American Association for the Advancement of Science

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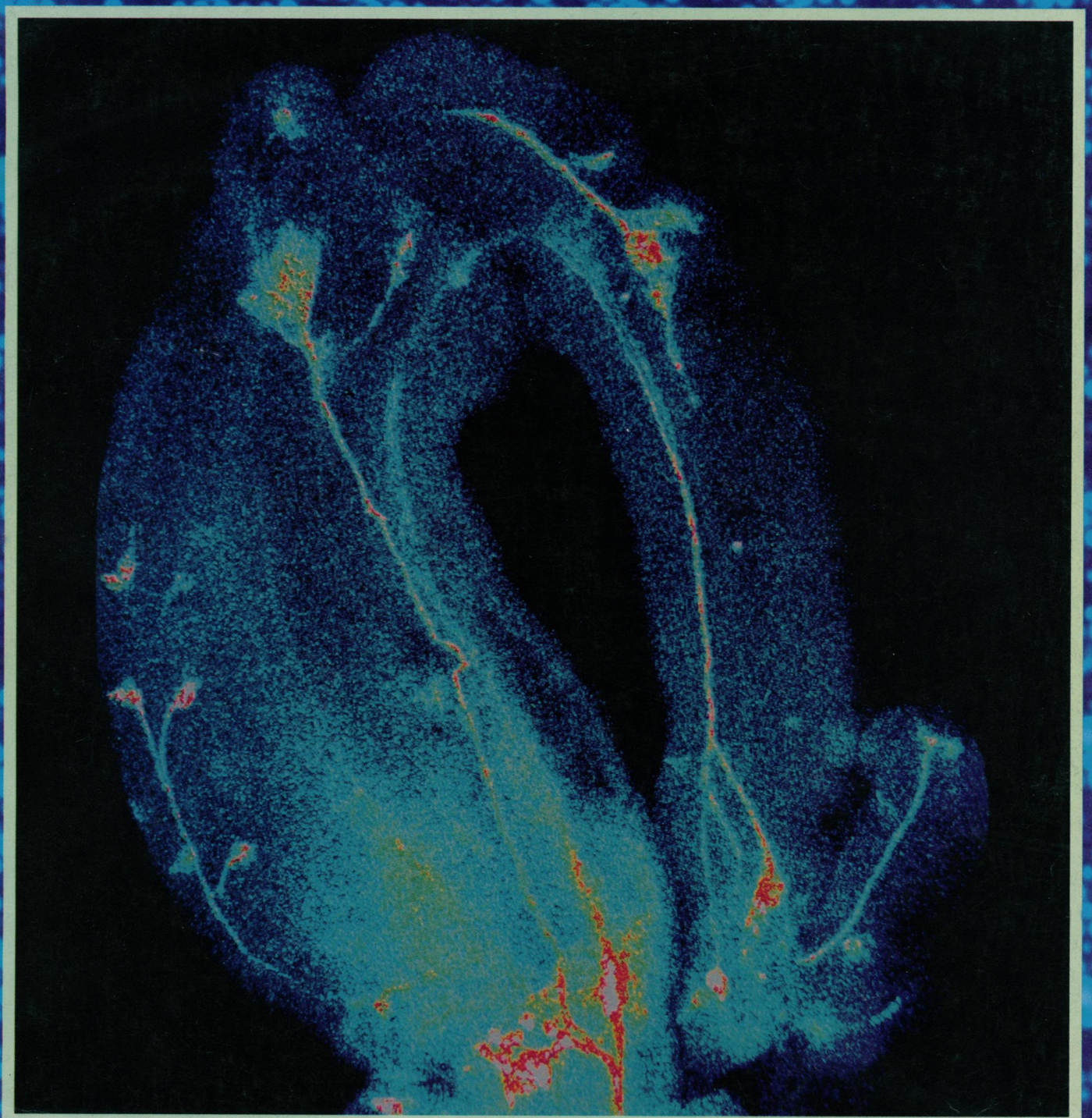

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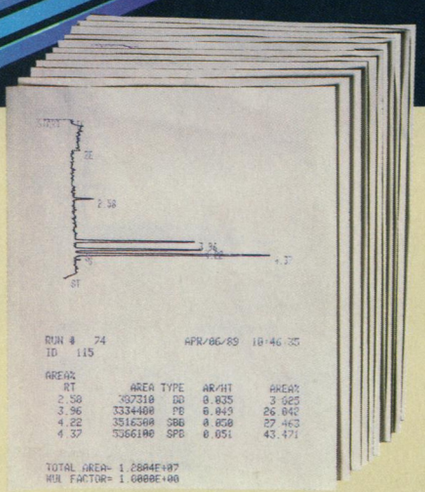

