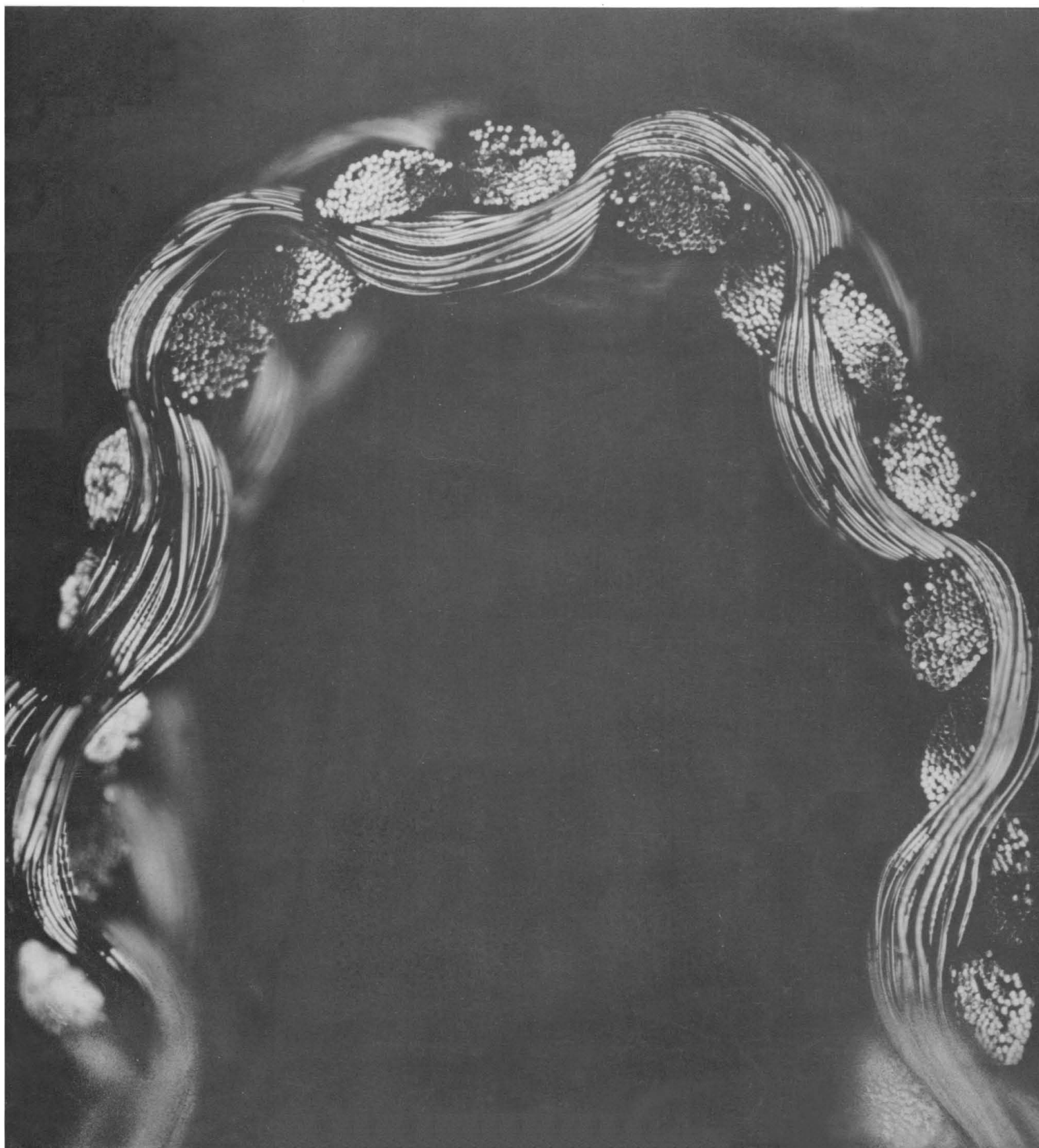


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25 August 1972

Vol. 177, No. 4050

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COVER

Metal-shadowed section of a bent nylon fabric midway between two warp yarns. At points where they cross the central plane of the fabric, the bent yarns are constricted by the perpendicular filling yarns. Regular patterns of light and dark areas on individual warp filaments indicate depressions caused by the contact of filaments in adjoining yarns. ($\times 45$). See page 657. [Leo Barish, Fabric Research Laboratories, Dedham, Massachusetts]

