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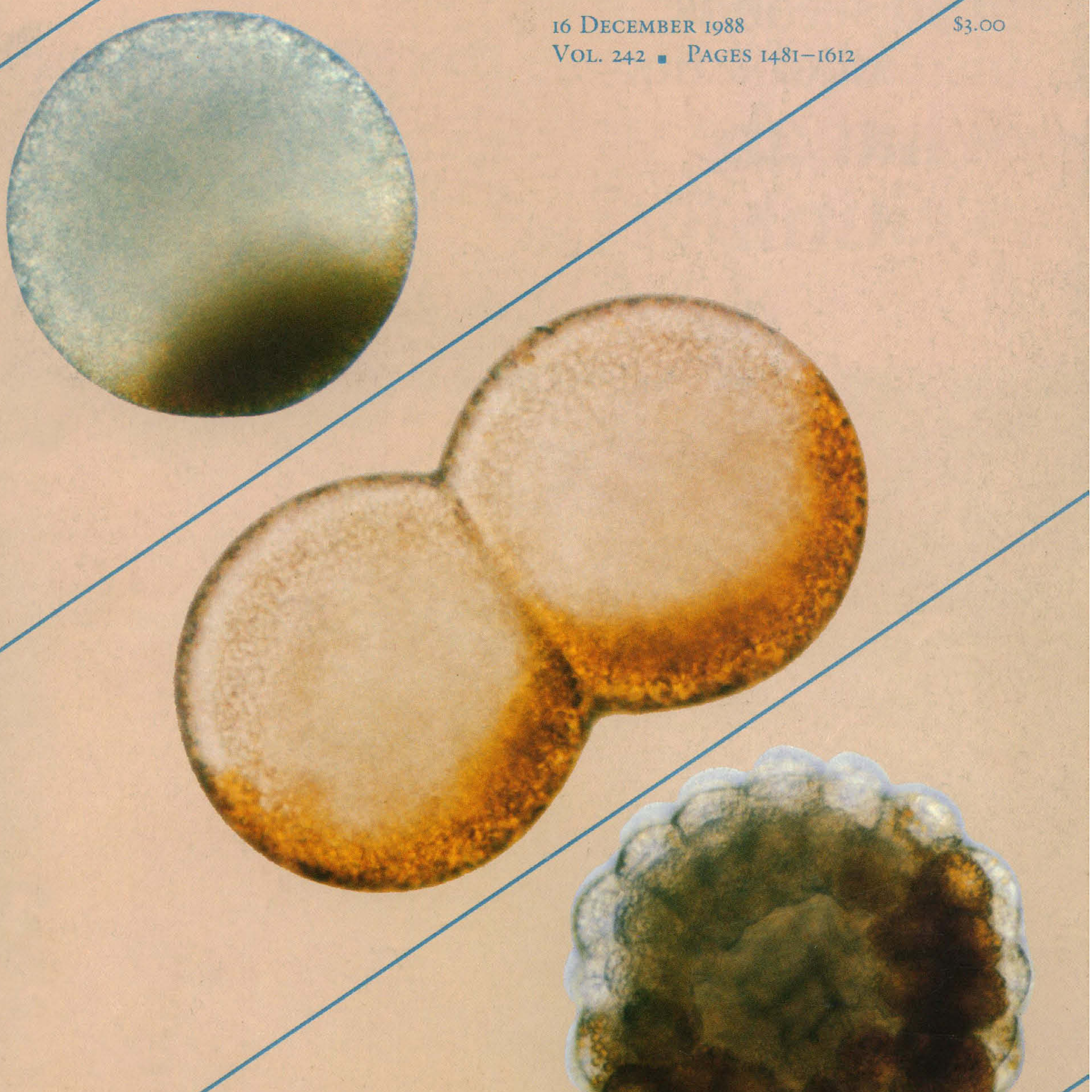

