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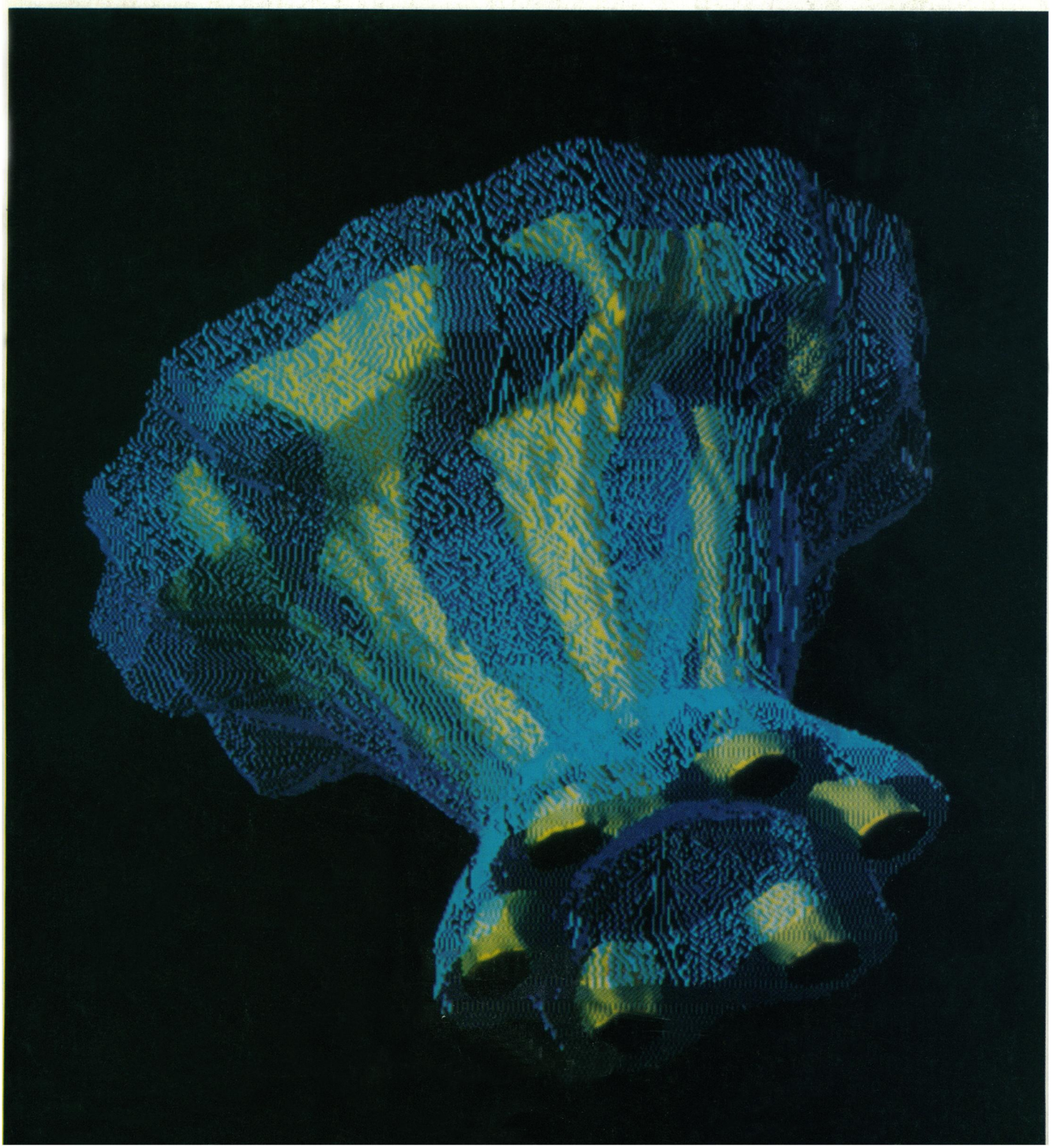