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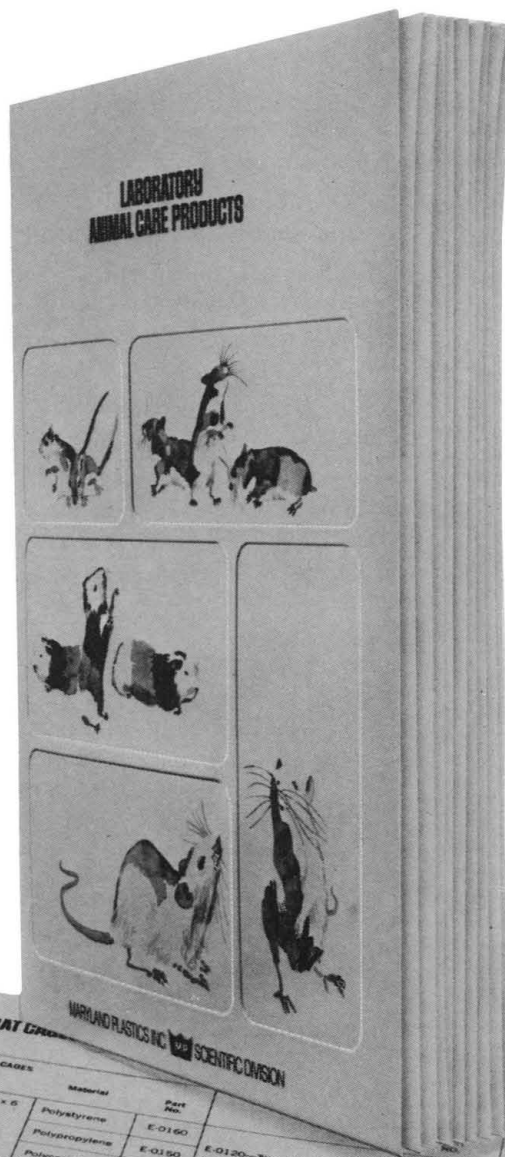
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Physiological Data

Lipase activity:
 Age at puberty
 Age at first estrus
 Age at first mating
 Age at first pregnancy
 Age at first lactation
 Age at first weaning
 Age at first parturition
 Age at first abortion
 Age at first death

Reproductive cycle:
 Estrous cycle
 Gestation period
 Lactation period
 Weaning age
 Temperature, rectal
 Respiratory rate

Rate of heartbeat

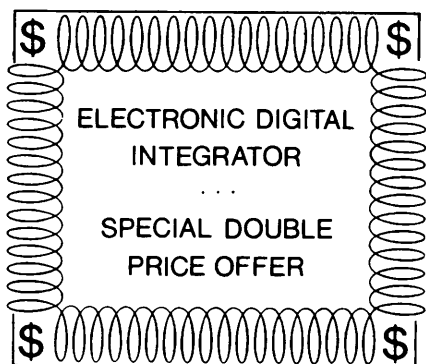
Food consumption, daily
 Water consumption, daily
 Urinary volume, daily

Life expectancy:
 2-3 years
 Average: 70 days, vaginal opening on 42nd day
 80-120 days
 4-5 days
 20-30% lactating female
 24-30 days
 31 days
 90-100 gms range of averages
 Range of averages 85-113
 minimum, 1-2 maximum
 Range of averages 32-392
 beats per minute, 300
 minimum, 504 maximum
 12-15 grams
 25 milliliters
 11-15 milliliters

SPECIFICATIONS-RAT CAGES

Series and Nominal Dimensions (in.)	Material	Part No.	No.	CAGE PER STANDARD RACK
11 x 8½ x 6	Polystyrene	E-0160		
	Polypropylene	E-0150	E-0120—Zinc Plated, Wire Bar	
	Polycarbonate	E-0170	E-0190—Stainless Steel (Type 304), Wire Bar	
14½ x 12½ x 6½	Polystyrene	E-0560		E-0130 Molded Spun Polyester
	Polypropylene	E-0580	E-0520—Zinc Plated, Wire Bar	
	Polycarbonate	E-0570	E-0590—Stainless Steel (Type 304), Wire Bar	
19 x 10½ x 6½	Polystyrene	E-0460		E-0530 Molded Spun Polyester
	Polypropylene	E-0480	E-0420—Zinc Plated, Wire Bar	
	Polycarbonate	E-0470	E-0490—Stainless Steel (Type 304), Wire Bar	
19 x 10½ x 8	Polystyrene	E-1460		E-0430 Molded Spun Polyester
	Polypropylene	E-1450	E-0420—Zinc Plated, Wire Bar	
	Polycarbonate	E-1470	E-0490—Stainless Steel (Type 304), Wire Bar	
20 x 16 x 8½	Polystyrene	E-0760		E-0430 Molded Spun Polyester
	Polypropylene	E-0750	E-0720—Zinc Plated, Wire Bar	
	Polycarbonate	E-0770	E-0790—Stainless Steel (Type 304), Wire Bar	
				E-0730 Molded Spun Polyester

