time. Hearing this, she seized her husband by the arm and said, "You see, I always told you so."

Life, this anti-entropy, ceaselessly reloaded with energy, is a climbing force, to ward order amidst chaos, toward light among the darkness of the indefinite, toward the mystic dream of love, between the fire which devours itself and the silence of the cold. Such a nature does not accept abdication, nor skepticism.

No doubt, man will continue to weigh and to measure, watch himself grow, and his universe around him and with him, according to the ever-growing powers of his tools. For the resolving powers of our scientific instruments decide, at a given moment, the size and the vision of our universe, and the image we then make of ourselves. Once Ptolemy and Plato, yesterday Newton, today Einstein, and tomorrow new faith, new belief, and new dimensions.

As a result of the scientific revolution of the present century we are finding ourselves living in a magic world, unbelievable as little as 100 years ago: magic our telephone, radio, television by multichannel satellites; magic our conversations with the moon, with Mars and Venus, with Jupiter; magic these means which transform our former solitude into a permanent simultaneity of presence among the members of the solar system.

And here at home, thanks to these new media and the ever-increasing speed of transportation, we are witnessing a vast mutation taking place, no longer local, but of the dimensions of the globe: the birth of a new biological organism, in which all continents and all the human races participate.

For this equilibrium now in sight, let us trust that mankind, as in the greatest periods of its past, will find for itself a new code of ethics, common to all, made of tolerance, of courage, and of faith in the spirit of men.

NEWS AND COMMENT

NSF Peer Review Hearings: House Panel Starts with Critics

The first 2 days of House oversight hearings on the National Science Foundation's peer review system were dominated by the testimony of two congressmen who have been the principal critics of NSF in recent months; both pressed for major modifications of the peer review system.

Representative John B. Conlan (R–Ariz.), who has made a big issue of behavioral science courses developed with NSF support (*Science*, 2 May), asked for a "total openness" in peer review procedures, requiring, at least, that peer reviews and names of reviewers be made available to the principal investigators concerned and to Congress.

Representative Robert E. Bauman (R–Md.), author of the "Bauman amendment," which, if enacted, would give Congress authority to review and veto grants approved by NSF (*Science*, 25 April), argued for a stronger direct congressional control over research grants, although he seemed willing to depart from the letter of his amendment.

The two statements provided points of departure for discussion, but the subcommittee holding the hearings did not appear disposed to jump to conclusions. NSF officials had a chance on the third day of hearings to begin presenting their side of the case, and the hearings seemed to be settling down to a more than usually detailed examination of the inner operation of a science agency.

The hearings, which began on 22 July, are being held by the House Science and Technology Committee's subcommittee on science, research, and technology, chaired by Representative James W. Symington (D–Mo.). In his opening remarks, Symington set the general goals for the panel. He said that the subcommittee would take a detailed look at how responsibility in the peer review process was divided between peers and the NSF staff, examine alternative methods of selecting research projects for support, and seek to determine whether NSF was doing an "adequate job." Symington said the group would not take up questions such as those which have been raised about curriculum implementation and about "priority setting" between research fields and disciplines. Originally scheduled for a total of 6 days over 2 weeks, the hearings have now been extended to include an additional day on 1 August.

Conlan, the first witness, indicated that his grievance against NSF arose out of the agency's refusal to provide information on peer review of the school behavioral science course projects in which he was interested—information to which, he insists, Congress should have access.

Conlan said that, under NSF's current management practices, "they have a completely arbitrary system that is closed and unaccountable to the scientific community and to the Congress." He charged that "It is common knowledge that NSF program managers can get whatever answer they want out of the peer review system to justify their decision to reject or fund particular proposals." He added that "I know from studying material provided to me by NSF that this is an 'Old Boy's System,' where program managers rely on trusted friends in the academic community to review their proposals. These friends recommend their friends to reviewers."

Perhaps the most serious allegations against the NSF review managers came when Conlan described what happens if a reviewer fails to send back "the anticipated rave review."

