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EDITORIAL

Reflections on the Environment

William K. Reilly, former administrator of the Environmental Protection Agency (EPA), can now speak bluntly about U.S. policies. He has been the Payne Visiting Professor at Stanford University. What follows is based on a lecture he delivered on 12 January 1994.*

The overall tone was that bad judgments have been involved in priorities allocated to environmental matters. Huge sums of money are being spent on hypothetical risks experienced by a few individuals while ecological matters affecting millions of people are not adequately addressed. One of Reilly's targets was the Congress:

Throughout the 1970s and 1980s, Congress constructed an arsenal of laws, typically in response to an episode of media attention and public alarm. ... Many of these laws addressed serious problems but they were typically conceived in isolation, and constructed without reference to other environmental problems or laws. ... No law ever directed that we seek out the best opportunities to reduce environmental risks, in toto; nor that we employ the most efficient, cost-effective means of addressing them.

A substantial portion of the lecture was devoted to risks. Risks involving technology over which the individual has no control are regarded by the public as most fearsome. The EPA adjusted its policies accordingly. When granting a tolerance for a new pesticide or an air pollutant, a lifetime risk of one in a million for cancer was the standard. Reilly mentioned a number of familiar risks that are greater. The hazard of death by lightning is 35 times as great; by accidental falls, 4000 times as great; and in a motor vehicle, 16,000 times as great. He emphasized that one in a million is a very remote risk.

Reilly indicated an open mind with respect to the validity of risk assessment procedures used by the EPA. He pointed out that in analyzing results from test animals the EPA was an order of magnitude more stringent than the Food and Drug Administration. He mentioned the fact that Bruce Ames has pointed to flaws in assumptions about human effects based on the incidence of tumors in mice and rats given huge doses of chemicals.

Reilly suggested that one way risk regulation might be improved would be to avoid basing it on the most exposed individual. The costs that society must bear to protect such individuals may be excessive:

Superfund has relied on different exposure assessments from other EPA programs, though it conducts its risk assessments similarly. The risks it addresses are worst-case, hypothetical present and future risks to the maximum exposed individual, i.e., one who each day consumes two liters of water contaminated by hazardous waste. The program at one time aimed to achieve a risk range in its cleanups adequate to protect the child who regularly eats liters of dirt. ... And it formerly assumed that all sites, once cleaned up, would be used for residential development, even though many lie within industrial zones. Some of these assumptions have driven clean-up costs to stratospheric levels and, together with liabilities associated with Superfund sites, have resulted in inner-city sites suitable for redevelopment remaining derelict and unproductive. The consequence, in New Jersey and other areas, has been to impose a drag on urban redevelopment in the inner city, and to push new industry to locate in pristine, outlying sites.

Reilly noted that costs of cleanup of federal facilities such as Department of Energy sites have been threatened with billions of dollars. He recommended that Americans ask themselves what they are getting from the existing federal facilities cleanup programs. He stated that risks attributable to contaminated underground water at some sites are negligible and no reliable assessments of risks to health and the environment have been conducted. He went on to say that there is now a need for developing new priorities and redeploying scarce budget outlays toward environmental problems that affect millions of people, like improving air quality and protecting coastal waters, the Great Lakes, Chesapeake Bay, the Gulf of Mexico, and other highly productive but imperiled natural systems on which we depend. Federal budget outlays for clean-up of contaminated federal facilities are out of control, ill-considered, and in need of a thorough review to base clean-up priorities on actual threats to people's health and the environment.

Philip H. Abelson

Our Competitors' Enzymes Can't Pass The Quality Testing Performed On Gibco BRL Restriction Endonucleases

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= One Failure

Summary: Seven out of ten restriction endonucleases from each competitor failed one or more of our quality tests.

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*Enzymes tested in the manufacturers' recommended buffers: BamHI, BglII, ClaI, EcoRI, HindIII, KpnI, NotI, PstI, SalI, and SstI (Svu)
ORI and Misconduct Investigations

The strong public support of biomedical research has been tested at times by serious allegations of misconduct by scientists conducting this critical research. These accusations of cheating (fabricating data, falsifying results, plagiarizing, and other dishonest types of behavior in conducting research) resulted in the Public Health Service (PHS) establishing the Office of Research Integrity to deal with these issues.

