16 May 1980 • Vol. 208 • No. 4445 $1.50

SCIENCE

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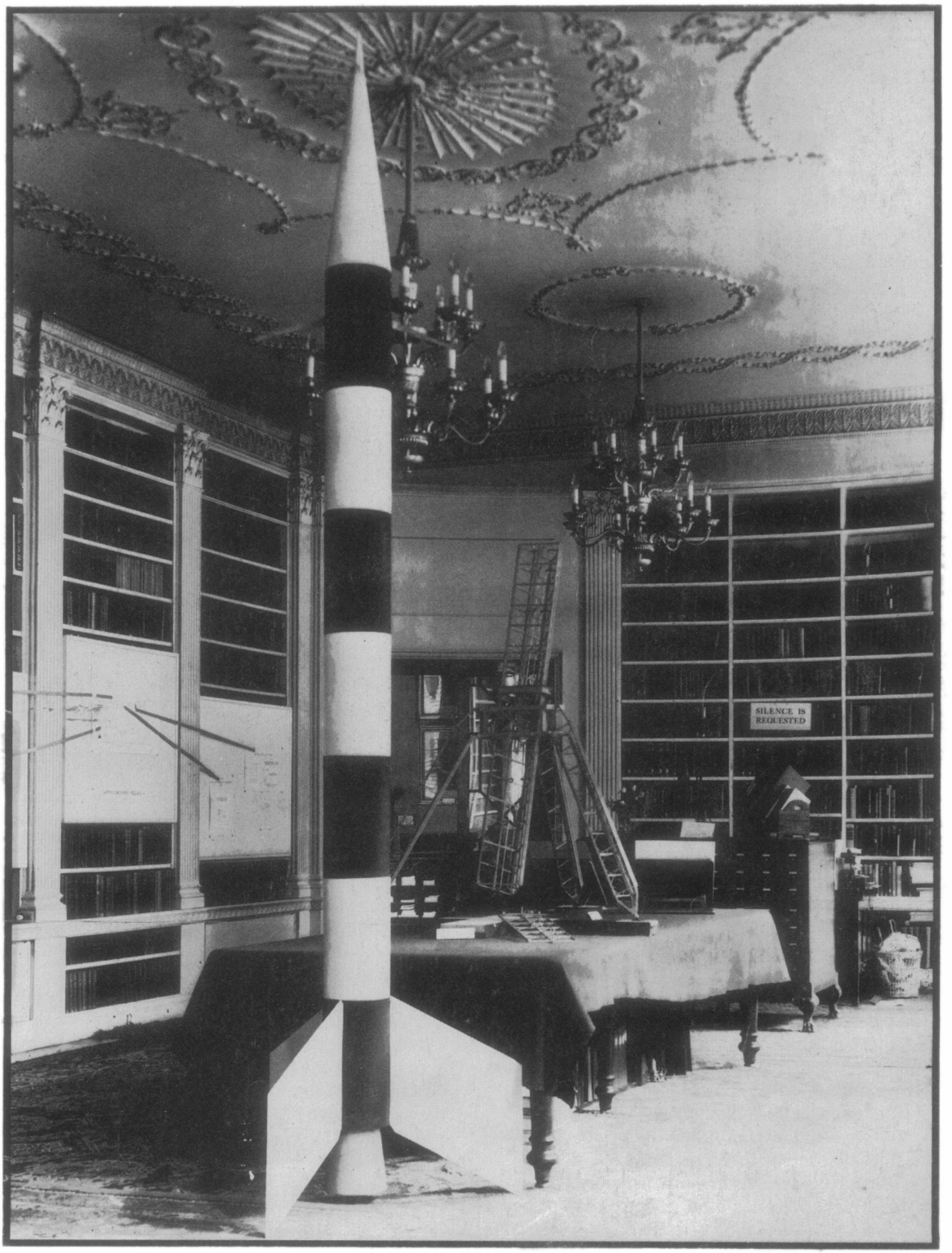
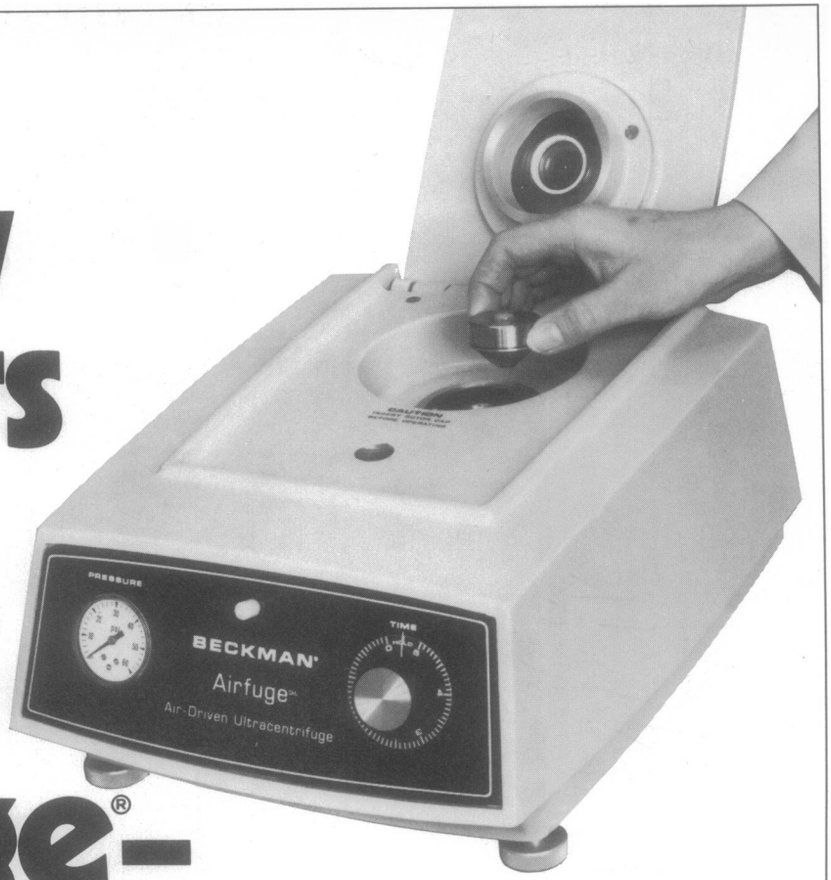
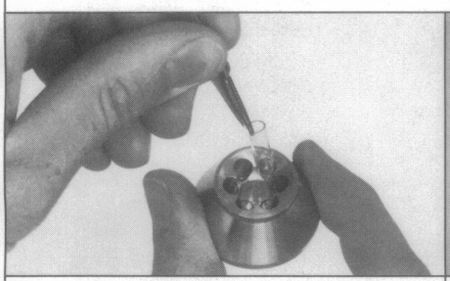


