Cool Policy

We at *Cool* would like to commend *Science* and its staff on Leslie Roberts' recent article "The rush to publish" (News & Comment, 18 Jan., p. 260). We agree that this is an issue of concern in the scientific community; however, we were disappointed to find no discussion of our publication guidelines. Under the time reversal policy™, we offer to authors the possibility of publishing their results before they actually do their experiments. This policy is specifically intended for only the coolest papers; clearly, rigorous fundamental papers have other, more appropriate and receptive outlets. Needless to say, we realize that it presents a number of ethical dilemmas, but given the competitive nature of the scientific enterprise and the fact that some of the coolest experiments are just too difficult to do, we feel that we are performing a "service" to the scientific community. Despite generally enthusiastic reviews of our debut issue (Briefings, 7 Sept., p. 1102), as a result of the advice of legal counsel (as well as a fair amount of pressure from our advisers to actually do some experiments), we intend to cease publication effective with our first issue.

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Explaining the Avocado Illusion

The avocado illusion described by Paul E. Sandorff (Letters, 21 Dec., p. 1646) is, indeed, of interest to experimental psychologists. If I may add spice to the guacamole and take a whack at the tennis ball illusion, my guess is that both are mediated by the same mechanisms that produce the moon illusion (Book Reviews, 28 Sept., p. 1590). There is little agreement, however, as to what those mechanisms are (*1*). I would explain them, as I did the moon illusion (*2*), by invoking the inherent activity of the eye-brain system. I proposed that this structure evolved to produce the perception of rigid objects moving in three dimensions whenever it is activated by an expanding or contracting retinal pattern. This constancy constraint is also activated by static stimuli such as avocado. In my view, the apparent size of the avocado, and that of the moon, is determined by the retinal size of the light reflected from them and by their relative apparent depth as determined by the context. In the case of the avocado, it is well known that depth perception is greatly impaired in leafy surrounds (*3*), and I would suggest that, like the moon on the horizon, the avocado appears to be closer than its actual distance. Because the retinal size is constant, the inherent constraint that normally produces size constancy when activated by a changing stimulus now produces the anomalous enlarged perceived size.

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High-Temperature Superconductivity Theory

David P. Hamilton's article "HTS theory: Where's the beef?" (Research News, 19 Oct., p. 375) contains a number of factually incorrect and misleading statements that I would like to address. First, he comments that the Bardeen-Cooper-Schrieffer (BCS) theory of superconductivity, while explaining low-temperature superconductivity, "didn't offer much predictive power." This statement overlooks several facts: (i) the theory was the basis for predicting the dramatic Josephson effects of fundamental scientific and technical importance; (ii) the theory accurately predicts the transition temperature of the low-temperature superconductors, provided the properties of the normal phase of these materials are known; and (iii) the theory predicts the form and temperature dependence of essentially all fundamental properties of low-temperature superconductors, including so-called strong coupling effects that go beyond the Fermi liquid theory of the normal phase.

Second, while I and many other theorists believe that the pairing condensation is essential in explaining high T_c superconductivity, the observed factor of 2 in the flux quantum is merely consistent with the BCS theory and is not a proof of its validity in these high-temperature materials.

Third, while high T_c theorists face many difficulties, one that is *not* likely to be serious is "a peculiar disorder that defies one of solid-state physicists' most cherished assumptions—periodic symmetry." As P. W. Anderson showed in the early 1960s, the BCS theory is, in essence, unaffected by scattering that breaks long-range translational order. Furthermore, most theories of superconductivity can rather easily include such symmetry breaking effects, as they are in no way of essence to the fundamentals of the theory, so long as the relevant order parameter is nonzero in all directions.

Missing from the article is a discussion of central issues of concern to the high T_c theorists of today. Fundamentally, the BCS theory has three ingredients: (i) the Fermi liquid description of the normal phase; (ii) the phenomenon of pairing condensation in the presence of very strong pair overlap and Pauli principle correlations; and (iii) the specific attraction mechanism causing this condensation. At present, most theorists are focusing on the nature of the normal phase. The cuprates have many features reminiscent of a Fermi liquid, but many other features are strange to those familiar with conventional solids (*1*). Another issue is whether the pairing theory holds for high T_c materials regardless of the nature of the attraction. I should be pleased by the comment that "Most physicists now agree that Cooper pairs lie at the heart of high temperature superconductivity." While I *believe* that this is the case, there is a difference in science between believing and proving; we have not proven the case at this point.

Finally, the nature of the attraction which causes the pairing condensation has received considerable attention, yet it is *not* the topic of primary theoretical interest in this field at present.

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NOTES

1. An excellent source of information on this topic is Bertram Battlog's review in *The Los Alamos Symposium on High Temperature Superconductivity* [K. S. Bedell, Ed. (Addison-Wesley, Reading, MA, 1990), pp. 37–93].

Hamilton's article "HTS theory: Where's the beef?" trivializes the science in this field and ignores the content of the mainstream of scientific effort in favor of side issues. Contrary to statements in the article, the main issue for most mainstream theorists today is not what mediates pair bonding. The key question is actually the nature of the "normal" metallic state *above* T_c. Many of us feel that the solution of that problem will almost automatically solve the problem of T_c. A number of researchers believe that the normal state is a "Fermi liquid," which is the generalized version of a free, noninteracting