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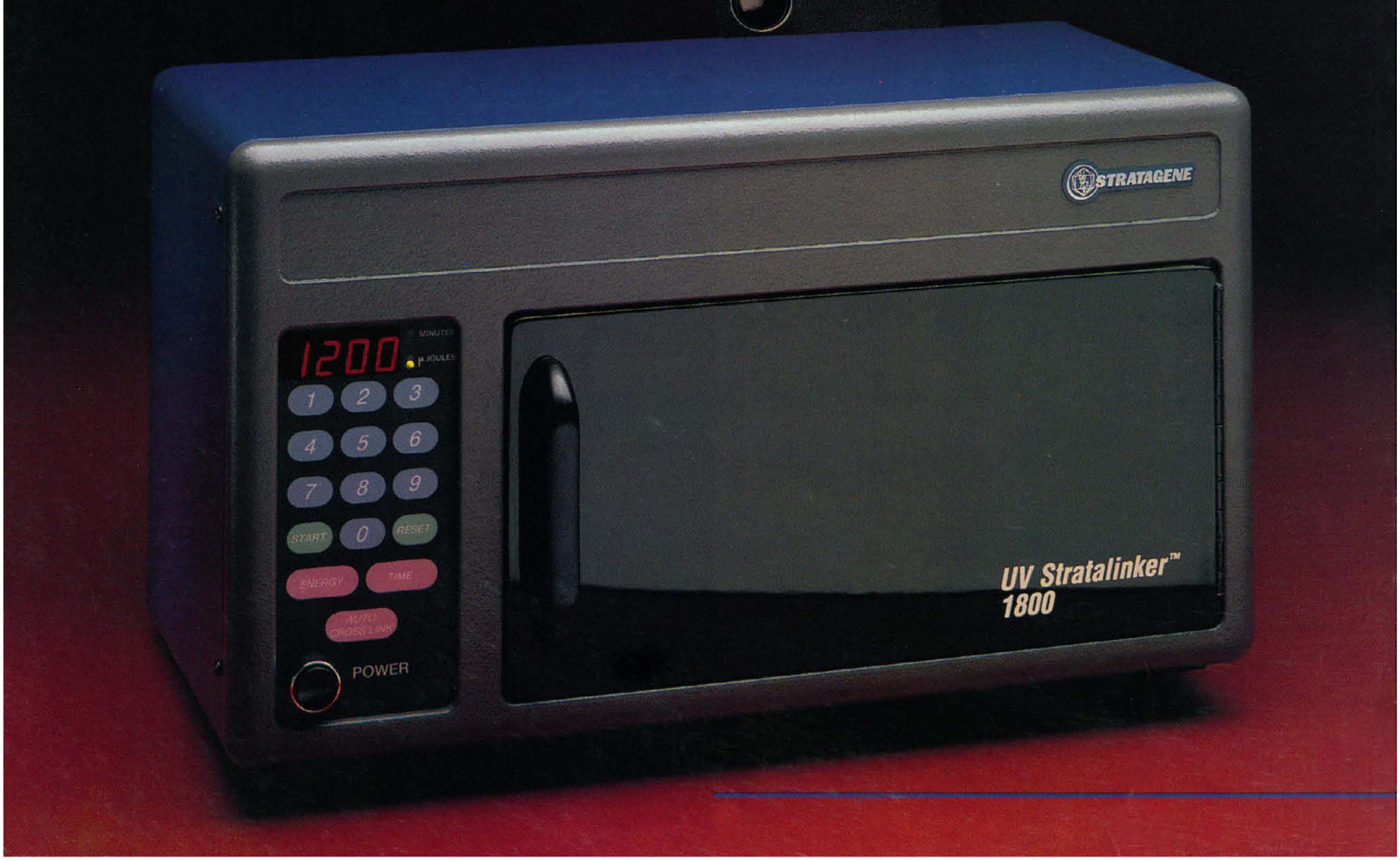

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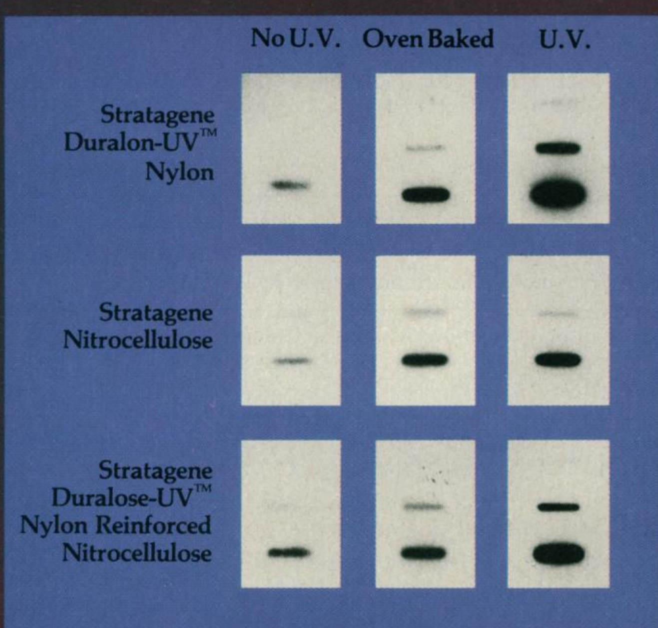
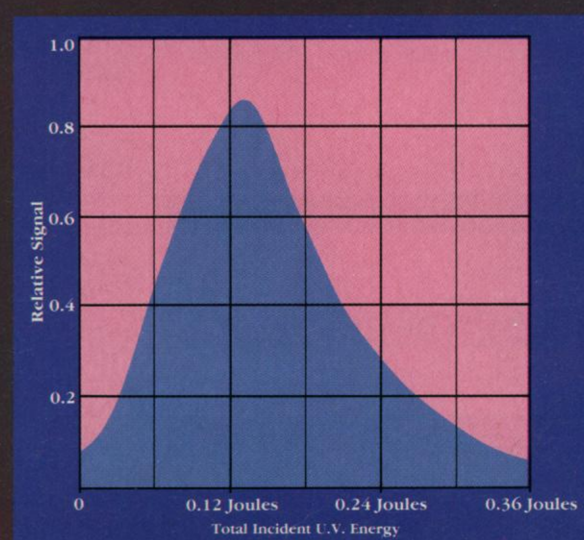