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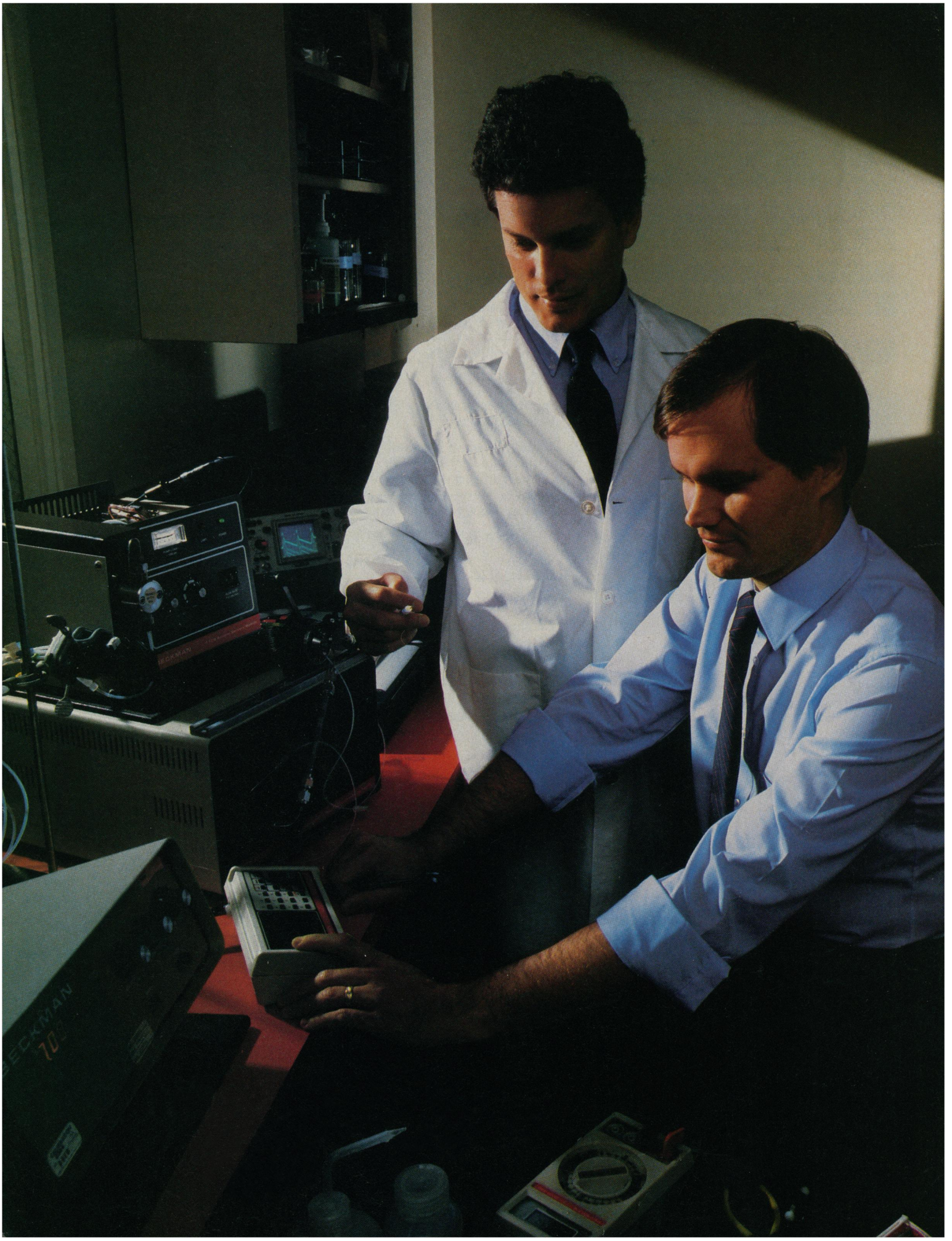
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COVER Three-dimensional reconstruction of the neck region of the $\phi 29$ bacteriophage virus, obtained by digital Fourier reconstruction from electron micrographs of 2-D crystals. The outer transparent and the inner solid surfaces correspond to different staining levels on the micrographs and are visualized using improved computer graphic techniques. See page 1113. [J. Jiménez, IBM Scientific Centre, P. Castellana 4, 28046 Madrid, Spain, and J. M. Carazo, Centro Biología Molecular, Universidad Autónoma, 28049 Madrid, Spain]