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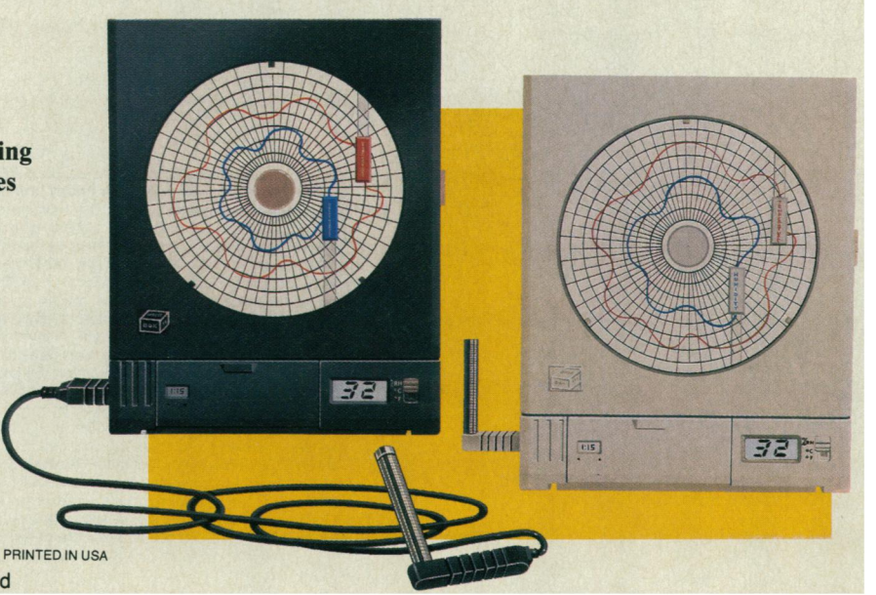

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■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve 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 An embryonic grasshopper jumping leg imaged in a laser confocal scanning microscope, computer-enhanced, and pseudo-colored. The developing nervous system is labeled with fluorescent, neuron-selective antibodies. A major leg sensory nerve (far right) has failed to connect to the central nervous system because of the absence of a single pair of pioneer neurons. See page 982. [Photograph by Monika Klose, David Bentley, and Janet Duerr]

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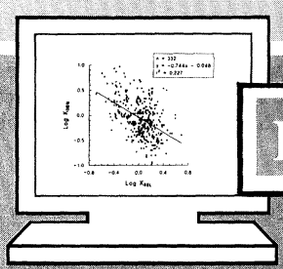

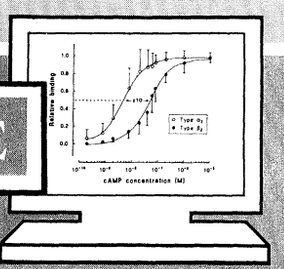

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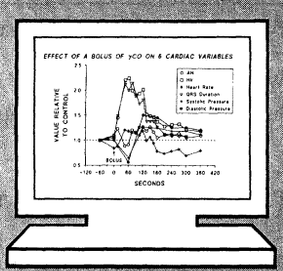

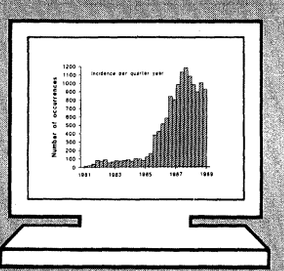

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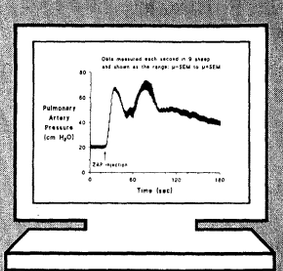

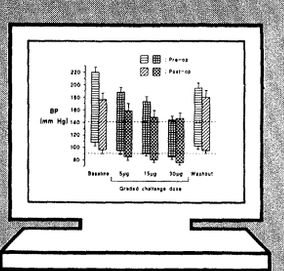

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This Week in SCIENCE

Voyager at Neptune

ALMOST 150 years have passed since the existence of the planet Neptune was predicted mathematically and confirmed telescopically. Now the giant blue planet has been observed at incredibly close range: on 24 August, the Voyager 2 spacecraft, which left Earth 12 years ago, flew within 3000 miles of Neptune. Writing from mission headquarters at the Jet Propulsion Laboratory, Kerr reports on the latest discoveries in this remarkable NASA venture (page 928). Voyager cameras and remote sensing equipment have provided new and confirmatory information about Neptune's atmosphere and rock-ice interior, its rings, its moons (one of which, Triton, is unique among known moons in orbiting in a direction opposite to the direction that the planet rotates), its magnetic field, and its Great Dark Spot (a gigantic storm system in the southern hemisphere). The data collected during the close encounter should provide new insights into the evolution of the Neptune system.