Book Issue

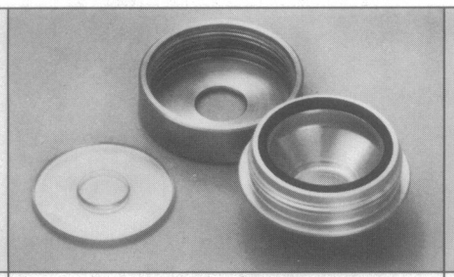
New rotors for the Airfuge®–



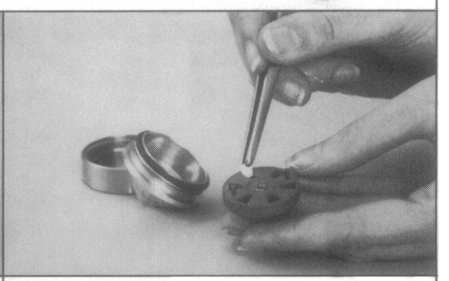
the small-sample ultracentrifuge.



The new 30° fixed angle rotor holds up to 240 μl per tube and provides forces up to 178,000 g.



The new Batch Rotor rapidly pellets 2 to 7 ml of material.



The new Electron Microscopy Particle Counting Rotor is useful for virus research.

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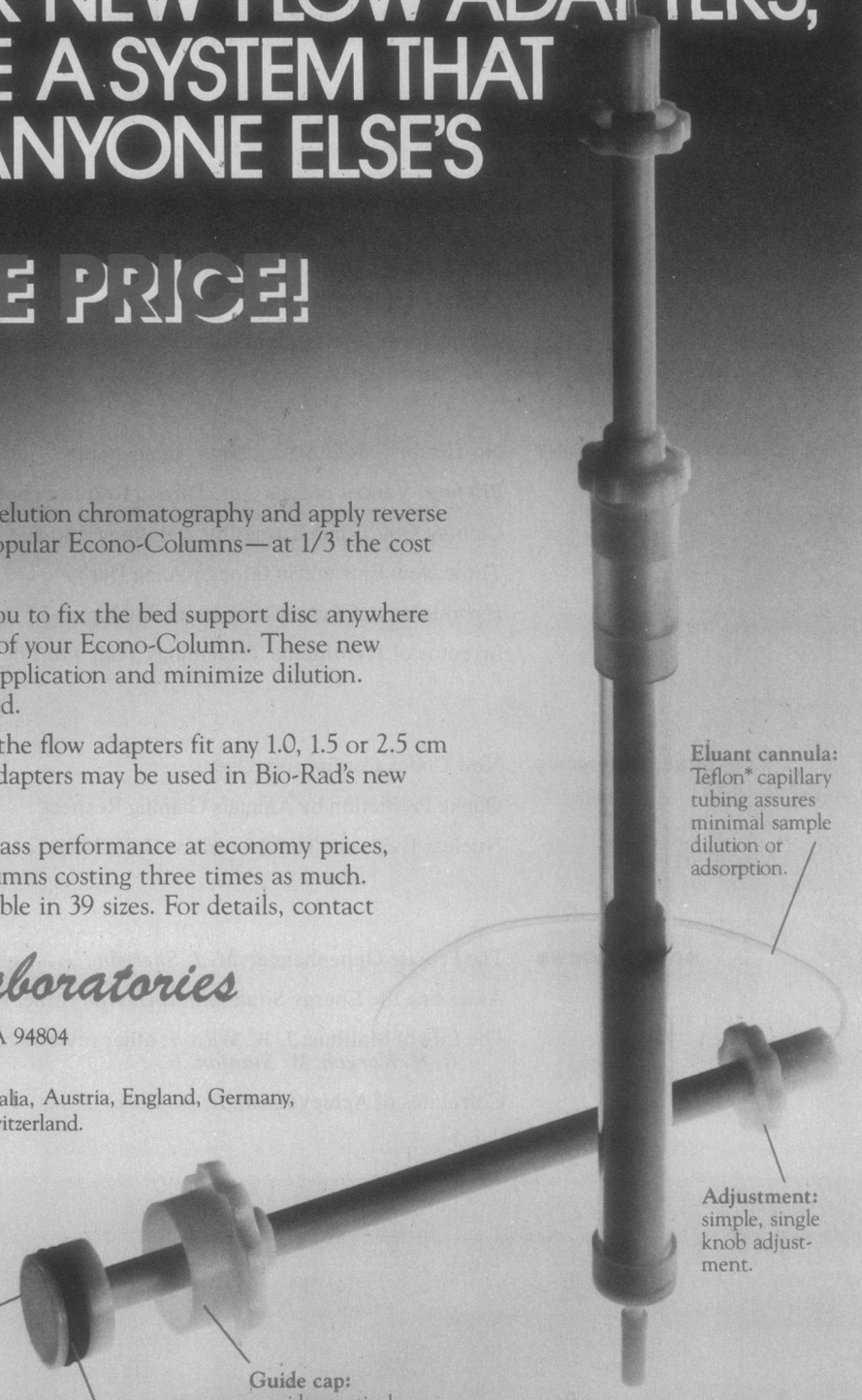

