Letters

Fraud Allegations

We were distressed by Constance Holden's article about the recent congressional hearings regarding fraud in science (News & Comment, 22 Apr., p. 386). The article merely repeated the allegations made at the hearings by Margot O'Toole, Charles Maplethorpe, Ned Feder, and Walter Stewart, regarding the paper by D. Weaver *et al.* [*Cell* **45**, 247 (1986)].

As the three scientists who, at the request of O'Toole, reviewed the data on which the *Cell* article was based, we feel that other views should have been aired, not just the charges. The failure to do this perpetuates the injustice generated by hearings in which none of the scientists who performed the relevant experiments or participated in the reviews were asked to testify. The result is that a one-sided version of events has been put before the public.

O'Toole initially turned to us as friends to seek our help and judgement on what seemed to her evidence of fraud involving the article in *Cell*. Her accusations were not based on her own work at the Massachusetts Institute of Technology, but on some notebook data that she had come across by chance. After reviewing the data and consulting with the involved parties we unanimously concluded that there was (i) no sign of fraud; (ii) no evidence of misrepresentation; and (iii) no error that undermined the article's basic conclusion. Contrary to O'Toole's statement at the hearings, we did not concede that her criticism was sound.

It was suggested at the hearings that the whistle-blowers in this case have sacrificed their careers by questioning the science of senior investigators. We know of nothing that was done to impede O'Toole in making an official complaint to MIT or to *Cell*. To the contrary, she testified that she was encouraged to ask for an official inquiry but chose not to do so. We know of no steps that she has taken to continue her career, nor have we, or anyone to our knowledge, made any attempt to block her in this endeavor. Furthermore, the other individual who raised charges of fraud, Charles Maplethorpe, is still in science.

Up to the present, the scientific issues have not been put before the public. We thus welcome the independent scientific investigation that the National Institutes of Health is organizing. However, we believe a picture depicting the authors of the *Cell* article as guilty has been created and we fear that, no matter what results from the official inquiry, an afterimage will remain.

It has always been our belief that the most important test of a scientific claim is independent experimental verification, not judicial review. We hope that the editors and readers of *Science* share this view.

HENRY H. WORTIS
BRIGITTE T. HUBER
Tufts University School of Medicine, Boston, MA 02111
ROBERT T. WOODLAND
University of Massachusetts Medical School, Worcester, MA 01605

PRC Students Abroad

Dorothy Zinberg's Perspective "PRC science students and scholars abroad" (25 Mar., p. 1475) touches on an ever-sensitive issue on my mind. As a student from the People's Republic of China studying in the United States, I have constantly been asked the question, "Do you want to go home?" Unwillingly, I have come to the conclusion that I do not have an answer, despite my deep love of China. A famous and well-respected Chinese physicist who studied and worked in Europe in the 1930s once said, responding to the inquiry as to why he had returned, that one did not need a reason to return; on the contrary, one needed reasons not to do so. I quite agree with him; therefore, it is painful for me to think about the reasons why one may not want to go back.

The availability (or lack) of professional opportunities is a major factor. I think that China's current science and technology (S&T) reform policy, which overemphasizes the commercialization of research activities and tries to use administrative measures to coerce scientists into playing the role of businessman, is extremely short-sighted and will do profound damage to the nation's S&T base. For instance, as part of the plan, in 5 years the government will stop funding institutes that do applied research; they are to find partners in the industrial sector to support them, so that their research activities will be directly tied to economic benefits. The definition of development and the appraisal of science in purely economic terms are unjustifiably narrow. Needless to say, there are many drawbacks and problems in the past "government-cover-it-all" type of funding for research. It is debatable, however, whether the apparently slow diffusion of new technologies from the research community to industry can be attributed solely to government support of research. Among other possible explanations, administrative barriers between the two sectors and lack of interest on the part of industry might be cited. Current reform should focus on eliminating barriers to collaboration between industry and the scientific community rather than imposing new bureaucratic measures to push something that will not happen otherwise. The new policy has already met with strong opposition from concerned scientists in China, but different opinions have been ignored. That the policy-makers can carry out such a policy, which has a broad and profound impact on the future of China's development, is disheartening to me. Under this policy, research opportunities for both domestic- and overseas-trained scientists and engineers will diminish rather than flourish, because relinquishing the sole responsibility of applied research to industry will result in the neglect of research that has no immediate commercial payoff.