Each window represents a slot blot of lambda DNA applied at concentrations equivalent to 0.1, 1.0, and 10 copies per mammalian genome diluted in 5 micrograms of calf thymus DNA and hybridized with a 32P-labeled lambda DNA probe. The film was developed after an overnight exposure.



The effects of altering the incident energy for crosslinking nucleic acids to nylon membranes. The peak signal intensity is at approximately 0.12 Joules. The significant drop in signal intensity at energies below and above 0.12 Joules demonstrates the limited optimal range for U.V. treatment.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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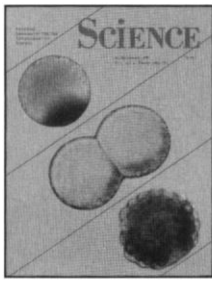

COVER Three stages in the embryogenesis of the ascidian *Boltenia villosa*. Upper left: fertilized egg, 30 minutes after sperm penetration. The endogenous orange pigment, which was uniformly distributed in the unfertilized egg, has formed a cap at the vegetal pole. Center: two-cell stage, 120 minutes after fertilization. Lower right: gastrula, 13 hours after fertilization. The pigment has segregated into muscle-lineage cells, which line the posterior rim of the blastopore. See page 1572. [L. Simoncini, M. L. Block, W. J. Moody, Department of Zoology, University of Washington, Seattle, WA 98195]

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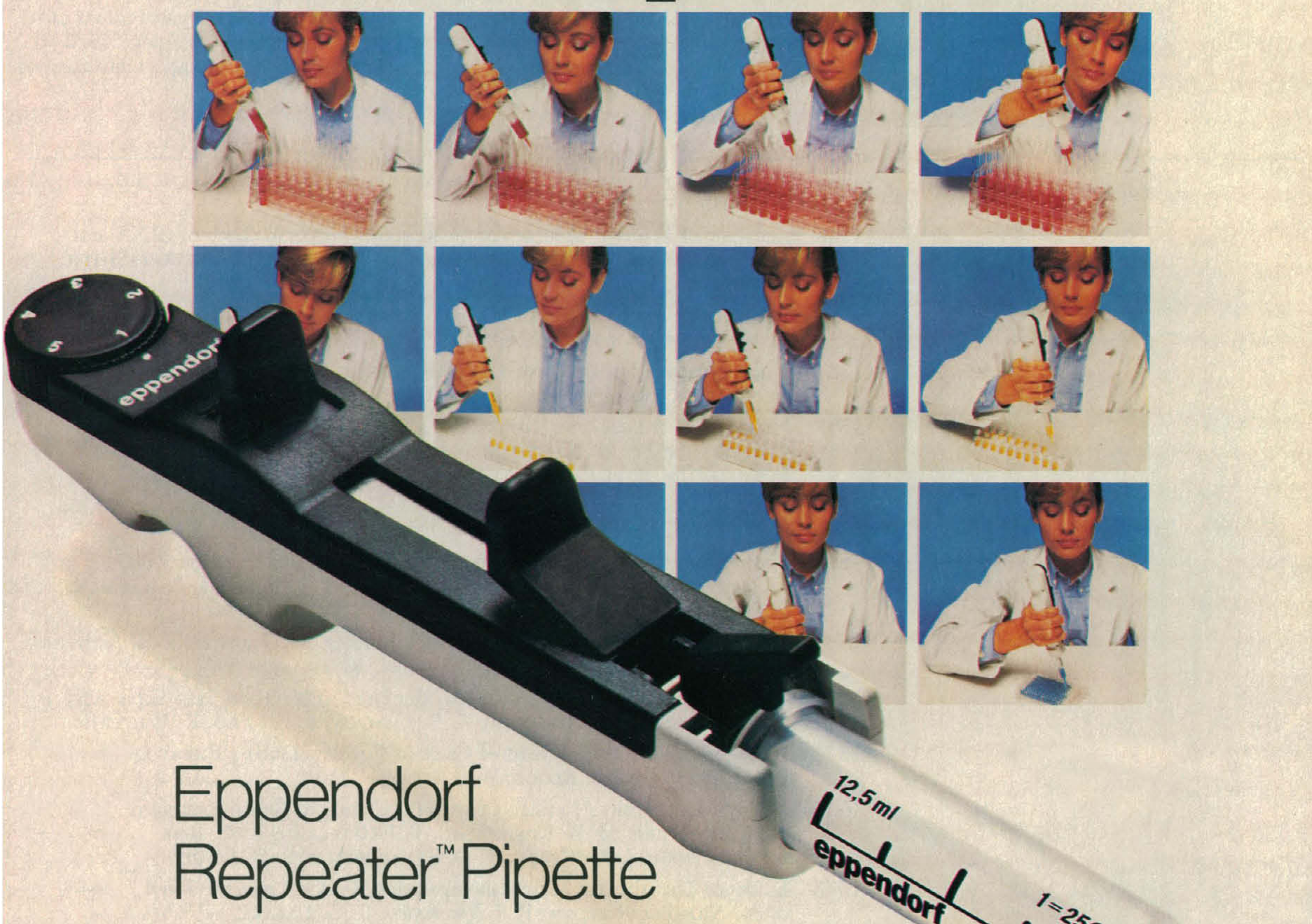