The Office of Research Integrity (ORI) was established independent of the agencies that fund research and further strengthened by federal law so that it could deal independently and fairly with the myriad of issues, allegations, and concerns about the integrity of research funded by the PHS.

Christopher Anderson’s 7 January article (News & Comment, p. 20) discusses criticisms of the office, mostly due to the results of the Gallo and Popovic cases. Although these cases enjoyed considerable notoriety, they are only 2 of the 22 cases in which ORI has found misconduct, 16 of which have been sustained. Even more important (to put these cases in context) is the fact that it was ORI that established the hearing process in response to concerns of the scientific community. While losing is never pleasant, it would be difficult to believe in an adjudication process that decided all cases “as guilty as charged.”

Many believe that we should not have pursued these cases. Had we not, the allegations as well as the scientific and legal issues raised in this process would not have been aired. The only way to deal with issues and problems is to confront them and bring them to resolution. I think the results of these cases are most significant in that they crystallized a number of issues, especially materiality and intent. We will be dealing with these issues in a number of ways, most notably through the new, statutorily mandated Commission on Research Integrity that will be fully operational in the near future and through the public rule-making process.

My chief concern about the Gallo and Popovic cases is that the media focus on them tended to obscure the broader, and probably more important, ORI mandate to see that all universities and other research institutions have in place an appropriate process to deal with accusations of misconduct in research funded by the PHS. The size and scope of the research effort make it critical that each institution be prepared to deal properly and effectively with such issues. Furthermore, those actually conducting research at individual institutions must take the lead in fostering integrity in research and dealing with misconduct. Within the limits of its budget, ORI supplements these “local” efforts with its own outreach and educational efforts, including an annual report and quarterly newsletter.

Neither ORI nor the scientific community can be thin-skinned or reluctant to deal with critical issues in a rational, straightforward manner. ORI will attempt to be as open, as ready for the rough-and-tumble of discussion and debate, and as fair to scientists and the public as possible. We seek to win no popularity contests with any part of the broad communities with which we deal. We do seek fairness and full public airing of issues and problems.

Lyle W. Bivens
Director, Office of Research Integrity, Public Health Service, Department of Health and Human Services, Rockville, MD 20852

Incorporating Minorities in Science

In the article by Karen Fox “A guide to minority aid from scientific societies” (Minorities in Science, 12 Nov., p. 1134), the American Society for Biochemistry and Molecular Biology (ASBMB) was cited as one of several societies that “offer no programs for minorities,” thus characterizing it as one that does “the least . . . for minority students and scientists.” These statements are incorrect. The ASBMB Council has been consistent in its support and generous in its allocation of resources for such efforts.

First, our standing Committee for Equal Opportunities for Minority Groups has sponsored programs and workshops at national meetings for about two decades. Second, 10 years ago, ASBMB pioneered the High School Teacher Research Fellowship Program, now also offered by other professional organizations. This program has as one of its top priorities the participation of teachers who are members of a minority group, or whose classes are largely made up of minority students. Up to 20% of the participants fit this description. Third, ASBMB organized groups of minority high school teachers in cities where its national meetings were held (some 80 teachers total) and provided 3 days of activities including...
lectures, workshops, receptions, and discussion groups. These teachers have been entering the Research Fellowship Program as regular applicants. Lastly, ASBMB has already met with other societies to discuss our activities and programs within the Federation of American Societies for Experimental Biology (FASEB).

The point should also be made that over the past 2 years ASBMB has taken a new approach in its support for members of minority groups. Special targeted programs, of the type highlighted in the article, can marginalize efforts and isolate the groups for which they are intended. Instead, ASBMB has gathered committees together toward the goal of making minorities and women full and equal participants in the society. We are taking a leadership position by promoting and sponsoring activities to incorporate, not isolate, members of minority groups.

David L. Brautigan*  
Martin Gellert†  
American Society for Biochemistry and Molecular Biology,  
9650 Rockville Pike, Bethesda, MD 20814

*Chairman, Human Resources Committee  
†President, ASBMB

Response: Incorrect information about the ASBMB in Fox's article was provided to Science by an ASBMB representative. We regret the error.—Eds.

