Letters

Replication and the Scientific Method

Edward E. Jones, in a footnote to his article "Interpreting interpersonal behavior: The effects of expectancies" (3 Oct., p. 41) tries to explain why the exclusive use of undergraduate college students as subjects in his social psychological experiments should not invalidate his conclusions. His explanation, that "Precise empirical replications are . . . not to be expected, but a conceptual relation that is demonstrated in one context, with one sample of subjects, should be reproducible (with appropriately varied operations) in another context with a different sample," is, at its core, the antithesis of the scientific method. If the report of an experiment performed to test an hypothesis does not describe all the relevant operations, how can another investigator confirm or disconfirm the outcome of the original work? How does one specify the conditions that are necessary for replication of the "conceptual relation"? Does Jones mean that the procedure and methods sections of his research reports are not to be taken literally? When is a replication really a replication?

Probably it is sheer coincidence, but Arthur H. Neufeld's letter ("Reproducing results," p. 11) in the same issue of *Science* as the article by Jones warns us that the "implications of not reproducing experiments are severe." Indeed they are; that's what science is all about.

ALVIN G. GOLDSTEIN
Department of Psychology,
University of Missouri,
Columbia, MO 65211

Public School Teaching: An Alternative

The Carnegie Forum on Education and the Economy has recently published a report (*1*) on elementary and high school education. Some of the proposals set forth in this report appear quite unrealistic. The argument made in the Carnegie report is that primary and secondary school teachers are grossly underpaid, and therefore, these positions do not attract talented people with adequate interest and background in teaching. This does not appear to be the problem. There are many qualified, talented people who are able to teach and would be happy to teach at current salaries, but who are prevented from teaching in public schools by unrealistic requirements imposed, usually, by state laws. At the elementary school level above the second grade, relatively little background in course content or method is needed. What is needed is the ability to read an elementary textbook and interpret it with imagination and enthusiasm. Mostly one needs the willingness and ability to relate to young people.

At the high school level, only a few college preparatory or advance placement courses such as languages, upper-level science, art, and music require any special knowledge of the field. Even these need only a college graduate who has majored in the subject. Requiring more than a bachelor's degree needlessly increases the already too high cost of teacher training.

In spite of a booming economy, many bright college graduates have difficulty finding their first job. They have no experience to offer, and frequently they want or need a geographical change. Characteristically they have enthusiasm and energy. Many are only a few years removed from jobs as camp counselors or similar jobs where they have had excellent experience in handling children and young adults. Let's make use of them in the educational system, not as underpaid practice teachers, as has been proposed, but as full-time elementary and high school teachers.

The argument about inadequate salaries does not apply to fresh college graduates. Current starting salaries for teachers are in the range of $17,000 to $20,000 a year for a 10-month period and could be higher as school systems are relieved of the high cost of career teachers. This would be a respectable first job salary for most college graduates. These noncareer positions would be offered for 4 or 5 years, with the deliberate intent of rotating personnel to provide starting jobs for the plentiful supply of new graduates.

Other than solving disciplinary problems, which are largely social rather than educational issues, smaller classes would probably be the most effective improvement we could realize in our current system. The lower cost of the noncareer teacher would allow us to have more teachers, smaller classes, and more individual attention.

In each school one or two tenured career teachers could coordinate and help with difficult children and situations where special training and greater experience are a distinct advantage.

One might ask whether bright, able people would take jobs limited to 4 or 5 years. I think they would. The Peace Corps is this type of commitment and it attracts very good people. The permanence of the job is important only after one has invested a subtantial part of one's life in it.

What I am proposing is revolutionary and will draw fire from teachers' unions and other parts of the educational establishment. These institutions have had more than a fair chance to do the job and have failed. Even during the post-Sputnik period, with tremendous pressure and resources being applied to produce better education, the result as judged by colleges and graduate schools has been a progressive decline in college preparation. Change is needed, but it must be change consistent with the society's ability and willingness to pay for it.

WILLIAM SIMON
Department of Biophysics,
University of Rochester Medical Center,
Rochester, NY 14642

REFERENCES

1. *A Nation Prepared: Teachers for the 21st Century. The Report of the Task Force on Teaching as a Profession* (Carnegie Forum on Education and the Economy, Carnegie Corporation of New York, New York, 1986).

GenBank Status Report

As Roger Lewin reported (Research News, 27 June, p. 1599), GenBank (*1*) has been unable to keep abreast of the rapidly expanding flow of nucleic acid sequences into the literature. In response to continuing inquiries by GenBank users, we should like to offer an updated status report.

The database now contains about three-fourths of the data published in 1985 and one-fourth of that published in 1986. Sequences totaling just over 11 million bases are now entered, of which about 1 million are awaiting full annotation and are available in a new "unannotated" division of the database; we have shifted some effort from annotation to make more of these available rapidly. Data collection is a joint effort of GenBank and the European Molecular Biology Laboratory (EMBL), each group forwarding data collected by it to the other for inclusion in what is effectively a common database.

Although we will continue to improve computational tools for formatting, managing, and checking data and for computer-assisted annotation, investigators are in the best position to provide the annotation. Several thousand investigators have received our request for data and annotation in a standard form that greatly eases entry; responses to these inquiries are given priority for processing into the database. The response rate is below 30 percent, perhaps because we write to authors only after a paper has appeared in print. *The Journal of Biological Chemistry* has taken the initiative and is including our request with acceptance of a sequence paper, with very encouraging results. Data sent at the time of acceptance are available in the database at about the time of publication. We and our colleagues