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SCIENCE

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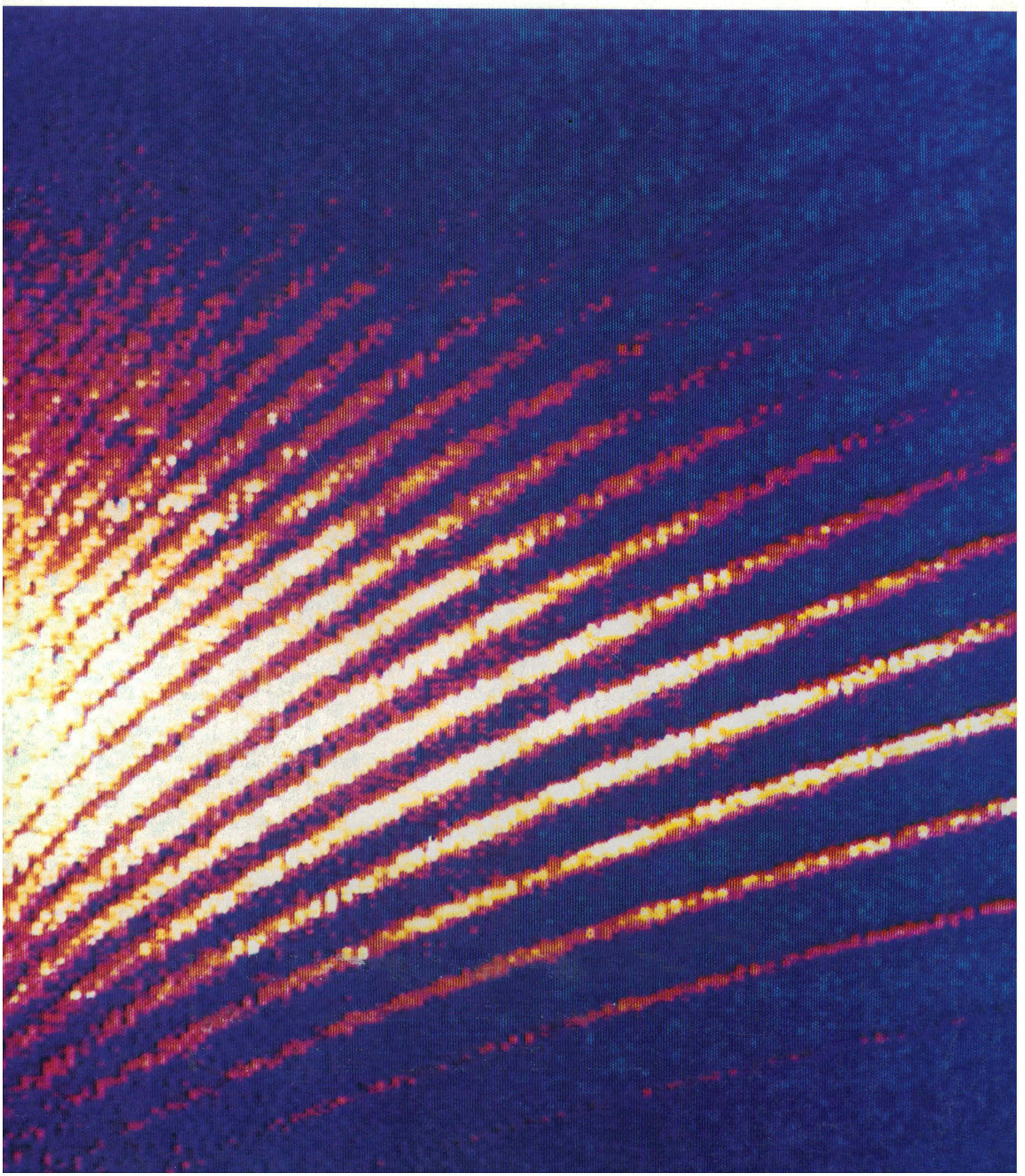