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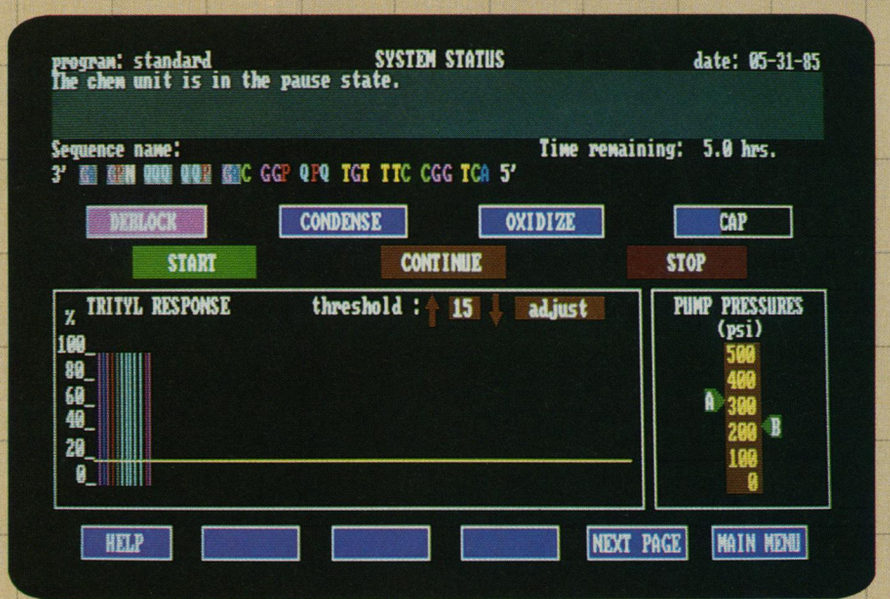

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Shuttle retrospectives

EVERY aspect of the U.S. space program has come under close scrutiny in the aftermath of the shuttle disaster. The current national predicament is ascribed by Van Allen to a clash between the mythology of space exploration and the realities of space achievement (page 1075). The myths include the notion that manned is best and that the future lies in mining, manufacturing, and living in space; the realities are that the major accomplishments—space exploration, advances in communications, surveying of earth resources, weather forecasting—have come through use of unmanned spacecraft. He urges that NASA pursue space applications of broad practical importance along with pursuit of knowledge of the universe and that the agency resume production of unmanned launch vehicles. Logsdon describes the process, including compromises made along the way, which led to final approval for the shuttle project (page 1099). He points out that public justifications and private ones (those used to get presidential approval) for the program were different. Often, long-range goals took a position secondary to short-term political considerations: for instance, approval came at one point because it meant provision of jobs in key states in an election year. Further, funds were not adequate to meet the program's needs, in part because program aims were poorly enunciated. He concludes that a long-range national commitment is essential to the success of any future U.S. space program.

Solar system dust trails

PORTIONS of cometary orbits are demarcated by thin trails of dust that have been detected by the Infrared Astronomical Satellite (IRAS) (page 1115). Large particles of ice and debris are ejected at low speeds (meters per second) as comets pass close to the sun; the surviving rocky debris then assumes an orbit nearly identical to that of the comet from which it was emitted. Trails are found both in front of and behind comets and represent material left by the comet during hundreds of years and many orbits. Sykes *et al.* describe the three brightest trails detected; they correspond to the orbits of comets Tempel 2, Encke, and Gunn. Meteor streams that can sometimes be seen as meteor showers may evolve from dust trails whose orbits have been perturbed over time. The IRAS scans detected about 100 other trails in the sky; these may define orbital paths of other periodic comets or may be debris from recent asteroid collisions.

Sjögren's syndrome: genes and antibodies

GENETIC factors determine and modulate many diseases, one of which is severe primary Sjögren's syndrome (page 1145). This is thought to be an autoimmune disorder: the main symptoms—dry mouth and eyes—result from infiltration of lymphocytes into salivary and tear glands, and enhanced antibody responses are common to a number of "self" antigens. Harley *et al.* found that autoantibody production is greatest in patients who have the DQ1 and DQ2 combination of alleles (alternative forms of a gene) at a genetic locus known to affect many immune functions. The DQ alleles code for proteins of the cell surface, and, in DQ1/DQ2 heterozygotes, it is possible that hybrid molecules, structurally different from parental molecules, may be made and viewed as "foreign" by the immune system. Such gene complementation was predicted for the human system from results of animal studies of a comparable (histocompatibility) genetic locus.