Kenneth Olden's article "Bringing science back to the neighborhood" (Minorities in Science, 12 Nov., p. 1116) focuses on the fraction of participants in the National Institutes of Health's (NIH's) minority programs who enroll in medical school and become practicing physicians rather than pursuing Ph.D. degrees and research careers. Olden refers (although not by name) to the Minority Biomedical Research Support (MBRS) and Minority Access to Research Careers (MARCORD) programs and states that, according to NIH data, two-thirds of the students in these programs follow the path to medical school. One can, however, view the data differently. The data from NIH (1) also show that, in the 5-year period from 1985 to 1989, at least 132 African American or Hispanic former participants in the MBRS and MARC programs earned the Ph.D. degree in either chemistry or the biological sciences. When one considers that the nationwide total number of African American and Hispanic Ph.D. degree recipients in these fields for the same period was 576, it is apparent that these programs supported almost one-fourth (2) of these scientists at some point in their undergraduate or graduate training. It is doubtful that the minority programs of any other agency, government or private, could claim better results.

To be sure, we should continue working to encourage a larger fraction of MBRS and MARC students to pursue research, rather than medical careers, and we should recruit students who express this objective. However, once they are admitted to the programs, students cannot be forced to follow through. Exposing these students to the research endeavor reveals to them both its advantages and disadvantages. Thus, as pointed out in Koshland's accompanying editorial (12 Nov., p. 971) and in Elizabeth Culotta's article "Finding—and keeping—minority professors" (12 Nov., p. 1091), the tight job and grant situation in academic science as well as the professional and social problems encountered by minority professors will steer some of the research-oriented students away to medicine and other fields.

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In spite of these influences, the MBRS and MARC programs are clearly having a positive impact on the production of Ph.D. minority research scientists.

Robert M. Hoyte  
MBRS Program Director  
State University of New York,  
College at Old Westbury,  
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Old Westbury, NY 11568

Notes

1. Data from the Office of Program Analysis, National Institute of General Medical Sciences, and the National Academy of Sciences, Doctoral Records File.
2. Officials at the National Institute of General Medical Sciences indicate that because social security number data matched to the National Academy of Sciences doctoral record file is incomplete for early participants in the programs, this fraction is an underestimate.

I congratulate Science for its 1992 and 1993 issues on Minorities in Science, as I believe that this is the most challenging and important issue facing the biomedical community, now and in the future. The issues addressed, the individuals featured, and the general commentary on this problem were commendably appropriate.

I would like, however, to emphasize the lack of priority of these issues at some of our major institutions (often research universities), most often demonstrated by the lack of recognition of faculty (both tenured and nontenured) who are committed, devoted, and dedicated to these efforts. Although the efforts are not made for recognition, very often they act as an impediment to an individual's career, thereby serving as a disincentive. Most certainly under these conditions, the problem will not be solved, let alone even addressed.

The disappointing aspect of this is twofold. First it is a fairly well-recognized occurrence and therefore represents an issue that should be addressed. Second, it could be addressed in a straightforward manner if the traditional, change-resistant system in place at our institutions of higher learning were willing to make a change. The system needs to recognize that this is important for our faculty to do, especially when there are those who choose to make the major and important commitment that it takes to address this issue. As such, the presidents (who set the universities' mandates) and the provosts or vice presidents (in charge of academic affairs) must make the academic community, particularly the deans, chairs, and faculty, aware of the importance of this issue by assurances that these efforts will indeed "count" in promotions and other forms of advancement and recognition within the academic system.

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University of Michigan,  
Ann Arbor, MI 48109-0626

Daniel E. Koshland Jr.'s editorial "Minorities in science" (12 Nov., p. 971) makes two major suggestions: (i) that only a goal of a color-blind recruitment policy for science is ultimately morally justifiable and (ii) that the scientific community will benefit from increased minority representation primarily through an extension of the talent pool.

There is more to be said about the true activity and nature of the scientific community. Science is about vision and direction as much as it is about talent. Individuals who belong to cultural minorities possess slightly different concepts of the world, and these different concepts bring a valuable diversity into the vision of the scientific community.

We must integrate the potential critiques and novel perspectives of those individuals who are members of "marginalized voices" in American society: African Americans, feminists, homosexuals, and others. A diversity of cultural identities in science is invaluable in producing innovative and reliable knowledge.