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Volume 208, No. 4445

SCIENCE

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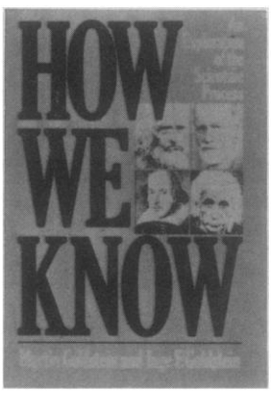
COVER

Full-scale model of the Skylark rocket at the 1957 International Geophysical Year exhibition at the Royal Society, London. Bailey Bridge parts were used in the launching platform, a model of which is on the table. [From *Atomic and Molecular Collisions*, reviewed on page 727]



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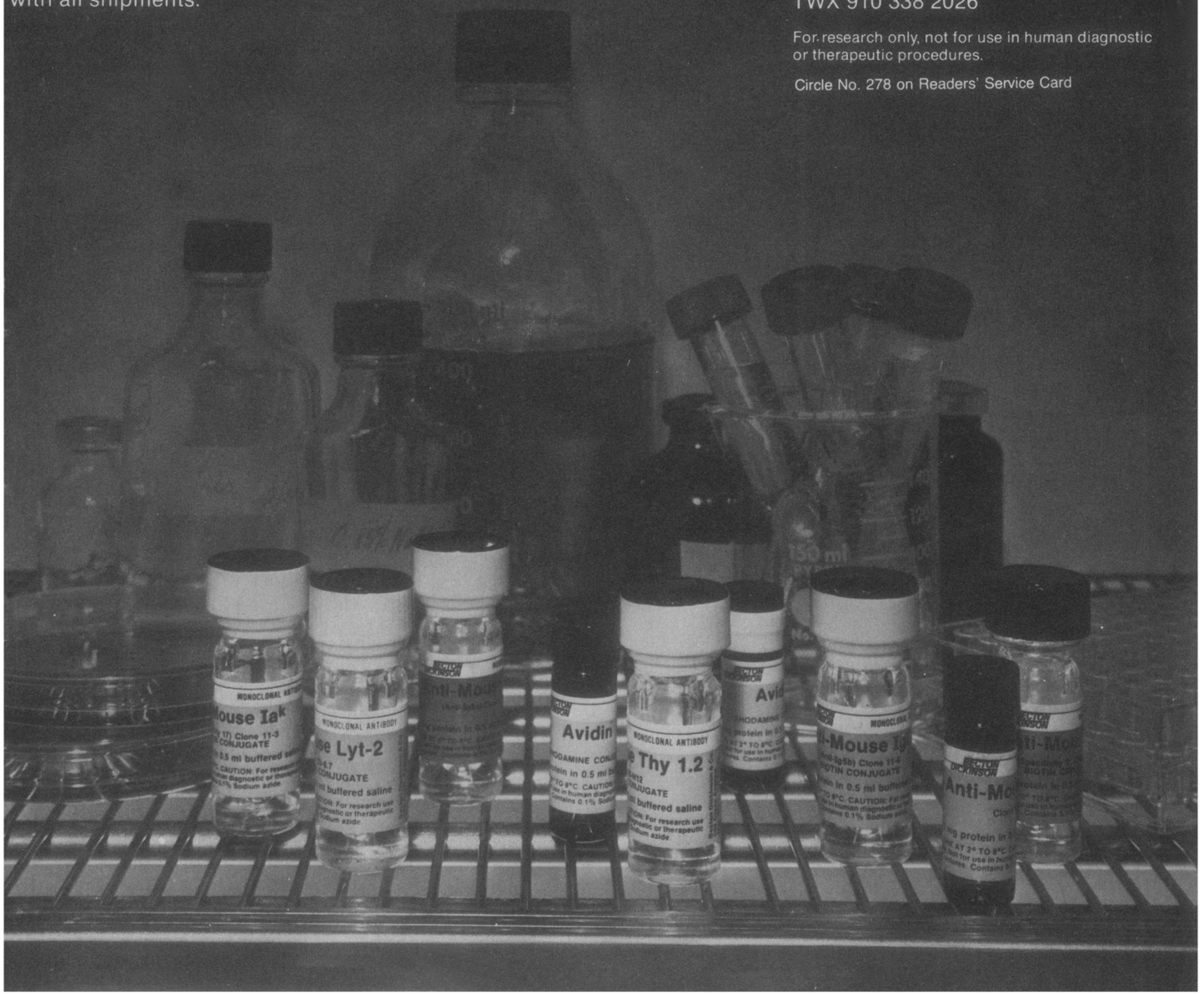

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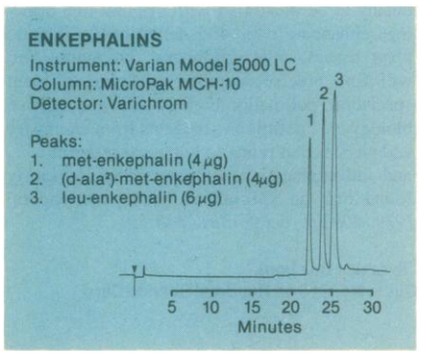
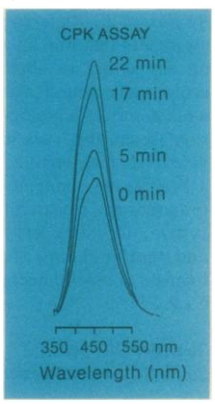
1 **Separate proteins and peptides**, nucleosides, nucleotides, PTH-amino acids and fatty acids with the new microcomputer-CRT-based **Model 5000 Liquid Chromatograph.** In the chromatogram shown, peptide species differing only in a single amino acid are sharply separated.