Drug separations

SYNTHESIS of a drug frequently yields a mixture of mirror-image chemical compounds, only one of which produces the desired pharmacologic effect (page 1132). Armstrong *et al.* describe a technique by which single highly purified drugs—antihistamines, diuretics, anticonvulsants, antiestrogens, synthetic opiates, and others—can be separated from such mixtures. High-performance liquid chromatography is performed using β-cyclodextrin as the crucial component of the stationary phase and solutions of organic and aqueous solvents as the mobile phase. Complexes of the drug and β-cyclodextrin must form for the separation to succeed. Side groups on the drug are key to the separation of mirror images, but the drug must have at least one aromatic ring (preferably two) and other structural elements in order to fit into the cavity of the β-cyclodextrin molecule. Computer-generated projections of the complexes that can form and calculations of the most favorable positioning (lowest free energy) of drug and β-cyclodextrin make possible predictions about which separations will work and which substitutions on β-cyclodextrin would improve the separation.

Thymosin for AIDS vaccine

A novel vaccine for AIDS may be produced from thymosin α_1, a thymic hormone that cross-reacts with a component of the AIDS virus (page 1135). Sarin *et al.* report that antibody to thymosin blocks replication of the AIDS virus that is growing in a cell line. The virus-thymosin association was made after an interesting clinical observation by Goldstein and Naylor. Many clinical signs in AIDS patients and in children with primary immunodeficiency diseases (PID) are similar, but sera of AIDS patients react strongly with antibody to thymosin whereas levels of thymosin are depressed in PID patients. Computer-assisted comparisons of protein sequences indicated that thymosin and the *gag* protein of the AIDS virus have about 50% homology over a stretch of 18 amino acids. If thymosin, the *gag* protein, or synthetic peptides resembling their homologous region can be used to immunize individuals at risk for developing AIDS (without eliciting immune reactions against the host's thymus), replication of the AIDS virus might be arrested in infected individuals.

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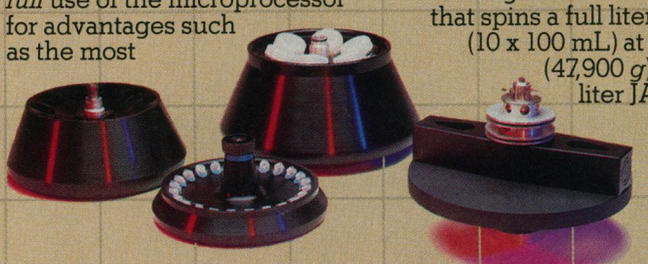

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How in the World Are We?

That question is triggered by the current report, *State of the World 1986*.* The report, which does not set out to be restful reading, presents a balance sheet calculated to agitate misgivings regarding national goals, priorities, and public expenditures. Whatever one thinks of its conclusions, the report serves the public interest in a time of trillion-dollar annual budgets and even more astonishing levels of national debt.

The message of *State of the World 1986* is that global military expenditures are sapping the capacities of big and small nations to stay solvent and provide the resources needed to meet basic priorities. It reminds us that for many countries the true threats to security are not primarily military in nature but rather arise from ecological deterioration, which goes on at an accelerating rate. The authors dwell on the evidence of vanishing forests, soil depletion, falling water tables, ruined grasslands, pressures of population on food sources and economic assets, and the effects of all these interlocked problems on political options and stabilities.

On the bright side, China emerges as a model for economic development, and there is a note of optimism in evidence of receding dependence on oil by the industrialized countries. Still, there is a lot of bad news. If the report reflects the state of much of the world, as it seems to, the uses of public investment by the more fortunate national economies are overdue for reevaluation. But the search for solutions would only begin, not end, if the arms race and militarization budgets were rolled back. The open question, no less problematical than the route to disarmament, would be whether the Western democracies would willingly and generously transfer defense savings to a decade of ecological rescue efforts, and whether for their part the Soviets would do the same in the face of their own dismal domestic miseries and failures. We have found out that economists have a point when they tell us that tax resources are not fungible. Taxes levied to support high national security outlays are not easily reprogrammed or reappropriated to more altruistic purposes in like amounts, certainly not while a huge public debt sits out there or while supply-side nostrums dictate returning tax money to individuals and corporations for the sake of the stimulating consumption, investment, and employment. In its sharpest form the trade-off problem leaves the area of economics and falls squarely into that of politics. We have to wonder whether a public inured to sacrificing for nuclear and conventional deterrence could be persuaded that the national security calls for proportional sacrifice to forestall a global firestorm arising from ecological collapse and its accompanying human desperation.

