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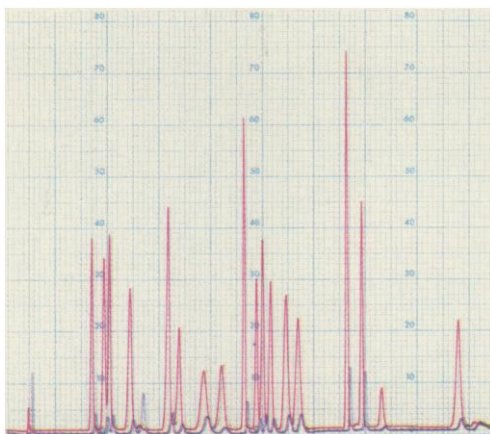
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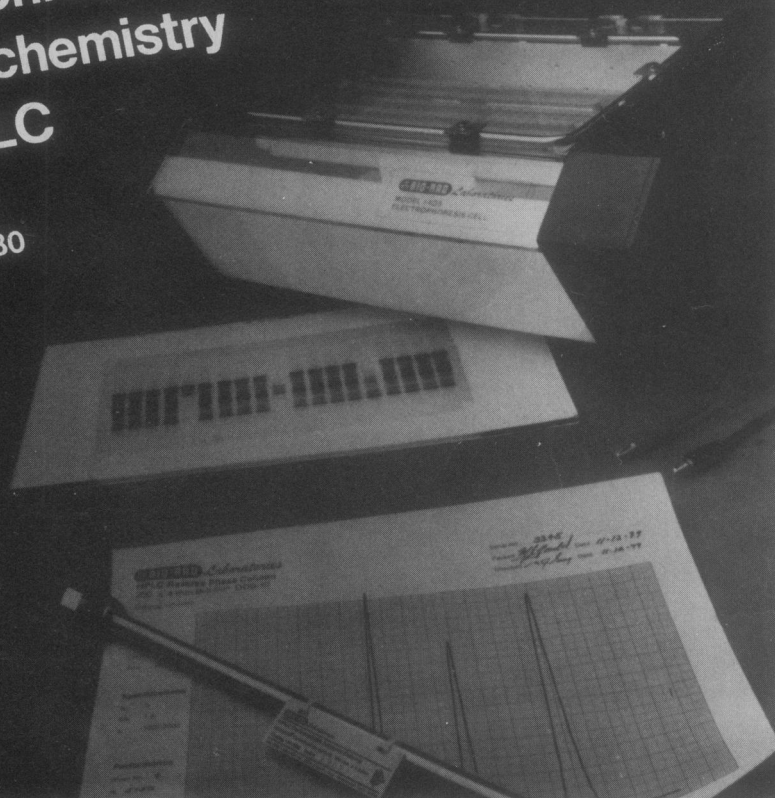
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COVER

Male, black-chinned hummingbird (*Archilochus alexandri*) feeding at *Penstemon barbatus* at a site in the Chiricahua Mountains, Arizona. This tubular corolla, with the recurved lip to eliminate a landing place for insects, is adapted to attract hummingbirds. Although many hummingbird-pollinated flowers are red, the birds must learn to associate red with nectar sources. Moreover, the birds' vision extends into the near ultraviolet, and they can be taught to associate food with any color. See page 786. [T. H. Goldsmith, Yale University, New Haven, Connecticut]

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.

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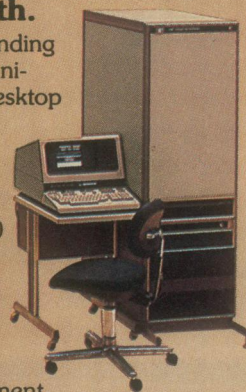
We build a broad range of desktop computers, with one just right for your data acquisition and control application. From the low cost HP 9815 through the HP 9825, the standard for HP-IB controllers; the HP System 35 with BASIC and assembly language; and the HP System 45B with advanced graphics capability, every HP desktop computer has superior interfacing characteristics in terms of human engineering, ease of use and power.

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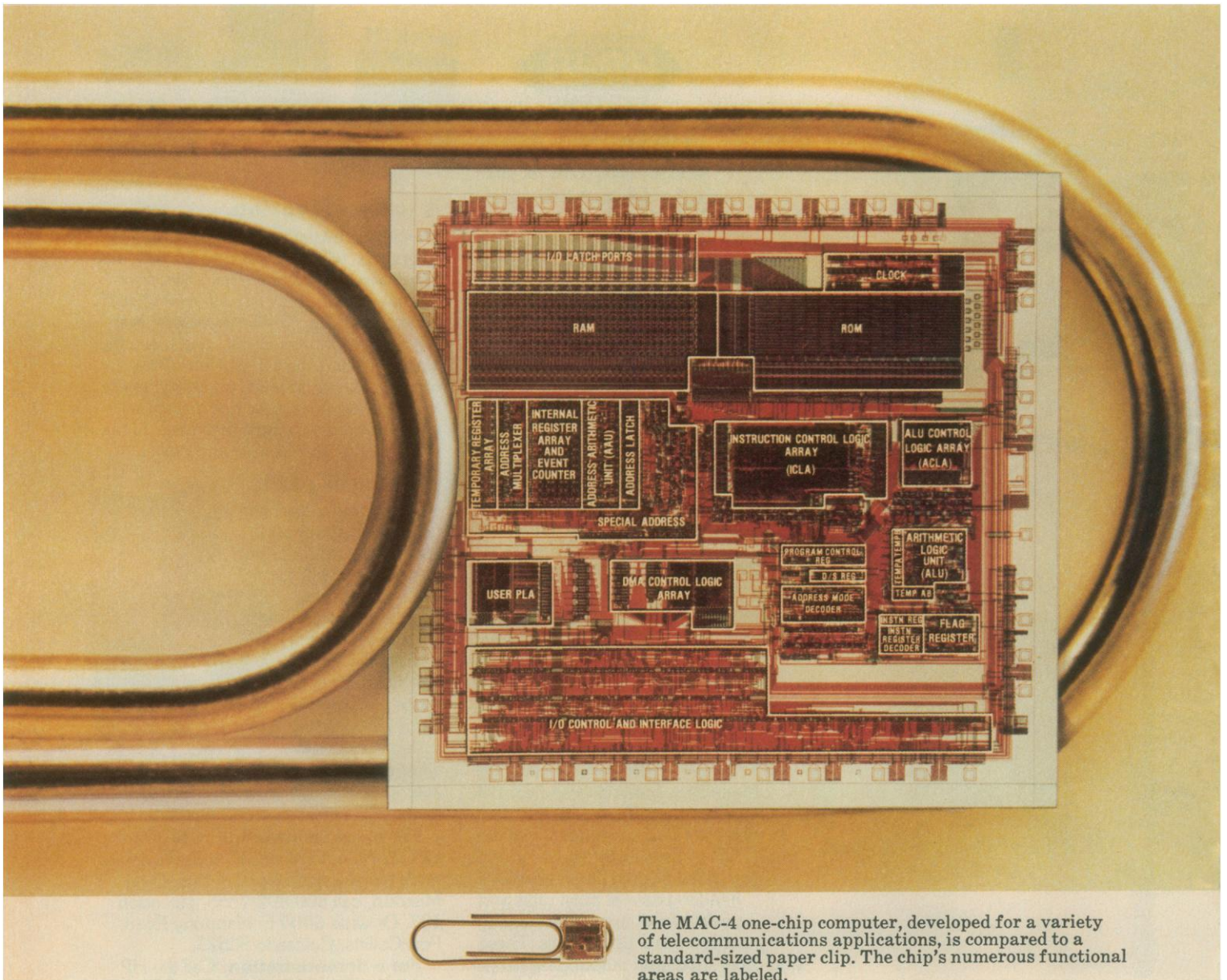


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The one-chip computer: offspring of the transistor



The MAC-4 one-chip computer, developed for a variety of telecommunications applications, is compared to a standard-sized paper clip. The chip's numerous functional areas are labeled.