The 5000 will store nine complete separation methods in memory for instant call-up. Saves time. Makes method development easy. **Reader Service No. 137**

2 **Do enzyme assays** on microsamples with the new **SF-330 Spectrofluorometer.** It gives you broad bioanalytical capability at modest cost.

The SF-330's special microflow cell also lets you measure PNAs, vitamins, drugs and amino acids after separation by liquid chromatography. **Reader Service No. 138**



Ex = 340 nm, slit = 10 nm
Em = 465 nm, slit = 20 nm
Temperature 27°C

3 **Investigate drug metabolism**, study the topography of binding sites, enzymatic reactions, membrane structure, and the effects of anesthetics with the **E-109E EPR Spectrometer System.**

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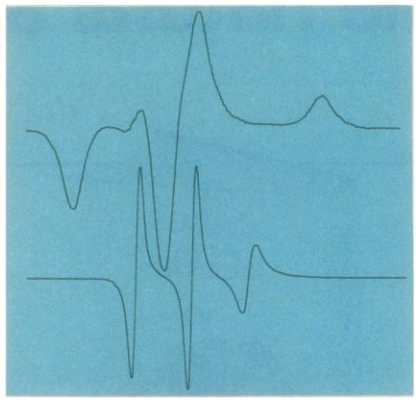
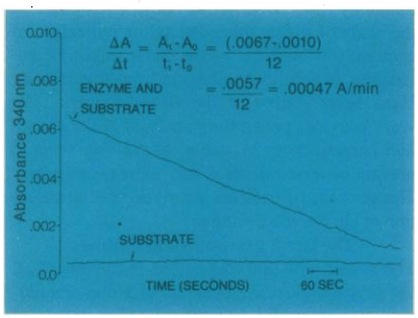


Before (A) and after (B) administration of anesthetic.

stored by the E-900 EPR data system for future comparison and manipulation. **Reader Service No. 139**

4 **Measure enzyme activity** at 0.0005 A/min with the new **Models 210 and 219 UV-Vis Spectrophotometers.** You don't have to concentrate your column fractions when the activity is low and you don't have to dilute your samples when highly turbid material is present. The Models 210/219 will handle them all.



And Models 210/219 have routine sampling kinetics systems that will sip a 500-μl sample and in 15 seconds measure its kinetics at 20°, 25°, 30°, 32° or 37°C. To make interpretation easy, the instrument will print all results on its microprocessor-based Smart Printer. **Reader Service No. 140**

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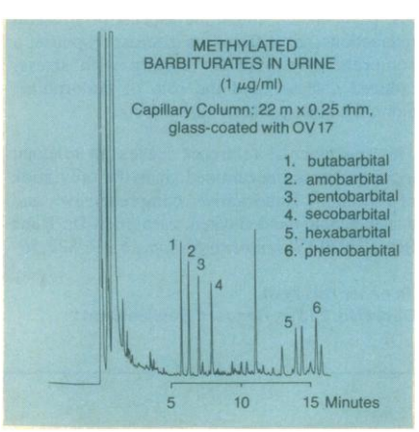
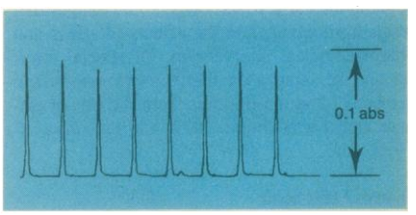


6 Use the new Varian **AA-875 Atomic Absorption Spectrophotometer** to **measure electrolytes in tissues, cells, and fluids;** determine toxicity; nutrient and metabolic activities; therapeutic effects of some 67 elements. Extreme sensitivity of the AA technique enables characterization of microliter samples. **Reader Service No. 213**



Replicate measurements of lead in blood-acid solution, using carbon rod atomizer. Sample volume 2 μl. Lead level 400 pg. Relative standard deviation 3.2%.

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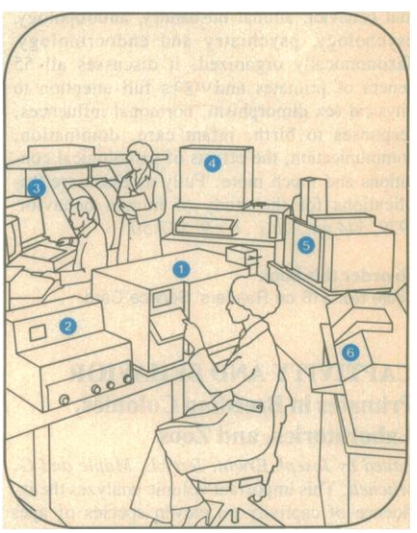

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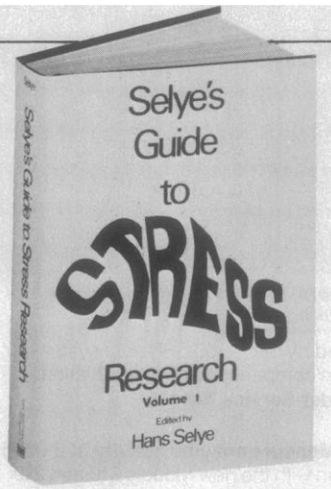

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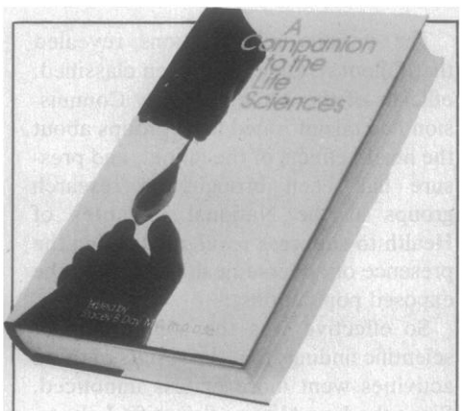