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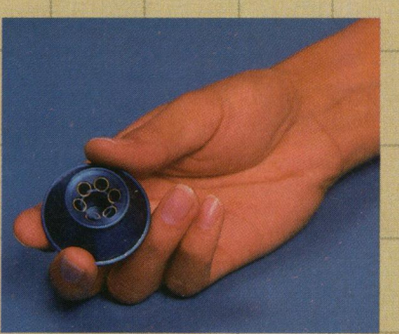

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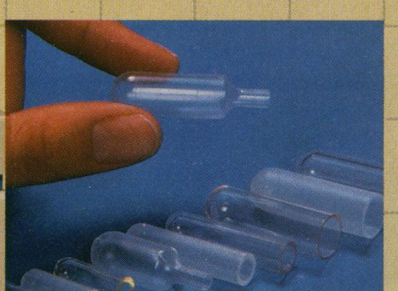
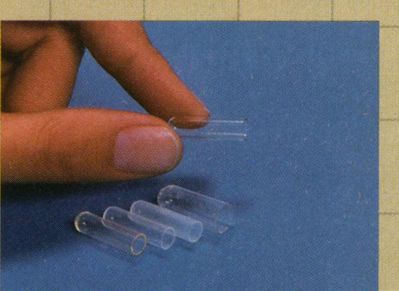


TL-100 milliliter-sized tubes. A choice of 10.



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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

Power as observed in solar 5-minute oscillations with frequency ν (from about 1.5 mHz at bottom to 5.7 mHz at top and degree l (from about 7 on left to 170 on right). The narrow ridges of concentrated power (shown by the lighter tones) corresponds to theoretically predicted acoustic resonances in the sun. Analysis of observed frequencies permits study of the structure and dynamics of the solar interior. See page 923. [T. L. Duvall, Jr., and J. W. Harvey, National Solar Observatory, P.O. Box 26732, Tucson, Arizona 85726]

Don't miss
"Quest for the Killers"
a PBS special series starting Monday, September 9.
See local listings for further information

Silent partners in world health

Recent triumphs in the field of tropical medicine will soon be celebrated in "Quest for the Killers," a documentary series to be aired nationally on PBS. One program will describe the fight against a worm infestation called schistosomiasis on the island of St. Lucia in the Caribbean.

Schistosomiasis affects as many as 200 million people in Africa, Asia, the Middle East, Puerto Rico and Latin America. It is often called "snail fever" because at one stage of their life cycle, *Schistosoma* worms infect snails that live on the bottom of rivers and streams. These parasites invade the skin of humans who drink, wash or swim in contaminated waters. They can cause severe itching, fever, diarrhea, and eventually irreversible damage to the liver. For 16 years, researchers visiting St. Lucia have been testing the practicality of various methods of control. Three approaches have proven to be most effective.

First, a public health team sprayed the rivers and streams of St. Lucia to get rid of infested snails. New plumbing facilities were constructed to assure a supply of uncontaminated water. Finally, treatment of people carrying the parasite was greatly facilitated by a drug developed and supplied by Pfizer. While previous treatments had to be given by injection, this drug was given orally only once, making it much simpler to reach a large number of people. The total control and elimination of the parasite is not yet a reality, but this combined medical and environmental program has done much to make life better for the people of the island.

Developing a drug such as this is a significant task that takes a decade or more and tens of millions of dollars. It generally involves the synthesis of hundreds of compounds in the organic chemistry laboratory. These compounds are then screened for antiparasitic activity. If one or more of them shows promise, the next step is to do toxicity studies and learn all about how the potential new drugs behave in laboratory animals. Only after completion of extensive, time-consuming animal studies can the drug be tested for safety and effectiveness in humans. And clinical trials in human patients can last for several years.

If the clinical trials indicate that the drug should be made available, new technology must be developed to produce it on a mass basis, and in cases like this, with little if any profitability for the developer.