One of the transistor's latest descendants is the Bell System's 30,000-element MAC-4 "computer-on-a-chip." It's another in a long line of microelectronic developments that have come from Bell Laboratories.

The MAC-4 is so efficient that a program written on it takes 25 percent less storage space than that required by most other microcomputers. Its assembler language, C, also developed at Bell Labs, has features that make MAC-4 easier to program, debug and maintain. And the MAC-4 can handle anything from nibbles to bytes to words with its 4-, 8-, 12-, and 16-bit operations capacity.

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It started with the transistor

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Over the past three decades, our advances in materials, processing, and devices have been vital to solid-state technology. These include:

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- Zone Refining
- Field-Effect Transistor
- Diffusion
- Solar Cell
- Oxide Masking
- Thermocompression Bonding
- Photolithography
- Epitaxial Film Process
- Magnetic Bubble Memory
- Charge-Coupled Device
- Semiconductor Heterostructure
- Laser Used in Lightwave Communications
- Electron-Beam Exposure System

Today and tomorrow

Today, we continue to make important contributions to solid-state technology. For example, we've developed a rugged 65,536-bit RAM that can tolerate processing faults. Corrections can be made on the chip itself, so we can get more usable chips out of each manufacturing batch—and thus lower unit costs.

In materials processing, we've

developed a technique for precisely controlling the growth of successive atomic layers of single crystal materials. This "molecular beam epitaxy" process is finding increasing use within Bell Labs and elsewhere in the electronics industry. We've used it to fabricate a device that permits us to double the speed of electrons by channeling them into crystal layers where they meet less resistance.

Other advances, in X-ray lithography and new resist materials, for example, promise to help place more elements on microelectronic devices and thus enhance their ability to perform important tasks.

As the solid-state revolution continues, these and other developments from Bell Labs will play an important part in it. What's important to us is the promise these advances offer for new telecommunications products and services. Like the transistor, MAC-4 and its solid-state relatives will find more and more applications in the nationwide telecommunications network.

For further information, or to inquire about employment opportunities, write: Bell Laboratories, Room 3C-303, 600 Mountain Avenue, Murray Hill, N.J. 07974.

