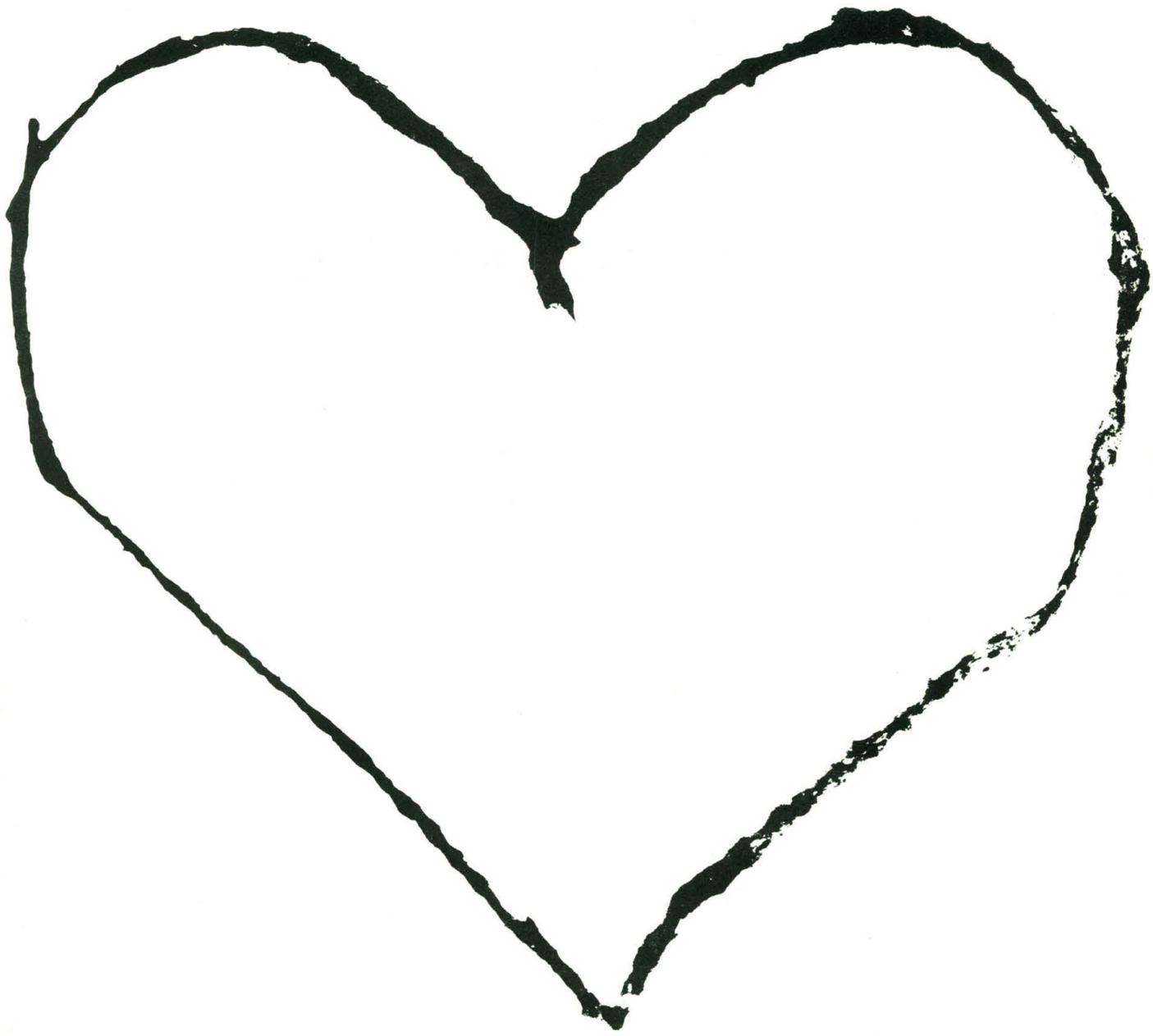
SCIENCE

25 February 1972

Vol. 175, No. 4024

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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25 February 1972
Vol. 175, No. 4024

SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Embryonic chick heart cells (trypsin disaggregated) were growth oriented in tissue culture for 8 days and formed a "heart"-shaped, synthetic strand of cardiac muscle. The preparation was fixed in Bouin's fluid and stained with phosphotungstic acid–hematoxylin (about × 6.8). See page 909. [Thurman Ellis, Duke University Medical Center, Durham, North Carolina]

