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
Ocean Research Laboratory, Westinghouse Electric Corporation, Annapolis, Maryland 21404

Reference

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

I did not remove PCB's during cleanup. 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 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.

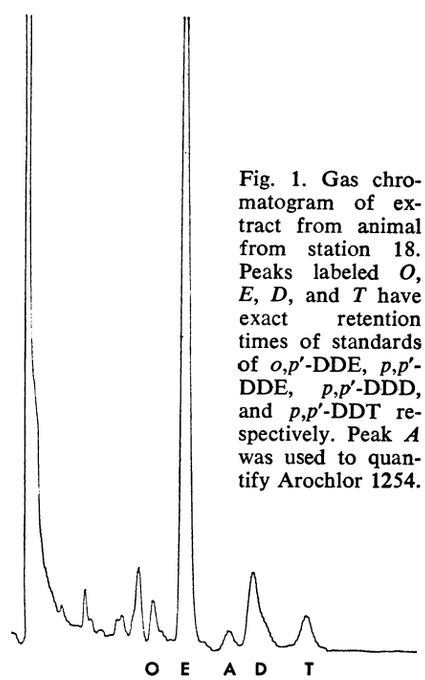

Fig. 1. Gas chromatogram of extract from animal from station 18. Peaks labeled *O*, *E*, *D*, and *T* have exact retention times of standards of *o,p'*-DDE, *p,p'*-DDE, *p,p'*-DDD, and *p,p'*-DDT respectively. Peak *A* was used to quantify Arochlor 1254.

ROBIN BURNETT
Hopkins Marine Station, Pacific Grove, California 93950

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

MARK V. MORKOVIN
Departments of Mechanics and
Mechanical and Aerospace Engineering,
Illinois Institute of Technology,
Chicago 60616

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
134 Horseshoe Drive,
Williamsburg, Virginia 23185

Lunar Studies

The Lunar Science Institute, Houston, Texas, is building a data information bank to straighten out lunar studies since 1950. We would appreciate receiving any material—reprints, reports, photos, maps, and so forth, that relate to this project. We reserve the right to weed the material, and contributed materials will not be returned.

FRANCES B. WARANIUS
Moon Literature Project,
Lunar Institute Library,
3303 NASA Road 1,
Houston, Texas 77058