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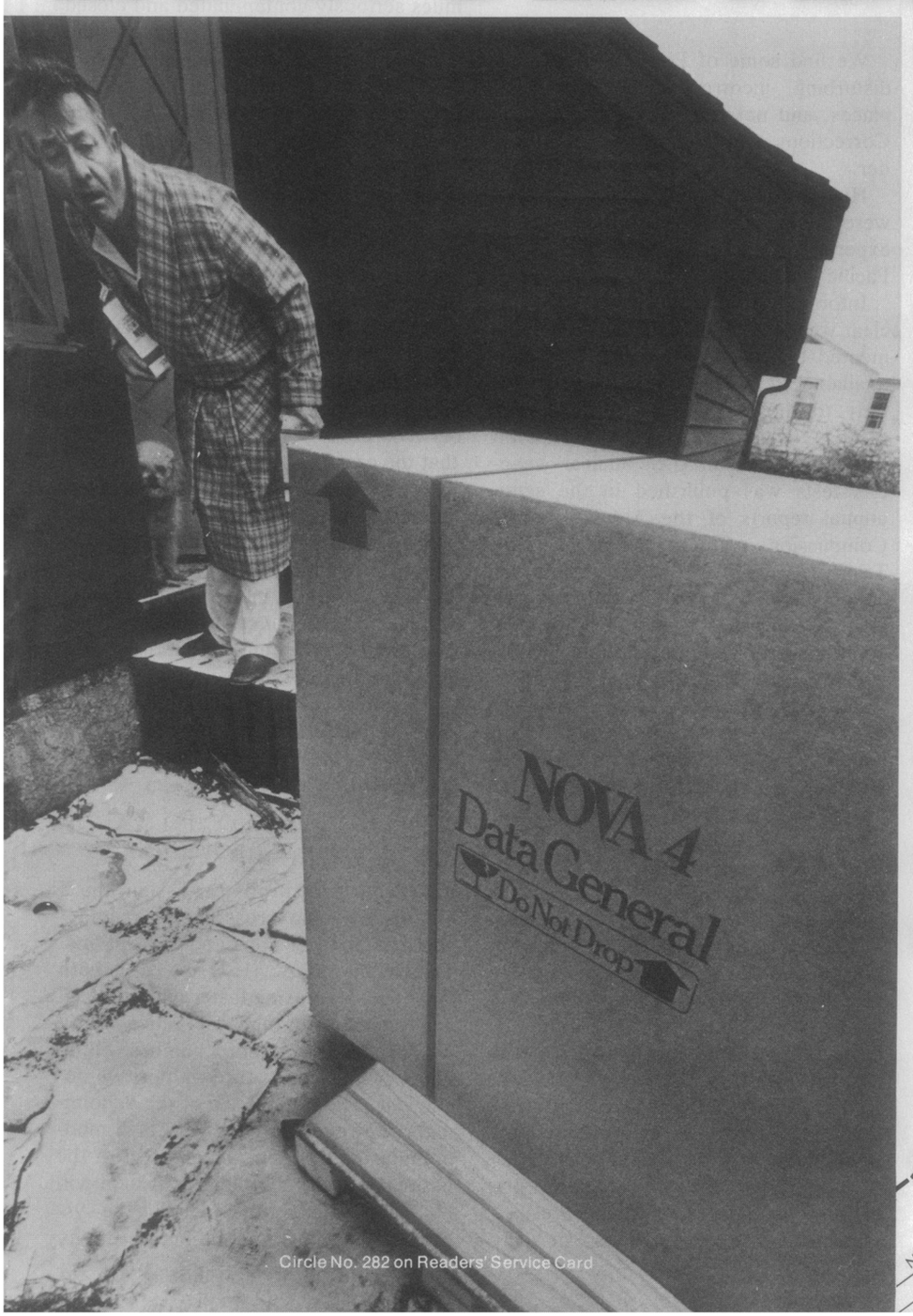

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trough where sinking air is generally found.

Hence, the suggested hypothesis is tenable only if the airburst occurred on either 28 January or 10 February 1958. Or—to turn the argument around—how about accepting the cause-hypothesis and concluding that the weather maps for the Soviet Union pinpoint the times of the nuclear tests?

E. PAUL MCCLAIN
National Environmental Satellite Service, National Oceanic and Atmospheric Administration, Washington, D.C. 20233

References

1. U.S. Weather Bureau, *Northern Hemisphere, Sea Level and 500-Millibar Charts* (Department of Commerce, Washington, D.C., January 1949 on).

We find some of Postol's allegations disturbing, incorrect in a number of places, and not relevant to our article. Corrections and comments are in order.

High-yield thermonuclear devices were never exploded in Nevada. Such experiments were conducted only in the Pacific test range.

Information on fallout from U.S. nuclear weapons tests has been well documented for many years and is readily available to those wanting it, particularly to those residing in the vicinity of the Nevada Test Site. Information on fallout from all U.S. nuclear weapons tests was published in the semiannual reports of the Atomic Energy Commission (AEC), beginning with Trinity (*1*), the first nuclear weapons test conducted in July 1945. In addition, two extensive hearings (*2*) were held by subcommittees of the Joint Atomic Energy Committee (27 May to 3 June 1957 and 5 to 8 May 1958). These contain tables of the exposures to the off-site population and, in some cases, the measured fallout patterns. In particular, the 16th report (*3*, pp. 48–52) of the AEC gives the exposures to populations from operation Upshot-Knothole in 1953, which contributed the major exposure to the population of southwest Utah.