Thomas Cameron  
Baird Research Group,  
Department of Chemistry,  
Cornell University,  
Ithaca, NY 14853

Triple Repeat DNA as a Highly Mutable Regulatory Mechanism

In a recent Perspective, "Molecular genetics of neurological diseases" (29 Oct., p. 674), J. B. Martin discusses several human diseases that develop when certain variable-length, repeated trinucleotide DNA sequences exceed their normal range, noting that disease severity and age of onset are correlated with the length of the triple repeat. In effect, the repeat length seems to regulate the expression of a disease state. Possibly this variation in repeat length has no effect unless a critical threshold is exceeded, with disease as its only consequence. But variation within the normal range might also be meaningful. What if the length of a triple repeat were correlated with the penetrance of some normal phenotypic trait? Could these diseases be revealing, in deleteriously exaggerated form, the expression of an unsuspected but normally advantageous regulatory mechanism?

If triple repeat length were to regulate the quantitative expression of an associated gene, then spontaneous changes in sequence length (by whatever process this
might occur) would provide generation-by-
geneneration variability in phenotype. The
resulting phenotypic variation would be
similar to that caused by recombination
among multiple loci with many alleles, but
would have a more efficient molecular basis.
One stable allele associated with a sponta-
nceously variable regulator would enable off-
spring to display a range of phenotypic
values around a parental mean.

Significantly, such a mechanism for
spontaneous, site-specific mutagenesis of
a regulatory sequence would enable even a
small population to extend its range of
phenotypic variation, for the affected trait,
within a few generations. Natural selection
could establish and maintain an optimal
trait distribution in a shifting environment,
with no delay for the mutation of Mendel-
lian genes or for the elimination of less fit
alleles. Yet maladaptive extremes of gene
expression would be unlikely to arise except
from parents who were themselves far from
the population mean, so genetic load would
be minimal (unless, of course, the mecha-
nism slipped out of control or exceeded
some threshold, as it may have in cases of
human neurological disease).

From an evolutionary perspective, non-
standard mutational mechanisms that affect
specific loci can offer substantial advantages
(1). The triple repeats that are widespread
among animal genomes might represent one
such mechanism. Testing the hypoth-
thesis that variable repeat length may regulate
quantitative gene expression will be chal-
lenging precisely because such sequences
are not stable from one generation to the
next. But understanding a mechanism that
could generate copious but normally benign
mutation might be worth the effort. After
all, it’s been more than a century since
Darwin promised that “a grand and almost
untrodden field of inquiry will be opened,
on the causes and laws of variation” (2).

David G. King
Department of Anatomy,
School of Medicine, and
Department of Zoology,
Southern Illinois University,
Carbondale, IL 62901-6503

References
(1993); R. E. Lenski and J. E. Mittler, ibid., p.
1959.
2. C. Darwin, On the Origin of Species (Harvard

Genetics and Violent Crime

Peter R. Breggin writes (Letters, 3 Dec.,
p. 1498) that there are no known bio-
ological or genetic factors that contribute
to violent crime. Yet it is well known,
even by most psychiatrists, that individu-
als with Y chromosomes commit the
overwhelming preponderance of violent
crimes.

I. Tinoco Jr.
Department of Chemistry,
University of California,
Berkeley, CA 94720–9989

Corrections and Clarifications

In the report “DNA sequence determination by
hybridization: A strategy for efficient large-
scale sequencing” by R. Drmanac et al. (11
June, p. 1649), the sequence of clone 8 in
figure 2B (p. 1650) was inadvertently short-
ened by the deletion of “GA” at the seventh
position from the right in the second line. In
reference 20 of the same report, the probes
ATATGGGG and ATGTCCTG should not
have been included.
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These products are sold under licensing arrangements with Roche Molecular Systems and The Perkin-Elmer Corporation. Purchase of these products is accompanied by a license to use them in the Polymerase Chain Reaction (PCR) process in conjunction with an Authorized Thermal Cycler.

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AAAS–Newcomb Cleveland Prize

To Be Awarded for a Report, Research Article, or an Article Published in Science

The AAAS–Newcomb Cleveland Prize is awarded to the author of an outstanding paper published in Science. The value of the prize is $5000; the winner also receives a bronze medal. The current competition period began with the 4 June 1993 issue and ends with the issue of 27 May 1994.