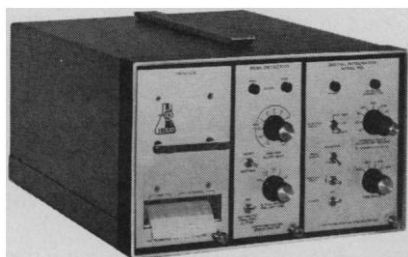
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PCB's in Sand Crabs

I read with great interest the report by Robin Burnett (5 Nov. 1971, p. 606) on DDT residues in sand crabs along the coast of California. I analyzed samples of different organisms collected 4 months earlier from locations that were very close to Burnett's stations 16 and 18. Burnett reported that polychlorinated biphenyls (PCB's) were not present in the processed extracts, but he did not specify whether the PCB's were intentionally removed during cleanup of the extracts or whether the sand crabs were thought to contain no PCB's. The sand crabs probably contained relatively high levels of PCB's. In the organisms I sampled, I found that the average ratio of total DDT to PCB's was 1.0 at station 18 and 0.35 at station 16 (1).

T. O. MUNSON

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Reference

1. T. O. Munson, *Bull. Environ. Contam. Toxicol.* 7, 223 (1972).

I did not remove PCB's during clean-up. While no assemblage of peaks characteristic of any commercial PCB mixture is seen, several peaks with retention times identical to those for Arochlor 1254 peaks were indeed present. If I use peak A in Fig. 1 to quantify PCB's in the manner used by Munson, I obtain a total DDT to PCB ratio of

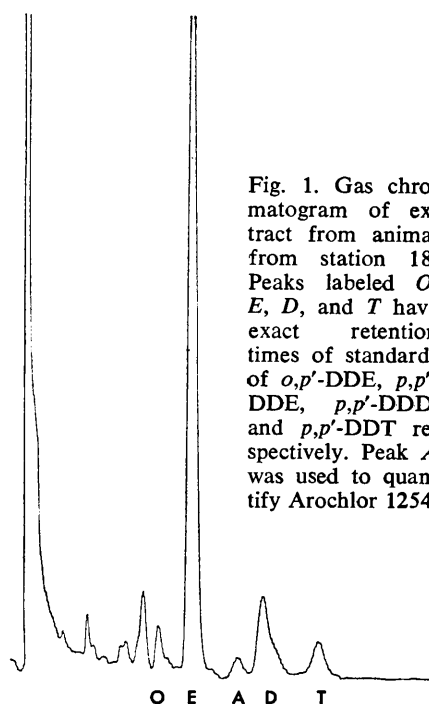


Fig. 1. Gas chromatogram of extract from animal from station 18. Peaks labeled O, E, D, and T have exact retention times of standards of *o,p'*-DDE, *p,p'*-DDE, *p,p'*-DDD, and *p,p'*-DDT respectively. Peak A was used to quantify Arochlor 1254.

0.9 for station 16 and 1.4 for station 18. Although conclusions using this method of quantification can only be tentative, perhaps one reason for Munson's lower values is that he collected his samples much closer to large sewer outfalls, a possible local input of PCB's.

ROBIN BURNETT

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Uses of Research

In response to the report "Defense research: The names are changed to protect the innocent" by Deborah Shapley (News and Comment, 25 Feb., p. 866), I would like to add to the perspective on the problem of Department of Defense (DOD) funding of fundamental research. Much of the philosophy of the National Science Foundation (NSF) was forged in the 1940's within the Office of Naval Research (ONR) with James H. Wakelin and Alan Waterman (later the first head of NSF) as leaders. The spirit of ONR has diffused to the Air Force Office of Scientific Research (AFOSR), the Army Research Office (ARO), and beyond. The personnel in these branches of DOD are, by and large, in tune with the basic approach of the university researchers, but they are often caught in the collision between Congress and DOD on research funding and by the short-range refocusing of DOD research that comes with every period of financial austerity. From experience they know that cycles come and go; by means of heavy emphasis on potential military applicability in the contract descriptions they are trying to ride out this particular stormy cycle. Most of them understand the main features of each program, but they may falter in trying to link the detailed techniques with the potential applications. Understandably, the word "potential" is generally dropped.