Drug research and development isn't always "good theater." And it's largely a team endeavor generally without charismatic heroes. The days of Paul Ehrlich and his "magic bullet" are long past. The work of the pharmaceutical industry isn't usually the stuff of TV documentaries. But the drugs depicted in the various episodes came from the laboratories of pharmaceutical companies all over the world. The pharmaceutical industry has been the silent partner of government agencies, physicians, nurses and their associates who achieved public health miracles in St. Lucia and other developing countries.

In the Third World, pharmaceuticals are perhaps even more important than in advanced industrial countries. Often they are the only form of advanced medical technology which is practicable. Other forms of care, such as surgery, are often too cumbersome and too demanding of scarce resources. Drugs, by comparison, are portable, relatively inexpensive and comparatively simple to use.

The vast majority of drugs for the Third World and also for developed countries originate in the pharmaceutical industry. The government agencies do not have the broad expertise or resources for drug development, and medical schools and universities have different missions. Only the major research/pharmaceutical companies have the necessary skills and resources. Most manufacturers of generic drugs lack the research capabilities to create new drugs and test them for safety and efficacy. And that's only one reason an economically viable research-based pharmaceutical industry is important to all of us.

Pfizer is pleased to have been a partner in helping to reduce the hazards of one of the world's more widespread health problems. Pfizer is also pleased to have had an opportunity to help make it possible to tell this story. Therefore, we hope you will find time to watch "Quest for the Killers."

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Strangler's adaptation

The strangler fig *Clusia rosea*, growing in the Virgin Islands, uses a special mechanism (commonly used by cacti and other plants in arid areas but not by woody trees) for intake and storage of carbon dioxide for photosynthesis (page 969). Ting *et al.* determined that the plant uses CO_2 crassulacean acid metabolism (CAM), a metabolic cycle in which CO_2 is taken into leaf pores at night. This is an adaptation that plants in water-stressed environments employ to minimize water loss through the pores. The CO_2 is stored as malic acid in the leaves and is released the next day for use in the standard photosynthetic process. *Clusia* spends the first part of its life attached to a tree; its roots grow down and around the host, and water and inorganic nutrients are absorbed from rain running down the trunk. Later, having killed the host by strangulation and shading, *Clusia* becomes a free-standing tree. Its roots enter the ground, absorbing water and nutrients from the soil, but CAM can still be used for CO_2 absorption.

Climate history in ice cores

Two cylindrical cores of ice (each more than 150 meters long) from a remote permanent ice cap high in the Peruvian Andes provide records of past wet and dry periods and help depict the climatic conditions, volcanic activity, and glacial movements that affected the tropical mountain region during the past 1500 years (page 971). Thompson *et al.* collected the cores with a solar-powered drill and measured microparticles, oxygen isotopes, radioactivity, chemicals, conductivity, and pollen in the ice. The annual wet season (November to April) is followed by a dry period during which a layer of dust settles on the ice surface; each year's record is thus separated from the next, and the core can be dated and past periods of severe drought and heavy precipitation can be documented. From these and similar data from other mountain regions around the world a picture of global climate variations that have occurred during the past will emerge.

Human gut coronavirus isolated

A human coronavirus may be the cause of necrotizing enterocolitis (NEC), a serious bowel disease characterized by blood in feces, exfoliation of cells from walls of the intestines and colon, penetration of air within the gut wall, dehydration, shock, food intolerance, and abdominal distention (page 978). During an epidemic of NEC in a hospital nursery, Resta *et al.* found coronaviruses in stool samples from patients, but not controls, and antibody that reacts with the virus was found in convalescing infants. Isolates were propagated in cultures of human fetal intestinal organs; they destroyed portions of the cultured intestinal walls. These, like other coronaviruses, had a crown-like appearance (hence the name), RNA as the genetic material, and structural components of distinct sizes. Although coronaviruses have been associated with diarrheal diseases in animals, it has not been known to be associated with a human diarrheal disease. In humans, previous associations have been with the common cold.