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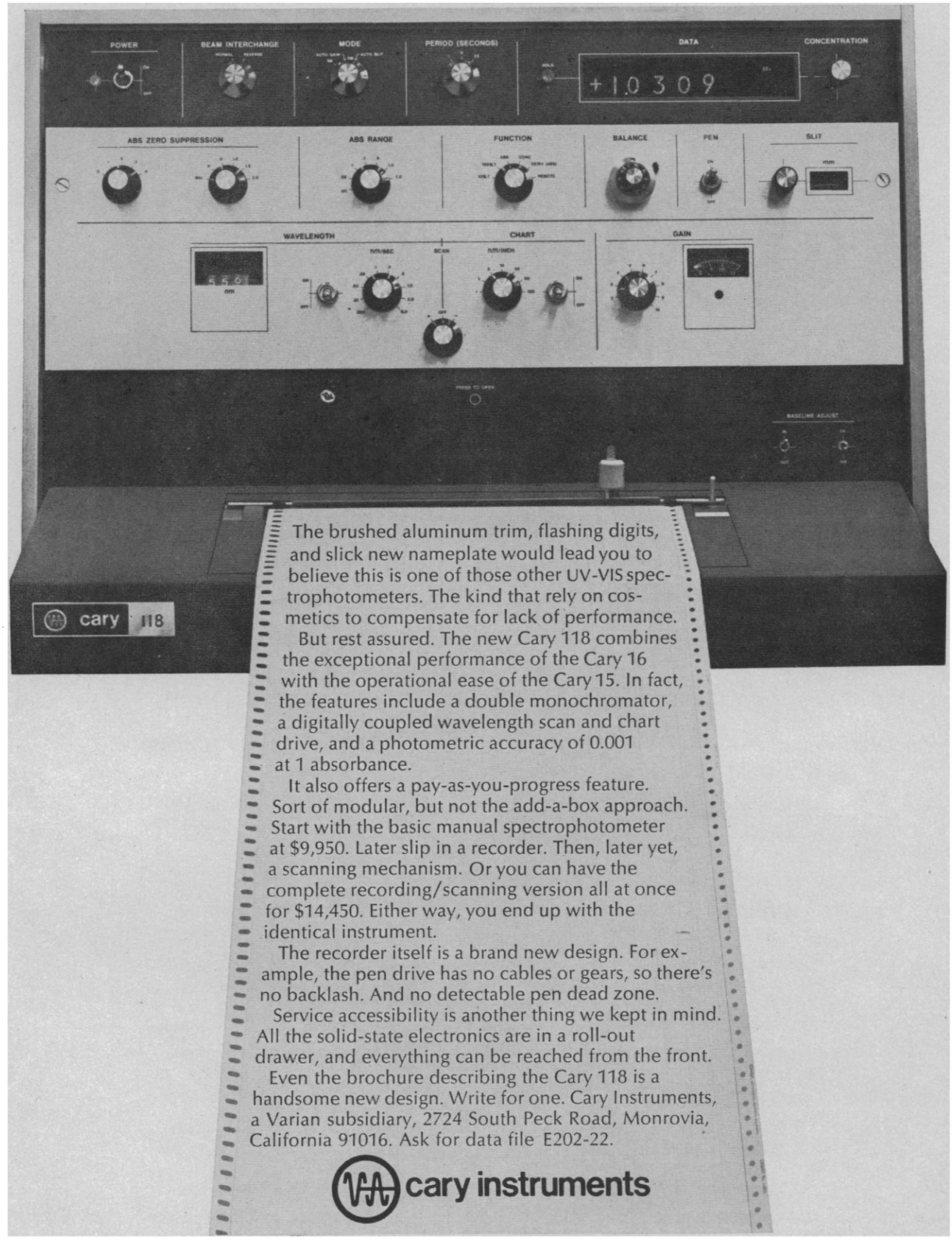

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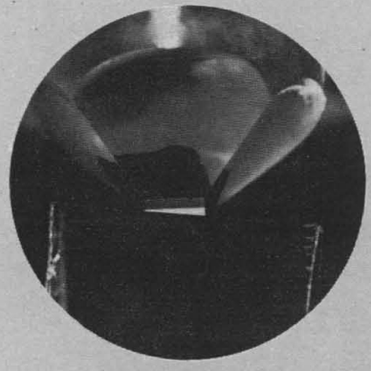

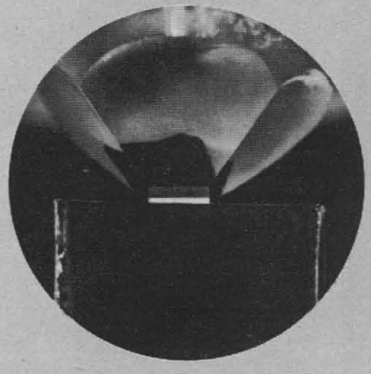

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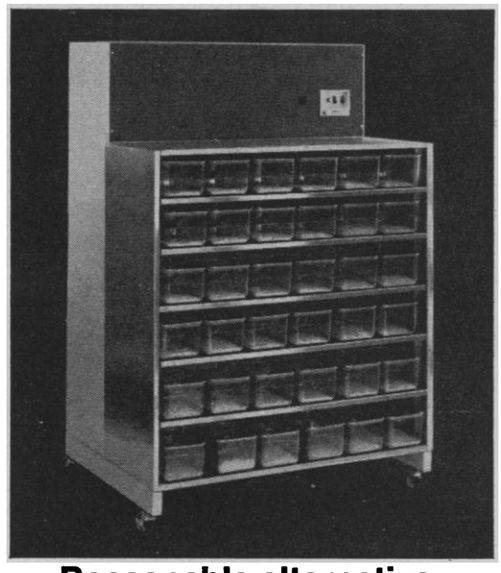

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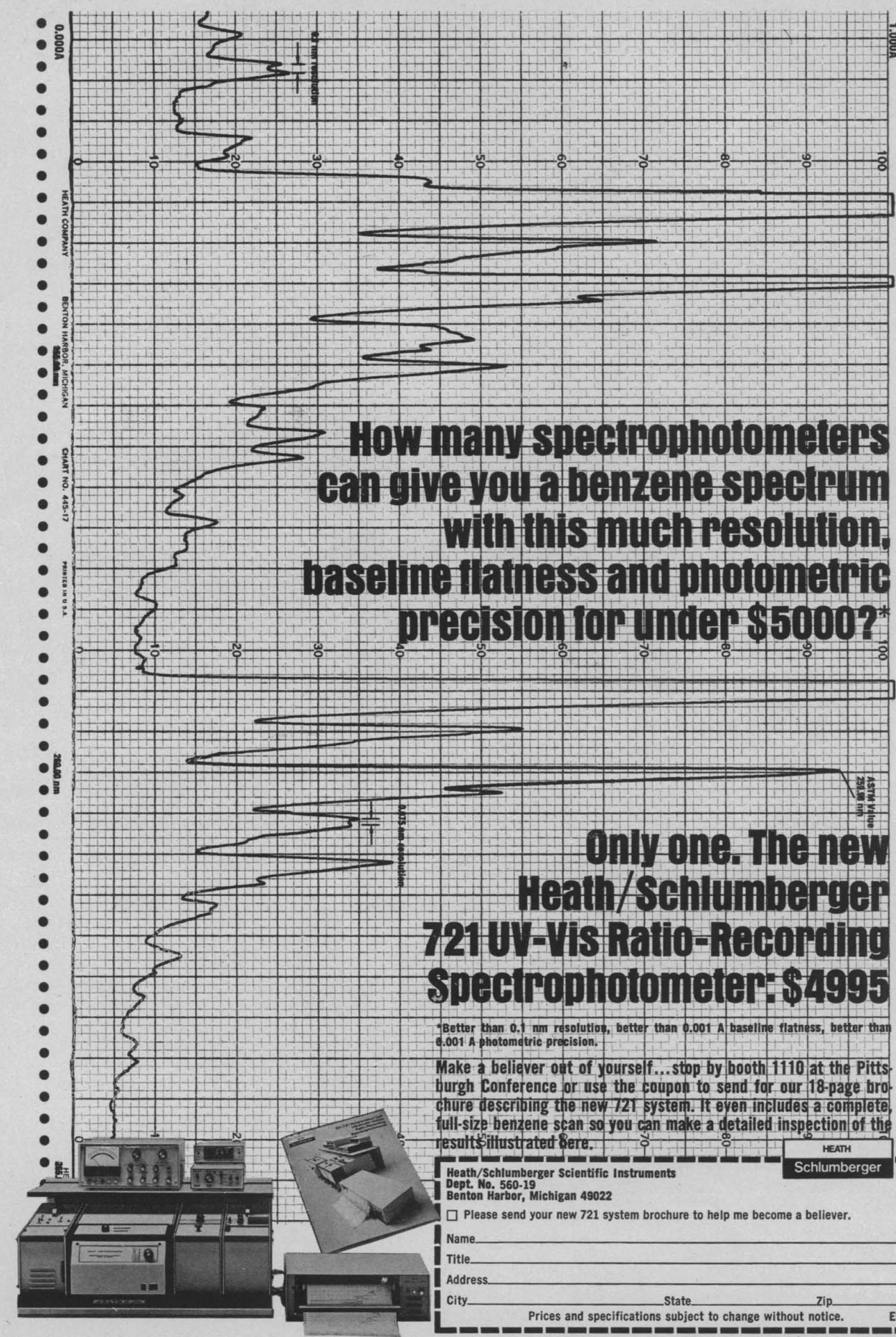