Before a test series at the Nevada site, senior members of the test organization visited the surrounding communities to inform them of the program, outline the protection measures being taken, and to answer questions. Movies of previous nuclear tests were shown, and information pamphlets were distributed (numbering into the thousands) giving details of the purpose of the program, precautions being taken, and exposures sustained by off-site populations.

Radiation monitors from the Public Health Service were assigned to a community, held discussion sessions, and lived and worked in the community. Resident monitors were augmented by roving monitors in radio contact with the test organization. In addition, the state health officers in Nevada, Utah, California, and Arizona were kept advised.

The phenomenology of fallout was described in 1950 (*4*) and in updated editions (*5*) of the same publication. These have been available from the Governmental Printing Office for a nominal fee.

With reference to Postol's final sentence, we can only paraphrase Medvedev's allegations: Hundreds killed, tens of thousands injured, more than 1000 miles seriously contaminated and closed to the public. We repeat that we find it hard to believe that such a calamity could occur and the event not be discussed in detail by more than one individual in 20 years.

Dyson raises an interesting and valid point. The thermal fission cross section of plutonium-239, indeed, displays a resonance at 0.3 volt, the value of which, at the peak of the resonance, is about three times the cross section at 0.025 volt. This resonance is sufficiently large that the fission and absorption cross sections are influenced by it even at thermal energies (0.025 volt). The usual relation between cross section and energy (E) is that the cross section decreases inversely as the neutron velocity (v) increases; the resonance changes this relation so that the cross sections decrease less rapidly with increasing E or v, and, for a very highly moderated fissioning system, the resonance produces a positive temperature coefficient of reactivity, albeit small at low temperatures.

This effect is explained as follows. The neutron multiplication factor of (for example) a plutonium-239–water system can be written

$$k_\infty = \frac{\nu\Sigma_f(\mathrm{Pu})/\Sigma_a(\mathrm{Pu})}{1 + \Sigma_a\,(\mathrm{H_2O})/\Sigma_a\,(\mathrm{Pu})}$$

in which ν = neutrons per fission, the Σ are macroscopic cross sections, and f and a refer to fissions and absorptions. Thus, if the ratio $\Sigma_a(H_2O)/\Sigma_a(Pu)$ is both large and decreasing faster with increasing temperature than the ratio $\Sigma_f(Pu)/\Sigma_a(Pu)$, the reproduction number will increase with temperature—a positive coefficient. The dominance of the denominator, however, implies very high moderation; the first significant effect of the fissioning of such a sluggish system will be to boil water, both expanding the system and reducing moderation. Reactivity

would then decrease rather than increase.

We agree that a study with a rigorously correct computer program (these are called coupled neutronic-dynamic-thermodynamic codes) is necessary to establish this qualitative discussion in a quantitative manner and should be done to settle the question. We reassert, however, that widespread dispersal of fission products by such a mechanism is monumentally difficult and a most unlikely mechanism to cause them to be airborne, especially over 1000 square miles.

We thank McClain for advising us that 500-millibar charts for the entire Northern Hemisphere are available, especially for the period from 1957 to 1958.

WILLIAM R. STRATTON
Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544

References

1. *13th Semiannual Report of the Atomic Energy Commission* (Government Printing Office, Washington, D.C., 1953), p. 80.
2. Special Subcommittee on Radiation, Joint Committee on Atomic Energy, *Fallout from Nuclear Weapons Tests* (Government Printing Office, Washington, D.C., 1959); *On the Nature of Radioactive Fallout and Its Effect on Man* (Government Printing Office, Washington, D.C., 1957).
3. *16th Semiannual Report of the Atomic Energy Commission* (Government Printing Office, Washington, D.C., 1964).
4. S. Glasstone, *Effects of Atomic Weapons* (Department of Defense and Atomic Energy Commission, Washington, D.C., 1950).
5. _____, *Effects of Nuclear Weapons* (Department of Defense and Atomic Energy Commission, Washington, D.C., 1957); *ibid.* (1962); *ibid.* (1964); *ibid.* (1979).

Significant Sevens

In his recent article on Oral Roberts "And God said to Oral: Build a hospital" (News and Comment, 18 Apr., p. 267), William J. Broad observes that secular forces in the form of the 1974 National Health Planning and Resource Development Act (NHPRDA) forced Roberts to reduce the number of beds in his City of Faith "Health Care and Research Center" from 777 to 294. Due to the biblical significance of the number seven, Roberts went so far as to liken the NHPRDA to the Devil. However, both Broad and Roberts seem to have missed God's Divine Order as expressed through the NHPRDA.

Mirabile dictu, 294 is equal to $7 \cdot 7 \cdot 7 - 7 \cdot 7$. Thus, Roberts may wish to note that the new 294-bed City of Faith is actually "two sevens better" than the original Divine Plan.