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This Week in SCIENCE

Chernobyl's legacies

THE immediate toll from the 1986 explosion at the Chernobyl Nuclear Power Station was 237 cases of acute radiation sickness and 31 fatalities; now, some two-plus years after the accident, sufficient information is available on types and amounts of radioactivity released and on atmospheric transport patterns in the days and weeks following the accident that collective risks can be calculated for populations throughout the world (page 1513). The 30-kilometer zone surrounding the station, from which 115,000 people were evacuated, received especially high exposure: the risk of spontaneous leukemias is now double for these people for the next decade, and some genetic disorders may appear in individuals who were exposed in utero to the radiation. Although atmospheric transport carried most of the radiation to the western Soviet Union and Europe, projections indicate that the number of additional cancer cases and genetic defects in this population will be so small as to be undetectable by epidemiologic analyses. Anspaugh *et al.* conclude that Chernobyl's major global effects could well be economic—with costs soaring to $15 billion—and psychological—with plant workers and the general population intensely anxious about the dangers of radiation.

Bone formation

ALTHOUGH it has been known that sticks and stones break bones, what induces bone repair has been mysterious. Three likely contributors to repair, all components of a protein extract called bone morphogenetic protein (BMP), are described by Wozney *et al.* (page 1528). Complementary DNA for each protein (BMP-1, BMP-2A, and BMP-3) was prepared, expression was studied in mammalian and bacterial cell systems, DNA sequences for each were determined, and amino acid sequences were predicted. BMP-2A and BMP-3 are similar to a class of growth and differentiation factors that participate in embryonic morphogenesis. BMP-1 differs from known growth factors. Each BMP protein was able to induce cartilage formation in rats. Interactions among the BMP proteins and other proteins and cofactors may account for the remarkable regenerative capacity of bone; if applied locally, they may promote restoration of bones broken in accidents or lost in diseases such as osteoporosis.