The case for the "sustainable society" on the global scale has an irrefutable political and indeed moral logic. The time constants reinforce it. But the search for workable solutions does not follow straight lines any more than it does in the instance of the intricate dilemmas posed by terrorism, the rise of Islamic activism, or mutual superpower distrust. As the late Robert Lovett once noted, the foul-up factor is built into the making of choices in an open society, and it is there for very good reasons.

The state of the world deserves a lot of thinking, and the report that has provoked these reflections is profoundly disturbing. It throws perspective onto the limitations of policy planning on the very large and elongated scale. We, and not we alone, come up well short of having the available political technology to match the state of the world's problems on the eve of the third millenium. And for all the fanfare and pretentiousness, the planned economies are in no better shape, laden as they are with ideological baggage. Where the Worldwatch study points us wisely is toward much stronger and better-supported interdisciplinary monitoring of indicators that bear on the chances for progressing toward a sustainable society. This much, at least, can be agreed to.

Within AAAS itself, a new interdisciplinary program on population, resources, and the environment, supported by foundations, is moving ahead. We mean to give it the best we have; for we, too, have our eyes on the state of the world.—WILLIAM D. CAREY

*L. R. Brown *et al.*, *State of the World 1986, A Worldwatch Institute Report on Progress Toward a Sustainable Society* (Norton, New York, 1986).

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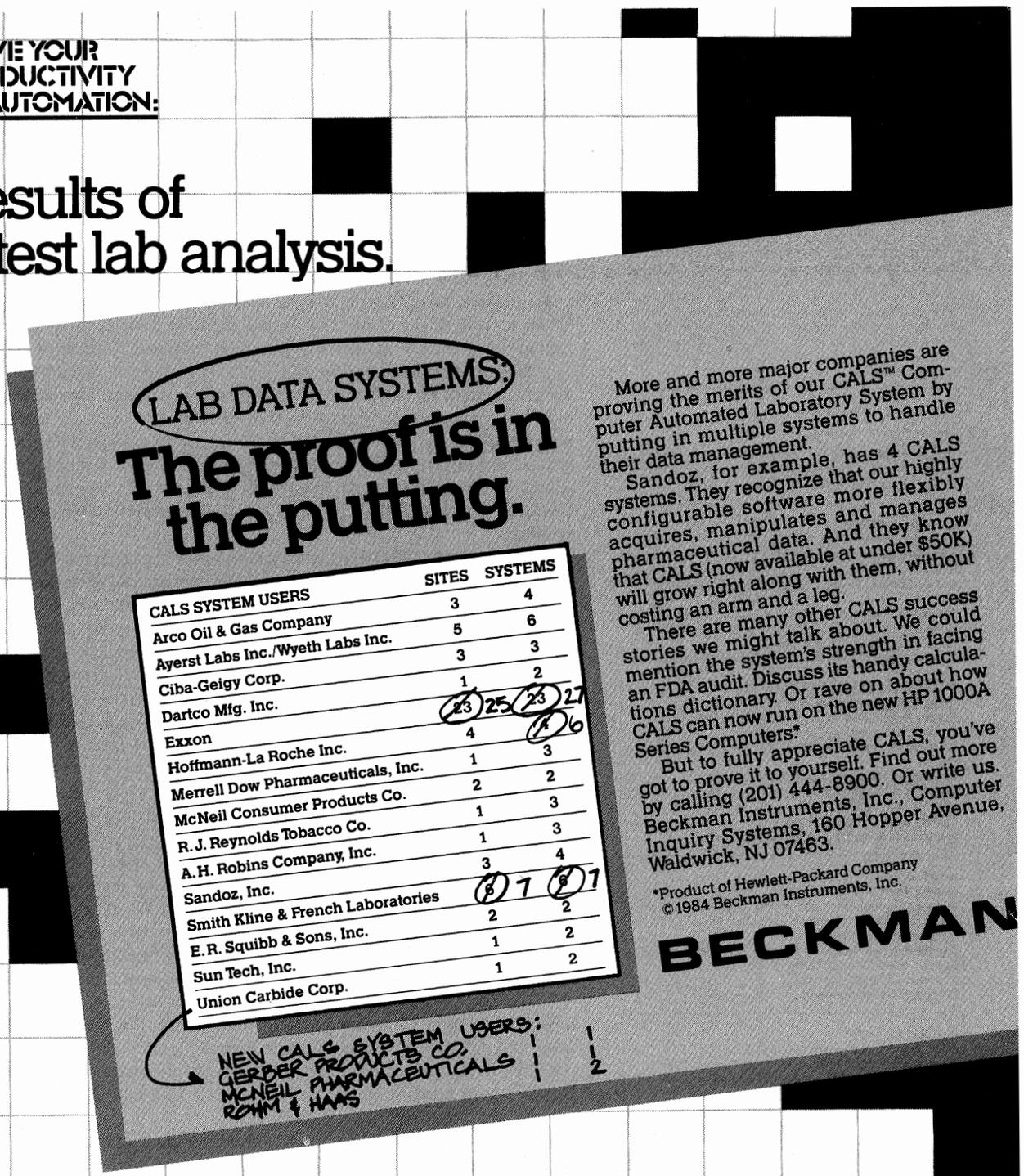