Among other things, such an S&T policy inevitably causes students abroad to be concerned about whether they will have appropriate career opportunities at home and therefore influences their decision to return or not. Applying governmental power to ensure that students abroad go home, an action that could be viewed as trying to save the current regime from political embarrassment, will only produce the opposite effect.

XIN HAO
150 Albany Street, Cambridge, MA 02139

Zinberg's Perspective calls for further comment. The problem of whether students sent abroad return to the PRC after completion of their studies is quite confusing, partly because of how the PRC defines a nonreturnee. This definition includes anyone who does not return at the time that his or her original study plan stipulated. Thus, a student who, upon finishing a Ph.D., stays an extra year or two to conduct postdoctoral research is classified as a nonreturnee, although such a student may well return to China after the postdoctoral research. Similarly, students who originally go abroad for a master's degree and stay to do the Ph.D. are classified as nonreturnees. For this reason, the very high nonreturn rates that have been publicized may be spurious.

Second, the Chinese perception certainly is that this is a serious problem. As Zinberg indicates, steps are being taken in the PRC to deal with it. For example, government-sponsored students now have to name a guarantor (or hostage) before leaving, who may be held financially accountable if the traveler fails to return. Within the past few weeks, a court in Shanghai levied an extremely large fine on the wife of a student who did not return to China after taking a language course in Japan. Also, the State Education Commission of the PRC is now pursuing the establishment of programs in

which students will go abroad for much shorter periods than previously and will receive their graduate degrees from a Chinese, rather than a Western, institution. It is expected that if such programs are successfully established, students will be less tempted to stay abroad and will also be much less marketable since they will not have a Western doctoral degree.

The reasons for nonreturn or delayed-return are complex. Many students who have become used to pursuing independent research find that, upon return to the PRC, they are slotted into organizations and used as research assistants carrying out plans formulated by their seniors (who in many cases, often because of the educational gaps caused by the Cultural Revolution, are not nearly as knowledgeable as they). Along with the deterrent and coercive measures, the Chinese scientific establishment might do well to consider some positive incentives for their scholars to come home.

The appropriate role of Western educational institutions in arguable. Western governments clearly have the option of denying extended visas or permanent resident status to students from the PRC. Attempts to enlist the universities in enforcing prompt return are something else again. From the academic point of view, there appears to be no valid reason for Chinese students to be treated any differently from others: that is, students with appropriate levels of academic performance should be permitted to continue their work through graduate school and postdoctoral appointments, without the academic decision being influenced by political concerns.

PETER SUEDFELD
University of British Columbia, Vancouver, BC, Canada V6T 1Z5

Estimates of Species Duration

In an interesting and provocative article, David Jablonski (Reports, 16 Oct. 1987, p. 360) argues that the geographic ranges of fossil mollusks provide evidence for the macroevolutionary phenomenon of species selection. He proposes that geographic range satisfies the three basic requirements for species selection: (i) it is an emergent property of species that exhibits variation, (ii) this variation is heritable, and (iii) this variation results in differential survival of species. Evidence presented to demonstrate differential survival includes plots of geologic duration versus geographic range for 421 species of bivalves and 540 species of gastropods from the Late Cretaceous of North America. However, sampling bias can influence studies of species richness, origination, duration, and biogeographic patterns (*1*). When species distributions are examined in space and time, sampling bias can yield patterns that may not actually differ from those expected by chance alone.

Before the positive correlation between geologic duration and geographic range can be adduced as evidence for species selection, an appropriate test is necessary. Taxa having long geographic ranges are more likely to be preserved in the fossil record because they occur at a greater number of fossilization sites. Therefore, long-ranging species have higher probabilities of displaying longer geologic durations than do taxa with short geographic ranges, even if there is no difference in geologic duration.

Testing for a statistically significant positive relation between duration and range is not sufficient evidence for assuming geographically long-ranging species survive through evolutionary time longer than do short-ranging species. The null hypothesis in such a test assumes a zero slope. Until the sampling bias associated with short-ranging species can be quantified, the species selection hypothesis for the Cretaceous molluscan fauna remains untested.