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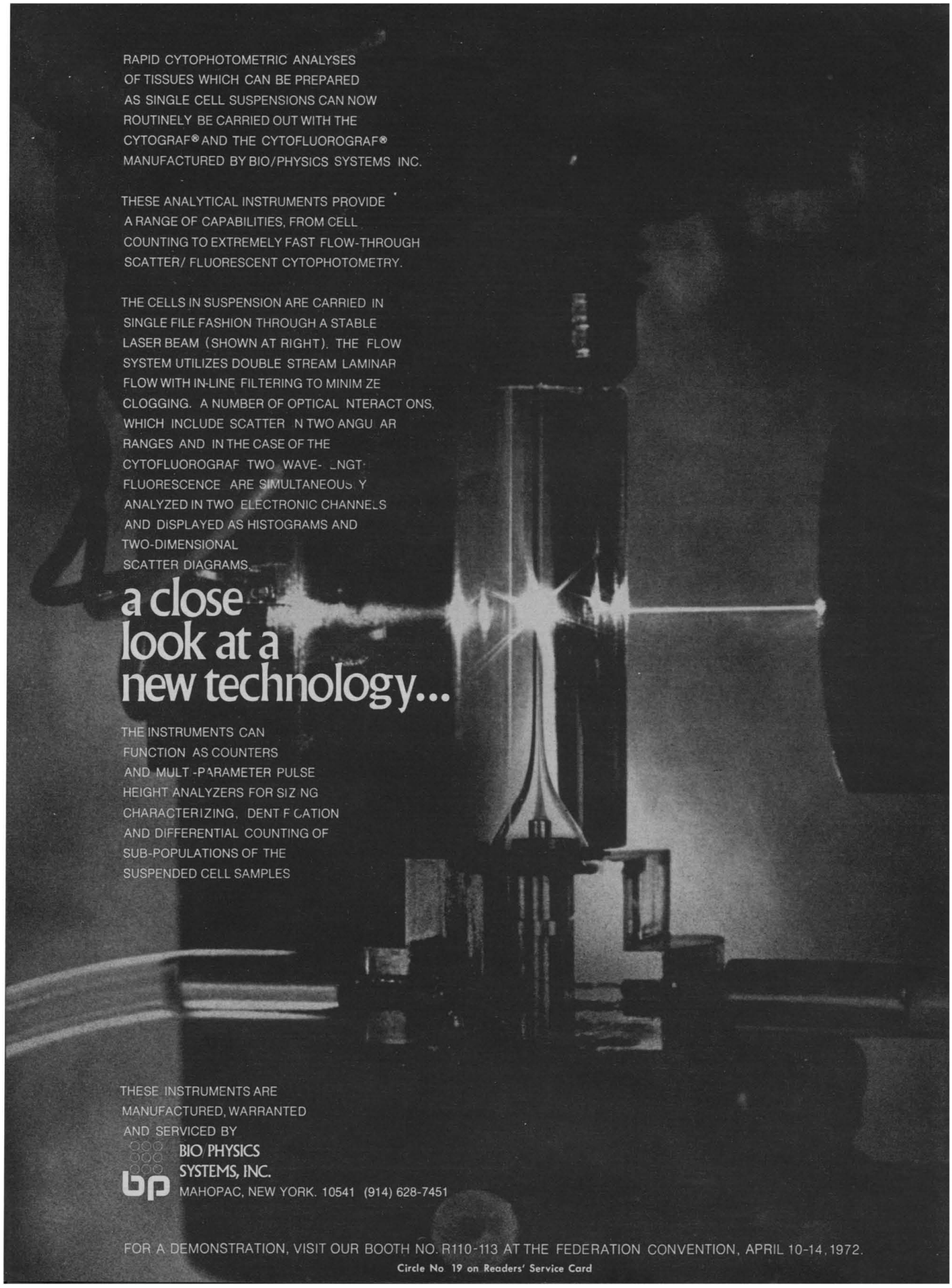