Polyvalent genetically engineered vaccine

Rabbits can be vaccinated against three pathogens at once with a single genetically engineered vaccine (page 981). Perkus *et al.* inserted genes from three pathogenic viruses—hepatitis, herpes, and influenza—into the large molecule of DNA of the vaccinia virus. When immunized with the vaccine, rabbits made antibodies to the three pathogens (and to the vaccinia virus). Sequential immunizations with two engineered vaccines, each carrying genes of only one foreign pathogen, showed that the vaccinia carrier could be used repeatedly in individual animals. Polyvalent vaccines—containing genes of several pathogens, as in this experiment, or containing several variants of a single pathogen, such as the influenza virus—constructed with the stable vaccinia delivery system may eventually become routine for immunizations. Only the host's ability to respond immunologically to many foreign materials may limit the use of this sophisticated technology.

Growth factor for pigment cells

A factor that stimulates growth and cell division in melanocytes—pigment cells of the skin that have been difficult to study because they grow sluggishly and divide rarely—is made by melanoma cells and may contribute to unregulated cellular growth and division in malignant melanoma (page 984). Eisinger *et al.* isolated the growth factor from cell extracts of melanoma cells and other cell types in the neuroectodermal lineage. Production of the factor by normal skin cells derived from this line may be a part of the natural physiologic mechanism for regulating melanocytes. The new factor differs in physical and biological properties from previously isolated growth factors.

Hallucinogen effects

A popular street drug called MDA produces selective toxic effects in rat brains on the group of nerve cells that use serotonin as their neurotransmitter, raising the possibility that similar effects could be produced in the brains of humans who use the drug (page 986). Ricaurte *et al.* found that uptake sites for serotonin, but not other neurotransmitters, were destroyed by MDA and that levels of serotonin and one of its metabolites were reduced. These effects could be produced in rats with a single injection of the drug. How MDA, a synthetic compound structurally related to amphetamine and mescaline, produces its effects may help explain how naturally occurring analogs contribute to the development of neuropsychiatric disorders or degenerative diseases of the central nervous system.

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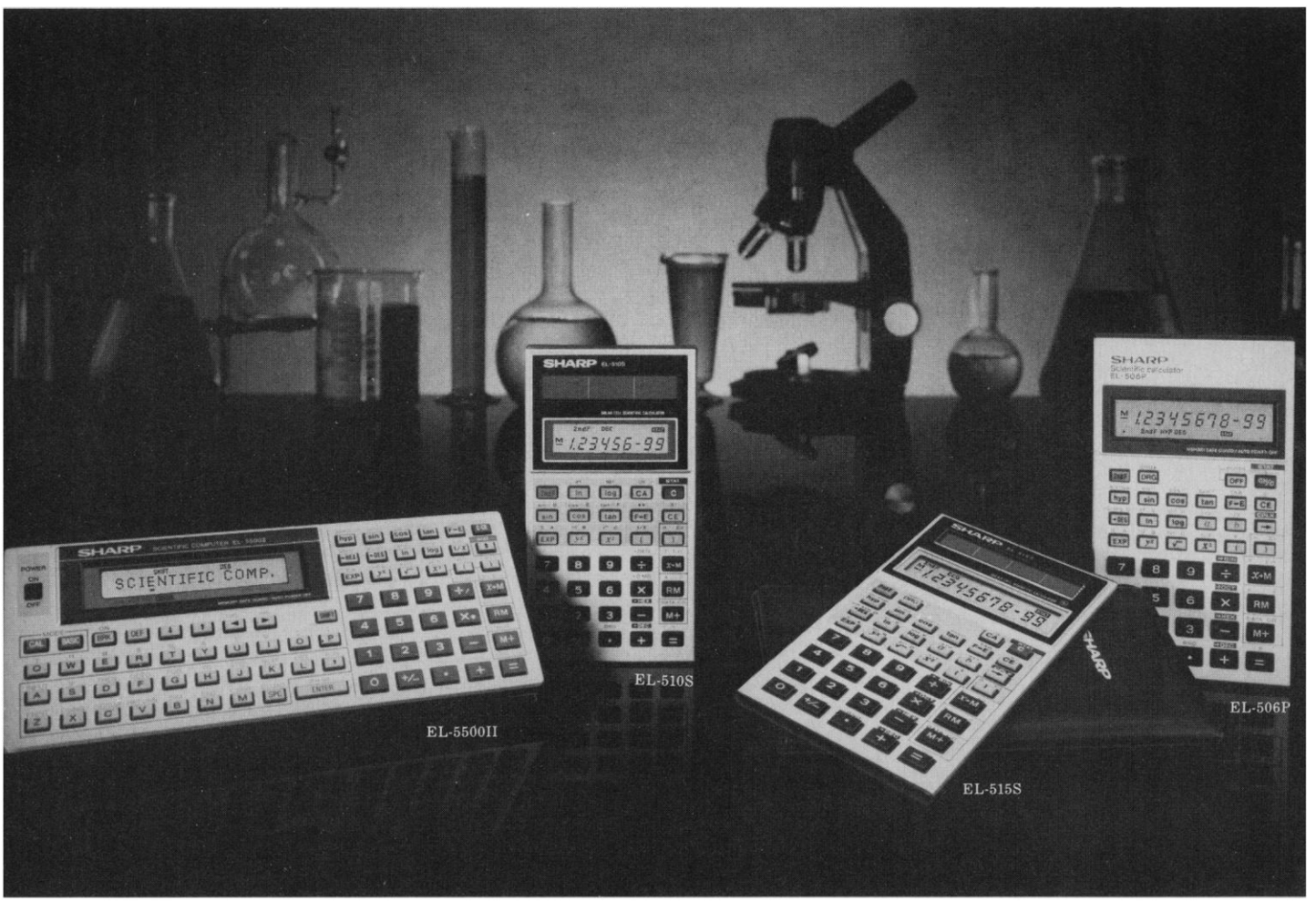