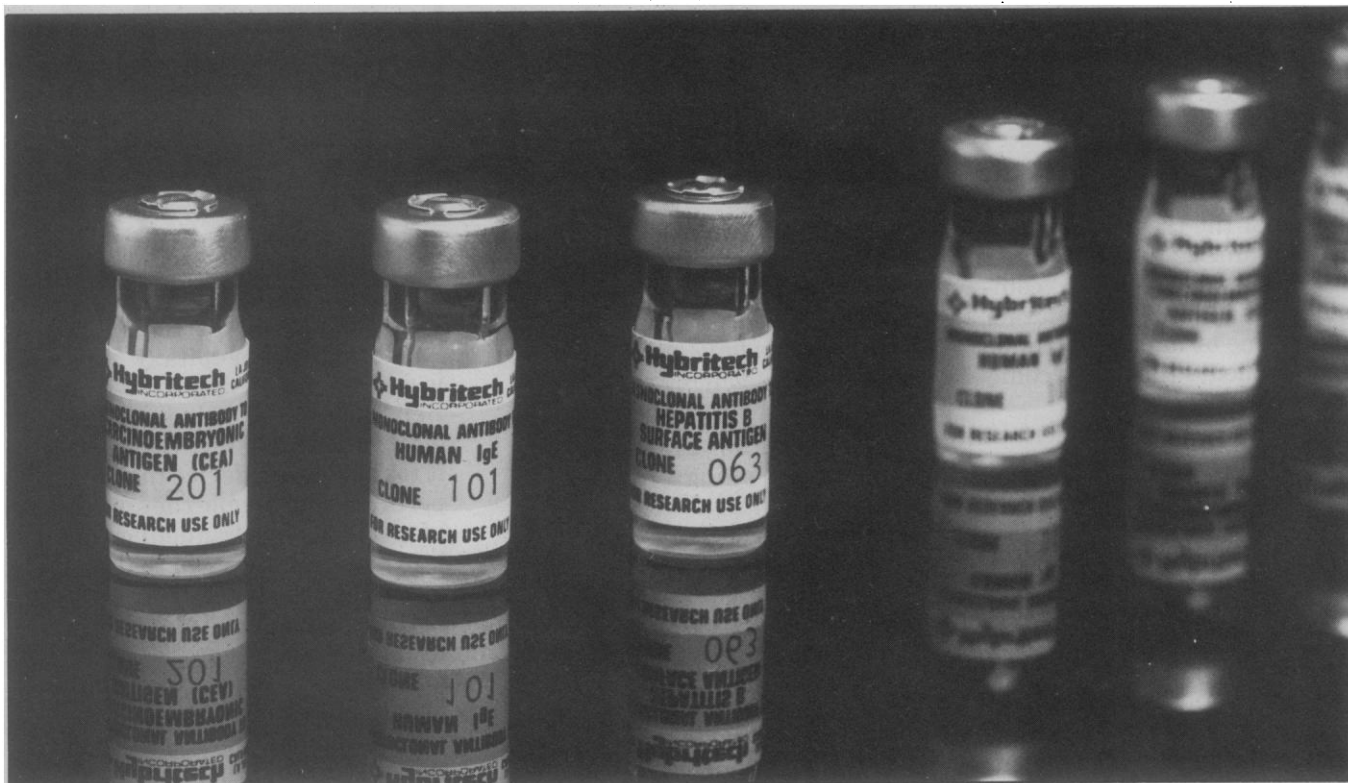


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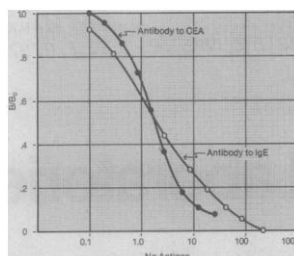
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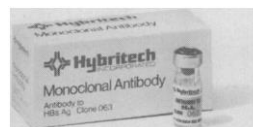
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Mass. Mutual	182.50	310.50	732.50	171.50	286.50	697.00
Metropolitan	119.00	225.50	584.50	103.50	177.50	469.00
New York Life	171.50	290.00	624.00	156.00	236.50	465.00
Northwestern Mutual	154.00	277.00	628.50	137.00	242.50	545.00
Prudential	150.50	239.00	552.00	130.00	179.50	336.00
Travelers	198.50	352.50	801.00	181.50	275.50	589.50
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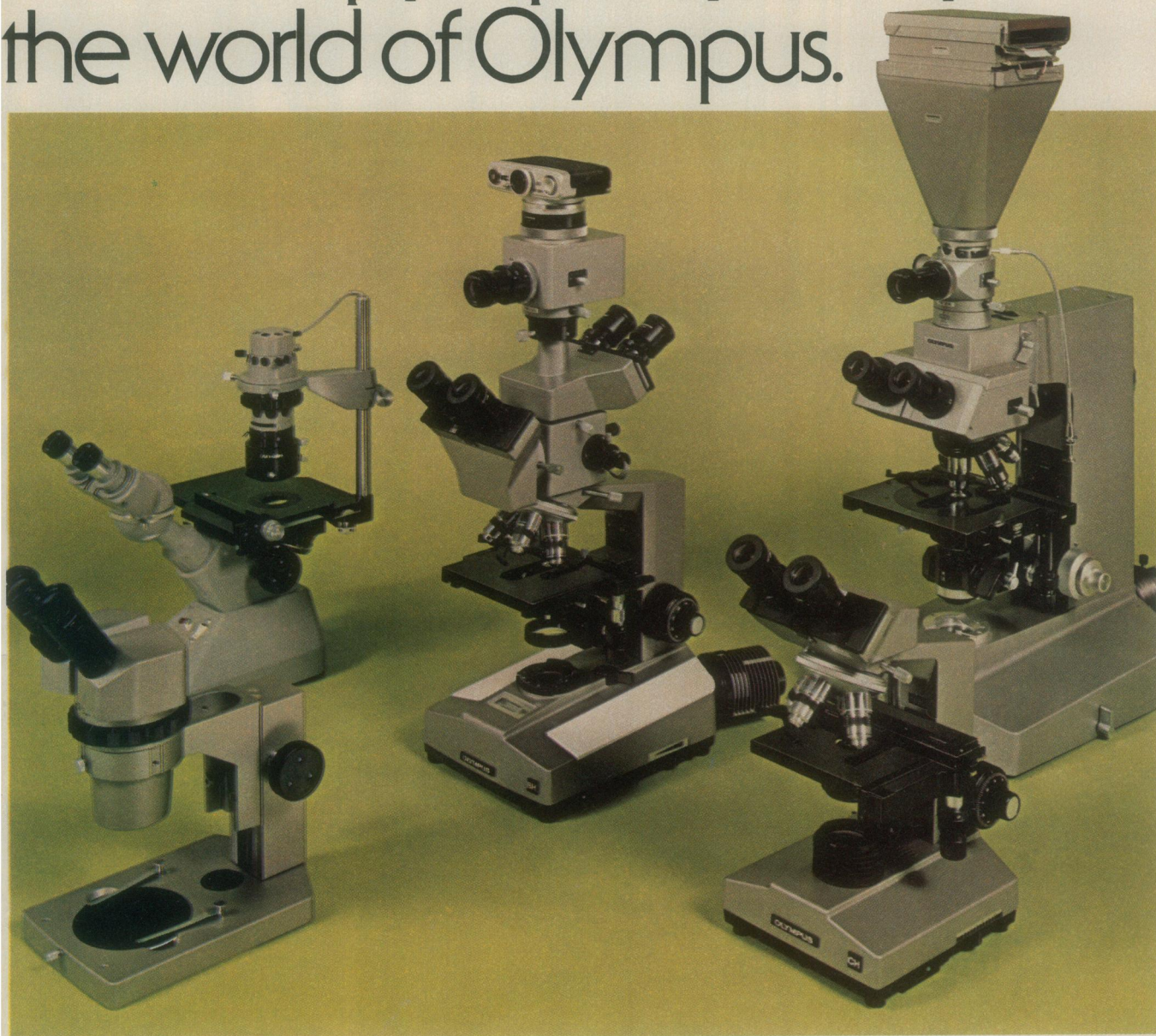
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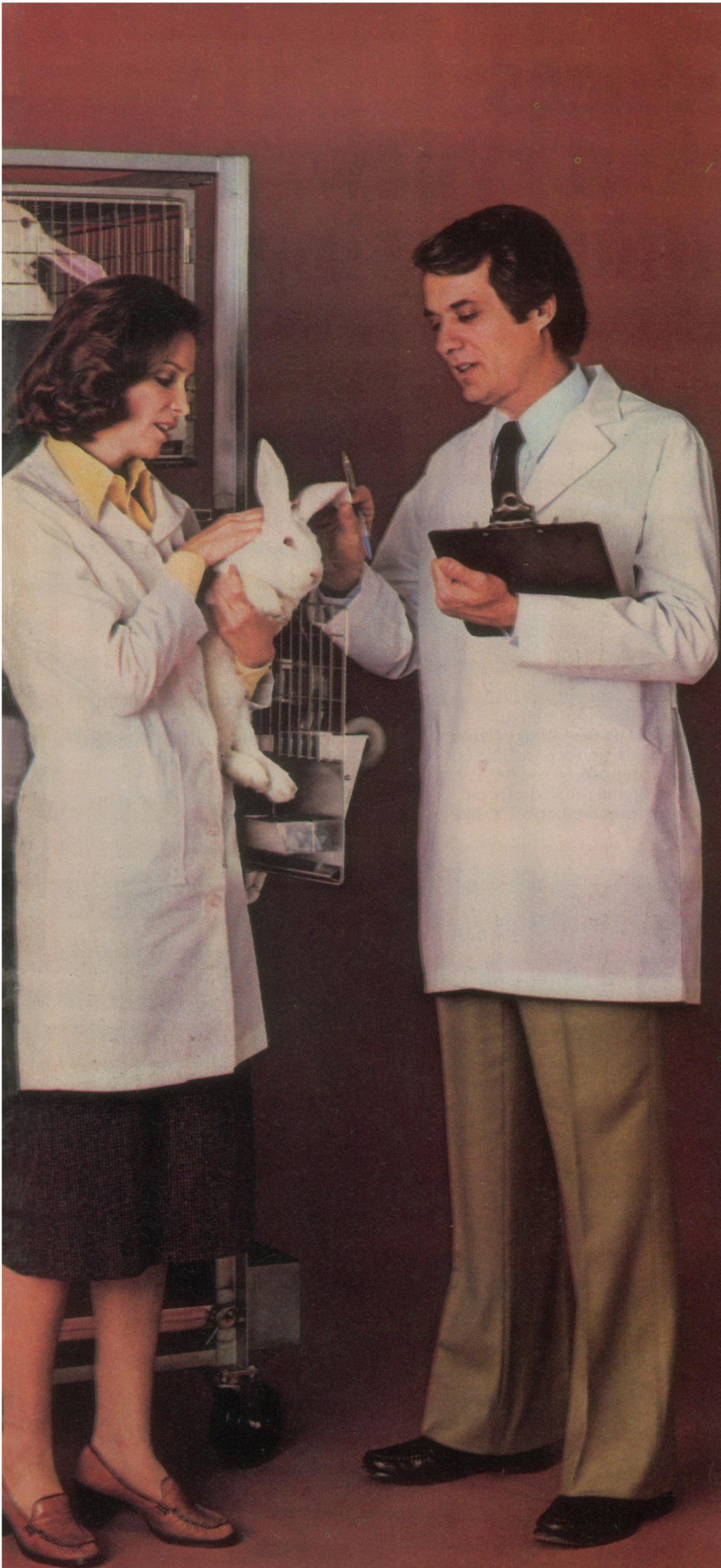
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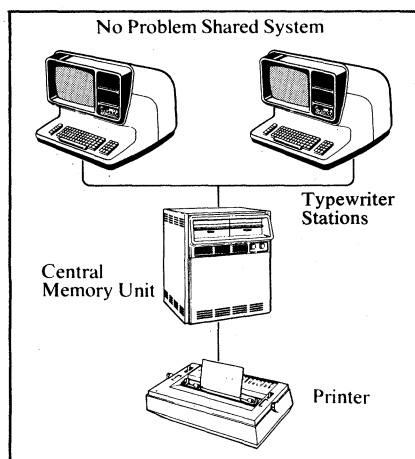


