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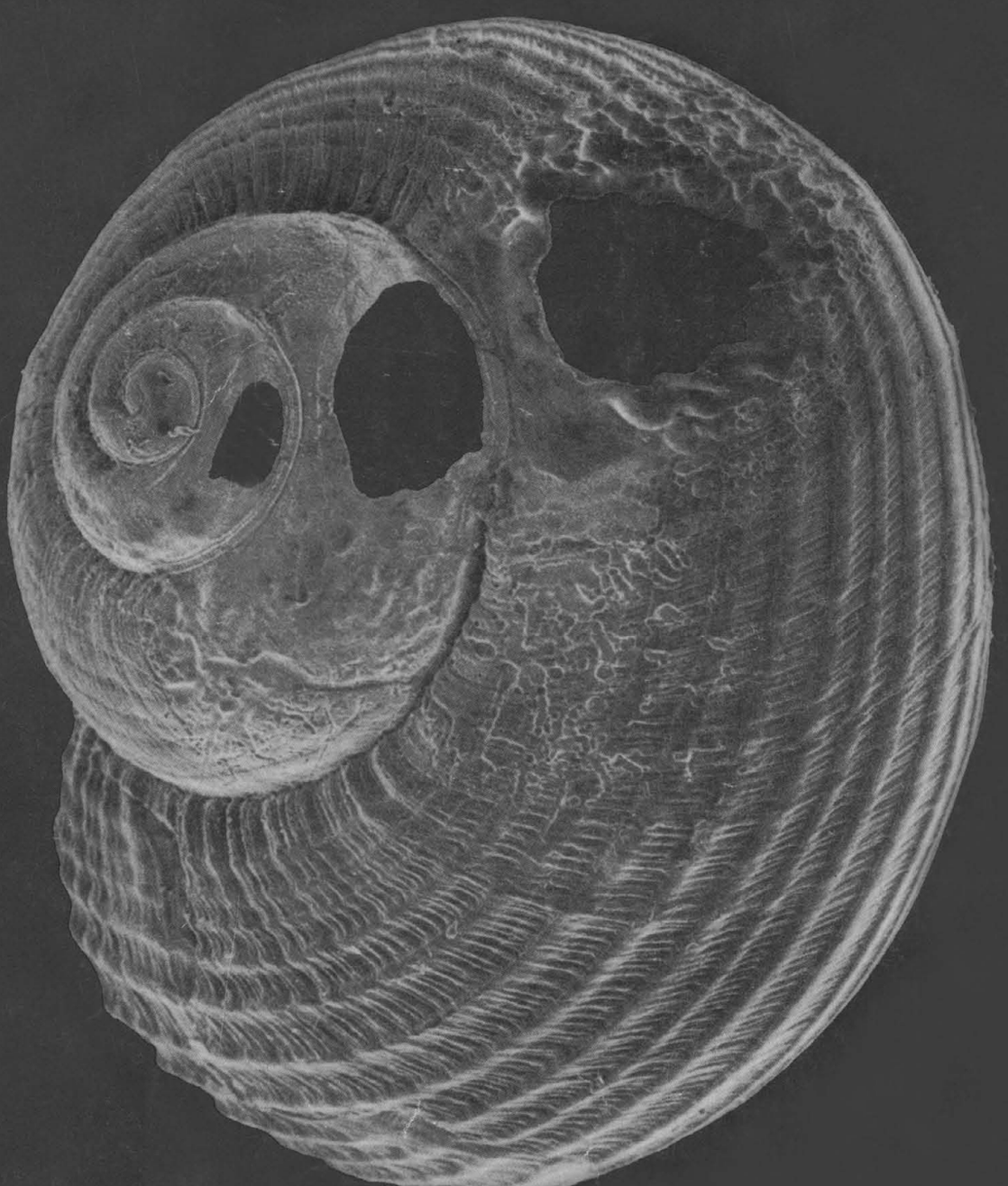