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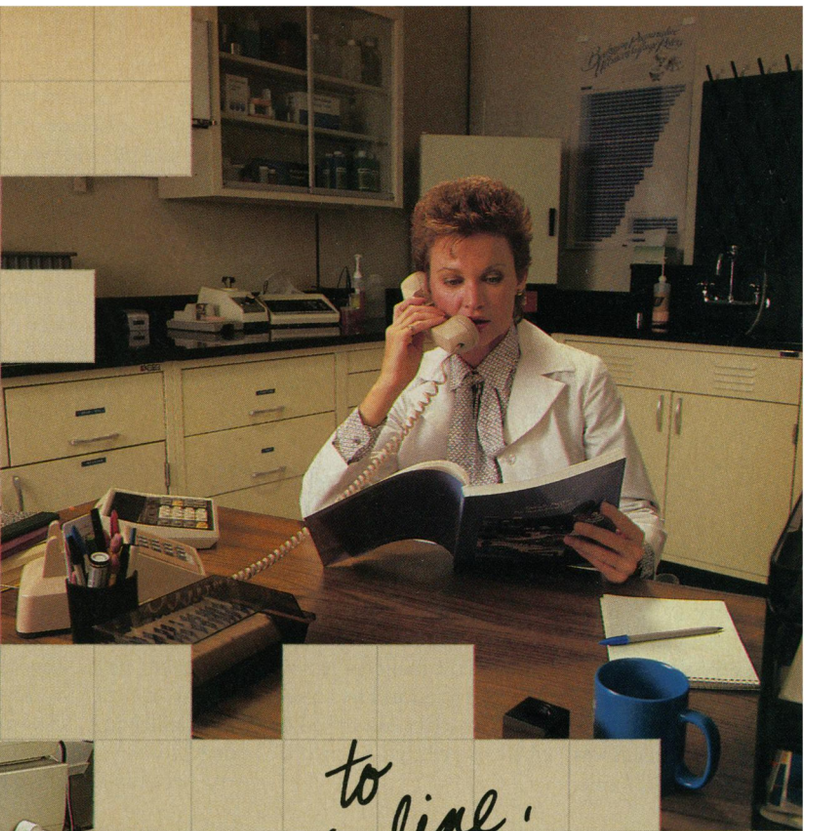

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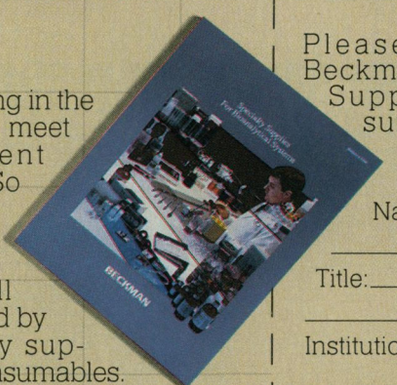

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Letters

Administration of Research

Never have I seen so sad, and so ominous, a juxtaposition of views as in the issue of 25 April, in which the editorial "A time for steadiness" by Provost Cornelius J. Pings of the University of Southern California (p. 437) is followed by a letter from Professor Joseph Arditti of the University of California, Irvine (p. 439).