Cell killing by AIDS virus

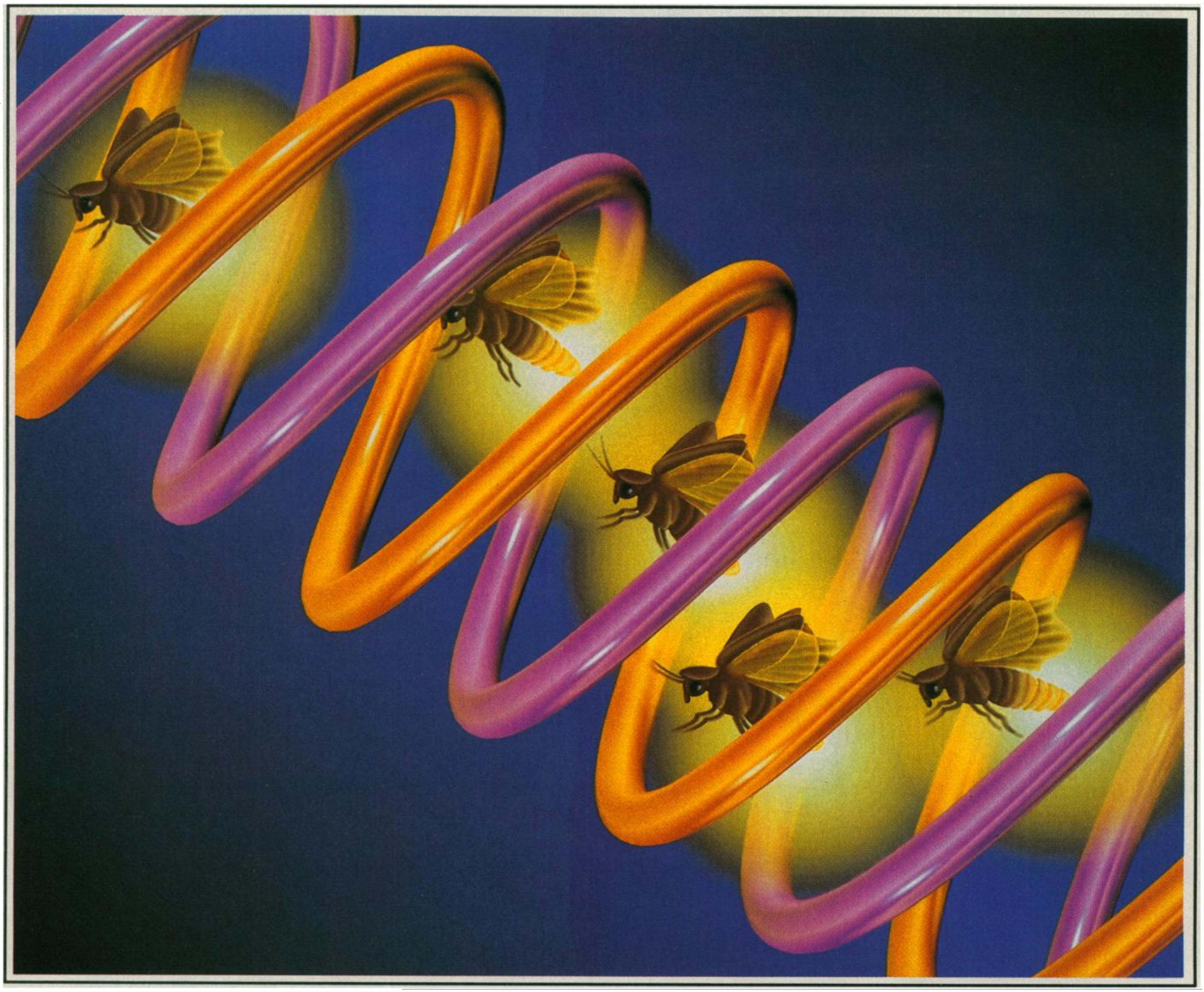
PREEMPTION of the metabolic machinery of a host cell may be one mechanism used by the human immunodeficiency virus HIV-1 to kill an infected cell (page 1554). HIV-1 may, in addition, actively inhibit use of the synthetic machinery by host nucleic acids. Experimental results reported by Somasundaran and Robinson are consistent with these proposals: when lymphoid cell lines or peripheral blood lymphocytes were infected with a laboratory strain of HIV-1, up to 2.5 million copies of the viral RNA were produced by cells, and, within 3 days of infection, up to 40% of the total protein synthesized by the cells was viral rather than cellular. This is an unprecedented takeover for a retrovirus—which typically uses the host cellular machinery for making only modest amounts of RNA and protein—but is not unusual for infections with other classes of cytopathic organisms. What might distinguish cytopathic HIV-1 infections from more moderate retroviral infections may be the many copies of unintegrated viral DNA that accumulate in HIV-1–infected cells; these molecules may be especially efficiently expressed.

Tumor suppressor gene

RETINOBLASTOMA is a form of eye cancer that appears in children. Its development is associated with inactivation or absence of a gene locus called RB. This locus also is sometimes inactivated in osteosarcomas, lung and breast carcinomas, and sarcomas. Thus active RB genes have been associated with active tumor suppression and inactive genes with tumor outgrowth, but the evidence has only been correlative. Huang *et al.* have studied what happens to tumor cell lines when they receive active cloned RB genes (page 1563). In both a retinoblastoma and an osteosarcoma line, the RB protein was expressed in the right place (the cell nucleus), and its expression caused marked changes in cellular morphology and inhibited tumor cell growth. In nude mice, RB-carrying retinoblastoma cells failed to develop into tumors. The results raise the possibility that tumor suppressor genes like RB might be useful for gene therapy: they could be introduced into tumor cells where they might permanently correct defects in tumor cell regulation and thereby interfere with tumor cell growth in vivo.

