J. J. Thomson's studies of cathode rays, and yielded the result that atomic line spectra seemed to be produced by the oscillations of objects of negative charge with a charge-to-mass ratio about a thousand times larger than that of a hydrogen ion.

Thus, Zeeman and Lorentz observed electrons inside atoms producing the atomic line spectra at about the same time that Thomson was discovering free electrons in the cathode rays. Yet I have never heard anyone claim that Zeeman/Lorentz discovered or even codiscovered the electron. As Abraham Pais pointed out,[1] Zeeman and Lorentz—unlike Thomson—did not call attention to the fact that the large charge-to-mass ratio implied the existence of an object of very large charge or more likely very small mass relative to the hydrogen ion.

Can the work of Zeeman and Lorentz be characterized as an example of what molecular biologist Gunther Stent has called a "premature" discovery[2]—that is, a discovery that, because it does not connect to the canonical knowledge of its time by simple logical steps, has only limited impact until such time as the canonical knowledge catches up? In this case, the catching up came very soon with the discovery of the electron by Thomson and its general acceptance by the scientific community.

References

1. A. Pais, *Inward Bound*, Oxford U. P., New York (1986).
2. G. Stent, Sci. Am., December 1972, p. 84.

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Your October 1997 special issue celebrates 100 years of the electron, but shouldn't that really be 108 years?

I ask because it was in 1889 that Heinrich Hertz's student Wilhelm Hallwachs, together with Julius Elster and Heinrich Geitel, discovered that negative particles were emitted from a photocathode and proved that they were indeed ballistic particles with well-defined maximum stopping potential and hence kinetic energy.[1] By the time J. J. Thomson conducted his now-celebrated cathode-ray experiment in 1897, Walter Kaufmann had already shown that the charge-to-mass ratio depended on the velocity of the electrons (which was later explained by the relativistic electrodynamics of Hendrik Lorentz and Albert Einstein). Also, Lorentz had calculated the best value of e/m from his classical electron theory of the Zeeman effect.

Unfortunately, in terms of their place in history, Hallwachs and his colleagues neglected to call their particles "electrons." Nevertheless, it was their work that led Einstein to his photoelectric equation and the birth