An important aspect, not touched upon in Shapley's report, is that we are talking about unclassified research. In fact, the researchers are urged not to publish just institutional reports, which may have a total circulation of 100-200 copies, but to process their results for the earliest and widest scientific publication. This is in the original ONR-NSF spirit and also constitutes quality control for the contract monitors. As I understand it, the researchers with publications in the top-notch scientific journals are assigned

special brownie points in the evaluations when contracts come up for renewal.

The twin aspects of *potential* applicability and *openness* of the research are crucial to "grappling with the key moral issue of the uses to which their research results will be put," as Shapley puts it in her dramatic ending. The applicability of such research is very wide, and most of the results will be used in peaceful applications. A case in point is the research of S. J. Kline on "Basic structure and stability of turbulent shear flows," discussed in the report. There can hardly be more basic experimental research in this subfield. Its results will nurture fluid mechanicians for generations. And yet some of the insights therein should lead to better design of rocket nozzles if DOD engineers digest Kline's results and implement them. The Russian engineers also have the publication, translated into Russian, where these results appeared (1) and are just as likely to improve their rocket motors. But the application of the research of Kline's group may as likely be in the rejuvenation of the Great Lakes, through an understanding of the parameters controlling the mixing of fluids. Those who are upset by the circumstances of the funding of this research should ask themselves, "Should such research not be funded at all because of its potential applicability?" What research would then deserve funding? (They should also ask themselves whether it is immoral for that research to be of potential use to DOD engineers, keeping in mind other moral issues associated with, say, the lessons of Budapest (1956) and Prague (1948 and 1968). But many students have not heard of or have forgotten these events in their understandably deep concern for the lessons of Vietnam.)

If the main objections are to the source of the funding rather than to the research itself, the critics should be lobbying in Congress rather than exposing the tight-rope which the beleaguered contract monitors of ONR, AFOSR, and ARO are trying to walk during this austerity cycle. One wishes that the new groups in the Department of Transportation, the Environmental Protection Agency, etc., had developed a comparable philosophy with respect to long-range, basic, potentially applicable research. NSF, of course, has the philosophy, but not the funds, to take over much of the ongoing basic DOD research. In the type of research discussed in Shapley's report, is the issue really a moral one, resting with the sci-

entists and the monitors, or is it politico-economic, resting with Congress and the public at large?

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References

1. S. J. Kline, W. C. Reynolds, F. A. Schraub, P. W. Runstadler, *J. Fluid Mech.* **30**, 741 (1967); H. T. Kim, S. J. Kline, W. C. Reynolds, *ibid.* **50**, 493 (1971).

Deborah Shapley's review of the SWOPSI (Stanford Workshop on Political and Social Issues) student report on DOD research at Stanford ends with the comment that "... DOD now exempts all scientists from grappling with the key moral issue of the uses to which their research results will be put." Let me propose a generalization of this moral issue to the effect that *all* scientific research has a finite probability of being applicable to uses which most men would agree are immoral. The problem is two-fold; is this probability calculable, and if so, where does each scientist set the probability level above which he will choose not to pursue the research. (You will notice that I still fancy that the scientists have a choice, though one could argue that both the students and the professions are doing their best to eliminate it.)

If one cringes at the task of measuring the probability that a given area of research may lead to negative benefits for humanity, then perhaps a historical study would be a starting point. Poor Faraday.