Archean impact debris

IN South Africa's Barberton Greenstone belt there are large layers of tiny spheres the size of sand (page 959). Based on their geochemical properties, textures, distributions, and compositions, Lowe *et al.* credit formation of these "debris blankets" to impacts by large meteorites during early Archean time (about 3.4 billion years ago). The spherules are enriched in the element iridium, which is associated with extraterrestrial material and impact deposits, and their content of some of the noble metals resembles that found in certain stony meteorites called chondrites. The spherules could have formed as condensates in a vapor cloud derived from the meteorite and the target rocks. The thicknesses and extents of the spherule blankets suggest that the Archean meteorites were very large, perhaps with diameters up to 50 kilometers. This is the oldest geologic record of meteorite impacts, which, during the early evolution of the earth, were much more frequent events than they are today.

Malaria vaccine setback

NEWLY discovered heterogeneity in the human malaria agent *Plasmodium vivax* will add further complexity to the development of an effective malaria vaccine (page 973). A key candidate for malaria vaccines has been a nine–amino acid repeating segment of the parasite's major surface protein, the circumsporozoite (CS) antigen; the nonapeptide has generally been found to be conserved among isolates, is repeated often in the CS molecule, and is able to elicit immune responses. However, Rosenberg *et al.* report that, in a western province of Thailand, over 14% of sampled malaria parasites had a different nonapeptide. These novel organisms evade detection by tests based on the standard nonapeptide and make counts of malaria-infected mosquitoes inaccurate; furthermore, no protection against these strains is likely to be provided by a vaccine elicited against the standard nonapeptide.

Pioneer neurons

PIONEER neurons in developing insect embryos establish preliminary nerve pathways to the central nervous system from distant parts of the body; later, growth cones that will produce mature nerves traverse this rudimentary route and establish a permanent pathway, and the pioneer neurons disappear. Klose and Bentley show that the pioneer pathways are absolutely essential for the development of mature nervous pathways: inhibition of differentiation of pioneer neurons in developing grasshopper limbs blocked development of the dorsal nerve pathway but not the development of the limb itself (page 982). Growth cones that produce pioneer neurons are apparently able to cross the tibia-femur boundary freely whereas those that will produce mature neurons cannot; the high affinity that boundary cells develop for growth cones (and which inhibits migration) may only be fully expressed after the pioneer growth cones have migrated. Are pioneer neurons found in the nervous systems of higher mammals? McConnell *et al.* found that the subplate neurons in the developing cortex of the brains of cats and ferrets fit the profile of pioneer neurons (page 978): axons from subplate neurons invade the thalamus early in fetal life; after birth, when the adult pattern of neuronal circuitry is fixed, most of the subplate neurons disappear. The pioneer neuron strategy—acting when distances are short and tissues are simple and can be traversed—may be a common feature of diverse nervous systems.

Cat naps

CATS that are wide awake can fall into REM sleep (the rapid eye movement form of sleep during which dreaming occurs) in a matter of minutes as a result of injections of the substance carbachol. Carbachol activates the cholinoceptive class of nerve cells, none of which are actually situated in the sleep-wakefulness center of the brain. However, axons of these cells terminate in this center, and therefore a retrograde tracer that enters the terminals and travels back to the cell bodies can be used for locating such cells. The mapping of nerve cells involved in inducing REM sleep was accomplished by Quatrocchi *et al.* with a marker composed of carbachol linked to fluorescent latex microspheres (page 984). Like free carbachol, the complex was a potent sleep inducer; unlike free carbachol, the complexes were reliable as labels, diffusing little from injection sites. Nerve inputs to the sleep-wakefulness center emanated from widely distributed networks in the pontine tegmentum of the brain stem. The correlation of REM sleep induction with the neuroanatomy and neurophysiology of the brain is a step toward defining what biochemical and electrochemical processes bring about sleep and wakefulness.

■ RUTH LEVY GUYER

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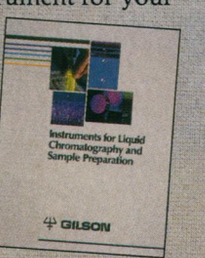

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SCIENCE

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AAAS Presidents

Throughout its 141-year history, AAAS has been blessed with exceptionally distinguished leadership in the office of its president. Instead of an inaugural address by the incoming president, however, AAAS has adopted the custom of having the president give a major speech during the annual meeting that concludes his or her presidency. In most cases the president's address has subsequently been published in *Science*. This issue contains the address delivered by Walter Massey in San Francisco this past January.

It is noteworthy that both Massey and his immediate predecessor, Sheila Widnall, chose as themes for their presidential addresses the combined issues of education and human resources. Widnall's address [*Science* **241**, 1740 (1988)] focused on "who will do science" and made the telling point that increased participation of women is a critical factor if the United States is to have adequate numbers of outstanding scientists and engineers in the future. In that regard, Widnall's article is worth rereading because she identified critical points in the so-called pipeline where intervention strategies would have the most leverage. She also reported data showing how our educational system works to lower the self-esteem of women compared to men as both groups move from high school through college, even when the women, by objective measures, are more academically capable. Widnall identified such "environmental issues" as constituting significant impediments to increasing the future participation of women. Unfortunately, these environmental issues have not received adequate attention from the academic community.