The Provost—who happens also to be a distinguished scientist—calls attention to the effort of the Office of Management and Budget (OMB) "unilaterally, and fundamentally" to change the rules of partnership between government and the universities, a relationship that has been the main source of preeminence of American science. His argument and his plea are themselves examples of the "steadiness" which is referred to in the editorial's title.

Were one to stop at the editorial page, one might conclude that Pings speaks for the universities. But on the next page of text is Arditti's letter. To be sure he speaks for himself; but for those who must, by the bad luck of employment, be close to administration and research, it has a familiar ring. It has the sound of many, perhaps even a majority of, university scientists. Freely but accurately translated, Arditti's letter encourages government to proceed as announced: to make new and Draconian rules for funding the indirect cost of research. He depicts science administration in the universities as shot through with misfeasance, with bureaucrats fattening upon "inflated salaries." He implies that administration is parasitic upon working scientists who must bring in the cash in order to survive. He goes further: encouraging OMB to proceed by fiat, he urges new rules and enhanced scrutiny in order to prevent the universities from collecting unearned tribute "under other guises."

As between these two points of view there is no possible accommodation, yet they coexist throughout the system of academic research. Pings does not, therefore, speak for the system. Neither, perhaps, does Arditti, but his speech is heard more often on the campus.

The problem is that, while some academic administrators—certainly not all—are or were serious scholars and understand the complexities of research, very few full-time scholars know anything about the finances and management of the institutions they work in. That situation (which I see little hope of rectifying, given what else faculty have to do merely to stay current as investigators) is the basis of a deplorable new alliance of government accountants with university faculty. It should be receiving urgent attention within the universities from that handful of administrators and professors who know something of both worlds.

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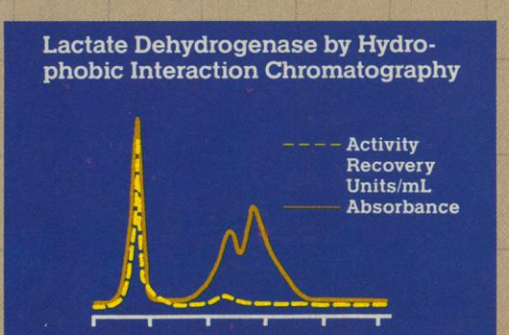

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Animal Models in Research

Constance Holden (News & Comment 11 April, p. 147) points to the negative impact on biomedical research from compliance with the new amendments to the Animal Welfare Act and continuing pressure from the animal welfare movement. Animal care committees, extensive record-keeping and reporting requirements, frequent laboratory inspections, and modified animal facilities will clearly translate into higher administrative costs for biomedical research and higher costs for health care. Legislators have apparently found this acceptable. The adverse consequences to our society may, however, be more profound than most scientists and policy-makers realize.

The most important and inadequately addressed public policy issue is the impact the new law will have on narrowing the U.S. lead in biomedicine. The law will certainly slow down the whole process of biomedical research and direct it away from practical end points. These are ominous signs for the United States, which has been the world's premier generator of biomedical knowledge and useful medical products for the benefit of humans and animals.

In government and university laboratories, the shift of funds from direct research to indirect administrative costs will predictably slow the generation of new knowledge. This occurs at a time when the fiscal year 1987 budget of the National Institutes of Health represents a cut in funding, Gramm-Rudman-Hollings will result in further cuts, and the Office of Management and Budget is acting to cap the percent of indirect costs of research that universities can charge to government grants. Furthermore, the balance between in vivo and in vitro experiments will not be determined by their perceived usefulness in providing essential insights into biology, but will be driven increasingly by extraneous factors such as regulation. Fewer academic research programs will use animals, and fewer students will be trained in animal studies than may be optimum for advancing biomedicine. In her 18 April article (Research News, p. 309), Deborah Barnes describes some valuable animal models whose continuing availability to science has already been threatened.

For society to benefit from biomedical research, a strong health-care industry is essential. In addition to generating basic information, it performs the pivotal function of translating knowledge into products. The viability of the industry is only possible if its technology is protected by patents that allow the recovery of the huge investments necessary for innovation. If procedural burdens imposed upon research result in a delay of weeks or even 1 day in obtaining results and submitting a patent application, a loss of patent rights to a competitor is incurred. Being second simply translates into a wasted R&D investment. When a foreign competitor receives the patent, the U.S. work cannot be rewarded, and our nation becomes a loser in the worldwide competitiveness arena.