"The program manager," said Conlan, "has one of two choices: He can toss out the uncomplimentary review, since he is in complete control of reviewers he selects and reviews he uses. Or he can paraphrase the negative comments, and make the review appear positive."

To illustrate his thesis, Conlan cited a recent instance in which, he said, "a program manager and his superiors misrepresented peer review comments." At issue was the Individualized Science Instructional System (ISIS) for high school students being developed at Florida State University, which Conlan said had received some $3.3 million to date from NSF.

Conlan charged that "the NSF staff appears to have purposely misrepresented reviewers' comments to the programs committee of the National Science Board in order to get approval of the current budget of $2.2 million in further funding."

As evidence, Conlan submitted for the record an NSF staff summary of the ISIS project prepared for the National Science Board when new funding for ISIS was requested and, subsequently, approved. In his testimony, Conlan quoted an extract from a review statement by Philip Morrison of MIT which appeared in the NSF summary prefaced with the sentence, "Representative of the overall tone of the reviewers' comments is this excerpt from

Dr. Morrison's review:" What followed was a short paragraph characterized by the fairly heavy use of ellipses, rather in the way that book or movie reviews are often excerpted to construct blurbs. The paragraph concluded, " 'The personnel and advisors are excellent.... The idea is good....' "

Conlan observed that the quote conveyed unqualified support, not only by Morrison, but by all 11 reviewers of the project. Conlan said his staff had checked with Morrison, and "he informed us that he definitely *did not* give his unqualified support when he reviewed the proposed project more than two years earlier. On reflection he also said that he had been very critical of the careless scope, content and purpose of the 80 to 125 'mini-courses' to be developed."

When asked by *Science* whether the Conlan statement accurately reflected Morrison's comments on the ISIS review, Morrison said that the account was "itself a misrepresentation." Morrison said that he had written a letter to Conlan discussing the matter and found it hard to understand why Conlan had not produced the letter at the hearings.

More light on the subject is likely to be shed on 1 August when Morrison—who has been invited to testify and has accepted the invitation—is scheduled to appear.

At the hearings, NSF officials acknowledged that the reviewers' comments had been presented as they were because shortcomings in the project to which the reviewers had objected earlier had been corrected and that the staff felt that the favorable review was justified. NSF officials, including NSF director H. Guyford Stever, agreed that a fuller explanation of the circumstances which produced the review should have been included.

The ISIS incident appears to have assumed a fair degree of importance in the hearings, not only because it provides a specific instance in which NSF is accused of misuse of the peer review system, but also because it involves a question of Conlan's credibility as well as of NSF's.

Conlan's advice to the subcommittee "is to make the peer review system open and accountable. This means that the 'Old Boy's System' which is so cherished by certain big institutions and the National Academy of Sciences, which benefit from it, must go.

"The peer review system must operate in an environment of *total openness*."

By total openness Conlan means that verbatim reviews and the names of reviewers should be available on request to the principal investigators who submitted grant applications and also to Congress. A Conlan staff member says Conlan would prefer to see the press and public given access as well but hesitates to advocate it without further examination, particularly because of the administrative burden it would place on NSF. [The National Science Board recently revised NSF policy to make verbatim reviews available to the principal investigators concerned and is considering the question of whether identities of reviewers should be made known on the same terms (*Science*, 11 July)].

Reaction on the subcommittee to Conlan's advocacy of opening up peer review

NSF Gains Social Sciences Champion

Richard C. Atkinson, who spoke for the defense at congressional hearings on the National Science Foundation's peer review system, is now, as deputy director, the highest ranking social scientist at NSF.

His installation on 2 June coincides with the agency's reorganization (*Science*, 25 July) which, among other things, raises the status of social science research by putting it in a separate directorate along with biological research. Atkinson, a research psychologist who will be interim head of the new directorate, believes the reorganization is a significant step toward placing social and behavioral sciences within the whole spectrum of science rather than subordinate to the hard sciences.