In his presidential address, Massey broadens the argument to include other underrepresented groups, as well as education at all levels for all students, not just those interested in careers as scientists or engineers. He also notes the sorry state of scientific literacy among U.S. adults and correctly pinpoints this as a likely handicap to the future competitiveness of the United States.

A number of programs have been established in the past to address some of these issues. For example, the National Science Foundation and the Department of Education have had activities, some in place for many years, aimed at improving both formal and informal education, boosting scientific literacy, and increasing participation of underrepresented groups. Yet the evidence shows that the scientific literacy of the U.S. adult population has not sensibly changed over a period of 30 years. Similarly, how are past efforts aimed at increasing minority participation to be judged when fields like physics produce a handful or less of black Ph.D.'s each year? In fact, the numbers are so small for a country of our size that it is arguable whether we would get the same results even without special programs. Thus, Massey calls on every school in the United States with Ph.D. programs to commit to doubling "plus one" the number of black Ph.D.'s during the next 6 years. Why the "plus one"? Because, according to Massey, in most cases "the initial number would be zero, so that doubling it would be meaningless."

It would seem that it is time for some new ideas and new approaches. Massey calls for "bold new initiatives" on the part of the scientific and technical community to demonstrate that they care enough about the education issue to get their own hands dirty. Massey argues that only then is it likely that the rest of the U.S. public will support other needs of the scientific community. Massey makes some specific recommendations, such as commitment by AAAS and Sigma Xi members to work a certain number of hours each week with local schools and museums. And he proposes that faculty members make a pledge to cut in half the attrition among students who plan technical majors.

Given the now familiar statistics—and the immutable nature of demographics—it is clear that improved education and better use of human capital are not transient issues. Recognizing this, the AAAS Board of Directors recently gave this area top priority for AAAS in the years ahead. In so doing, the board is hopeful that the scientific and technical community in this country will make a renewed commitment to effecting change. Taking on some of Walter Massey's challenges would be an excellent place to start.

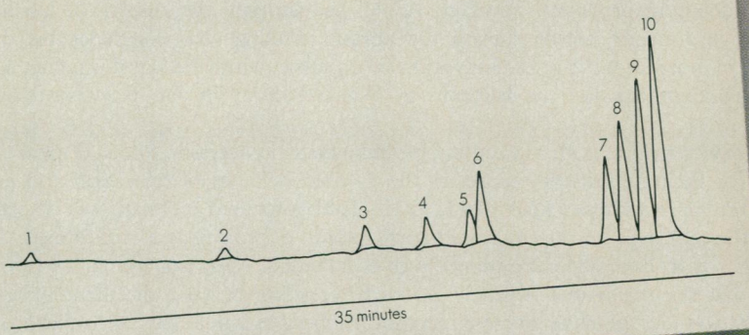
—RICHARD S. NICHOLSON

Nucleic acid analysis

Sample: Hae III Digest of ΦX
Column: Gen-Pak™ FAX (4.6mm x 100mm)
Detection: UV at 260nm
Eluent A: 100mM Tris/Cl, pH8.0, 1mM EDTA
Eluent B: 100mM Tris/Cl, pH8.0, 1mM EDTA, 1M NaCl

Fragment size

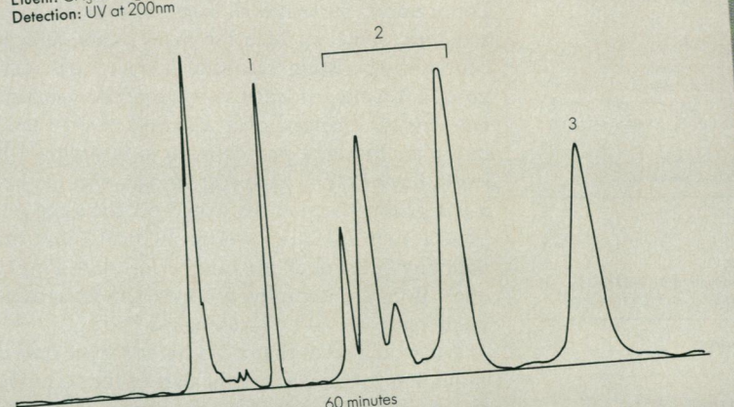
1) 72	6) 281,310
2) 118	7) 603
3) 194	8) 872
4) 234	9) 1078
5) 271	10) 1353



Carbohydrate characterization

Sample: Mixed neutral oligosaccharide standards
Column: Glyco-Pak™ N (7.8mm x 300mm)
Eluent: CH_3CN/H_2O (68:32) (v/v)
Detection: UV at 200nm