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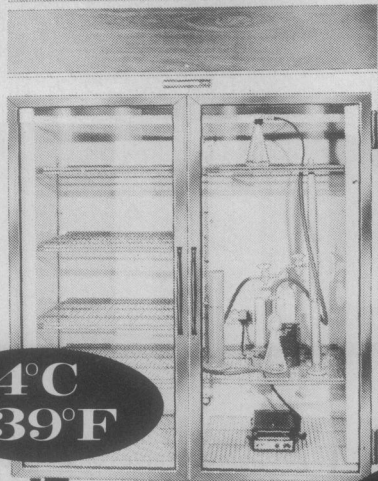
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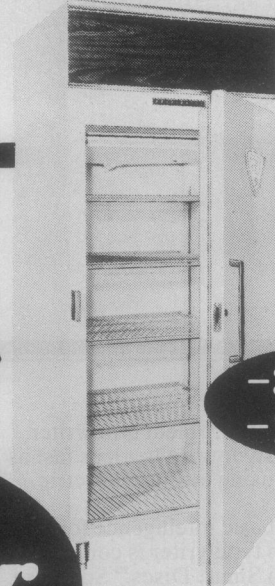
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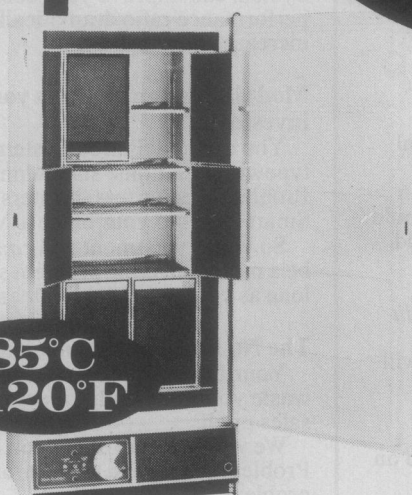
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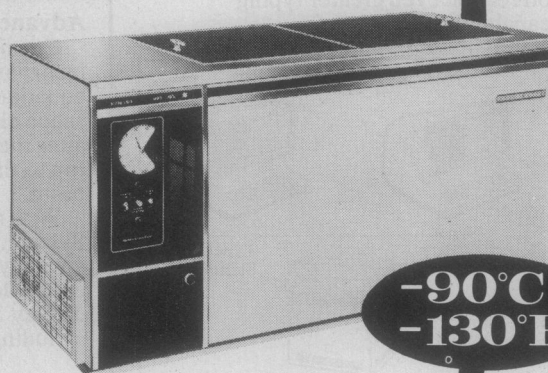
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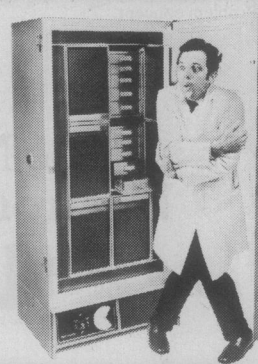
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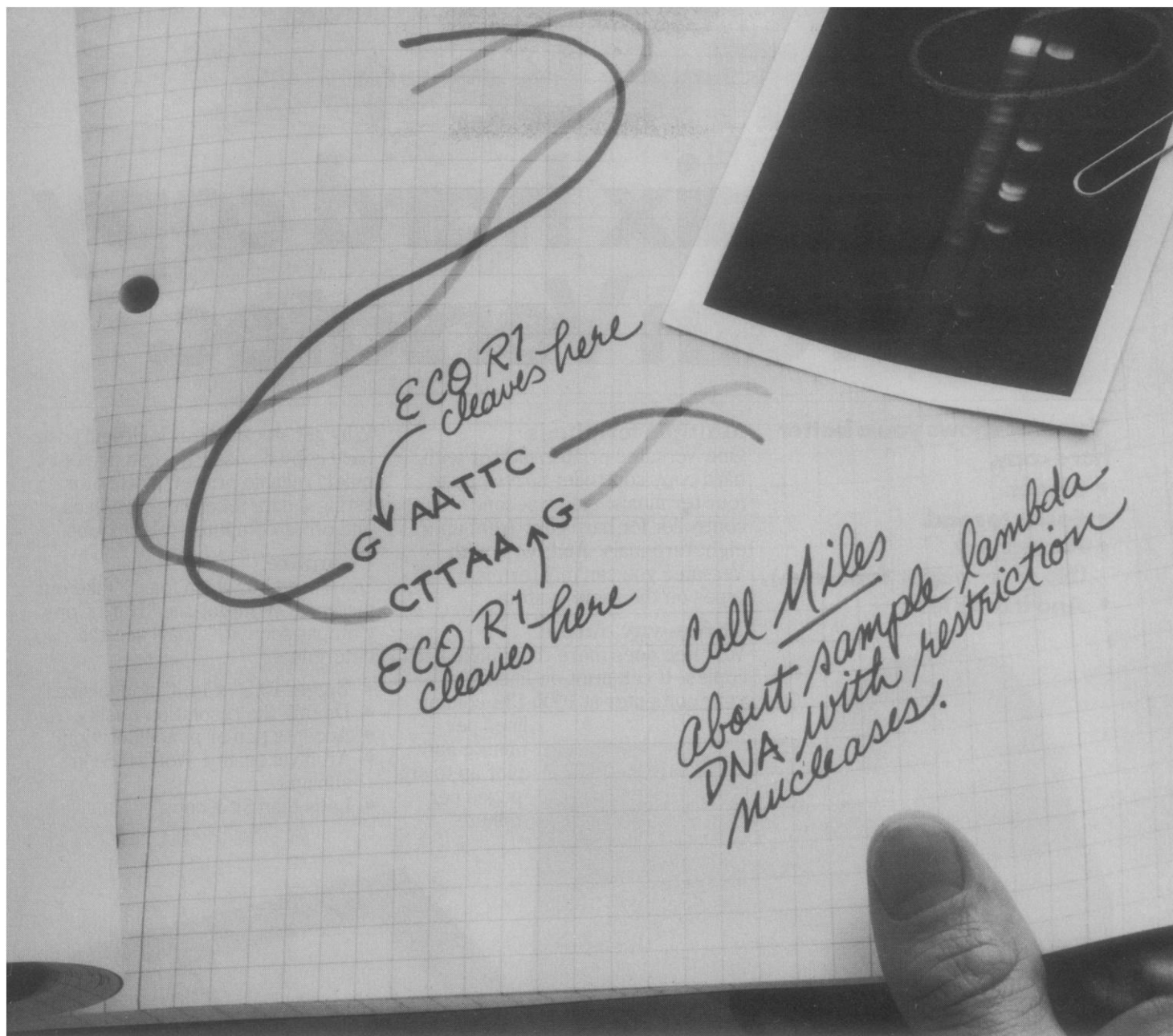
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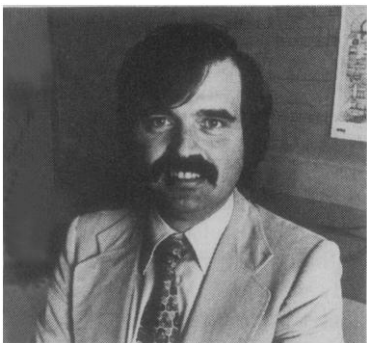
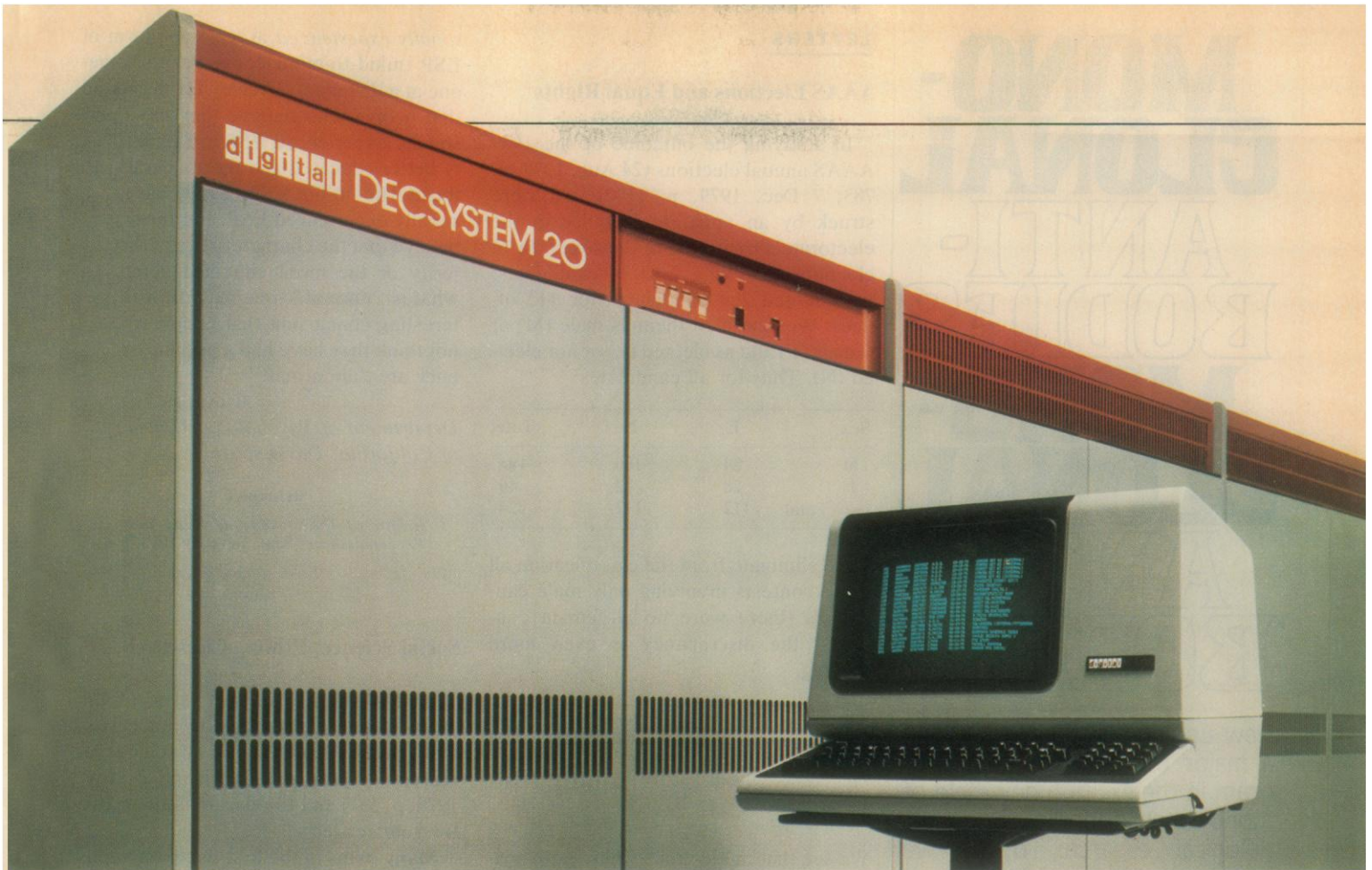
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LETTERS