Restorative brain grafts

CENTRAL nervous system defects may some day be corrected with implants of therapeutic cells in the brain. Rosenberg *et al.* describe promising experiments toward this goal (page 1575). Cultured fibroblasts, modified genetically so as to produce and secrete nerve growth factor, were implanted in the brains of rats that had surgically induced lesions in the fimbria-fornix, the pathway that connects cholinergic neurons of the forebrain to their targets in the hippocampus. This type of damage typically results in degeneration and death of cholinergic neurons; but, in rats that had received the transgenic cells, the neurons survived and even sprouted new axons toward the nerve growth factor. Although short-term functional restoration of the cholinergic neurons (a population of cells that, in Alzheimer's disease, is severely depleted) was demonstrated, additional studies are needed to establish whether fibroblasts or some other cellular grafts work best, how long grafts can survive and function, whether immune or other adverse responses in recipients can be avoided, and whether such grafts will be effective in reversing damage resulting from degenerative diseases.



SCIENCE

16 DECEMBER 1988
VOLUME 242
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Science Advice to the President

In a little-heralded speech on 25 October 1988, George Bush, now President-elect of the United States, announced that he would upgrade the office of science adviser, appoint a committee on science and technology, and see that the science adviser had access to him personally (see News & Comment, 4 Nov., p. 665). Most of the press, busy berating the candidates for not discussing the issues, ignored this speech. Yet it is a policy speech, the portents of which are good for the nation and good for science.

So much has been written and said about a science adviser to the President, including nostalgic and myopic glances back into history, that one fears to tread on too well-trodden paths. Yet several aspects of the situation facing a science adviser in 1988 are different from those of earlier eras. The most important is that the budget has become an issue of great political importance and that science today accounts for a much bigger percentage of the budget than before. Thus a science adviser will need to have a broad vision, not only to evaluate the relative values of an array of scientific projects but also to defend the merits of scientific projects in comparison with other parts of the budget.

Access of the science adviser to the President has been much discussed. But there is a second requirement: access of scientists to the science adviser. Scientists have always enjoyed the pluralism with which science is funded. A proposal that does not engender the enthusiasm of one department may find a sympathetic ear in another. An autocratic czar, too committed to tidiness and unfriendly to disciplines outside his own, could actually damage science more than help it. The science adviser, therefore, must be a person of wide contacts in the scientific community and must have a reputation for being a good listener as well as a forceful advocate.

Perhaps the most important contribution of the science adviser will be his vision of the future. Science is inevitably tilted toward future gain. The adjudication of priorities in the present, important as that is, pales in significance compared to projects that affect lives into future generations. As pollution becomes an increasing problem, a much heavier research orientation in the Environmental Protection Agency may be needed, and the science adviser should be able to be persuasive in new directions of this sort. The greenhouse effect, whether it has arrived already or is many years in the future, is sufficiently serious, together with a dwindling supply of oil, that energy efficiency and use must be policy matters of major interest to this generation as well as to future generations. Only utopians can believe that the problems of energy consumption will be solved by a U.S. president advocating a lower standard of living, or a Chinese premier saying we should stick to bicycles because the developed countries have already saturated the atmosphere with CO_2. The solutions will have to be scientific, such as biosynthetic approaches to CO_2 fixation, solar power, organisms that biodegrade pollutants, and cleverer uses of water resources and urban transportation. The science adviser should be an intellectual leader in this effort.

These criteria should not in any way diminish the classical role of the science adviser, who also must advise the President on numerous appointments to scientific bodies, such as the National Science Foundation, the EPA, the Commerce Department, and so on. It is to be hoped that the science adviser will be appointed soon, so that he or she will have a major role in selecting the most appropriate individuals for those many positions. And it is to be hoped that the generally observed tradition of making science policy appointments on the basis of merit, not as part of the spoils system, will be preserved.

Perhaps the obscurity with which George Bush's statements in regard to a science adviser were treated by the press will serve to allay one doubt in regard to the advisability of appointing a strong individual widely supported by the scientific community: the downgrading of the science adviser office was frequently interpreted as a fear that the science adviser might resign in some dramatic disagreement, such as General MacArthur did under Truman. Those risks seem slight. The resignation of a science adviser might compete with the announcement of a new quarterback for the Washington Redskins in terms of national news. However, those who care about the welfare of this country will watch closely as the President chooses and will support the selection of a science adviser who has the independence, vision, and wide contacts that allow him or her to rise to the enormous challenges that must be faced.—DANIEL E. KOSHLAND, JR.