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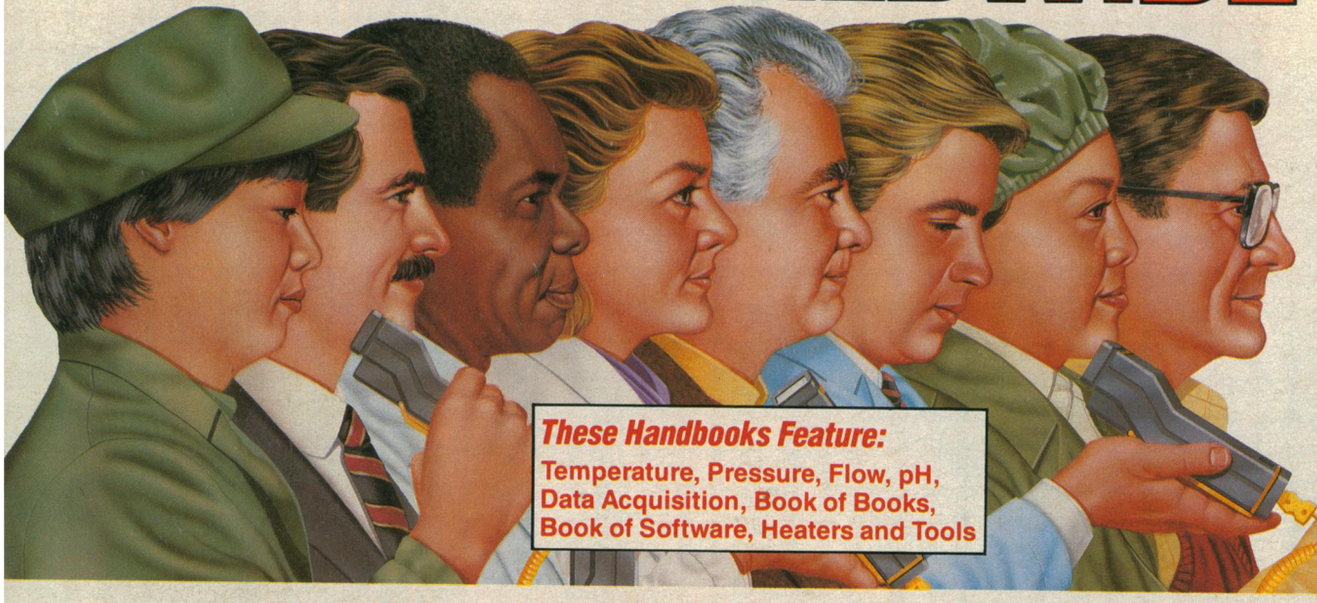