ROBERT T. SIEGEL

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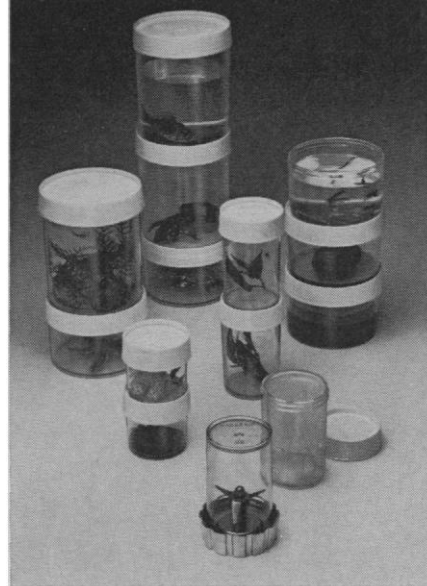
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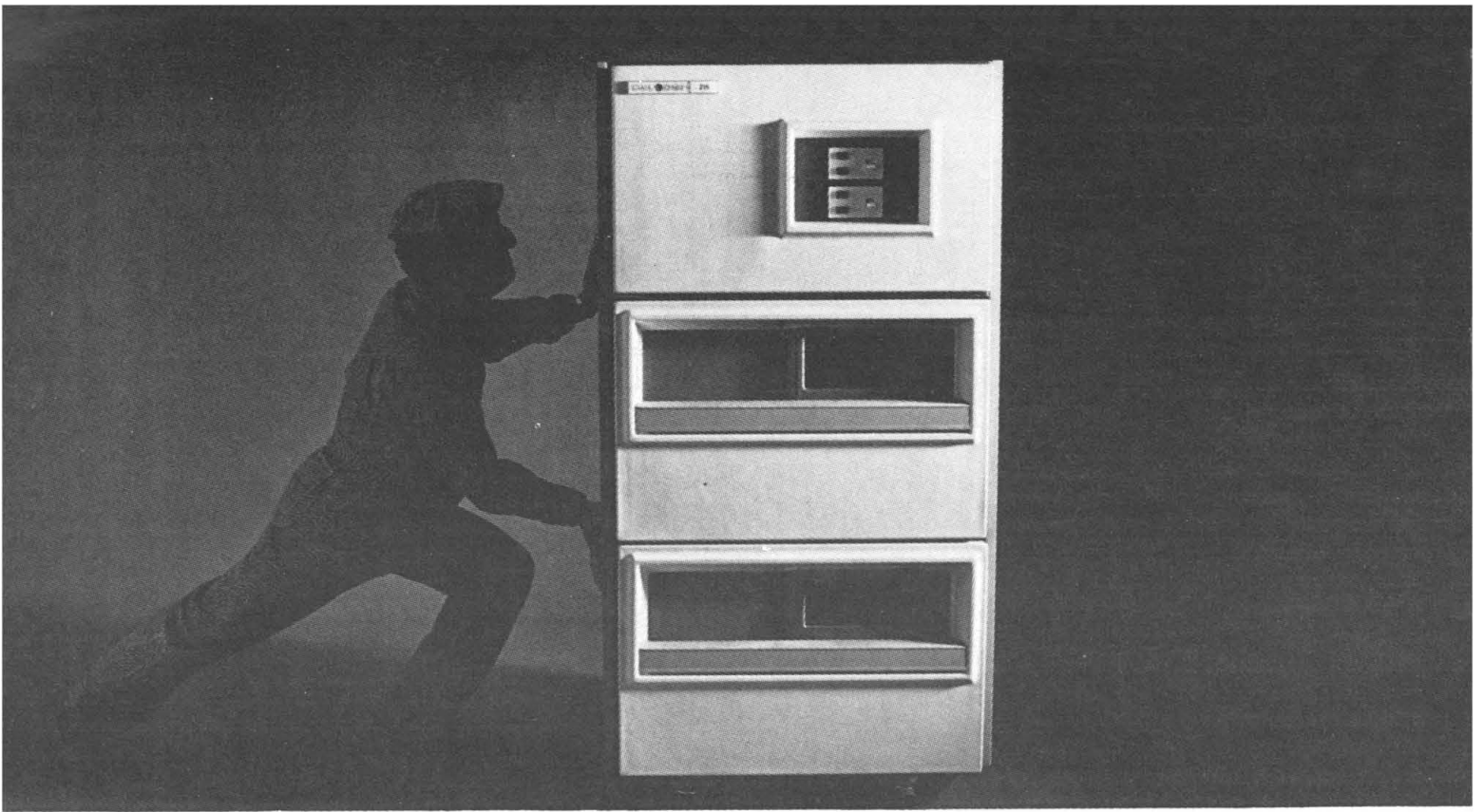
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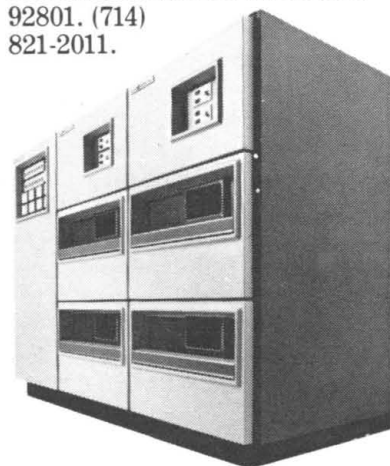
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Environmental Quality

Under the terms of the legislation creating it, the Council of Environmental Quality (CEQ) is required to report at least once a year on the state of the environment and efforts to improve it. Recently the third annual report* was issued. Because CEQ is charged with surveillance of the environment, the report touches on many topics, including air pollution, water quality, waste disposal, toxic substances, radiation, noise, land use, national parks, endangered species, and international matters. A perusal of the report discloses many things done and many undone. Much legislation has been enacted. Considering the complexity of environmental problems and the economic and political forces involved, the record of the Administration and Congress has been good, although Congress has been slow to pass on some essential Administration proposals.