AAAS Elections and Equal Rights

In studying the outcome of the 1979 AAAS annual elections (24 Aug. 1979, p. 783; 7 Dec. 1979, p. 1170), we were struck by an apparent inequity in the electorate's treatment of the sexes. In 73 elections involving 2 to 16 candidates, we counted 224 candidates for 112 offices. We classified them as male (M) or female (F) and as elected (E) or not elected (N). Thus for all candidates:

Sex	E	N	Total
M	84	100	184
F	28	12	40
Total	112	112	224

If we eliminate from the classification all those contests involving only male candidates (there were no all-female contests), the discrepancy is even more striking.

Sex	E	N	Total
M	28	44	72
F	28	12	40
Total	56	56	112

We see that in elections where both sexes were represented, 39 percent of the male candidates won, while in contrast 70 percent of the female candidates won.

If we reject as untenable the theory that the electorate is swayed by such an irrelevant characteristic as sex, this suggests that the nominating committees are applying more exacting standards to female candidates.

Or vice versa.

STEPHEN M. STIGLER
VIRGINIA L. STIGLER

5816 South Blackstone Avenue,
Chicago, Illinois 60637

Is the Paranormal "Normal"?

Nicholas Wade (News and Comment, 4 Jan., p. 41) writes of Wagner and Monnett's conclusion that American college professors have much more positive attitudes toward extrasensory perception (ESP) than does the American population in general. They report that 15 percent think ESP is scientifically established and 50 percent think it is a likely possibility. It is more likely, however, that college professors are simply typical Americans. In a representative survey of the American population, conducted in 1973, Greeley (*1*) found that 58 percent of the population believed they had per-

sonally experienced at least one form of ESP (mind-to-mind contact with someone at a distance). Greeley further found that people who believe they have personally experienced ESP are significantly better educated and more liberal than those who do not believe they have personally experienced ESP. For those who believe that the characteristics of the majority or the more educated determine what is "normal," one may draw the interesting conclusion that people who do not think they have had a psychic experience are "abnormal!"

CHARLES T. TART

Department of Psychology, University
of California, Davis 95616

References

1. A. Greeley. *The Sociology of the Paranormal: A Reconnaissance* (Sage, Beverly Hills, 1975).

Social Science: Ethics of Research

I am writing to correct some of the more blatant errors in Constance Holden's article "Ethics in social science research" (News and Comment, 2 Nov. 1979, p. 537) and to raise an issue or two for your readers.

Many items in the first two paragraphs of Holden's article are not accurate. In addition to those mentioned in the letter from Horowitz (30 Nov. 1979, p. 1022) and in the erratum in the same issue, I note the following errors. My research on impersonal sex acts in public restrooms was conducted not "in 1969" but from 1965 to 1968. Observations of these acts were made in dozens of public rest facilities rather than "in a public bathroom." My study was not "designed to cast light on society's treatment of homosexuals," noble as such a purpose might be, but to investigate a covert and highly stigmatized form of behavior engaged in by men who claim a *range* of sexual orientations and life-styles.

I did fill the role of a "watchqueen" to alert the participants to approaching intruders, although the purpose of performing those duties was to facilitate observing sexual behavior in a natural setting in the least obtrusive way possible. Rather than "lying" to the Department of Motor Vehicles (as the article's indictment reads) in order to trace license numbers of potential respondents, I misrepresented myself to the local campus police as engaging in "market research" for the purpose of protecting my respondents. The implication that I "then joined a public health survey team" in order to deceive my "subjects" is a distortion.