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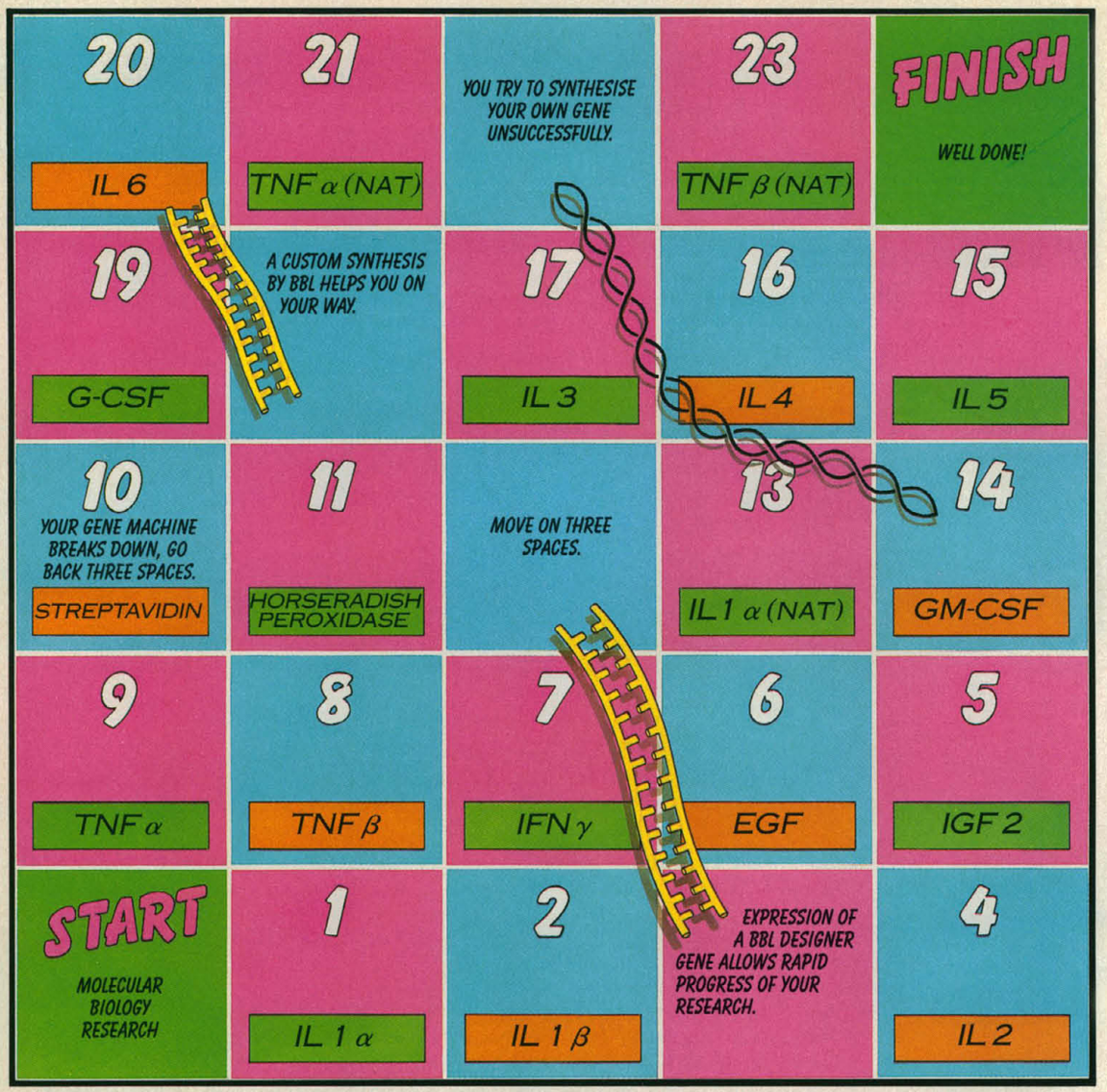
■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER A scanning electron micrograph of the shell of *Margarites sp.* recovered from the feces of *Asemichthys taylori*. The holes in the shell, produced by the vomerine teeth of the predator, allow digestive enzymes access to the body of the prey. The shell is approximately 2 micrometers in width. See page 92. [S. F. Norton, University of California, Santa Barbara, CA 93106, and T. Rice, Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138]

DESIGNER GENES FROM BRITISH BIO-TECHNOLOGY



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This Week in SCIENCE

Expert or not

EACH year, psychologists and psychiatrists participate in a million or more legal proceedings; many studies show that their professional judgments are no more accurate than are those of nonprofessionals. Furthermore, the opinions of both "experts" and others are less accurate than information from actuarial data that address the same difficult predictions (such as, is the accused likely to be a threat to society?) or retrospections (page 31). Faust and Ziskin conclude that time and money are wasted on such "experts" (although they could advise courts as to which cases might be addressed by certain actuarial data). These clinicians may actually interfere with the dispensing of justice, because a confident witness (whether accurate or not) can mislead a judge or jury.