The NSF job is Atkinson's first venture into the federal bureaucracy. He comes to Washington from the chairmanship of Stanford University's department of psychology, from which he is taking a 2-year leave of absence. He has made significant contributions to cognitive theory, and his immersion in computerized mathematical models of learning and memory theory makes him about the hardest social scientist NSF could find—a circumstance that may be expected to quell the fears of those who are anxious for NSF to retain its emphasis on basic research.

Atkinson, 46, graduated from the University of Chicago at the age of 19 and obtained his Ph.D. from Indiana University. He has published prolifically and is active in the affairs of numerous associations, including the American Psychological Association, on whose board he served for 2 years. He was the founding editor of the *Journal of Mathematical Psychology* and is coauthor with his wife, Rita Atkinson, and E. R. Hilgard of a widely used textbook, *Introduction to Psychology*. He was elected in 1974 to the National Academy of Sciences.

The new deputy director is not one to let the grass grow under his feet. Within a week of his arrival he had spearheaded a major new initiative: a request to the National Academy of Sciences to undertake a study of NSF's programs of support for the social and behavioral sciences. The committee is now being assembled and Herbert Simon of Carnegie-Mellon has been unofficially selected as chairman. It will, over the period of a year and with a budget of $133,000, review NSF's current programs and recommend future priorities. Atkinson says that in-house studies on social science programs have been inconclusive and that it is time for an outside appraisal. The effort is also clearly aimed at bolstering NSF's position vis-à-vis congressional efforts to interfere with its grant-giving operations. Atkinson believes congressional criticism of NSF's peer review system is unjustified and that there is in fact "incredibly broad participation" in the evaluation of research proposals. The "new problem" for NSF, he says, is that whereas the agency in the past had strong support from the scientific community, scientists are blaming the peer review system when deserving proposals go unfunded. But the real villain is the budget.

Atkinson has already met with Senator William Proxmire (D–Wis.), the man who got the anti-NSF snowball rolling on the Hill, and they found they understood each other quite well. (One of Atkinson's graduate students is teaching sign language to a gorilla, which he thought amusing in view of the senator's derision of a project involving language behavior in chimpanzees.)

Youthful in manner and appearance, Atkinson strikes one as being the type who is regarded as a precocious young man until well into middle age. He is aggressive, and not invariably tolerant with those who don't see things his way (he is impatient with the educational community, for example, because, among other things, it has failed to perceive the value in computer-aided reading instruction, an area in which he has pioneered). So far, anyway, everyone seems to like him.—C.H.

was mixed. Representative Thomas R. Harkin (D–Iowa), a freshman member of Congress, expressed sympathy for the general principle of breaking up Old Boy's Clubs but pointed out that confidentiality prevails in other walks of life. He said, for example, that in the legal profession the identities of those who mark bar examinations are not revealed. And Harkin and other subcommittee members suggested that identifying peer reviewers might expose scientists to more severe pressures than those generated by the "buddy system."

In an appearance interrupted by calls of subcommittee members to the floor, Stever provided what was in effect the NSF rebuttal to the Conlan statement. Stever and other NSF officials took issue directly with Conlan's assertion that NSF program managers might arbitrarily discard certain reviews, insisting that a hard and fast agency rule requires that all reviews become part of the permanent record of a project.

Stever said he was submitting for the record the full files on ISIS and on another case which Conlan charged illustrates NSF's violation of its own prohibition against providing verbatim reviews to applicants. To Conlan's question of whether these files would include peer reviews, Stever replied that NSF would continue the practice of withholding peer review information from Congress "unless Congress changed the law."

To the question of whether scientists now participating in the peer review process would continue to write reviews if reviewer identities were revealed, Stever and other NSF officials responded that there was a difference of opinion on the matter and that no systematic effort to get a reading has been made.

Stever conceded that "isolated mistakes" have been made in the peer review process but argued that the important question is "whether the system is a strong one." He ascribed the mistakes to "administrative slippages" rather than breaches of integrity.