Legislation is, of course, only a beginning. The full impact of the new laws is yet to be felt. We cannot accurately gauge either costs or benefits. The CEQ report provides an estimate of costs (about \$300 billion) that will be incurred in improving the environment during this decade. The estimate is based only on legislation already enacted and therefore undoubtedly understates the ultimate expenditures.

Of all the environmental parameters, the most universal and probably the most important is air. People can find ways of avoiding most unpleasant environmental impacts, but it is impractical to stop breathing. The CEQ report estimates that during this decade we will spend about \$100 billion in combating air pollution. In view of the importance of the matter, it would seem reasonable for the government to provide up-to-the-moment data on the status of air pollution abatement. Indeed, the report states:

Accurate and timely information on status and trends in the environment is necessary to shape sound public policy and to implement environmental quality programs efficiently. Further, the American people are entitled to know whether the public and private money being spent to protect the environment returns a commensurate improvement in environmental quality.

Unfortunately, realities do not measure up to intentions. Timely information on the status of the environment is not available. The CEQ report was compiled as of 30 June 1972, but its latest air data are those of 1970.

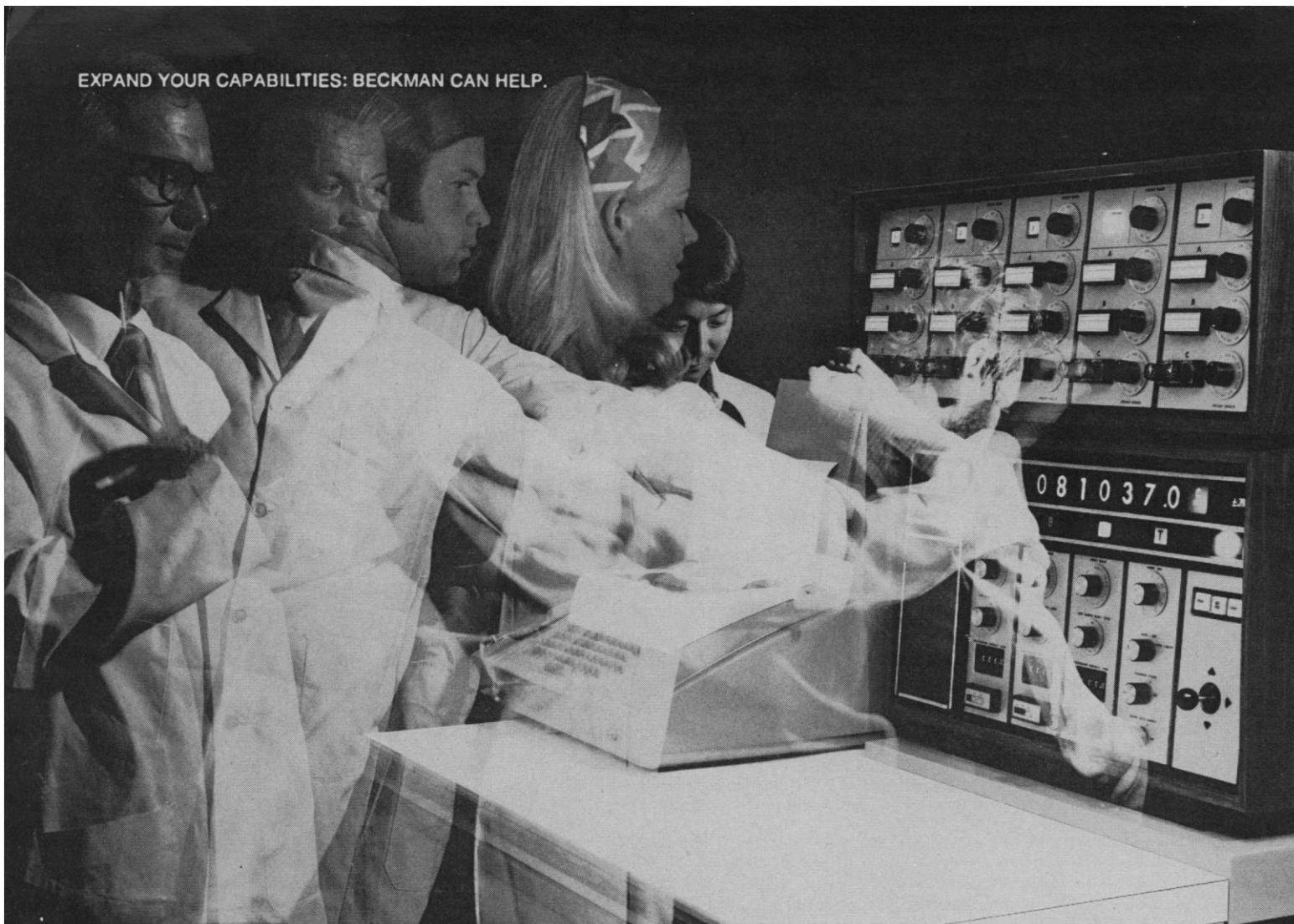
Implicit in the CEQ report is an even more fundamental gap in knowledge—the extent of the hazard posed by various individual pollutants. The council has been seeking an overall index for air quality. In this search, one of the problems cited is lack of knowledge concerning effects. The report rightly states that "the ambient air quality standards on which most of the air pollution indices are based are still somewhat controversial."