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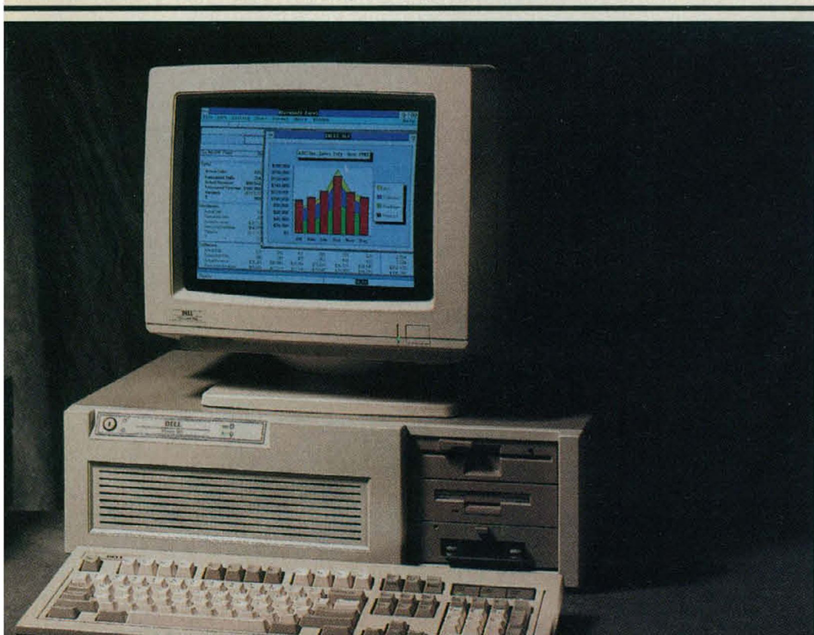

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molecular weight (1). The ultimate cure for the greenhouse should involve recycling of atmospheric carbon, not simply creating additional storage in various reservoirs. A marine farm has good potential for recycling carbon and reducing atmospheric pollution through production of clean-burning fuels. We urge that consideration be given to "Johnny Kelpspore and the Greenhouse."

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REFERENCES

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The Global ReLeaf effort described by Gregory Byrne (News & Comment, 21 Oct., p. 371) may be a worthwhile effort aimed at reducing atmospheric carbon dioxide. The proposed 100 million trees would certainly absorb carbon dioxide, but the impact on the carbon dioxide production-destruction equation is likely to be far greater than that suggested in the article. American Forestry Association executive vice president R. Neil Sampson is quoted as saying, "Those [trees] planted in urban areas would . . . help shade residences, leading to a savings in air-conditioning costs of $4 billion a year." That cost represents about 6% of all U.S. residential electricity consumption and the avoided combustion of 16 billion tons of coal. Avoiding the combustion of the coal saves the release into the atmosphere of about 60 billion tons of carbon dioxide, three times what is absorbed by all the trees.

If the estimates of the American Forestry Association are correct, high priority should be placed on the planting of trees in locations where they shade air-conditioned structures, as those trees may have about four times the impact in decreasing atmospheric carbon dioxide as trees planted in other locations.

JAMES SWARTZ
Department of Chemistry,
Grinnell College,
Grinnell, IA 50112-0806

I read with interest Byrne's article "Let 100 million trees bloom." The article points out that 100 million additional trees would remove about 18 million tons of carbon dioxide from the atmosphere each year and then goes on to state, "an estimated 6 billion tons of carbon dioxide from fossil fuels enter the atmosphere each year." The 100 million trees would therefore remove about 0.3% of the additional carbon dioxide.

A few simple calculations show that *all* of the additional carbon dioxide introduced by fossil fuels could be removed by a 2% increase in the quantity of phytoplankton in the world's oceans. We have effected marvelous improvements in the production of land-based plants. Could we not produce a 2% increase in the ocean's phytoplankton?

HORST HOYER
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Erratum: In the report "Single-chain antigen-binding proteins" by Robert E. Bird *et al.* (21 Oct., p. 423), references 17 and 18 were inadvertently interchanged. Reference 17 should have been to J. S. Huston *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **85**, 5879 (1988), and reference 18 should have been to D. Scandella, P. Arthur, M. Mattingly, and L. Neuhold, *J. Cell Biochem.* **9B**, 203 (1985).

Erratum: The proportion of dogs among animals used in research was incorrectly reported in Constance Holden's article "Billion dollar price tag for new animal rules" (News & Comment, 4 Nov., p. 662). Dogs make up about 1% of research animals, according to the Office of Technology Assessment. Primates make up about 0.05%.