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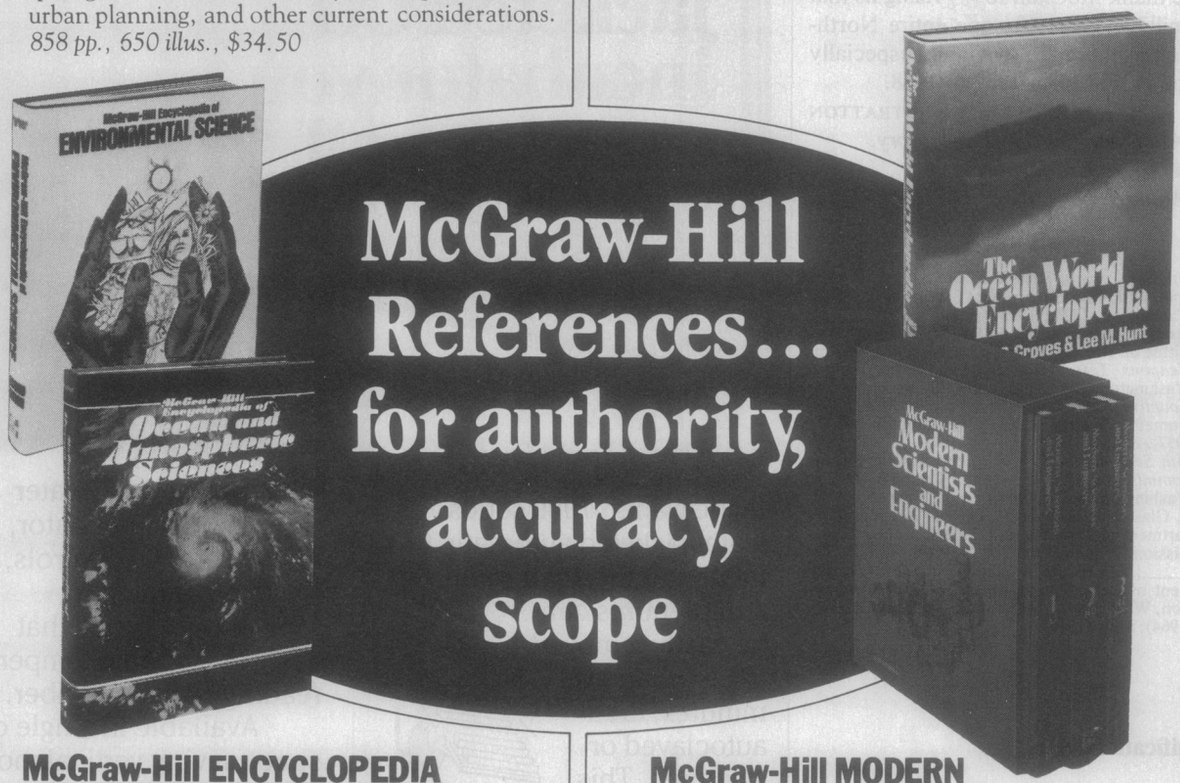

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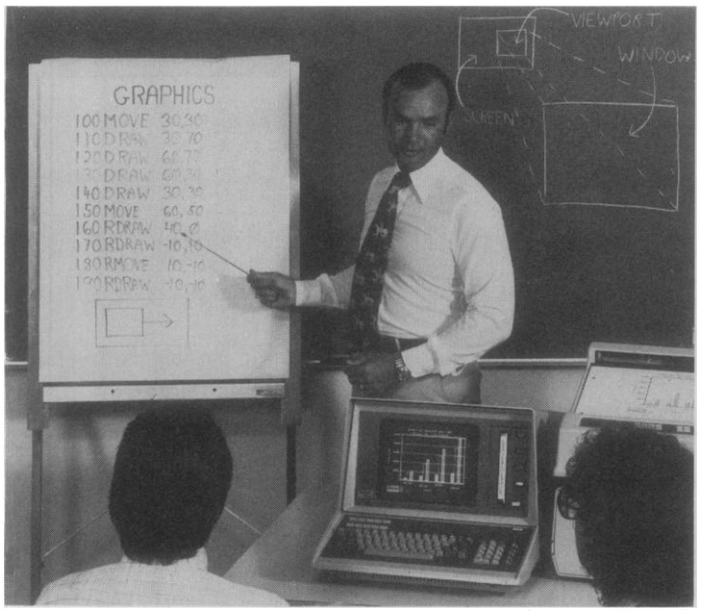

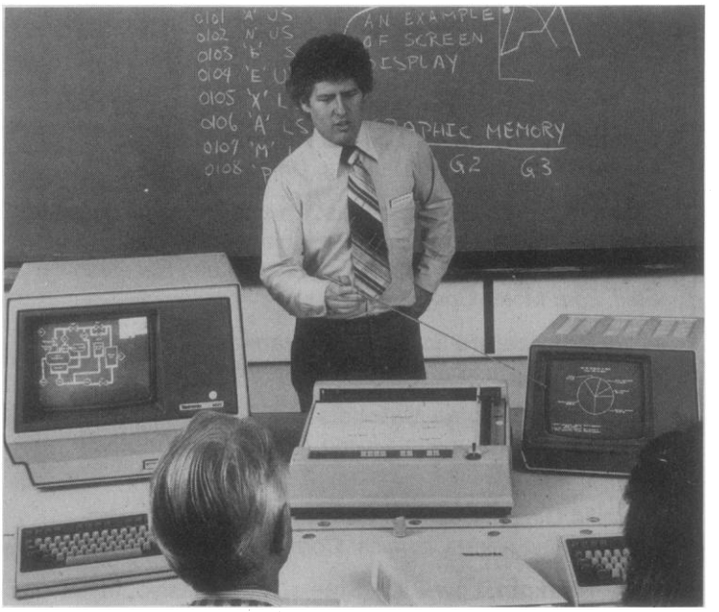

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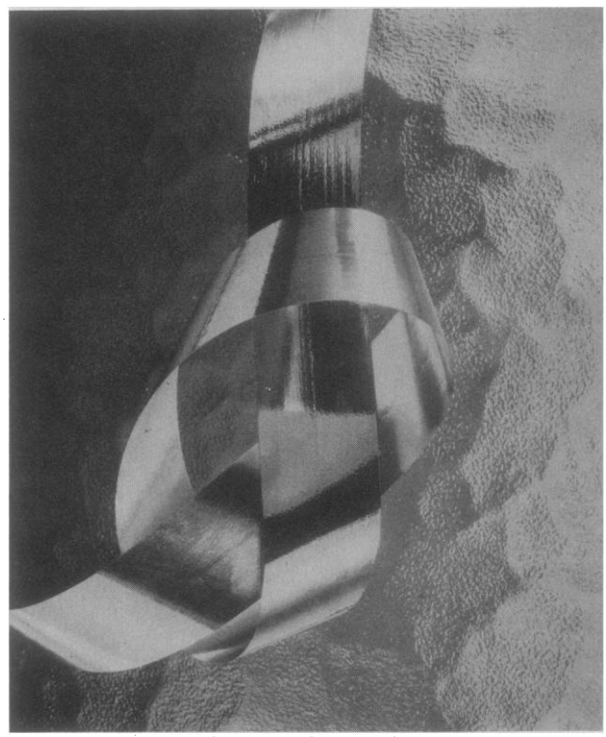