Pliocene splash

AN asteroid with a diameter of at least 500 meters crashed into the Pacific Ocean in the Pliocene, about 2.3 million years ago; its explosive power may have been comparable to that of 12 gigatons of TNT (page 63). The location and magnitude of this impact, which did not produce a crater on the ocean floor, have been estimated by Kyte *et al.* from analyses of iridium in sediments and meteoritic debris in six deep sea cores. The impact occurred at about a time of glaciation in the Northern Hemisphere and may have contributed to climate change: enough water may have been injected into the stratosphere to enlarge high-altitude clouds, the earth's albedo would have increased, and snow cover may have expanded.

Under pressure

PLANETARY scientists and chemists are interested in how high pressures affect matter, geophysicists being particularly concerned with dynamical mechanical properties of compressed materials. A technique for studying high pressure effects is described by Brown *et al.*, who used laser pulses to initiate traveling sound waves in liquids; from measurements of the velocity of sound through the material, the equation of state (relations of pressure, temperature, and volume) of the substance could be calculated (page 65). The materials studied were ethanol, methanol, and olivine, but the technique should be useful in analyzing pressure effects on diverse liquids, crystals, and glasses.

Bona fide estrogen receptors

OSTEOPOROSIS is a disease that plagues postmenopausal women; as bone mass drops with aging, the skeleton becomes increasingly susceptible to fracturing. Because circulating estrogen declines after menopause, low estrogen levels have been implicated in the development of this disease, and estrogen therapy has been found to halt disease progression. Komm *et al.* and Eriksen *et al.* show that the estrogen effect is a direct one: there are estrogen receptors in the nuclei of bone cells (pages 81 and 84). In human bone strains and in human and rat bone cell lines, estrogen induced biologic responses that characterize estrogen target cells: expression of other genes that affect the synthesis and maintenance of bone was altered, and receptors for a second hormone (progesterone) were induced. In each system, the estrogen receptors and the messenger RNA molecules encoding them were detected.

Cell fates

NEURAL crest cells of salamander embryos can develop into nerve cells or skin pigment cells; signals from the environment through which the cells pass are important in determining what fate any cell will have (page 86). Perris *et al.* studied cells developing on artificial membranes that had been preconditioned in vivo and contained adsorbed environmental factors. Neural crest cells growing on membranes conditioned in a subepidermal environment dispersed and developed into pigment cells, much as occurs when pigments form in the skin. Cells growing on membranes conditioned in a preganglionic environment developed into neurons; their maturation involved aggregation resembling the coalescence of cells into nervous system structures like ganglia. The matrix materials may provide maturing cells with instructions for differentiation; alternatively, these factors may just promote the outgrowth of one subpopulation of cells.

Punch for lunch

THE hard shells of many gastropods make them difficult foods for most bony fishes that generally swallow their prey whole without chewing. An unusual adaptation has, however, been found in a species of fish that live in the Pacific Ocean between southeastern Alaska and Puget Sound and whose diet is predominantly gastropods (page 92). Norton describes modification of the vomer, a T-shaped skull bone with rows of sharp teeth that extends into the buccal cavity of the fish's mouth. The vomer is used for punching holes in the snail shell which, along with the operculum, acts as a barrier to digestion; the holes give the fish's digestive enzymes access to the soft meaty body parts of the gastropod. Snails whose shells have not been punched can emerge live in the fish's feces; the "free ride" given the snail as the fish swims through the ocean may assist sedentary species in moving to new habitats.

The bottom lines

Cells from the bone marrow that are the common progenitors of mouse T lymphocytes, B lymphocytes, granulocytes, and macrophages have been purified. Fewer than 50 of these pluripotent stem cells can save a lethally irradiated recipient by restoring blood and lymphoid cell populations (pages 24 and 58.)

POTAMKIN PRIZE FOR ALZHEIMER'S DISEASE RESEARCH

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The deadline for receipt of materials is November 1, 1988. No nomination will be considered unless it is complete. The awardee must be present at the AAN annual meeting in Chicago, Illinois, U.S.A., on Saturday April 15, 1989.