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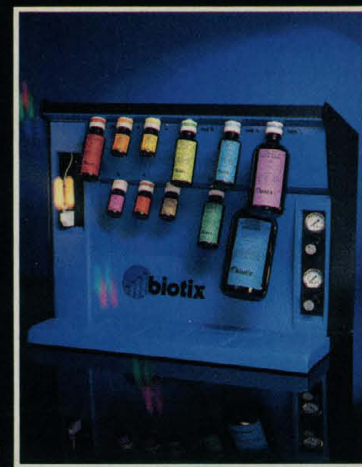

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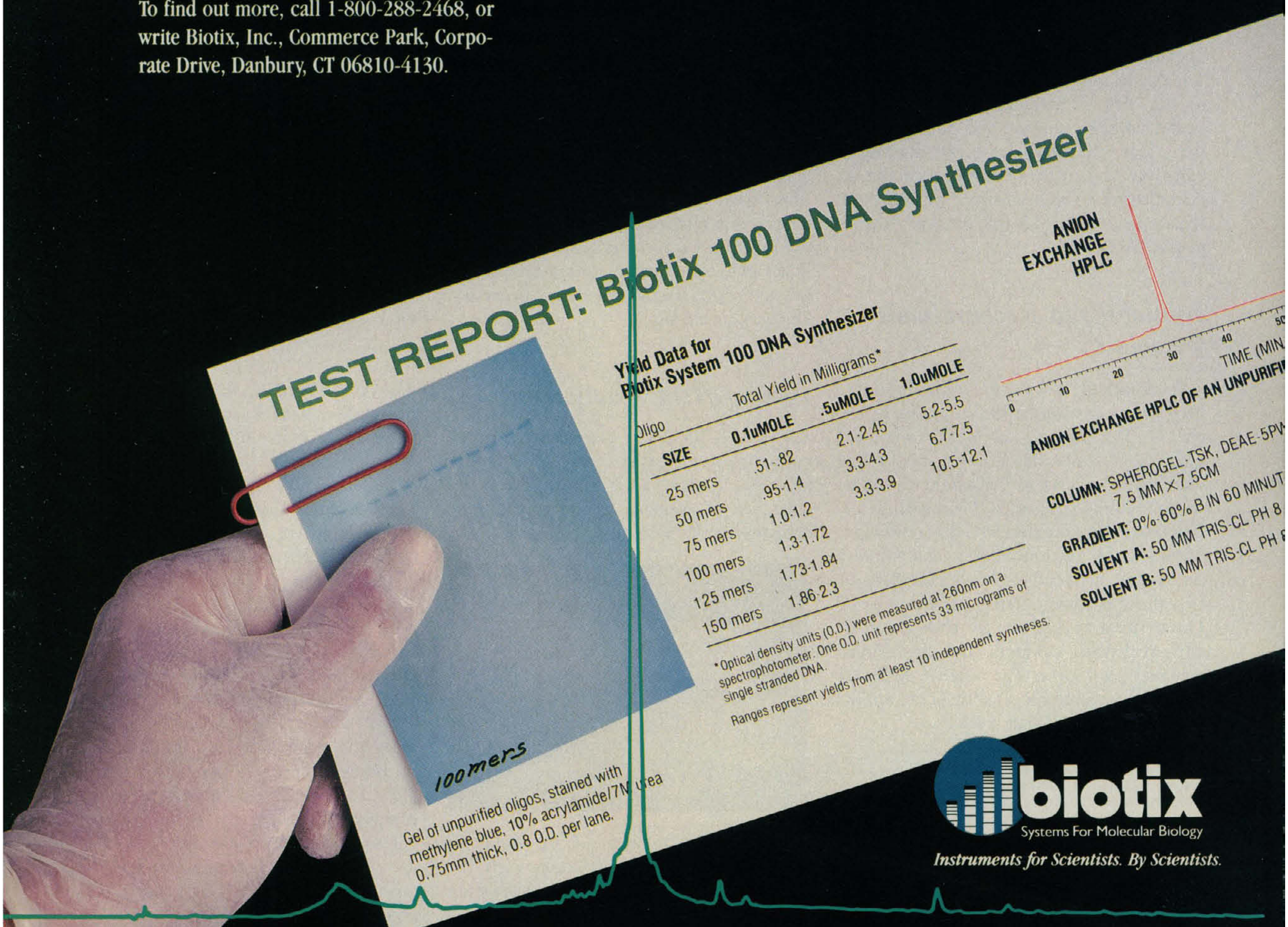

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