1. N-acetylglucosamine
2. biantennary complex
3. high mannose (MAN9)



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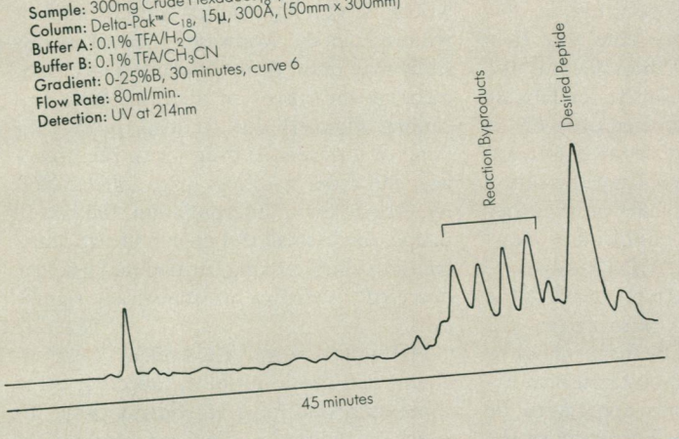
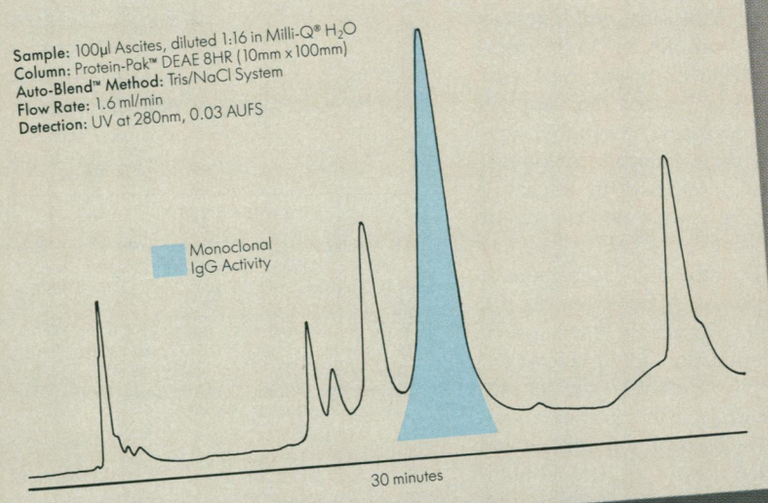
Peptide scale-up

Sample: 300mg Crude Hexadecapeptide
Column: Delta-Pak™ C_{18}, 15µ, 300Å, (50mm x 300mm)
Buffer A: 0.1% TFA/H_2O
Buffer B: 0.1% TFA/CH_3CN
Gradient: 0-25%B, 30 minutes, curve 6
Flow Rate: 80ml/min.
Detection: UV at 214nm



Protein purification

Sample: 100µl Ascites, diluted 1:16 in Milli-Q® H_2O
Column: Protein-Pak™ DEAE 8HR (10mm x 100mm)
Auto-Blend™ Method: Tris/NaCl System
Flow Rate: 1.6 ml/min
Detection: UV at 280nm, 0.03 AUFS



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nonhousehold members, perhaps drug users, with a high prevalence of AIDS and a distinct distribution of AIDS cases. If the two populations are wholly isolated from each other, with no one in the first group knowing anyone in the second group, our procedure will miss all those AIDS cases in the second population and thus misspecify the overall distribution of AIDS cases. But if, instead, the two populations fully comingle, our procedure can accurately capture the overall distribution of AIDS cases.

The truth surely lies somewhere between these two extremes. For the case in hand we believe, for two reasons, that we have probably captured most but not all of the distribution of AIDS cases among those nonhousehold populations. First, there is no evidence that the social networks of persons with AIDS are so unlike persons without AIDS that they will differentially appear in the network reports from a general population sample. While persons in the crisis stages of drug use or a fatal disease may not be able to sustain extensive social ties, this does not mean that in relatively recent periods they were atypical members of society in terms of their social bonds to family, friends, neighbors, or workplace acquaintances. The advantage of the network approach is that it does not depend on the immediate accessibility of an individual to a scientific observer for his or her behavior to be reported. Second, the General Social Survey (GSS) is estimated to include 95% of the population resident in the United States in its targeted universe.

Berkelman *et al.* report that there is substantial evidence of undercounting of AIDS and HIV-related morbidity among intravenous drug users (IVDUs), minority women, and children. Indeed the recent report of the Government Accounting Office (*1*) suggests more generally that the undercount of AIDS cases may approach 40%. This is an estimate based on those populations in urban centers where there are the most cases and the greatest effort devoted to their ascertainment. Given the size of the undercount in those places where there are many AIDS patients and a sensitized reporting system, surely one can expect that many cases will slip through the net in those places outside the epicenters of the epidemic. It is this imperfection of the decentralized monitoring system which may be the source of the undercounting of cases which the network procedure finds in the Midwest.

The other comments by Berkelman *et al.* surely have merit, but their import rests on the interpretation of the glass being half empty or half full. We see the similarity of official statistics and our estimates on homicide as reassuring, but as Berkelman *et al.* rightly say, they are not exactly identical. That can raise doubt, as it does for them, just as the overall similarity raises confidence, as it does for us.