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SCIENCE

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The Howard Hughes Medical Institute

The Howard Hughes Medical Institute was born rich and has become richer. Like a child with a silver spoon in its mouth, the Institute spoke haltingly in its infancy, but recently it has discarded the spoon and is starting to speak eloquently. Last week the Institute announced a program in which it would give $30 million to 44 undergraduate institutions, 34 small liberal arts schools and 10 undergraduate black colleges. The program is both wise and timely and offers a constructive response to the chilling statistics on diminishing numbers of young people entering the sciences.

The burden of a large private philanthropic organization is enormous. It should provide innovative new programs because private organizations have a flexibility and freedom only infrequently available to consensus-driven public institutions. On the other hand it must avoid doing something different just to be different. The courage to be conventional and just do good is extremely important in a large foundation that must set standards of excellence.

The Hughes Institute gave money to good people at good institutions right from the beginning. Although that cautious approach was wise for a fledgling organization that did not wish to build up a large bureaucracy, it could hardly be described as innovative. Moreover, some of these early policies seemed to promote a musical chairs switching phenomenon and to drain scientists away from teaching.

Recently the Hughes Institute began to alter its policies, recognizing a key feature of education in the United States—the mutual benefit derived from professors being stimulated by bright young undergraduates and students being inspired by contact with the people who are actually working at the frontiers. Although the main emphasis is on medical research, this mandate is being interpreted more broadly. Hughes supports projects that keep research scientists in contact with students, and its rules allow investigators to carry out all professorial duties except administration. Now the foundation has stepped forth to articulate a creative new project aimed at enticing young minds into scientific fields through enhancement of the scientific environment in undergraduate colleges.

An important source of research scientists is small liberal arts colleges, which outdo their larger rivals in percentage of students going on to graduate and medical schools. Yet these small schools are having increasing difficulty in attracting scientific faculty and in keeping them both in touch with students and in touch with science. The Hughes program, by providing the wherewithal, enables these colleges to maintain modern facilities that not only attract young faculty, but also allow undergraduate students to experience scientific research directly.

Among undergraduate black colleges the need is even more acute. Only 10 percent of the doctorates awarded to black students go to those in the physical and biological sciences. Headlines citing the paucity of black scientific faculty frequently omit mention of the very small pool from which black faculty members must be selected. If there is to be any change in minority representation, increasing the size of the pool is the first and most essential step. A college environment that has an attractive and dynamic science department provides encouragement for students to enter research fields.

The Hughes initiative for small institutions is complemented by a graduate fellowship program that Hughes hopes to expand to 300 students in the early 1990s. Hughes has used the machinery of the National Research Council to select fellows, thus avoiding the need to develop a large infrastructure within its own organization. This program is conventional but needed.

It is good to see this extraordinarily wealthy infant growing up as a disciplined benefactor rather than a spoiled brat. It has shown the boldness to be traditional by supporting first-rate researchers and tried and true fellowships. It is now showing some of the innovativeness that is a particular responsibility of a private foundation in a democracy. There are some who say that money cannot bring happiness. That is a hypothesis that a lot of people might volunteer to test. Certainly those who receive the largesse of the Hughes Institute can manage to go through the motions of simulating happiness and the larger research community cannot help but rejoice that this large and powerful organization is developing into a constructive and imaginative force for science.

—DANIEL E. KOSHLAND, JR.

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Direct Action for Animal Research