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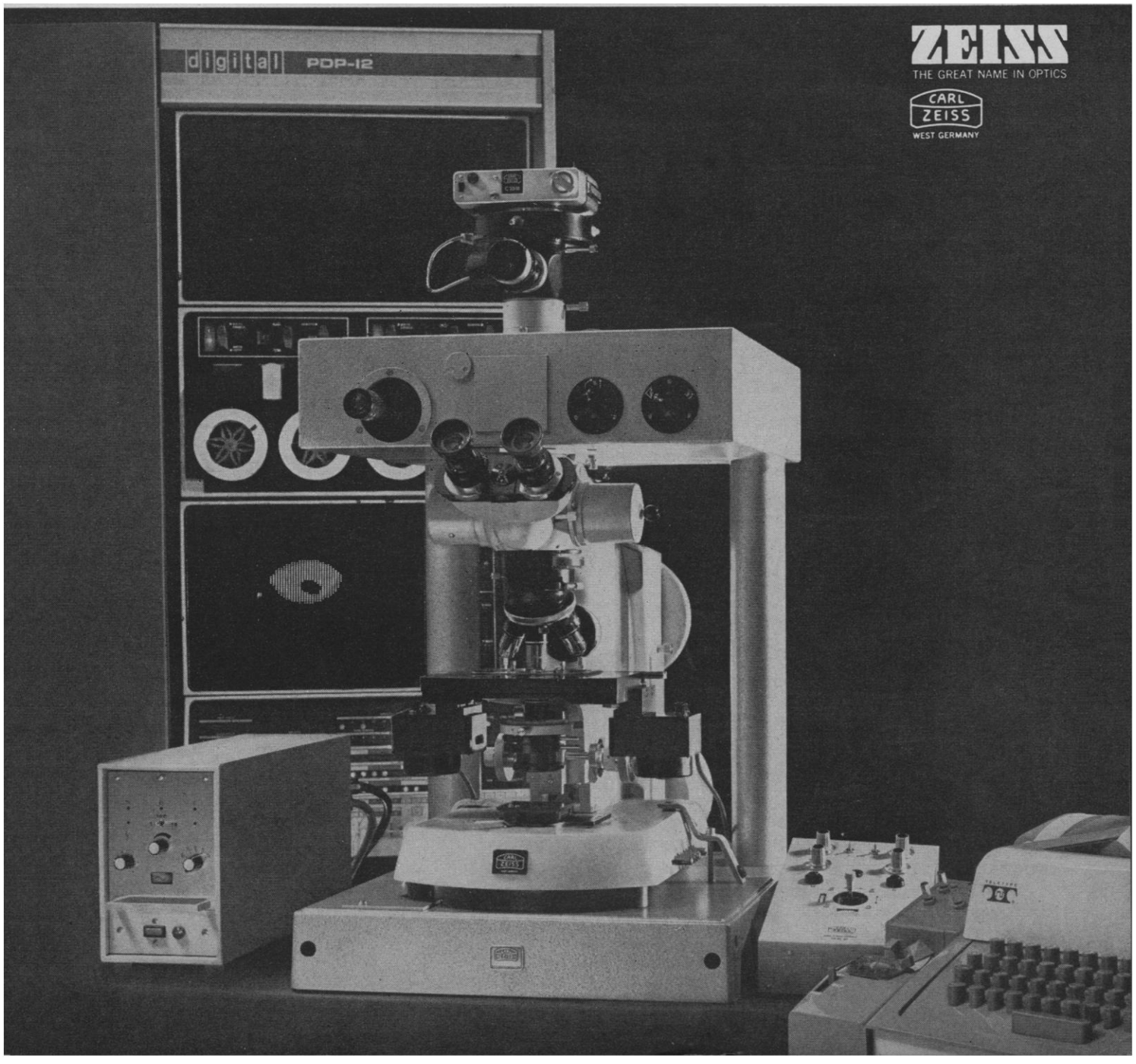

