the significance and scope of my study, it is clear we differ greatly on the historical reconstruction of 19th- and 20th-century biology. Readers should not be left with the impression that my argument teeters on the faulty supports he alleges.

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REFERENCES

1. R. Richards, *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior* (Univ. of Chicago Press, Chicago, IL, 1987).
2. J. Greene, *Science, Ideology, and World View* (Univ. of California Press, Los Angeles, CA, 1981), p. 42.

Response: I hope that the readers of my review of Richards' book understand that I consider it an important, if controversial, work—"well-researched, thought-provoking, ably argued, and highly readable." If I did not catch the drift of his argument in every detail, it was not for want of trying. Obviously, Richards and I disagree in many respects in our interpretation and evaluation of Herbert Spencer, and in all respects about the omnicompetence of science. So be it. Spencer's reservations about the relevance of evolutionary theory to his ethical maxims may be found in the preface to the second volume of his *Principles of Ethics*. I hope readers will be motivated to read both Richards and Spencer and form their own judgments on the issues raised in this exchange of opinions.

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Primate Research and "Psychological Well-Being"

Thank you for Constance Holden's informed article about the status of laboratory animal regulations (News & Comment, 13 Nov., p. 880). The 1985 amendment to the Animal Welfare Act requires the U.S. Department of Agriculture (USDA) to develop standards for physical environments that promote "the psychological well-being of laboratory primates." Last spring, USDA's Animal and Plant Health Inspection Service (APHIS) assembled a national advisory group to review regulations it was considering for adoption. The group included nationally recognized behavioral scientists and veterinarians with first-hand experience in primate husbandry and research. They analyzed the proposal and returned a much-revised version that APHIS will presumably take into serious consideration as it redrafts regulations to implement the 1985 law.

APHIS faces the problem that, while biomedical researchers are willing and eager to change their facilities to improve the psychological well-being of laboratory primates, they want reasonable assurance that the changes mandated will in fact have the desired effect. There are essentially no scientific data to support more specific requirements for single housing of laboratory primates than now exist in USDA and National Institutes of Health guidelines.

Eventually, four features of single cage housing are reasonable candidates for regulation to promote psychological well-being: cage size, opportunities for social contact, exercise, and cognitive stimulation. Cage size is the most salient target for arbitrary revision. Even minor changes in U.S. cage size standards translate into millions of dollars of investment in new and renovated hardware. There is now considerable public and congressional support for upgrading laboratory primate facilities, but arbitrary changes in cage dimensions that have no effect on the well-being of the animals can rapidly squander that support. APHIS needs to know the threshold cage dimensions at which the most commonly used laboratory primates evidence stress, the cage sizes that the animals "prefer," and the strength of those preferences.

Second, while behavioral scientists generally agree that social deprivation can compromise the psychological well-being of primates, it has also been established that frequent change in group composition is stressful (*1*) and can produce disease in macaques (*2*). In laboratories where animals only stay for a limited time, no physical contact may be better for psychological well-being than enforced contact with ever-changing strangers. What are the critical time parameters? Are there simple ways to identify compatible partners? Similarly, it must be established whether exercise and cognitive stimulation reduce stress in adult laboratory primates. How consistently do they respond to opportunities for exercise and other forms of stimulation?

These questions can be answered by relatively straightforward experiments. Physiological measures of stress and behavioral techniques for testing preferences and motivational intensity exist for assessing the influence of such factors on psychological well-being.

The necessary studies should be done in a few qualified laboratories before all of the several hundred primate laboratories in the United States are required by federal regulation to build facilities and adopt the husbandry routines necessary to ensure that every laboratory primate has such experiences.

Since the term "psychological well-being" entered the federal regulatory lexicon, at least four national meetings of professional biomedical, veterinary, and animal welfare societies have focused on the issue of laboratory primate housing and husbandry. The key questions are being delineated, and several laboratories have initiated pertinent research. Let us hope that arbitrarily restrictive regulations do not arrive before the answers.

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1. J. R. Kaplan, in *Behavior, Conservation, and Ecology*, G. Mitchell and J. Erwin, Eds., vol. 2, part A, *Comparative Primate Biology*, J. Erwin, Ed. (Liss, New York, 1986), pp. 455–494.
2. J. R. Kaplan *et al.*, *Science* **220**, 735 (1983).

Census Undercount Recommendation

Marjorie Sun's News & Comment article (29 Jan., p. 456) quotes former Census Advisory Committee (CAC) chair Benjamin King as saying that the American Statistical Association advisory group recommended in April 1987 that the Census Bureau "should plan to provide adjusted counts after the legal requirement dates, if necessary, so we can know as much as we can about the undercount."

However, the complete CAC recommendation stated, "*Should* the determination in May be that adjustment is feasible, *and if* subsequent analyses support that decision, the Bureau should plan to provide adjusted counts after the legal requirement dates for apportionment and redistricting, if necessary. If the Bureau does decide to adjust, we recommend that it view the adjusted estimates as generally superior to the census counts in planning its data release program" (emphasis added).

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Erratum: In Mark Crawford's News & Comment article "Superconductor funds flat" (4 Mar., p. 1089), Robert J. Birgeneau was reported to have had his grant cut to $4.4 million. That National Science Foundation grant actually covers the Massachusetts Institute of Technology's Materials Research Laboratory and supports 40 faculty members. Birgeneau's personal grant was reduced from $125,000 in 1987 to $122,000 for this year.