We are writing to inform the scientific community of a recent event which marked a significant change in the climate surrounding the issue of so-called animal rights versus animal research at the University of California, Berkeley. Our organization, Association for Animals and Animal Research (AFA&AR) (*1*), staged a highly successful rally in support of the use of animals in basic research. The rally, or Celebration of Life and Health Day as we chose to call it, was held on 21 April, the day that the animal rightists designated as their direct action day on the Berkeley campus. We mobilized several hundred students, staff, and faculty of the Berkeley scientific community and walked through the center of the campus at midmorning on 21 April distributing fliers that supported the case for continued animal research. At noon, several speakers, including Steven Carroll, executive director of Incurably Ill for Animal Research, as well as several local faculty and students, addressed our celebration with short talks that clearly and effectively described how animal research has benefited both humans and animals and why continued research is absolutely necessary to maintain and improve the quality of life. Also emphasized were the ways in which animal research helps save endangered species. Among the examples cited was embryo transplantation in endangered mammals, a technique perfected in domesticated animals which is now helping to preserve certain rare species that are on the brink of extinction. This event was, to our knowledge, one of the first at which scientists and their supporting community have assembled in large numbers to counter the false claims of the antivivisectionists.

In recent years, animal rights activists have become more visible, vocal, and militant. With the increasing abusiveness of the activists toward animal researchers, terrorist attacks by the Animal Liberation Front, and growing support for their cause by some legislators, the scientific community is awakening. We are only now coming to the painful realization that these antivivisectionists are not going to fade away. It is time to organize and create an effective force to stem the tide of anti-intellectual, antiscientific, antihuman obscurantism that the animal rights activists are propagating. It is for this reason that we on the Berkeley campus formed AFA&AR (*2*).

In the short period that we have been in existence as an organization, we have had a significant impact on how the academic community and the local public view animal research. We have produced and distributed intelligible, straightforward, nonpolemical pamphlets and fliers that present the truth about animal research and challenge incorrect statements by the animal activists. We have learned that when we are dealing with activists and with the public, the most effective approach is not only to use rational dialogue, but also to make the topic emotionally appealing. We therefore show photographs of young healthy children, healthy elderly persons, healthy cats and dogs, and include a brief statement about how animal research has benefited them.

We urge our colleagues to join us in fighting back. Please contact us for information about how to become a member of our organization or to gain assistance in starting a similar organization at your college or university. We have literature, advice, and moral support to offer. We ask you to help us preserve the health and happiness that we and the rest of the earth's fauna enjoy today because of animal research.

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AFA&AR
c/o Department of Physiology-Anatomy, University of California, Berkeley, CA 94720

NOTES

1. Formerly UC Berkeley Students and Staff for Biomedical Research.
2. Our organization now has a membership of more than 300 students, staff, and faculty on the Berkeley campus and continues to grow daily.

The Nature of Whistle-Blowing

Daniel E. Koshland, Jr.'s, editorial on science, journalism, and whistle-blowing (29 Apr., p. 585) raises many important and complex issues. I offer comment on some of them.

Whistle-blowing is generally a hazardous occupation. Those who have blown the whistle responsibly in government or industry, after first trying to get action through channels, have commonly encountered harassment and obloquy and have sometimes lost their jobs, before being vindicated in the end (*1*). Some of the testimony at the hearings of the House subcommittee on 12 April described by Constance Holden (News & Comment, 22 Apr., p. 386) indicates that scientific whistle-blowers can suffer a similar fate, as the cases of Robert Sprague and Jerome Jacobstein, briefly described by Holden, show. It took Sprague 3½ years to get his charges against Stephen Breuning settled by a National Institute of Mental Health (NIMH) review committee, which concluded that "Breuning knowingly, willfully and repeatedly engaged in misleading and deceptive practices." Since Breuning's false reports were probably influential in promoting mistaken treatment of mentally retarded people, the delay in resolving the issue was regrettable. Sprague said that he had been made to suffer, in the investigation, fully as much as Breuning, but felt ethically obliged to continue. NIMH had supported Sprague's work for 16 years, but about the time of the verdict against Breuning it delayed renewal of Sprague's grant. Later it gave him 1/10 of what he had applied for for a single year. Sprague said that it was hard for him to believe that this was only a coincidence.

On the other hand, persons who are subjected to charges of fraud or misconduct need protection against adverse publicity while the case is still under review. This responsibility appears to have been violated in the current dispute over a controversial paper in *Cell* (*2*) discussed in Holden's article.