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9. Roughly a quarter of the cogeneration was also renewable, burning mainly forestry wastes. By 1984, renewable sources provided 10 percent of total U.S. primary energy—the fastest growing part, outpaced only by savings. Between 1979 and 1983, the United States got more than 100 times as much new energy from savings as from all net expansions of energy supply.
10. *The 1985 California Electricity Report* (P106-85-001, California Energy Commission, Sacramento, May 1985), pp. 12–15. Additional cost-effective savings are stated to be available if desired.
11. Mostly renewable, with an average project size of 12 megawatts. This capacity is generally more likely to operate on-peak than central thermal plants are: even wind, 5.8 GW of the offered 20.3 GW, is quite reliable on hot summer afternoons.
12. Counting electricity at its heat value of 3.6 megajoules per kilowatt hour. See H. R. Heede, "A preliminary analysis of federal energy subsidies in FY1984," testimony before the U.S. House of Representatives, Commerce Committee, Subcommittee on Energy Conservation and Power, 20 June 1985, available from the author. Heede's data show that fiscal year 1984 federal energy subsidies exceeded $46 billion, and that $1 of subsidy to efficiency and renewables yielded 80 times as much energy as $1 of subsidy to nuclear power.

Smart utility managers can save electricity faster than building new power plants. In most instances it is the smart path. But as Lovins says himself: "Few utilities take electrical efficiency seriously." In the next few years it may become clear whether the utility industry will become truly aggressive in their conservation efforts or remain wedded to the "build" mentality.—MARK CRAWFORD

Crawford accurately describes a growing concern that generating capacity may be insufficient to meet demand in some parts of the country during the next decade. As he notes, major factors in this problem are the sizable uncertainty in future demand coupled with high social costs from either excessive or inadequate capacity. He also points out that new coal-based technologies are becoming available which have very attractive characteristics for adjusting to uncertain demand and environmental requirements: low air emissions, short construction lead times, and small unit size (and small capital investment commitments). Despite this, few new power plants have been ordered recently due to utility concerns that construction costs will not be recovered if demand grows more slowly than projected. The lack of new orders presages two other problems for the industry: an aging stock of power plants and dispersion of experienced engineering talent by power plant vendors.

The article does not mention the other major uncertainty facing the industry for the next decade—the environmental requirements for existing and new coal-fired generating plants. That reductions in sulfur and NO_x emissions are desirable is not in dispute; the problem is cost and its distribution.