In short, we would not argue, and indeed do not suggest, that our procedure should replace the CDC surveillance system; but we do suggest that it—like the important evidence cited by Berkelman *et al.* about incidence of HIV infection in blood samples—offers a means for validating or raising concerns about the details of the CDC statistics on this very important topic. One way to do this would be to collect similar data using large samples with more attention given to issues of network size and composition. We are attempting to do this by including network questions in the GSS for 1989 to 1992.

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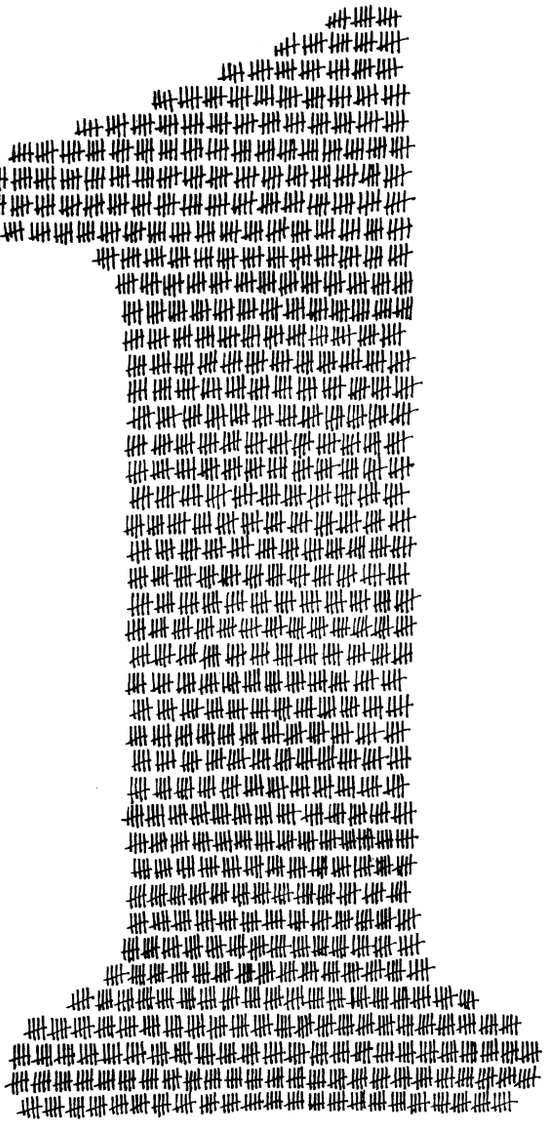
creased only among animals in the highest dose group in the Uniroyal bioassay, will be detected at the end of the study in the lower dose groups as well, and risk estimates based on subsequent findings could be one or two orders of magnitude greater than the risk estimates based on the interim study results (*19*). In other words, the agency's final revised q_1* may be similar to the agency's previous q_1* used by NRDC.

ROBIN M. WHYATT*
Natural Resources Defense Council, 40 West 20th Street, New York, NY 10011