At the hearings there was a great difference between the character of the Sprague and Jacobstein cases, where the charges had been confirmed by an independent review committee, and the *Cell* case, in which no verdict had been reached. If this case was to come up at all—and a congressional hearing is hardly the place to resolve a highly technical scientific dispute—the authors of the paper deserved to be heard, along with their critics. The critics, O'Toole and Maplethorpe, testified, although they evidently did so reluctantly, by summons from the subcommittee. None of the authors was invited. This asymmetry of presentation appeared unfair and might even be considered a violation of due process. I offer the tentative judgment that the case involved a question of possible error, with a strong unwillingness to admit error on the part of an author. I cannot pass judgment on the matter, but the presence of the word "fraud" in the title of the hearings catches the public eye and tends to taint all such cases with an aura of suspicion, even if innocence is later established.

Scientists know that error is a normal part of scientific research at the frontiers of knowledge, where workers are frequently bewildered by strange findings that do not seem to fit into any existing scheme. They grasp at the best explanation they can find, and then sometimes cling to it stubbornly in the face of later, contrary evidence. This may be human weakness, but it is not miscon-

duct, and certainly not fraud. Great and honest scientists have sometimes clung to their own views on disputed subjects, while almost everyone else rejected them.

We need to provide better safeguards for the rights of both the whistle-blower and the accused, to set up hearing committees when the accusations are serious, with members who are expert in the field under discussion, and are also chosen to be as free as possible from conflict of interest with respect to the case. It would also help to reduce the pressures for publication that many young investigators feel and to reward them for quality, rather than frequency, of publication. The attitudes of senior investigators, who should (and commonly do) serve as role models for the young, are also vitally important in maintaining the honesty of science.

JOHN T. EDSALL
Departments of Biochemistry and Molecular Biology, Harvard University, 7 Divinity Avenue, Cambridge, MA 02138

REFERENCES

1. A. F. Westin, Ed., *Whistle-Blowing: Loyalty and Dissent in the Corporation* (McGraw-Hill, New York, 1981).
2. D. Weaver *et al.*, *Cell* **45**, 247 (1986).

Computer Searches

In response to the letter from Susanne Bennett Clark (29 Apr., p. 587), there is no need for a "routine" computer literature search to be "short term." The files that would normally be used to investigate animal studies are MEDLINE and BIOSIS, which are available on line from 1966 and 1969, respectively, therefore covering an adequate 22 and 19 years of scientific literature. It is not necessary for a researcher to search manually or "by hand," as these files are readily available and actually each can be searched in one single time segment. With the readily available technology, there is no need to duplicate animal studies or to be ignorant of those already accomplished; in fact, new legislation discourages that practice.

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Clark alludes to an increasing trend in which "young investigators" duplicate earlier published work because of their increased reliance on computer searches and zeal to publish and because, as a group, they show reluctance to search the literature "by hand." Without a doubt, duplication of research that results from failure to "peruse the stacks" is a problem. It applies, however, to the general scientific community and is restricted neither to junior researchers nor to those who work with animals. As Daniel E. Koshland, Jr., states (Editorial, 29 Apr., p. 585), "scientists respect integrity, scholarship, and good judgment as much as they abhor fraud, sloppiness, and poor judgment." Perhaps we in the scientific community should make a scholarly effort to determine the causes of and remedies to the problem, rather than assigning blame to narrow subsets of the population.

STEPHEN T. AHLERS
JOHN F. HOUSE
Environmental Medicine Department, Naval Medical Research Institute, Bethesda, MD 20814-5055

Erratum: In Eliot Marshall's News & Comment article "South Africa blocks AAAS visit" (29 Apr., p. 595), the National Medical and Dental Association was mistakenly named as being among the 17 organizations banned by the South African government on 24 February 1988. Among the organizations that were banned were the South African Trade Unions, the United Democratic Front, the Detainees' Support Committee, and the Detainees' Parents Support Committee.