Policy-makers should now consider how much of the U.S. lead in biomedicine they

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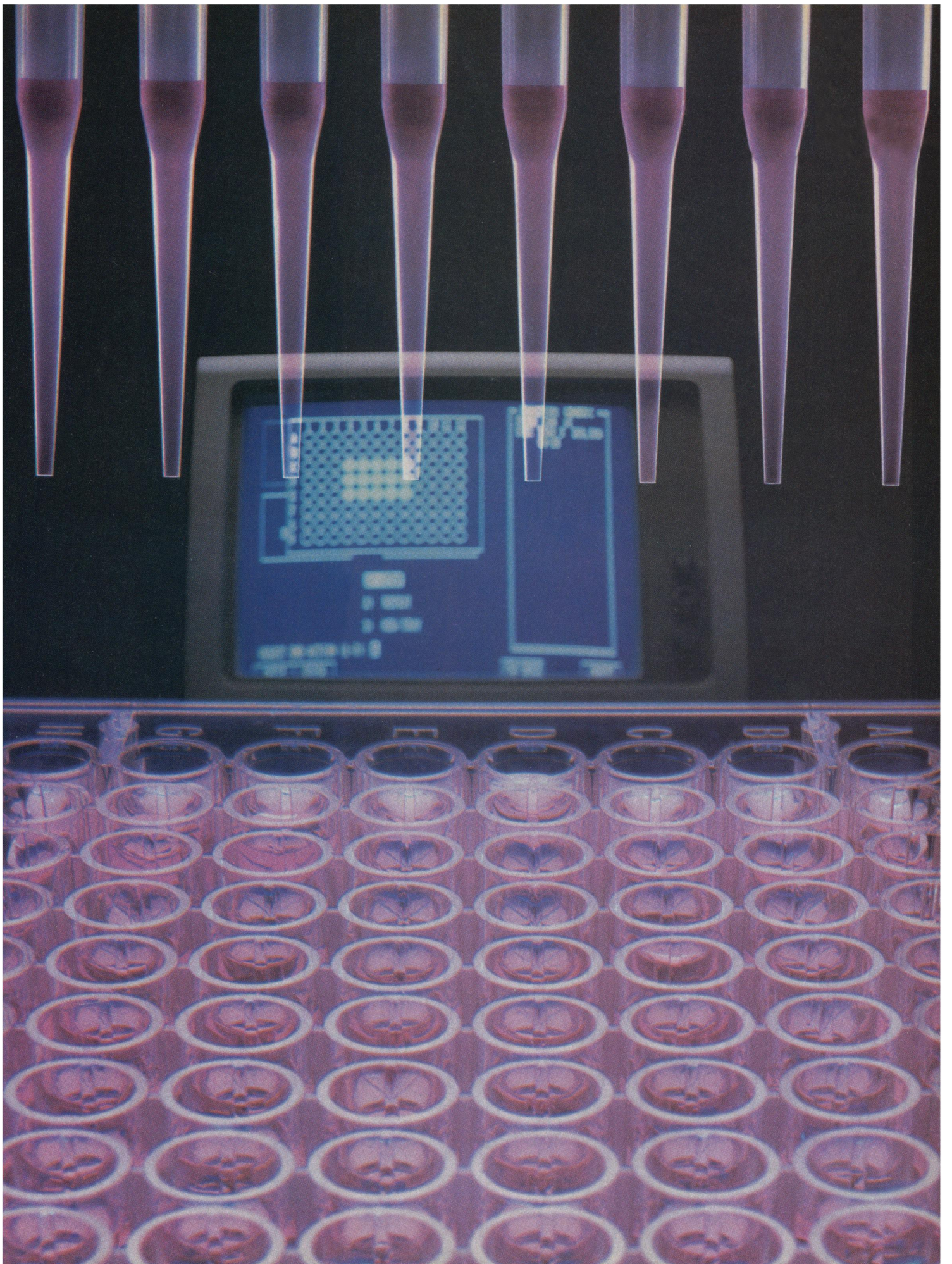

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