Reports, Research Articles, and Articles that include original research data, theories, or syntheses and are fundamental contributions to basic knowledge or technical achievements of far-reaching consequence are eligible for consideration for the prize. The paper must be a first-time publication of the author's own work. Reference to pertinent earlier work by the author may be included to give perspective.

Throughout the competition period, readers are invited to nominate papers appearing in the Reports, Research Articles, or Articles sections. Nominations must be typed, and the following information provided: the title of the paper, issue in which it was published, author's name, and a brief statement of justification for nomination. Nominations should be submitted to the AAAS–Newcomb Cleveland Prize, AAAS, Room 924, 1333 H Street, NW, Washington, DC 20005, and must be received on or before 30 June 1994. Final selection will rest with a panel of distinguished scientists appointed by the editor of Science.

The award will be presented at the 1995 AAAS annual meeting. In cases of multiple authorship, the prize will be divided equally between or among the authors.
Semiconductor lasers play a central role in many new technologies that are changing our everyday lives. About a decade ago they started to appear in commercial systems, including compact disc players and long-haul fiber telecommunication links. These devices were based on a semiconductor active medium (the portion of the device that imparts energy to the lasing mode by way of stimulated emission) having transverse dimensions comparable to the wavelength of light. By the time these so-called bulk or three-dimensional laser structures were introduced, however, they were recognized as only one possible branch in a hierarchy of laser structures based on the dimensionality of electrons in the active medium. Continuing improvements in crystal growth technology made possible a new class of ultra-thin active media in which electrons and holes are confined in one direction to sizes comparable to their de Broglie wavelength at the desired operating temperature (typically about 10 nanometers for room-temperature operation). The result is a structure with quasi-two-dimensional properties which, for electrons in most direct wide-gap materials, can be modeled using simple particle-in-a-well quantum mechanics; hence the name “quantum wells.” Quantum well lasers are semiconductor lasers that use these structures for their gain medium.

Because of the considerable advantages these devices offer over their conventional bulk counterparts, they are finding their way into many applications; they eventually could replace bulk devices everywhere. Quantum Well Lasers is the first book to review in detail the theory and properties of these important devices. It provides most of the physics needed to understand quantum wells at a basic level as well as how quantum wells affect laser performance. The editor has done an excellent job of holding the many contributors to a common theme and technical level. In addition, the chapters flow smoothly, with little overlap and few noticeable gaps.

The book’s introductory chapters provide the basic theory needed to understand and carry out calculations of optical gain spectra in quantum well active layers. A series of chapters then systematically reviews, among other things, threshold current and modulation dynamics (including the importance of carrier capture and escape processes) as well as the continued evolution of quantum wells to lower dimensions. Two chapters are devoted solely to the important topic of strained quantum wells. The book should be accessible to anyone who has had introductory courses in quantum mechanics and solid-state physics; however, a course in laser physics is advisable for full appreciation of the material. In addition, someone unfamiliar with the basics of III–V semiconductor crystal growth by molecular beam epitaxy or organometallic vapor phase epitaxy might benefit from a brief overview of these topics as a supplement to this book.

Quantum Well Lasers will be useful as a reference source or as an introduction for anyone who requires more than a superficial understanding of what makes quantum well lasers special.

Kerry Vahala
Department of Applied Physics,
California Institute of Technology,
Pasadena, CA 91125

Reprints of Books Previously Reviewed


Hibernation Induction Trigger for Organ Preservation. Sufan Chien and Peter R. Oeltgen. Landes, Georgetown, TX, 1993 (distributor, CRC Press, Boca Raton, FL). x, 118 pp., illus. $89.95. Medical Intelligence Unit.


The Pathophysiology of Schizophrenia. Ray S.
Medical Intelligence Unit.


Shikimic Acid. Metabolism and Metabolites. Ed. Haslam. Wiley, New York, 1993. xii, 387 pp., illus. $120.


Until the Cure. Caring for Women with HIV. Ann Kurr. Yale University Press, New Haven, CT, 1993. xiv, 327 pp., illus. $40; paper, $16.


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