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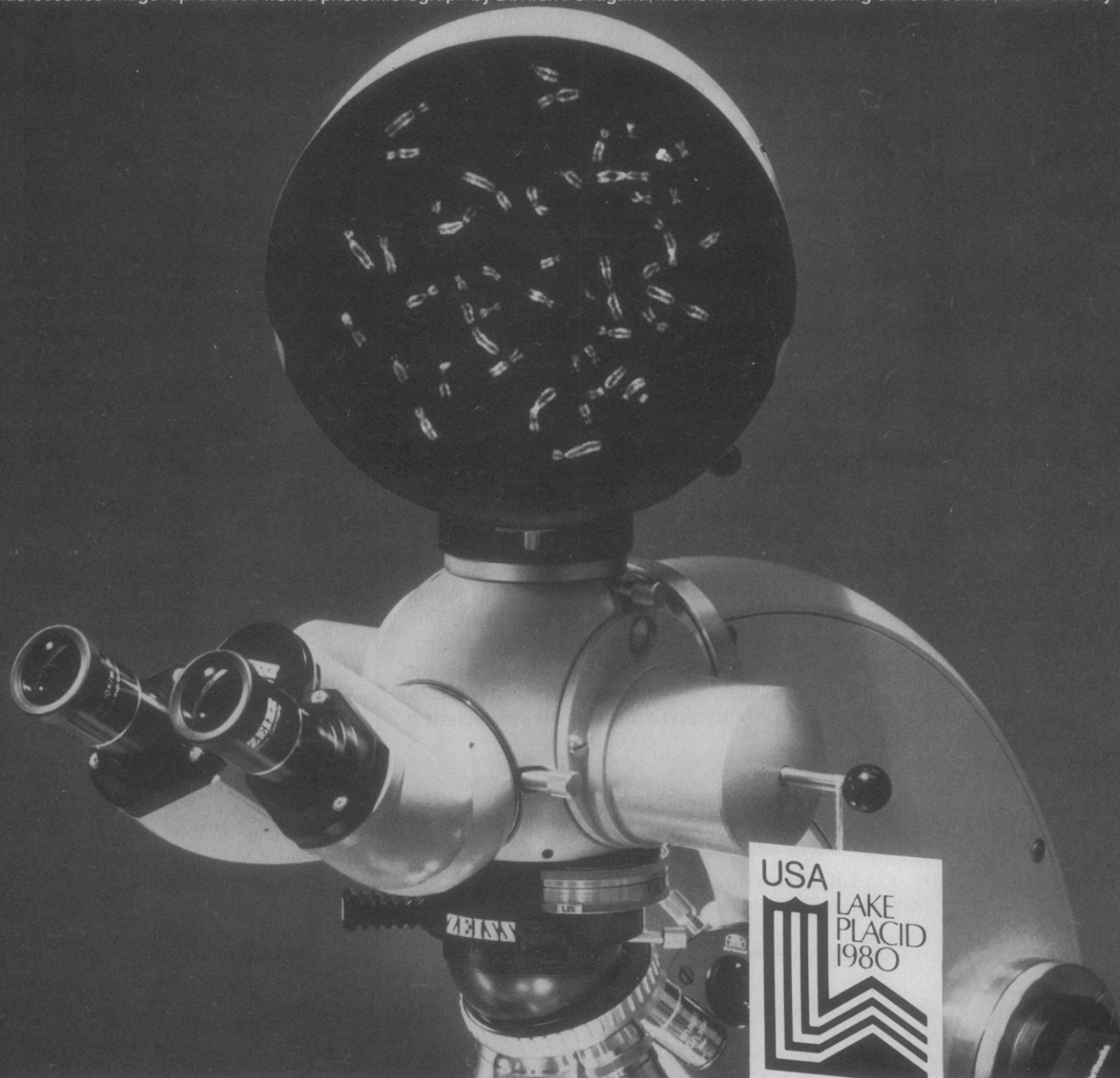
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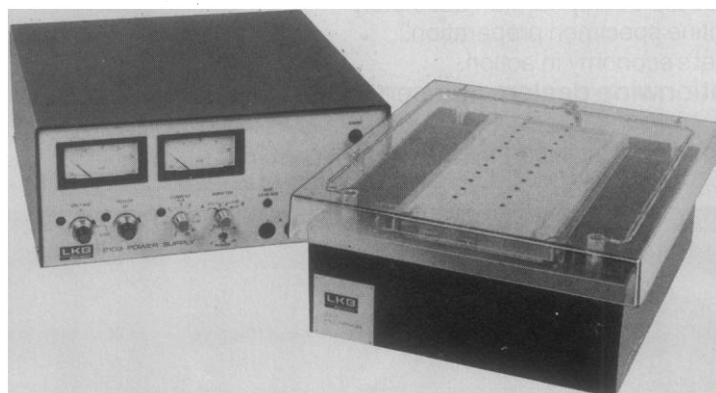
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Holden may be correct in noting that *Tearoom Trade* "has become a classic in the fast-growing field of ethics in social science research, where it is commonly cited as a crass violation of subjects' rights." What she does not report, however, is that the book won the C. Wright Mills Award of the Society for the Study of Social Problems in 1970 as "the outstanding work on a social issue."

It is disturbing to learn for the first time, from a journal article, of a 2-day conference that apparently featured discussion of my work. Are the distortions of fact perhaps the result of misrepresentations made in materials presented at that conference, to which I had no access?

Innumerable commentators have arraigned my dissertation research on charges comparable to those cited by Holden. Who, on the other hand, has mentioned the following points about the tearoom study?

1) Not one of my 100 respondents has ever reported suffering harm as a result of my research.

2) Many of my respondents (both those who were fully informed about the research and other, "deceived" men who later read the book), not to mention hundreds of other "tearoom participants," have expressed appreciation for ways they have benefited from the study.

3) The moral entrepreneurs fail to note that, in the mid-1960's, the sociologists had no Code of Ethics mentioning the need for "informed consent." The issue was never raised in my graduate studies, and I had never thought about that as a matter of concern. As Holden grants, I "was scrupulous about guarding the confidentiality" of my respondents. That was all anyone knew about the ethics of research in those days.

4) In the revised (1975) edition of *Tearoom Trade*, I added a 57-page "Retrospect" on ethical issues, including a complete reprinting of the major critical publications available at that time.

Do my critics offer me a comparable platform? Have those affluent foundations that foster the work and careers of the Ayatollahs of Research Ethics ever considered the possibility of allowing those of us assumed to be guilty to enter into dialogue with our accusers?

LAUD HUMPHREYS

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College, Claremont Colleges,
Claremont, California 91711

The letter from Horowitz, aside from its self-serving bromides, objects to the fact that an author who was "mentioned repeatedly" at a social science confer-

ence was not invited to attend. Well, who was to know in advance that the author would be mentioned repeatedly?

Nowhere does this well-known gatekeeper-editor, Horowitz, commend Holden for her brilliant article, which makes clear what is generally obscured by the social science jargon of our time.

BEN RUSSAK

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Power-Line Radiation

Thorne and Tsurutani (Reports, 25 May 1979, p. 839) address some important questions regarding power-line radiation (PLR) in the magnetosphere, a subject that has become a topic of intense research in recent years (1-3). Although Thorne and Tsurutani accept the existence of PLR in the magnetosphere, they conclude that it is unimportant in comparison to naturally occurring waves. We believe that their conclusion, based on analysis of a limited amount of data, is premature and that it is important to further investigate this man-made perturbation of the space environment out to a distance many times the radius of the earth.

It has been clearly demonstrated that PLR can trigger emissions that strongly interact with trapped energetic particles in the magnetosphere (2). However because of limitations in signal detection and processing techniques that have been employed to date, it is not always possible to determine conclusively whether a given emission is triggered or is generated spontaneously. For this reason, it is not possible at present to make a quantitative comparison between PLR effects and natural effects.

The main argument of Thorne and Tsurutani is based on the fact that their data on ELF (extremely low frequency) chorus collected by the Orbiting Geophysical Observatory (OGO) do not show significant variations at different longitudes that could be attributed to PLR. This is contrary to earlier results based on ELF and very low frequency data collected by OGO-3 (3). This discrepancy is not too surprising in view of the fact that the two relatively small data sets were acquired by different instruments covering different frequency ranges and were analyzed differently. Without getting into detailed technical arguments, we simply wish to make a fundamental point concerning their data—that the absence of evidence should not be used as evidence for absence.

There are undoubtedly waves of entirely natural origin that are important for magnetospheric dynamics. However, their importance cannot be used as evidence against the importance of PLR unless it is supported by a quantitative comparison. Such a comparison will require improved techniques for identifying PLR and PLR-triggered emissions. Fortunately progress can be and is being made in that direction. For example, since the report by Thorne and Tsurutani, direct evidence of PLR has been found in the deep magnetosphere in data from ISEE-1 and GEOS satellites (4). Theoretical and experimental studies of PLR sources are under way or are being planned by a number of research teams around the world (5).

It will be some time before we fully understand PLR effects and their importance, vis-à-vis natural phenomena, but there is certainly no basis at present to dismiss PLR as unimportant.