REFERENCES AND NOTES

1. *Intolerable Risk: Pesticides in our Children's Food* (Natural Resources Defense Council, New York, 1989).
2. Environmental Protection Agency, press release, 16 March 1989.
3. ———, *Fed. Reg.* **53**, 41101 (19 October 1988).
4. Office of Pesticides and Toxic Substances, "Memorandum—Daminozide special review—Phase III 1986 Uniroyal market basket survey" (Environmental Protection Agency, Washington, DC, 18 May 1986). EPA also relied on the 1985–1986 market basket survey results to conduct its latest (February 1989) carcinogenic risk assessment for UDMH.
5. UDMH residues in apple products used in the NRDC study were 2 ppb in apples, 14 ppb in apple juice, and 23 ppb in applesauce. (Levels were higher in juice and sauce because breakdown of daminozide into UDMH is accelerated by heat processing.) There is no tolerance level for UDMH. EPA generally sets tolerances only for parent compounds and not metabolites or breakdown products.
6. Office of Pesticide Programs, *Daminozide Special Review Technical Support Document—Preliminary Determination to Cancel the Food Uses of Daminozide* (Environmental Protection Agency, Washington, DC, May 1989).
7. Human Nutrition Information Service, *CSFII—Nationwide Food Consumption Survey: Continuing Survey of Food Intakes by Individuals, Women 19–50 Years and Their Children 1–5 Years, 6 Waves* (U.S. Department of Agriculture, Washington, DC, 1985).
8. Apple consumption contributed approximately 74% of the UDMH risk identified by the NRDC study.
9. Office of Pesticide Programs, "Tolerance assessment system routine chronic analysis, UDMH in Alar, children (1–6 yr. olds)" (Environmental Protection Agency, Washington, DC, 6 February 1989).
10. Some of the difference between NRDC and EPA estimates is due to the fact that daily exposure during the 6th year is lower than during earlier years, thus reducing the average daily exposure compared to average exposure for ages 1 to 5.
11. Office of Pesticide Programs, *List of Oncogenic Compounds and Suspects* (Environmental Protection Agency, Washington, DC, 17 February 1987).
12. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel, "Review of a set of scientific issues being considered by EPA in connection with the special review of daminozide" (Environmental Protection Agency, Washington, DC, 4 October 1985).
13. W. Pepelko, "Memorandum—evidence for carcinogenicity of 1,1-dimethylhydrazine (DMZ)" (Carcinogen Assessment Group, Environmental Protection Agency, Washington, DC, 9 January 1987).
14. Office of Health and Environmental Assessment, *Health and Environmental Effects Profile for 1.1-Dimethylhydrazine* (600X-84/134, Environmental Protection Agency, Washington, DC, January 1984).
15. D. S. Goldman, "Review of the audit conducted by Uniroyal Inc. on the carcinogenicity study of 1,1-dimethylhydrazine (unsymmetrical) conducted in Swiss mice at Eppley Institute for Research in Cancer and Allied Diseases," (Environmental Protection Agency, Washington, DC, 11 September 1985); Office of Pesticides and Toxic Substances, "Report of the audits of the studies on the carcinogenic potential of succinic acid 2,2-dimethylhydrazine (daminozide) and 1,1 dimethylhydrazine in Swiss mice conducted at the Eppley Institute, the University of Nebraska Medical Center, Omaha, Nebraska, audits conducted January 21–24" (Environmental Protection Agency, Washington, DC, 1985); D. G. Goodman, "Review of blood vessel neoplasms and neoplasms of lung, kidney, and liver in Swiss mice administered 1,1 dimethylhydrazine in drinking water" (prepared for the Dynamac Corporation, Rockville, MD, 29 August 1985).
16. C. DeRosa, "Memorandum—Uniroyal, Inc., Comments on 1,1 dimethylhydrazine" (Environmental Protection Agency, Washington, DC, 10 October 1985).
17. International Agency for Research on Cancer, *IARC Monograph, Suppl. 7* (1987); *Fourth Annual Report on Carcinogens* (Department of Health and Human Services, Washington, DC, 1986).
18. Environmental Protection Agency, *Fed. Reg.* **54**, 6392 (10 February 1989).
19. *IDRC 2-Year Oncogenicity Study in Mice* (IRDC 399-065, International Research Development Corp., Mattawan, MI, 12-month interim).
20. Office of Pesticide Programs, "Daminozide briefing paper" (Environmental Protection Agency, Washington, DC, 12 December 1988).

*Cosigners: Bradford H. Sewall, Natural Resources Defense Council, 90 New Montgomery, San Francisco, CA 94105; William J. Nicholson, Division of Occupational and Environmental Medicine, Mount Sinai School of Medicine, New York, NY 10029; Ian C. T. Nisbet, I. C. T. Nisbet and Company, 72 Codman Road, Lincoln, MA 01773–3701; Marvin Schneiderman, Mount Desert, ME 04660-423.



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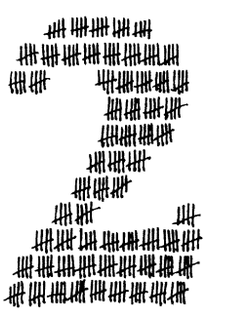

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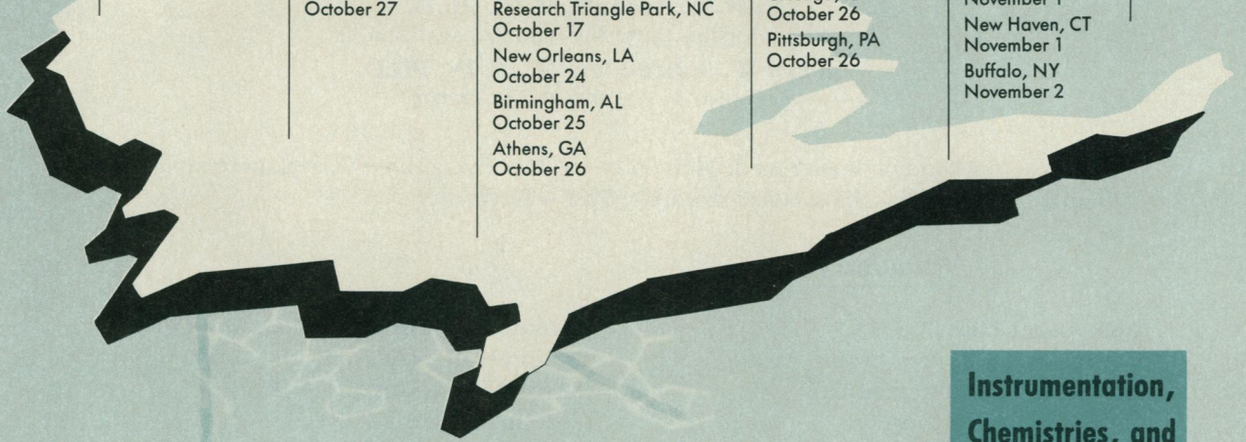