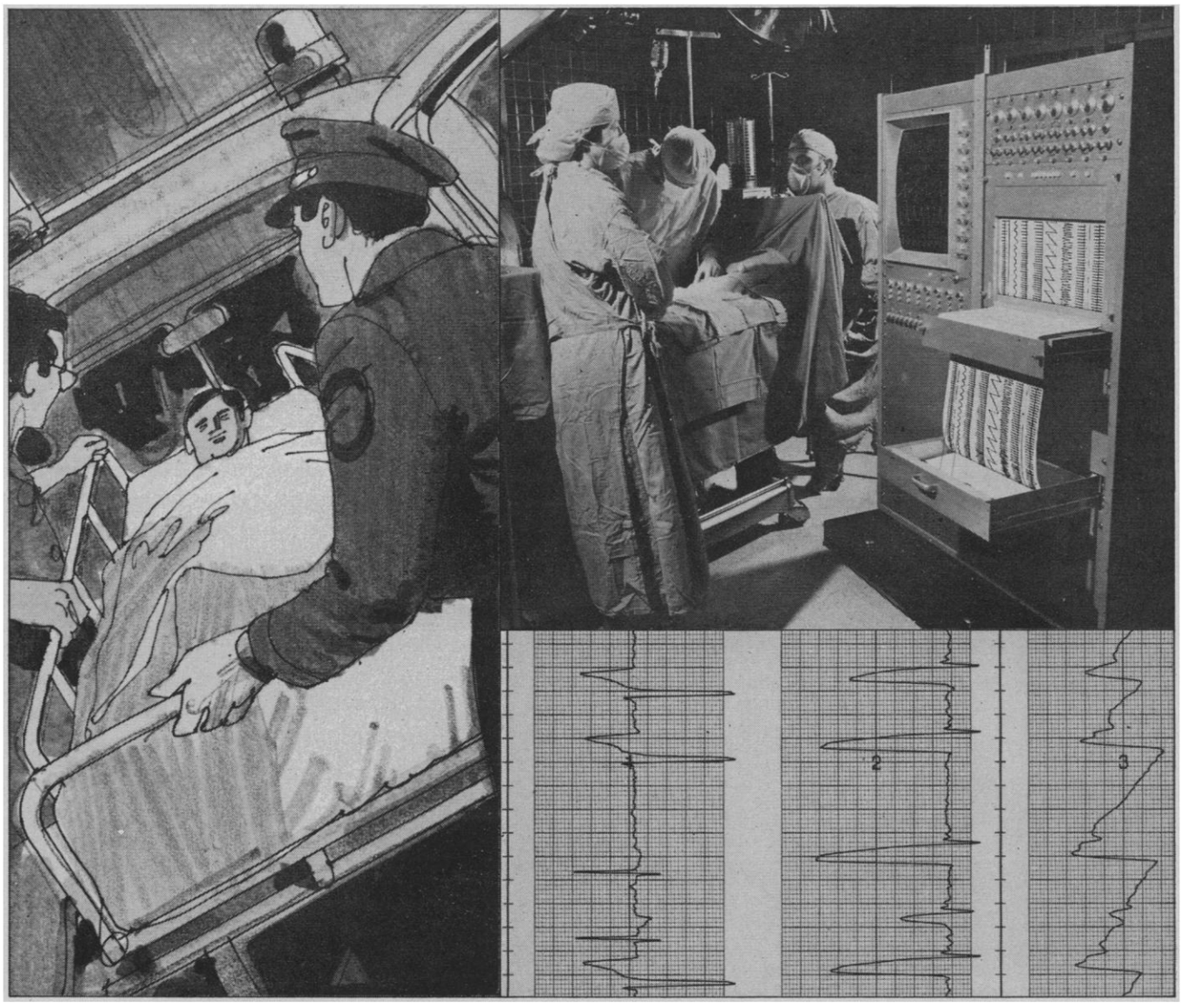

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GOULD

environmentalists would certainly be avoided if they abided by Stokinger's first and second "commandments": "Standards must be based on scientific facts . . ." and "All standards, guides, limits, and so on, as well as the criteria on which they are based, must be completely documented."

However, in his great zeal to prevent excesses in environmental conservation, I wonder if Stokinger does not himself violate his own "commandments." He implies that excessive (but presumably politically possible) antipollution expenditures could lead to ". . . economic upheaval approaching disaster." I would call this an undocumented fear. Reasonable arguments could probably be made that large antipollution expenditures could *aid* our economy almost as much as the same amount of defense spending.

Stokinger tells us that "Already a number of small manufacturing plants have been forced to close, unable to bear the burden of meeting pollution standards." He does not present evidence (or even *state*) that a significant fraction of these closings were unjustified when economic and environmental considerations were balanced. His argument seems a bit like the "scare tactics" used by overzealous antipollutionists.

I agree with Stokinger that increased costs for pollution control will be passed on to the consumer, but this in itself is not a negative aspect of pollution control. This factor should ordinarily have little relevance in determining whether or not a given antipollution action is justified. We should expect to pay for a cleaner environment, as we pay for improved automobile safety and more advanced medical care.

I quote, without comment (but with my italization), a part of Stokinger's conclusions on ". . . unnecessarily severe pollution standards." "It should thus be evident that such actions, with their unbearable consequences, should only be taken when it is clear *beyond a shadow of scientific doubt* that human health is in *imminent* danger. . . ."

BRUCE ROSENBLUM
Department of Physics,
University of California,
Santa Cruz 95060

Stockinger elevates pollutants to superhuman status by stating that antipollution "actions . . . should only be taken when it is clear beyond a shadow of scientific doubt that human health is in imminent danger. . . ." Such clarity, of course, is rarely attained.

Chemicals are not "innocent until proven guilty"; they do not have human rights. Unless we treat them as guilty until proven innocent, they will deprive real human beings of their rights to health. The burden of proof must be on the chemicals and their makers—not on the human population.

CHARLES F. WURSTER
Marine Sciences Research Center,
State University of New York,
Stony Brook 11790

The incomplete, seven-point decalogue of H. E. Stokinger can be brought closer to the needed "ecologue" by adding three commandments, since his strictly anthropocentric concept of environmental health gives short shrift to the health of the environment itself.

8) *Remember the planetary ecosystem, to keep it whole.* The most important system in which people function is not a medical system, but the planetary ecosystem; its own healthy operation is basic to human health and survival. The "scientific facts, realistically derived" of Stokinger's commandment 1 must not be limited to piecemeal facts derived from specialized "in vitro" laboratory science, but should also encompass an integrated understanding of the nature of the natural ecosystem and the limits of its tolerance to insults.

9) *Look upon short-term effects and actions as meaningful chiefly as they influence long-term effects and results, so that man may be long upon the earth.* To "determine trends" includes reasonable efforts at projection; the causes of the degradation and attrition of environment have been shown, by and large, to be increasing *exponentially*. "Osprey, bald eagle, and other fowl" may not be important to the "environmental health" discipline, but they are good indicators of the state of the biospheric life-support system. Concentrating too exclusively on direct, immediate effects of poisons on human health can be extremely short-sighted. Stokinger's claim to sanity and scientific objectivity would be more convincing if he had bothered to learn what is the consensus among ornithologists regarding the "questionable" harm from chlorinated hydrocarbons to other species at the top of the food chain. Perhaps unknowingly, Stokinger is disregarding much pertinent evidence from scientific (not "popular") ecology.

The ruinous concept "shoot first and ask questions afterward" has brought

on a pollution syndrome that present-day "banning" cannot cure for decades, even if such restraint operated effectively anywhere and were being applied worldwide. Neither proviso holds true. The main point of Stokinger's article is the need for restraint against restraints, a half-truth that, like a half-brick, can be thrown quite a distance in this year of ecologic backlash.

10) *Honor both economic and ecologic facts and principles, since a viable future for man depends on gradually but surely bringing human ecology into the functional respect presently accorded economics.*

ALTON A. LINDSEY
Department of Biological Sciences, Purdue University, Lafayette, Indiana 47907

Stokinger calls for the setting of standards for noxious agents in food and environment that are based on scientific facts, with the qualifications that "provisional, tentative, or best judgment standards" may be used when there is "definite need." He states that in the absence of definite need "it is better to withhold [standards] until such time as the facts are in." He apparently overlooks two points.

The first point, emphasized by Alvin M. Weinberg (Letters, 5 Nov., p. 546), is that in many situations (especially with carcinogens and mutagens) practical considerations prevent complete scientific answers, and thus trans-scientific judgments are required for standard setting. The notion that scientific research can provide absolute and definitive data before permissible standards are set for all noxious agents is a relic from the days when toxicologists were concerned only with acute toxic effects in situations where "no-effect levels" could be readily established. Weinberg points out that for some agents a "no-effect level" cannot be determined.