When Symington asked "how Congress can be reassured" about the workings of the system, Stever replied that checks can be made "statistically," by assembling data on questions such as whether some individuals are doing too many reviews and whether "top departments" are being treated too well. In addition, spot checks can be made on individual cases.

On the second day of hearings, Bauman appeared as a witness and urged strongly that a formal way be developed to give Congress "prior notification" when research projects are approved. He said, however, he was "not wedded" to the language of the Bauman amendment. Bauman expressed doubts that those involved in the "secret process" of peer review should be relied on exclusively by Congress for information on the process. He went on to assert that Congress has been remiss in monitoring NSF operations and that the authorizing and appropriations committee supervision of NSF "do not approach proper oversight."

Rep. John B. Conlan (R–Ariz.)

In other remarks, Bauman criticized NSF for a tendency to support orthodox scientists at the expense of potential innovators, indicating that he thought the agency should put more emphasis on basic research in hard sciences rather than make excursions into behavioral science research and education projects which have caused controversy. He suggested that NSF has favored the so-called centers of excellence too much and might get better results by shifting money to build up what, with an ironical twist, he called "centers of mediocrity."

The third day of hearings featured a statistical analysis of peer review transactions based on data from fiscal year 1974. NSF's new deputy director Richard C. Atkinson (see box) was the main witness for the agency during this phase of the hearings.

Atkinson said that, of 21,000 "actions" on project proposals during the year, about 49 percent were funded, although "usually in amounts lesser than requested by the principal investigator." He said that about 44 percent of the total got ad hoc reviews (written reviews); 28 percent, panel reviews; and 28 percent, both panel and ad hoc reviews. As a rule, physical science projects received ad hoc reviews, and life science and behavioral science reviews tended to receive panel reviews, more or less on the National Institutes of Health model. The general import of the analysis is indicated by the following excerpt from the testimony which Atkinson presented.

> In NSF's statistical studies of the distribution of research dollars by states, we have considered many other characteristics of the states. Some of these are reviewed in the report mentioned earlier. The picture that emerges is fairly clear. In general, the distribution of research funds is closely correlated with state characteristics, such as population, income tax revenues, doctoral scientists in the labor force, and so forth. There are three states—California, Massachusetts, and New York—which receive more NSF dollars than they should based on these criteria. However, when various measures of scientific excellence are examined, it is clear that these states are receiving fewer dollars than they qualify for based on their scientific merit. Obviously NSF's distribution of funds turns out to be something of a compromise between a state's population and its collection of scientific talent. NSF has no precise formula for making this compromise; rather the various forces operating on NSF have defined its policy. Whether this policy is correct may well be judged differently by different individuals.

Atkinson was representing NSF at a congressional hearing for the first time. He hasn't yet quite got the hang of giving the bland bureaucratic answer to the hostile query or of exploiting the fat, friendly question; some of the subcommittee members probably found this refreshing. Atkinson had been directly involved in the agency analysis of the peer review system and was thoroughly familiar with the figures. He was less successful, however, in dealing with questions from the subcommittee on the general operations of NSF.

Actually, this is not surprising. When subcommittee members asked specific questions about the rules under which NSF operates peer review, for example, veteran NSF officials had difficulty quoting chapter and verse. As one high-level staff member observed during a break, NSF administrators have depended as much on an "oral tradition" to transmit precedents and procedures to new staff members as on a body of written rules.

NSF for its first 25 years was a relatively small, intimate agency with a generally good reputation with both Congress and the scientific community. Until just a few years ago, the NSF director reviewed every grant award the agency made. NSF is too big for that now, and, after Watergate, it is too much for congressmen to assume that any government official's word is his bond.

The congressmen on the subcommittee appear to be a bit embarrassed that Congress hasn't done a more thorough job of oversight of NSF in the past and obviously intend to correct that. NSF officials, who are moving to tighten up NSF's administrative machinery, also seem aware that they will, henceforth, have to come up with better answers to congressional questions. The second week of hearings should continue the process of mutual education.

—JOHN WALSH