A partial solution to both environmental and potential capacity problems may be possible through a linkage of the two issues. For regions with dirty coal plants where capacity additions are desirable, it appears attractive to construct clean coal plants based on combined-cycle coal gasification or fluidized bed combustion. The new, clean plants would displace generation by plants with less sophisticated and effective pollution controls. The combined-cycle coal gasification system in particular has been demonstrated at a commercial scale to have low air emissions, high reliability, short construction periods, and generation costs which, although currently high, appear to be potentially competitive with standard coal plants with scrubbers. Such plants are now being offered to utilities by vendors.

The primary advantage from building these plants is that construction expenditures would provide both capacity additions and air emission reductions. Old coal plants would become part of the utility's capacity reserve, to be used if demand turned out to be high. Under slow demand growth, the older, most polluting plants would not operate. Unlike expenditures for scrubber retrofits to existing plants (some of which are already quite old), this program would not only reduce emissions but would increase peak generating capacity needed to deal with high demand. In contrast, scrubber retrofits do not increase capacity.

At present, scrubbers represent a cheaper path to pollution control than does construction of new, cleaner plants. Just how much additional cost is justified for new plants that provide both reductions in emissions as well as increased system capacity needs to be judged in each specific context. But a number of less tangible benefits are associated with new generation additions. Practical experience with new generating technologies, necessary for future utility commitments, would be gained. The aging of the power plant stock would be slowed, and power plant vendors and constructors would be kept going. Environmentalists may find the approach attractive as an addition to conservation and load management programs. State utility commissions could reassure utilities that cost recoveries for such projects would be allowed even if demand is low, recognizing that pollution reduction is the primary objective. This approach moves in the direction of reduced emissions, and also advances the availability of attractive new generating technologies.

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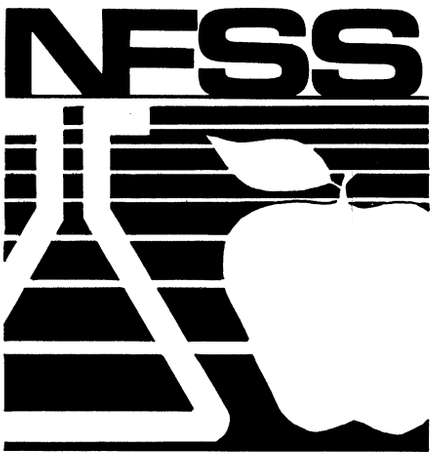

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6 September 1985, Volume 229, Number 4717 **SCIENCE**

To: Universal Science Foundation
Planet Utopia
Galaxy 7,073,216

From: Intergalactic Cultural Anthropology Expedition
Sections IV and XXI

Re: Anomalous Behavior Patterns

The expedition to examine subcultures and behavioral patterns on Planet Earth has uncovered an anomaly that defies explanation by the rational principles and Cartesian logic of our own planet. Sections IV and XXI traveled independently in separate cruise missiles and randomly selected inhabitants for analysis by our noninvasive probes; that is, acoustical eavesdropping and quantitative three-dimensional gossip.

At 3:00 p.m. Earth Time on 4 August, Section IV located an individual with a red face speaking into a telephone at the 10^3-decibel level. The subject was using arcane linguistic techniques with multisyllable words such as "nincompoop" and "incompetent" occasionally interspersed with four-letter words not available in captured dictionaries. This species, which Section IV calls "Author," was complaining bitterly to something called *The Journal* that his manuscript had received no decision in 3 weeks despite (i) it represented better work than had ever appeared in that journal for the last decade and (ii) it was easily the best of his 176 papers, none of which had been treated so shabbily. It was ascertained that this work had taken 2 years to complete, 3 months to write up, and 1.5 months to be criticized by colleagues of the Author before being sent to *The Journal*. At 3:37 p.m., Section IV moved on to study behavior of one horse, two bullfinches, and a garter snake, all of which behaved in a classical and rational Cartesian manner.