The second point is that although Stokinger modifies his commandment 1, "Standards must be based on scientific facts," to permit "provisional, tentative, or best judgment standards . . . ," it is possible that he could seem, to the casual reader, to be advocating the extensive use of human beings as guinea pigs. This, in fact, is what often happens when there is a practice of permitting widespread use or dissemination of any potentially toxic agent until a "definite need" for its control is demonstrated from studies on animals or humans. This is no longer a tenable public health practice. Prudence often demands action as soon as potential human injury is indicated; prudence will not countenance waiting to take action until the potential injury or harm is in fact an actuality. In addition, if one were to wait for hard scientific data before restricting the use of toxic agents, unconscionably long delays might occur because of limited research resources.

The "seven commandments," to be widely applicable, should be modified to mean that once an agent has been found to be a *potential* hazard to man, the setting of a "realistic level" for control must be based on available scientific facts, and *also* a reasonable interpretation of relevant governmental regulations, wise consideration of epidemiologically revealed trends, and use of a reasonable "safety factor" when scientific data are incomplete.

I do not mean to minimize the need for scientific data when permissible standards are being set for noxious agents in food or environment, but hard scientific data are rarely available (and if available are incomplete) when a potential human hazard is first perceived. Our society cannot always wait for such data before acting but must frequently set "provisional, tentative, or best judgment standards" on the basis of potential hazard, rather than demonstrated "definite need."

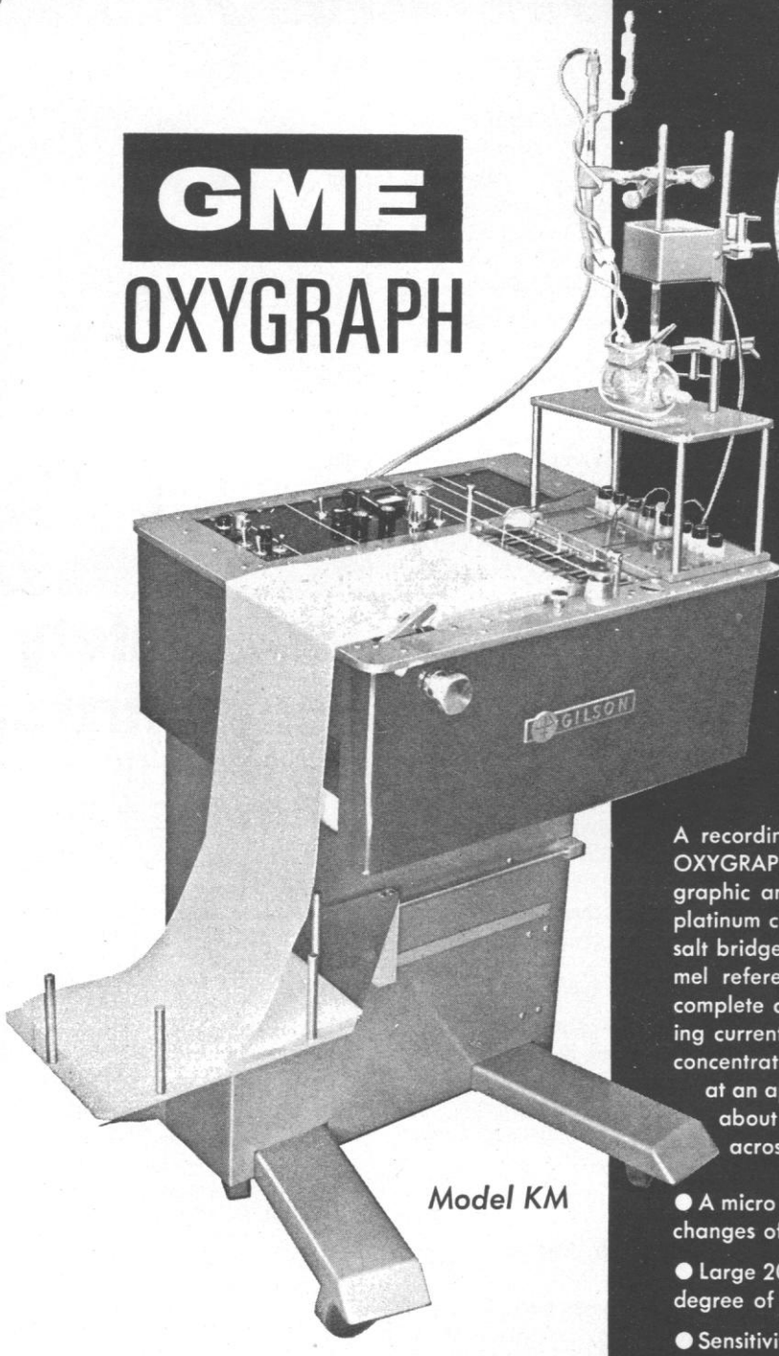
VICTOR E. ARCHER
Division of Field Studies and Clinical Investigations, National Institute for Occupational Safety and Health, P.O. Box 8137, Salt Lake City, Utah 84108

"Scientists of North America"

Dora B. Goldstein (Letters, 17 Sept., p. 1080) is right to complain about titles as *American Men of Science*, which imply, however inadvertently, that scientists are always men and never women. The old rule that "the masculine includes the feminine" seems uncalled for here. It is only fair that we male scientists recognize such slights and try to eliminate them. In this case, a title such as *Scientists of North America* would seem to be most appropriate, since Canadians are also listed.