MICHAEL P. RUSSELL
Department of Paleontology, University of California, Berkeley, CA 94720
DAVID R. LINDBERG
Museum of Paleontology, University of California, Berkeley

REFERENCES

1. C. F. Koch, *Paleobiology* **13**, 100 (1987); R. Lewin, *Science* **236**, 521 (1987).

Response: The role of sampling bias in generating spurious correlations in paleontological data has long been a concern. As Russell and Lindberg point out, an independent test (which they do not provide) is needed to assess the role of sampling in determining the relation between geographic range and stratigraphic duration, and the null hypothesis of a zero slope for that relation must be rejected. Here I provide a test that may be applicable to most paleontological situations, apply it to the Late Cretaceous bivalves and gastropods that provided the basis of my report of a significant positive relation between range and duration and reject the null hypothesis of zero slope.

If sampling bias alone generates the relation between geographic range and stratigraphic duration, then that (spurious) relation should vary systematically among taxa having different preservation potential. Linear regressions for the best preserved—and thus best sampled—taxa should more closely approximate the slope of zero than linear regressions for poorly preserved taxa (*1*). For example, oysters (Ostreacea) are particularly well sampled in the Late Cretaceous of the North American Gulf and Atlantic Coastal Plain: they are abundant, are absent from few marine facies, are biostratigraphically useful, and have thick, robust shells of dissolution-resistant calcite (*2*). In contrast, the tellinacean bivalves and such gastropod families as Buccinidae, Fasciolariidae, and Turridae contain much scarcer, small, thin, fragile shells composed of dissolution-prone aragonite. The venerid bivalves and the naticid and turritellid gastropods are also aragonitic, but shells are more robust and common than those of the other gastropods and thus should be intermediate in preservation and collection potential. The prediction of steeper regression slopes for the most poorly sampled taxa, intermediate values for the venerids, naticids, and turritellids, and shallowest slope for the oysters is not met for the Late Cretaceous mollusks (*3*). Thus, the null hypothesis based on sampling bias is rejected in this instance, corroborating my original interpretation.

Comparisons of patterns among taxa having disparate preservation potential may provide a general approach for assessing the effects of sampling bias. Although sampling is by no means perfect in the Late Cretaceous of the Coastal Plain and incompleteness of the record there precludes many kinds of analyses, rejection of the Russell-Lindberg hypothesis suggests that sampling biases are not the principal determinant of the observed relation between geographic range and stratigraphic duration in this instance.

DAVID JABLONSKI
Department of Geophysical Sciences, University of Chicago, Chicago, IL 60637

REFERENCES AND NOTES

1. Biogeographic and biostratigraphic data sets rarely conform to bivariate normality, and regressions are used here for comparative purposes only. Although I provided a bivariate plot in my report, my original analyses emphasized more robust nonparametric statistical methods.
2. K. E. Chave, in *Approaches to Paleoecology*, J. Imbrie and N. D. Newell, Eds. (Wiley, New York, 1964), p. 377; C. F. Koch and N. F. Sohl, *Paleobiology* **9**, 26 (1983).
3. Slopes (±95% confidence limits) for simple linear regressions of species duration on geographic range [for equation, duration (in 10^6 years) = slope × range (in 10^3 kilometers) + intercept]. All regressions are significant at $P < 0.01$ or better. Taxa are listed in approximate order of decreasing preservation and collection potential; the sampling bias hypothesis is rejected because the slopes do not systematically increase in this sequence. Ostreacea ($n = 28$), 2.1 ± 0.6; Veneridae ($n = 22$), 1.6 ± 0.9; Turritellidae ($n = 15$), 1.9 ± 0.7; Naticidae ($n = 15$), 2.2 ± 1.2; Buccinidae ($n = 16$), 2.7 ± 1.3; Tellinacea ($n = 23$), 1.8 ± 1.1; Turridae ($n = 25$), 1.5 ± 0.5; and Fasciolariidae ($n = 43$), 1.1 ± 0.5).
4. I thank S. M. Kidwell, D. M. Raup, and J. J. Sepkoski, Jr., for helpful comments.