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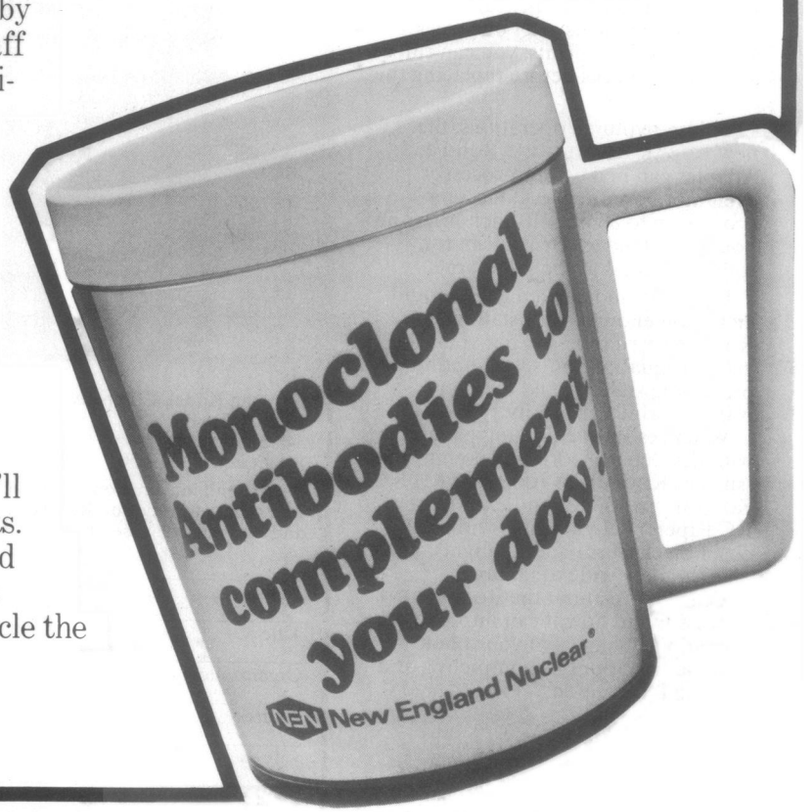

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16 May 1980, Volume 208, Number 4445 **SCIENCE**

Science, Technology, and the Court

The case load of our court today predominantly involves challenges to federal administrative action relating to the frontiers of technology. Expanding health and safety regulations and increasing citizens' suits have drawn us toward a new era in which at least two aspects of public policy related to technology and risk pose unique problems.

First, cases of the new era touch on personal interest in health and safety. The quality of air, food, and water and the safety of autos, drugs, and power plants penetrate our ways of life and determine our well-being. Regulations in these areas raise the stakes and emotions higher than do the economic issues handled by the IRS, the FCC, and similar agencies.

Second, the new health and safety regulatory matters deal with imponderables. When it comes to the effect of chemical exposure on hormones, chromosomes, and the like, the experts acknowledge how little they agree, and how little they know. They disagree about acceptable measurement techniques and about the reliability of raw data. They disagree even more about the inferences to be drawn from the facts. Often, they can tell us only of "the risk of risk." And even if there were a scientific consensus about the factual magnitude of risks, painful choices would remain. How can economic dislocation, food shortages, and inadequate fire protection be weighed against possible future harm to health?

Courts must not be expected to resolve such questions. What judge knows enough to understand issues on the frontiers of nuclear physics, toxicology, and other specialties informing health and safety regulations? Courts also lack the political mandate to make the critical value choices which ultimately are reserved for the public. These decisions must be made by elected representatives or public servants legally accountable to Congress and the people.

I believe that the judicial responsibility is to moniter and scrutinize the administrative process. Our task is to ensure that the agency's decision-making is thorough and within the bounds of reason. The agency's decisional record must disclose the evidence heard, policies considered, and the agency's precise reasons for resolving conflicts in the evidence. This includes the basis for selecting one scientific point of view rather than another. This permits quality checks through peer review, legislative oversight, and public attention. Only if decision-makers disclose assumptions, doubts, and moral and political trade-offs can experts and citizens evaluate administrative action. Only then can professional peer review bring to light new data or challenge faulty assumptions. And only then can Congress and the people gain sufficient understanding to permit meaningful debate of the value choices implicit in regulatory action.

Acting independently of both expert and political debate, courts can compel full ventilation of the issues on the record, as well as accustom decision-makers to the discipline of explaining their actions. Finally, courts can ensure that all persons affected have opportunities to participate. The result should be an open process that can reveal gaps, stimulate research, and thereby inspire more confidence in those affected, including the scientifically untutored.

There is one more element of the court's function. By requiring opportunity for challenges, the courts protect the use of an adversary process at the administrative level, thus forcing differing people to join issue.

In resolving differences, "civility" in both its common meanings should prevail. The first is related to politeness and accepted norms of social behavior in civil society. Civility can set norms of honest discourse, promoting listening as well as talking. The second meaning I give to civility is the quality we strive for in the name of civilization, the ideal state of human culture where human beings are the measure of value and humankind is the subject of enhancement.—DAVID L. BAZELON, *Senior Circuit Judge, U.S. Court of Appeals for the District of Columbia Circuit, Washington, D.C.*

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