T. EDWARD REED
Departments of Zoology and Anthropology, University of Toronto, Toronto, Ontario, Canada

GME OXYGRAPH



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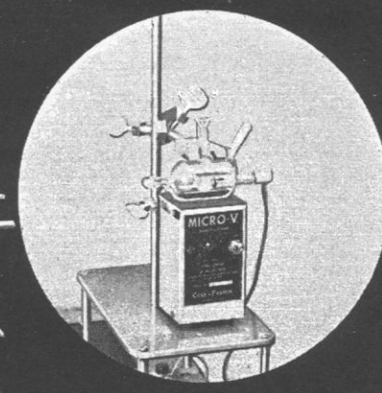

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25 February 1972, Volume 175, Number 4024 SCIENCE

Community Health

The assumption that effective treatment of illness vastly improves community health is incorrect. Prolongation of life often adds to the total burden of illness in the community, and therapeutic successes sometimes increase the proportion of defective genes in the community genetic pool. Even discounting these special circumstances, medical care from a community health viewpoint always comes too late. In 1920, Andrija Stampar, the great public health leader of Yugoslavia, wrote:

> No matter what the number of physicians may be, they will never improve people's health by individual therapy. . . . The successes of practical medicine are no doubt remarkable and the help offered by it . . . important, but always for a small number of people only. . . . People's health is never in direct relation to the number of physicians.

This is not an attempt to derogate the importance of medical care; however, community health is more directly a function of disease prevention than of the availability and sophistication of our resources for medical care.

Most of the decline in disease incidence and mortality, and therefore most of the increase in average life expectancy, has resulted from influences other than efforts aimed at controlling specific diseases. It is true that certain successes of preventive medicine are unambiguous. However, despite successes based upon the great expansion of knowledge of the specific etiologic agents of disease, the major benefits that have accrued to us in the past 100 years have resulted from the operation of undirected, nonspecific influences. Advances in medical knowledge and the decline of disease are simultaneous results of a general improvement in the quality of life.

The preceding discussion leads quite naturally to the conclusion that enormous improvements would be possible if we were able to understand and control the general environmental factors contributing to disease. Past scientific advances have been based very solidly on Aristotelian logic and reductionist philosophy. The successes attending this approach have been strong, and I would not be so foolish as to argue with success. However, I will argue that our obsession with reductionism has led us to ignore the very real values of a synthetic systems-oriented approach. To define, explain, and gain control of the various and extremely effective determinants of disease requires a deep appreciation of the ecological systems of which they are a part. Environmental management based on this kind of ecological research holds forth the promise of new and more effective means of disease prevention.

We can establish, despite the complicating factor of genetic variability, a working hypothesis that the differences in disease frequency between different populations is mainly a result of their different environmental experience. Therefore, the lowest observed risk of illness in any general population is a goal attainable in any other population. This falls somewhat short of the ideal of eradicating disease, but it is so far in advance of present reality that it should be acceptable as worthy of our efforts.

To pursue this approach will call for a philosophy substantially different from that which has usually guided epidemiological studies. We cannot ignore the usefulness of knowledge of specific etiologic factors; however, we should concern ourselves with clusters of causes and combinations of effects and how they relate to each other.—REUEL A. STALLONES, *School of Public Health, University of Texas, P.O. Box 20186, Astrodome Station, Houston, Texas 77025*

This editorial is excerpted from *Environment, Ecology, and Epidemiology*, Scientific Publication No. 231 (Pan American Health Organization, Washington, D.C., 1971).

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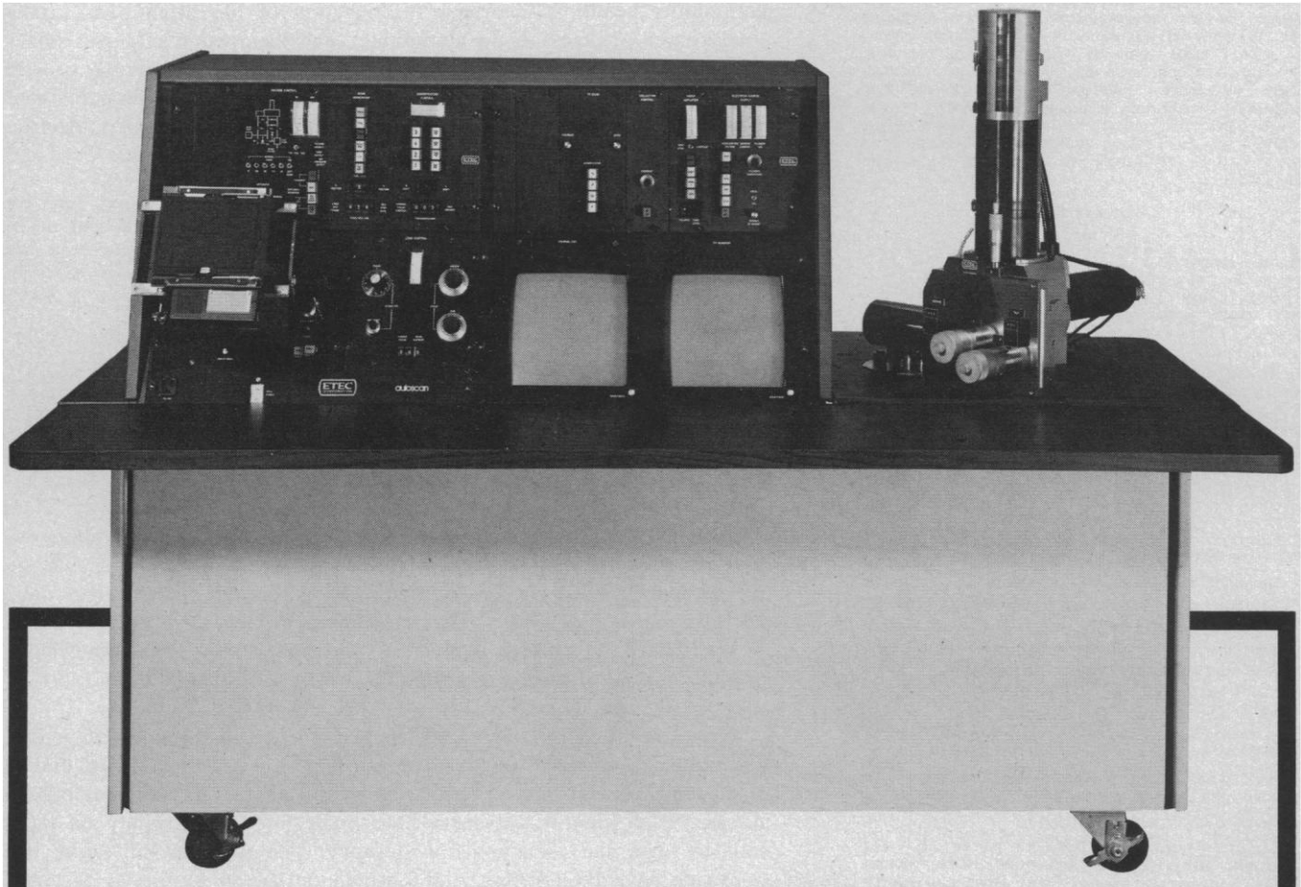