Weaknesses in the water quality surveillance program are also evident. There are more than 20,000 measuring stations, but only a small fraction are equipped to monitor as many as eight of the variables of interest. Performance of an adequate job of monitoring toxic substances will require a much expanded program. At the moment, it is likely that many chemicals that should be followed are not being measured at all.

Society wants cleaner air and water and is committed to spend some \$200 billion during this decade to attain them. Unless we understand better what we are trying to do and have done, a large fraction of that money could be spent ineffectively. It would seem prudent to devote at least a fraction of a percent of the huge sum to creating an adequate knowledge base.—PHILIP H. ABELSON

* Council on Environmental Quality, *Environmental Quality* (Government Printing Office, Washington, D.C., 1972).

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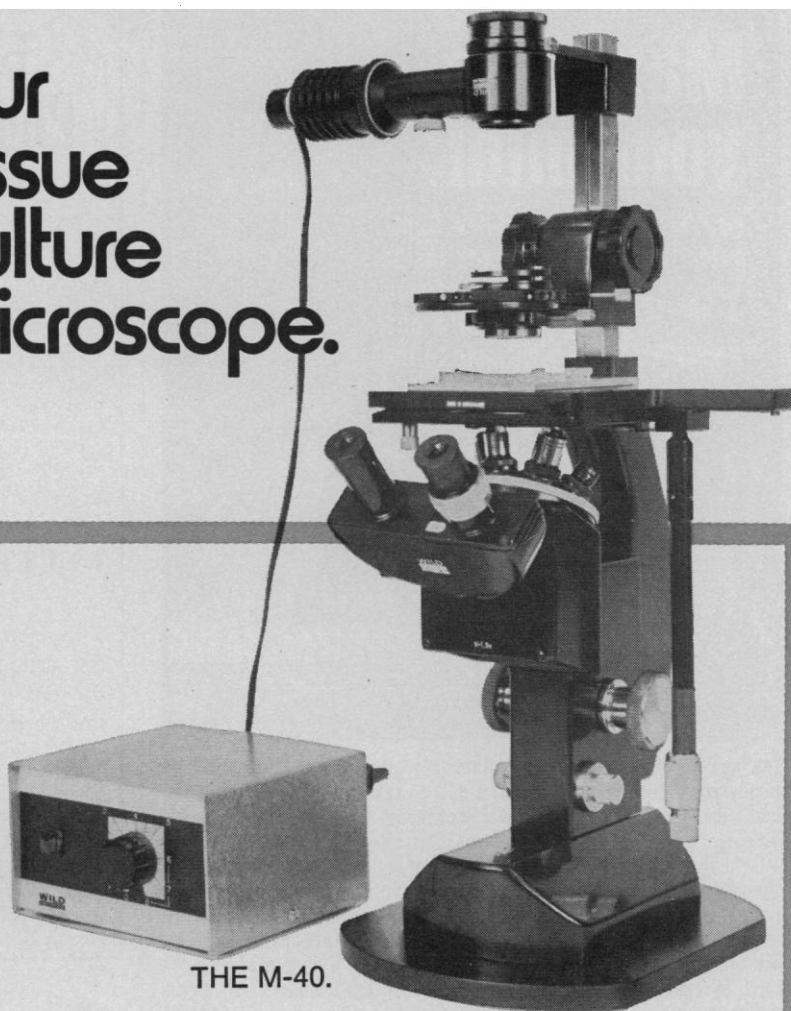
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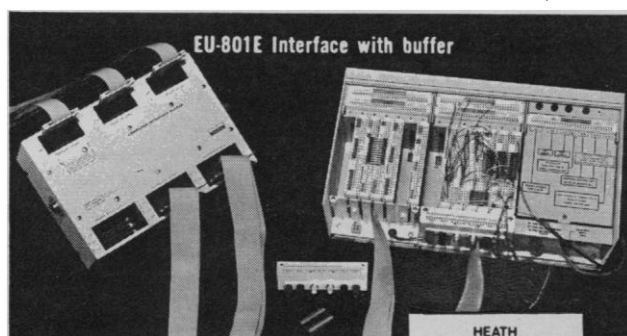
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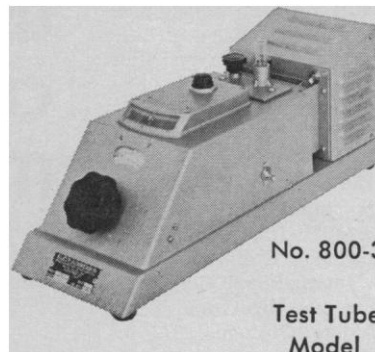
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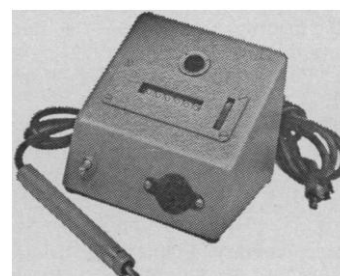
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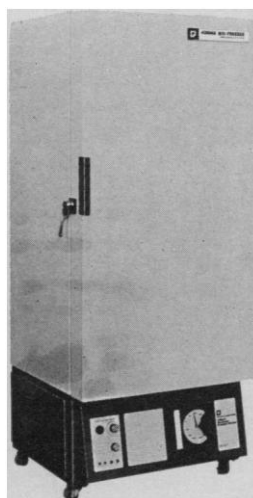
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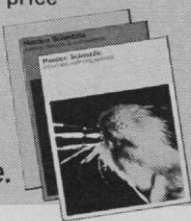
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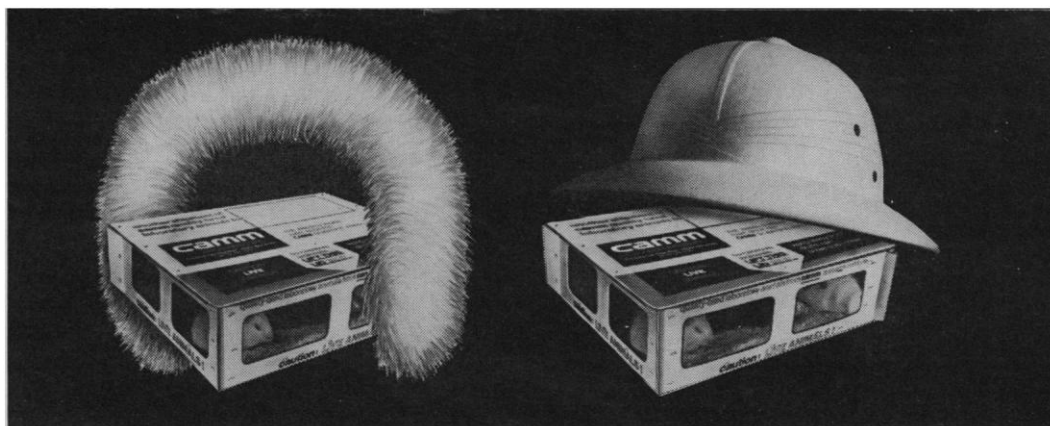
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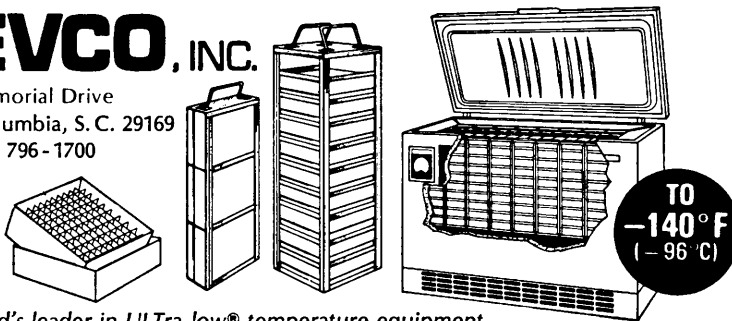
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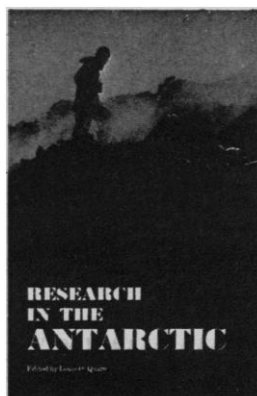
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