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Monday, October 23, 1989

SESSION I

JOSEPH L. GOLDSTEIN, Presiding Scientific Advisory Board Member

8:30 **JACK S. JOSEY**, President, Welcoming of Guests
8:35 **JOSEPH L. GOLDSTEIN**, Introductory Remarks

PROTEIN TRANSLOCATION ACROSS MEMBRANES
8:45 **GÜNTER BLOBEL**

THE SORTING OF RESIDENT ER PROTEINS FROM SECRETED PROTEINS
9:30 **HUGH PELHAM**

PROTEIN TRANSPORT IN THE GOLGI
10:45 **JAMES ROTHMAN**

TRANSLOCATION OF PROTEINS ACROSS MITOCHONDRIAL MEMBRANES
11:30 **GOTTFRIED SCHATZ**

SESSION II

GEORGE PALADE, Presiding Chairman

1:30 Introductory Remarks by **GEORGE PALADE**

FOLDING AND SHEPHERDING OF PROTEINS TO THE CELL SURFACE
1:45 **JOSEPH F. SAMBROOK**

RECEPTORS THAT MEDIATE ENDOCYTOSIS
2:30 **MICHAEL S. BROWN**

ROLE OF MANNOSE 6-PHOSPHATE RECEPTORS IN LYSOSOMAL ENZYME TARGETING
3:45 **STUART KORNFELD**

STRUCTURE/FUNCTION STUDIES ON MEMBRANE GLYCOPROTEINS FROM HUMAN CELLS, TRYPANOSOME SURFACE, AND INFLUENZA VIRUS
4:30 **DON C. WILEY**

Tuesday, October 24, 1989

SESSION III

KONRAD BLOCH, Presiding Chairman

8:30 Introductory Remarks by **KONRAD BLOCH**

THE ADRENERGIC RECEPTORS
8:45 **ROBERT J. LEFKOWITZ**

G PROTEINS AND REGULATION OF ADENYLYL CYCLASE
9:30 **ALFRED G. GILMAN**

INOSITOL LIPIDS AND CELL SIGNALLING
10:45 **MICHAEL J. BERRIDGE**

NON-RECEPTOR PROTEIN-TYROSINE KINASES AND SIGNAL TRANSDUCTION
11:30 **HIDESABURO HANAFUSA**

SESSION IV

DANIEL KOSHLAND, Presiding Chairman

1:00 Introductory Remarks by **DANIEL KOSHLAND**

FROM PHYSICAL CHEMISTRY OF DNA TO GENES CODING FOR ION CHANNELS
1:15 **NORMAN DAVIDSON**, 1989 WELCH AWARDEE

MOLECULAR INSIGHTS INTO THE FUNCTION OF IONIC CHANNELS
2:15 **SHOSAKU NUMA**

FROM PHOTON TO NERVE IMPULSE
3:30 **LUBERT STRYER**

HOW BACTERIA THINK
4:15 **MELVIN SIMON**

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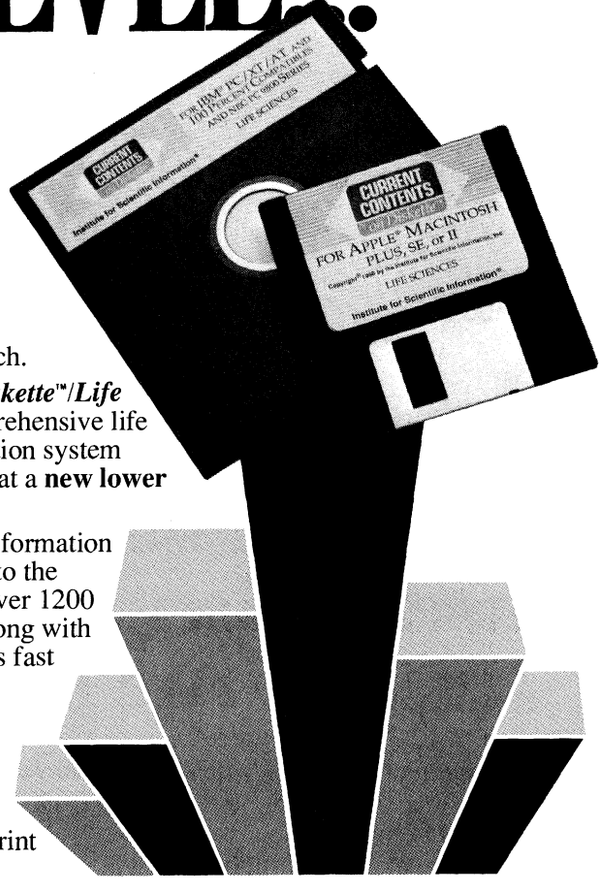

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