C. G. PARK

R. A. HELLIWELL

Radioscience Laboratory, Stanford,
University, Stanford, California 94305

References and Notes

1. R. A. Helliwell, J. P. Katsufurakis, T. F. Bell, R. Raghuram, *J. Geophys. Res.* **80**, 4249 (1975); C. G. Park, *ibid.* **82**, 3251 (1977); — and R. A. Helliwell, *ibid.*, p. 3234.
2. C. G. Park and R. A. Helliwell, *Science* **200**, 727 (1978); K. Bullough, A. R. L. Tatnall, M. Danby, *Nature (London)* **260**, 401 (1976); J. P. Lurette, C. G. Park, R. A. Helliwell, *J. Geophys. Res.* **84**, 2657 (1979); H. C. Koons, M. H. Dazey, B. C. Edgar, *ibid.* **83**, 3887 (1978); C. G. Park and T. R. Miller, *ibid.* **84**, 943 (1979); —, D. C. D. Chang, *Geophys. Res. Lett.* **5**, 861 (1978).
3. J. P. Lurette, C. G. Park, R. A. Helliwell, *Geophys. Res. Lett.* **4**, 275 (1977).
4. J. P. Lurette and T. F. Bell, private communication; F. Lefevre, private communication.
5. The PLR intensities near power lines have been recently measured by R. Barr in New Zealand and T. Yoshino in Japan, both of whom used ground-based as well as balloon and rocket-borne instruments. Yoshino and his colleagues plan to make more measurements using balloons, rockets, and satellites. The University of Manitoba, Stanford University, and the Sandia Corporation plan to make balloon measurements in Manitoba, Canada, in collaboration with the Manitoba Hydro.

Park and Helliwell disagree with portions of our *Science* report, particularly our conclusion that the stimulated generation of magnetospheric chorus by PLR is unimportant in comparison to naturally occurring waves. We argue that our conclusion remains valid. There is no conclusive evidence of any dependence of outer zone chorus on geographical longitude. Claims of such evidence (1) are based on erroneous statistical arguments (2). Furthermore, such a dependence would not be expected because chorus occurs on magnetic field lines that intercept the polar regions of the earth, well away from high-density population centers. As we stated in our report, PLR would also be strongly damp-

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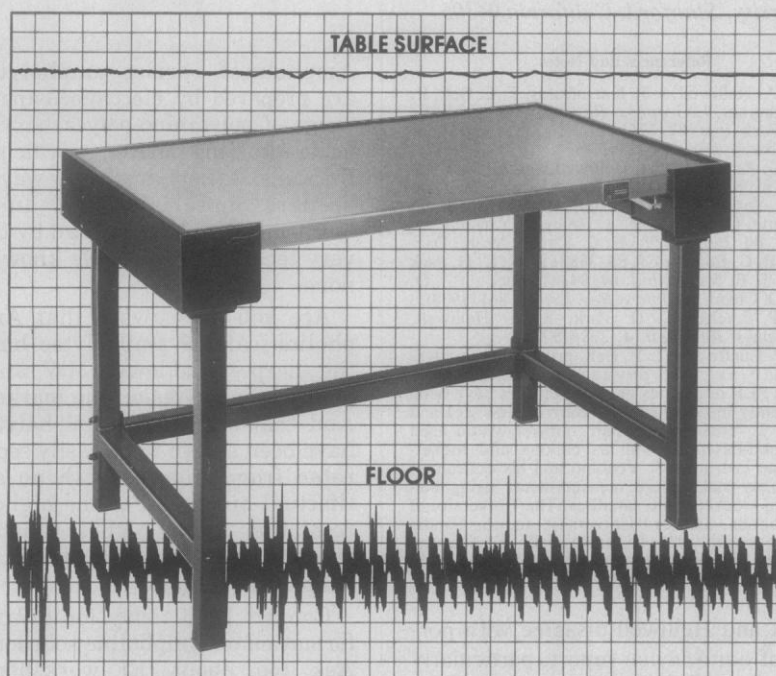
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ed as it propagates from the earth into the magnetosphere. Arguments concerning the dependence of chorus starting frequency on PLR frequency are contradictory (2, 3), and only further independent research will resolve the problem. Arguments concerning weekday dependence of chorus occurrence are also controversial. Ground-based evidence indicates a reduction of chorus occurrence on Sundays (4), but the validity of this work is currently being challenged (5). The only magnetospheric study done to date (6) shows no evidence of such an effect.

Previous discussions of PLR effects on chorus have generally ignored the wealth of published articles on energetic, outer zone electrons (7), magnetospheric substorms (8), and chorus, together indicating a natural generation of chorus. Space physicists have shown that intense fluxes of energetic (1 to 100 kilo-electron volts) electrons are injected into the near-midnight outer magnetosphere during the onset of substorms (7, 9). The electron fluxes are above the "stably trapped limit" (10) and generate chorus via the loss-cone instability, the "free energy" of the electrons going into wave (chorus) energy. The waves in turn interact with the electrons, scattering them such that they are lost into the upper ionosphere, giving rise to the polar x-ray aurora (8, 11). It has recently been confirmed that chorus is associated with substorm events and occurs at the same geomagnetic latitude and local time as the detected electron precipitation (12). Chorus has been shown to be localized close to the equatorial plane (12), where it is expected to be generated via a loss-cone instability. Examination of the energetic electron velocity versus magnetic field (pitch angle) distribution during chorus events shows that the electrons have the expected loss-cone distribution (13). Thus, the existing literature is adequate to explain the majority of chorus and its effect on the outer radiation belt electrons via natural causes.

Park and Helliwell (14) argue that PLR may act as an embryonic emission that stimulates the growth of chorus and subsequently induces the electron precipitation. However, they agree (15) that the electron flux must be high to provide the free energy for wave growth, thus a magnetospheric substorm must be in progress. The only consequential effect of PLR is to "force" the chorus growth and electron precipitation to occur over high-power consumption areas. However, even evidence for this is nonexistent; rather, within statistical uncertainty, chorus appears to occur at all geographic

longitudes with equal probability (1, 2).

We do not dispute the existence of PLR or PLR-triggered emissions especially in locations where there is adequate wave ducting (at latitudes less than 60°), allowing PLR field-aligned wave propagation to the equatorial region of the magnetosphere where unstable wave growth can occur. However, at magnetic latitudes above 60°, where chorus is principally detected (16), both the wave ducting and population centers are generally absent.

From the evidence and arguments presented in our report, we cannot rule out the possibility of minor PLR effects on chorus. We do show, however, that there is a general lack of evidence for significant PLR effects on outer-zone chorus. Until more positive evidence becomes available, we feel that it is best to remain with the well-established model for natural generation of outer-zone magnetospheric chorus.

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References

1. J. P. Luethe, C. G. Park, R. A. Helliwell, *Geophys. Res. Lett.* **4**, 275 (1977).
2. B. T. Tsurutani, S. R. Church, R. M. Thorne, *J. Geophys. Res.* **84**, 4116 (1979); B. T. Tsurutani, E. J. Smith, S. R. Church, R. M. Thorne, R. E. Holzer, in *Wave Instability in Space Plasma*, P. J. Palmadesso and K. Papadopoulos, Eds. (Reidel, Hingham, Mass., 1979), p. 51.
3. J. P. Luethe, C. G. Park, R. A. Helliwell, *J. Geophys. Res.* **84**, 2657 (1979).
4. C. G. Park and T. R. Miller, *ibid.*, p. 943.
5. R. M. Thorne and B. T. Tsurutani, in preparation.
6. B. T. Tsurutani, E. J. Smith, S. R. Church, R. M. Thorne, R. E. Holzer, *Trans. Am. Geophys. Union* **59**, 1159 (1978).
7. L. A. Frank, *Rev. Geophys. Space Phys.* **13**, 974 (1975); H. I. West, Jr., *ibid.*, p. 943.
8. R. L. McPherron, *ibid.* **17**, 657 (1979); S.-I. Akasofu and S. Chapman, *Solar Terrestrial Physics* (Oxford Univ. Press, New York, 1972).
9. S. E. DeForest and C. E. McIlwain, *J. Geophys. Res.* **76**, 3587 (1971); B. T. Tsurutani and F. Bogott, *ibid.* **77**, 4677 (1972).
10. C. F. Kennel and H. E. Petschek, *ibid.* **71**, 1 (1966); S. A. Curtis, *ibid.* **83**, 3841 (1978).
11. K. A. Anderson, in *Auroral Phenomena*, M. Walt, Ed. (Stanford Univ. Press, Stanford, Calif., 1965), p. 46.
12. B. T. Tsurutani and E. J. Smith, *J. Geophys. Res.* **82**, 5112 (1977); *ibid.* **79**, 118 (1974).
13. R. R. Anderson and K. Maeda, *ibid.* **82**, 135 (1977); K. Maeda, *Planet. Space Sci.* **24**, 341 (1976); B. T. Tsurutani, E. J. Smith, H. I. West, Jr., R. M. Buck, in *Wave Instability in Space Plasma*, P. J. Palmadesso and K. Papadopoulos, Eds. (Reidel, Hingham, Mass., 1979), p. 55.
14. C. G. Park and R. A. Helliwell, *Science* **200**, 727 (1978).
15. ———, personal communication.
16. W. W. Taylor and D. A. Gurnett, *J. Geophys. Res.* **73**, 5615 (1968); C. T. Russell, R. E. Holzer, E. J. Smith, *ibid.* **74**, 755 (1969); R. E. Barrington, T. E. Hartz, R. W. Harvey, *ibid.* **76**, 5278 (1971); N. Duncel and R. A. Helliwell, *ibid.* **74**, 6371 (1969); R. K. Burton and R. E. Holzer, *ibid.* **79**, 1014 (1974); R. M. Thorne, S. R. Church, W. J. Malloy, B. T. Tsurutani, *ibid.* **82**, 1585 (1977).