At 4:00 p.m. on 4 August, Section XXI located an individual with a red face speaking into a telephone at the 10^{-3}-decibel level using multisyllable words such as "impossible" and "inconceivable" occasionally broken by signs, groans, and anguished looks at the ceiling. This species, which Section XXI calls "Referee," was apologizing to something called *The Journal* that (i) the manuscript that he had received for review had only recently arrived, having been delayed in the mails; (ii) he had in fact been studying the manuscript for weeks; and (iii) it had come during a period when he was out of the country, writing a grant, lecturing to 300 students, and lying flat on his back in the hospital being fed intravenously. He promised that the manuscript would be put in the mail "tomorrow" and complained that it was unreasonable of *The Journal* to expect a busy Referee such as he was to review a manuscript in less than 3 weeks. Section XXI was unable to obtain a definition of the word "tomorrow" before it moved on to study the viscosity of rush-hour traffic.

The anomaly in the case was not recognized until the two sections received laboratory reports of their remote-sensing DNA-sequencing determinations and optical surface imagery. The former indicated identical DNA sequences for the two species and optical photographs revealed identical clothing and facial characteristics. The sections concluded that it was theoretically astounding, but experimentally conclusive, that both expeditionary units had observed the same individual. No explanation for the subject's behavior could be suggested until Professor X173 discovered that there were two hemispheres of the brain of *Homo sapiens*. We conclude that a single body houses both species, but that the Author species uses the left hemisphere and the Referee species the right hemisphere, and there is no cross-correlative system. Professor X173 predicts that such split personalities will create wars, famines, and two types of Coca-Cola.

—DANIEL E. KOSHLAND, JR.

THE SIXTH ANNUAL CONGRESS FOR
RECOMBINANT DNA RESEARCH
JANUARY 26 - 29, 1986
BALTIMORE CONVENTION CENTER, BALTIMORE, MARYLAND

Co-Chairmen:

John D. Baxter
Univ. of California
San Francisco, CA

Walter L. Miller
Univ. of California
San Francisco, CA

Peter Gruss
Univ. of Heidelberg
West Germany

The Annual Congress for Recombinant DNA Research, now in its sixth year, is recognized as the premier symposium on the subject, and presents the important developments that impact on current and future work.

Keynote Speakers: Charles Weisman, University of Zurich, Switzerland
Interferon Genes and their Expression

Philip Sharp, Massachusetts Institute of Technology, Cambridge, MA
Gene Expression in Mammalian Cells

Session Chairman

ONCOGENES
Peter Gruss, Univ. of Heidelberg, W. Germany

TRANSCRIPTION
Pamela Mellon, Univ. of CA, San Diego

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Walter L. Miller, Univ. of CA, San Francisco

PLANTS
Frederich Ausubel, Mass. Genl. Hosp., Boston, MA

HORMONES
John Baxter, Univ. of CA, San Francisco

DEVELOPMENTAL BIOLOGY
Shirley Tilghman, Fox Chase Cancer Ctn., Phila, PA

NEUROBIOLOGY
James R. Roberts, Columbia Univ., N.Y., N.Y.

YEAST
Jack Szostak, Mass. Genl. Hosp., Boston, MA

Poster Sessions: ADVANCES IN RECOMBINANT DNA RESEARCH

Participants are invited to submit abstracts for the poster sessions. These abstracts will be reviewed up until the time of the meeting; however, only those accepted by Nov. 15 will be published in the journal, DNA. Contact Edward Ruffing, Scherago Associates, Inc., (212) 730-1050.

Organized by Scherago Associates, Inc., in conjunction with the journal, DNA, and Genetic Engineering News

REGISTRATION FEES:

$400 On-site registration – includes a one year subscription or renewal to the journal, DNA.
$350 ADVANCE REGISTRATION – (Received by Nov. 15) – Includes a one year subscription or renewal to the journal, DNA.
$ 75 STUDENT REGISTRATION – Student status must be confirmed in writing by department chairman.
4-7 registrations received together from same organization $300 each. Includes 4 journal subscriptions only.
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