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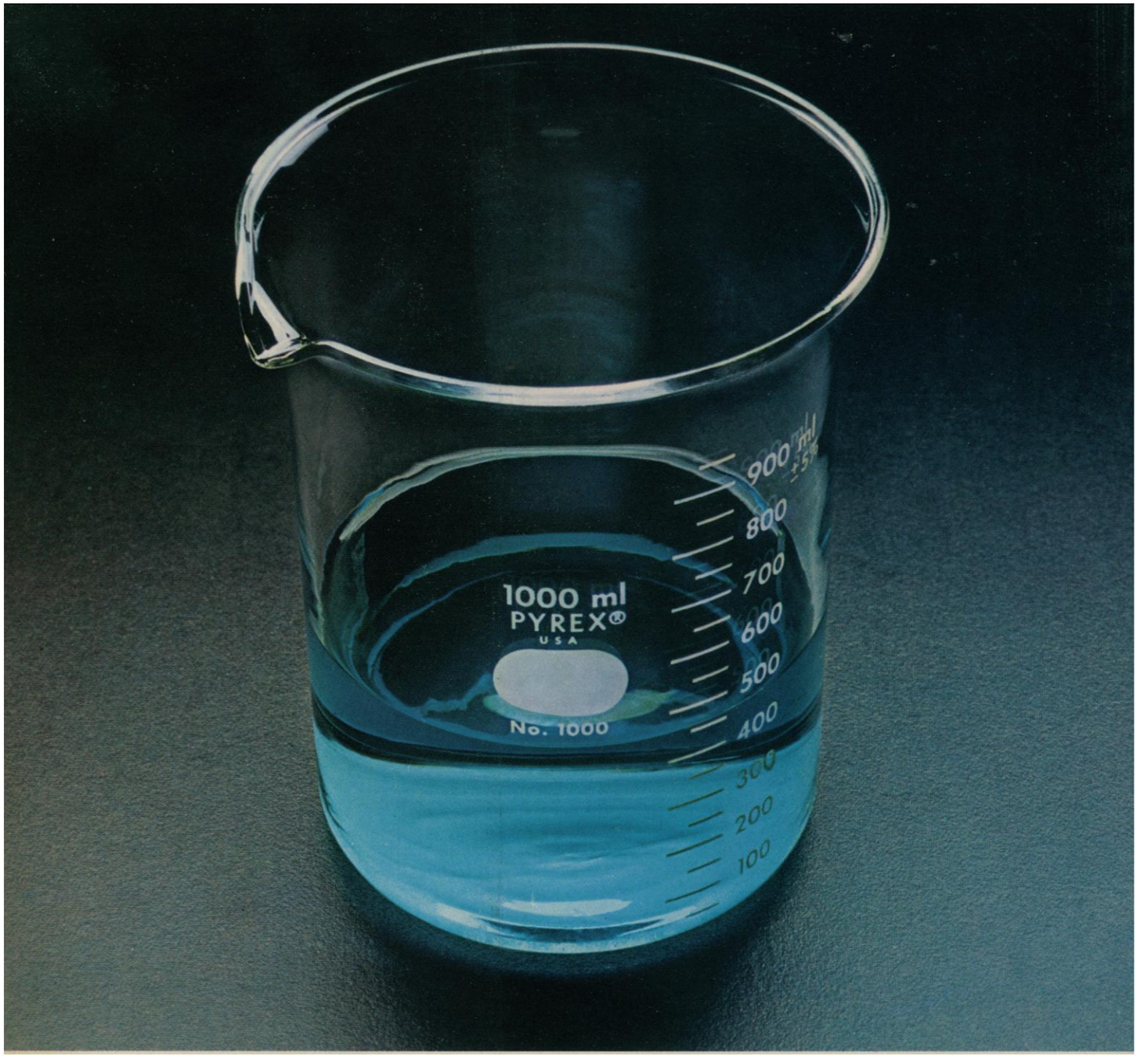

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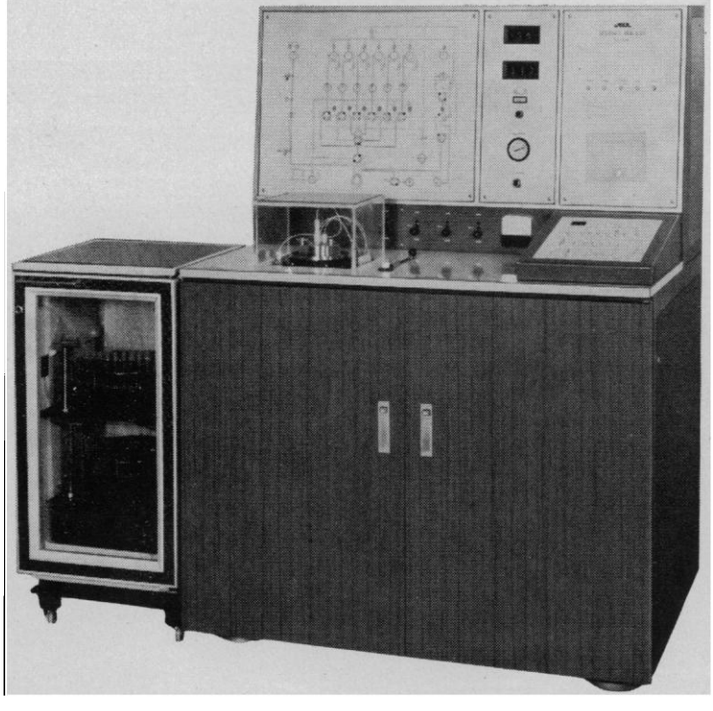

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