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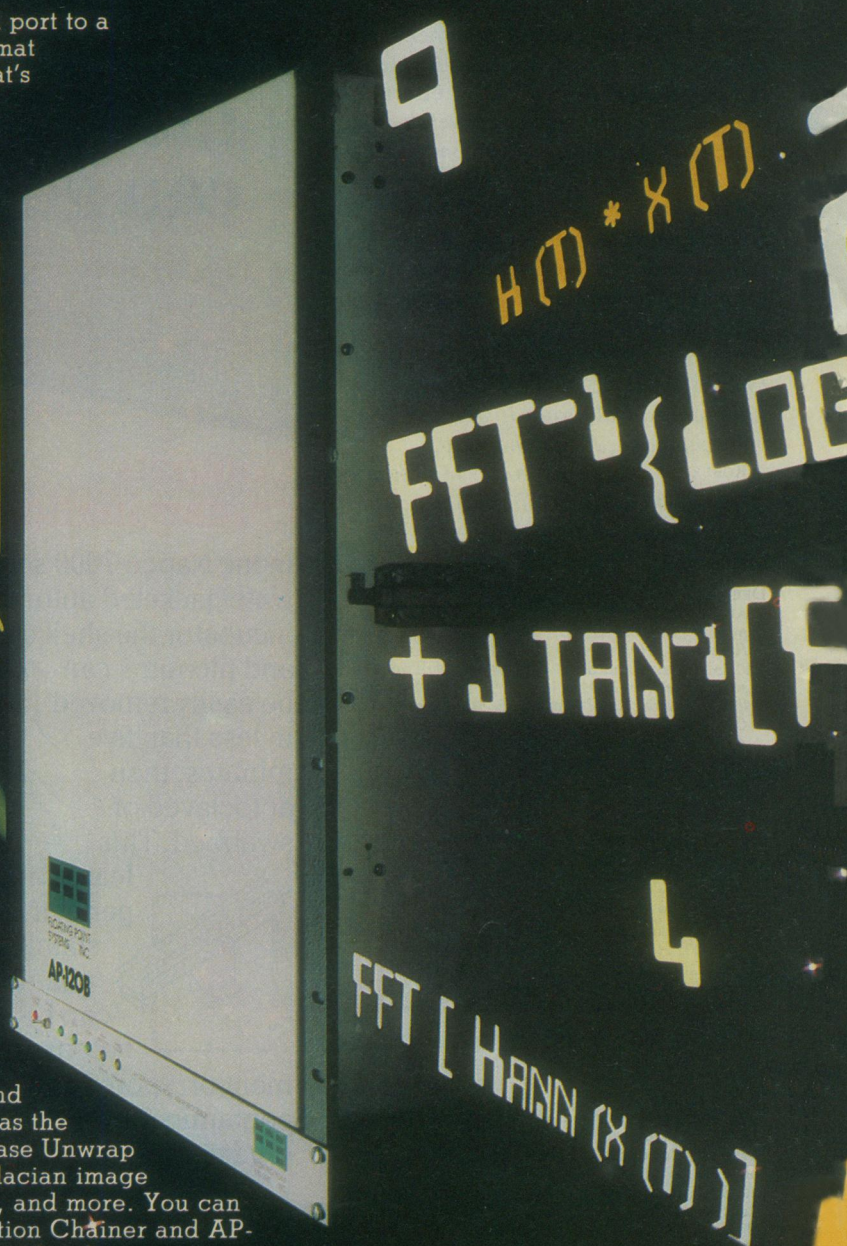
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General Sarnoff and Generic Research

General David Sarnoff is reputed to have said that 50 percent of invention is knowing what to invent. At one of his talks specifying what needed inventing, he is supposed to have remarked to the listening RCA researchers, "I've done my 50 percent, now it's your turn!" There is much of this philosophy in former Secretary of Transportation Brock Adams's proposal asking for the "reinvention of the automobile." To accomplish this feat, he proposed a \$100 million a year generic research program financed jointly by industry and government, and performed in academic laboratories specifically established for the task.

Such targeted, or generic, research can be productive when the state of knowledge is ripe, but more often targeting represents wishful thinking. Yet bills have been introduced by Senator Adlai Stevenson and Congressman George Brown to implement the idea of generic research centers which would conduct fundamental and interdisciplinary research on topics thought to be relevant to desired applications, among them automotive transportation. The President's message on industrial innovation contains similar initiatives. The State of the Union message mentions a 10-year, \$1 billion proposal for research on automotive fuel efficiency, a program presumably related to the Administration's Cooperative Automotive Research Program (CARP), son of Adams's idea.

These proposals represent an overt attempt to steer commercial technology into what are seen as "desirable" paths. Indeed, if one examines industrial research closely, it is hardly distinguishable from generic research. Industrial laboratories typically focus on interdisciplinary areas that underlie the objectives of the firm. This has long been the operational mode of great industrial laboratories, although their managements do not usually go as far as General Sarnoff in demanding specific inventions.

Is it feasible for government to use the industrial, interdisciplinary paradigm to augment ongoing industrial research? Not significantly. To be successful, industrial research must be part of a larger whole, which incorporates development, often involving highly-organized project work; engineering design, including means for manufacturing and quality control; securing financial support; and marketing the result in accord with consumer preferences. There is no reliable technique for connecting generic research done in academic or independent centers to this larger whole. Another difficulty is the mismatch in timing between the demands of the patron and the maturation of research institutions. It has taken decades for the Bell and IBM laboratories to achieve their preeminent state. Patience and resolve over at least a decade are required. Government cannot have that staying power because of changing political, social, and economic factors.

Nevertheless, there may be a few cases where federally inspired generic research could be productive. But these instances will be overwhelmed by the number of failures. The minimum requirement for generic research to be successful is that it have enthusiastic industrial involvement, fine leadership and management, and excellent research people. Such a conjunction will be rare. CARP and other massive proposals do not recognize these requirements. Neither does that of the American Council of Education for 10 to 15 federally funded, university-based research centers.

Even modest beginnings in these directions would be dangerous if they substitute for effective federal programs to encourage more fundamental industrial research and closer academic-industrial research relations. It is dangerous, too, if it diverts academic researchers from their disciplinary research toward specific problem solving where they have limited competence. Unfortunately, these are the likely outcomes unless generic research proposals become part of a larger effort to encourage innovative research in places of excellence where there is effective coupling to development, manufacturing, finance, and marketing.—EDWARD E. DAVID, JR., *President, Exxon Research and Engineering Company, Florham Park, New Jersey* 07932

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